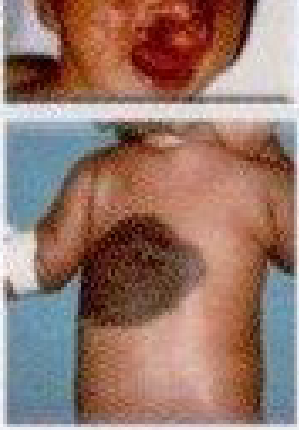
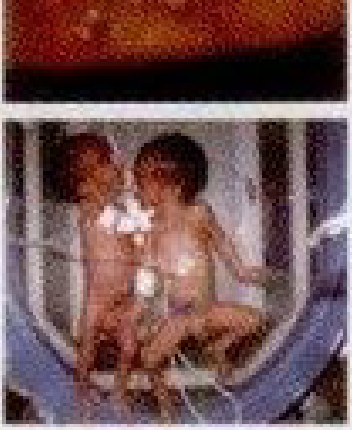
5th Edition

Differential Diagnosis in PEDIATRICS

(Including Color Atlas)



Third Decade of Publication

Suraj Gupte

Foreword
EA Robert

JAYPEE

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in
PEDIATRICS
(Including Color Atlas)
5th Edition

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Third Decade of Publication

SURAJ GUPTE MD FIAP
Professor and Head, Postgraduate Department of Pediatrics, Narayana Medical College/Narayana General and Superspeciality Hospitals, Nellore 524002, Andhra Pradesh, India E-mail: recentadvances@yahoo.co.uk, surajgupte@rediffmail.com

Honorary Director
Pediatric Education Network

Editor
Recent Advances in Pediatrics (Series), The Short Textbook of Pediatrics, Textbooks of Pediatric Emergencies Neonatal Emergencies, Pediatric Nutrition, Pediatric Gastroenterology, Hepatology and Nutrition
Towards MRCPCH Part II (Theory Examination, Pediatric) Yearbook (Series)

Author
Instructive Case Studies in Pediatrics, Pediatric Drug Directory, Infant Feeding, Speaking of Child Care The Baby Book: The Parent's Guide from Birth to Infancy

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Asian Journal of Maternity and Child-Health (Manila, Philippines)

Section and Guest Editor
Pediatric Today (New Delhi)

Editorial Advisor
Asian Journal of Pediatrics Practice (New Delhi)

Editorial Advisory Board Member/Reviewer
Indian Journal of Pediatrics (New Delhi), Indian Pediatrics (New Delhi), Synopsis (Detroit, USA) Indian Journal of Pediatric Gastroenterology, Hepatology and Nutrition (Jaipur), Journal of Clinical Pediatrics (Patna), Maternal and Child Nutrition (Preston, UK), Journal of Pediatric Infectious Diseases (Turkey)

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Fax: +91-11-43574314
Registered Office
B-3, EMCA House, 23/23B Ansari Road, Daryaganj, **New Delhi** 110 002, India
Phones: +91-11-23272143, +91-11-23272703, +91-11-23282021, +91-11-23245672
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- No. 41/3098, B & B1, Kuruvi Building, St. Vincent Road
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  e-mail: lucknow@jaypeebrothers.com
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  Mumbai 400 012, Phones: +91-22-24124863, +91-22-24104532, Rel: +91-22-32926896
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Differential Diagnosis in Pediatrics

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To

My parents
who always gave my efforts
the necessary blessings.
Their inspiration has been a
tower of strength in
bringing out this book as also
its subsequent editions

Foreword

I am most pleased to write the Foreword to the 5th edition of the *Differential Diagnosis in Pediatrics* by as illustrious an author as Prof Suraj Gupte. The author, Senior Professor and Head, Department of Pediatrics, Narayana Medical College, Nellore, India, has earned fame as a remarkable blend of academic brilliance, expertise and experience not only in India but also across the globe.

The well-illustrated book has a special accent on problems which are particularly meaningful in the Indian subcontinent. Of the five major parts, Part I is exclusively devoted to over 250 interesting and instructive clinical color pictures with very pertinent legends. Notably, rest of the volume too is adequately illustrated with diagrams, clinical photographs and radiologic/imaging pictures.

True to his reputation, Dr Gupte's style is clear, lucid and easy-to-understand. Undoubtedly, this and the wealth of valuable material contribute to the eminent success of the book in sharpening the reader's skills, in dealing effectively with the signs and symptoms and quickly formulating differential diagnosis relevant to a given situation.

I find the book very remarkable in many other ways too and have great pleasure in warmly recommending it to the target audience.

Prof EA Robert MD, PhD
Professor Emeritus (Pediatrics)
University School of Medicine
New York, USA

Preface to the Fifth Edition

First published way back in 1982, *Differential Diagnosis in Pediatrics,* the first and the only Indian textbook in the field, has won a pride of place as a popular treatise, meeting the requirements of the medical students, residents, teachers and practising pediatricians.

With every edition, the book has grown in size, stature and excellence. Now, it stands divided into five major parts:
Part 1 incorporates color atlas comprising some 250 instructive clinical photographs with legends in details.
Part 2 deals with detailed differential diagnosis of as many as 62 common presenting problems like abdominal pain, diarrhea, headache, deafness, jaundice, short stature, wheezing, etc.
Part 3 lists the differential diagnosis of selected clinical signs.
Part 4 focuses on selected laboratory findings.
Part 5 relates to selected radiologic signs.

Hopefully, the fifth edition of the *Differential Diagnosis in Pediatrics* with a continuing thrust on problem-solving approach shall turn out to be yet more useful for the target readership.

Prof EA Robert, a stalwart and a legend in the field of international pediatrics, has been gracious enough to write Foreword to the book and bless it profusely. My hats off to him!

My wife, Shamma and daughter, Dr Novy, contributed to the successful completion of the project in many a ways notwithstanding their other commitments.

My gratitudes are due to a large number of colleagues and readers, both within and outside India, for their suggestions, constructive criticism and patronization.

The credit for the production qualities of the book goes to Jaypee Brothers Medical Publishers (P) Ltd, and their dedicated staff.

Suraj Gupte

Preface to the First Edition

The vital importance of differential diagnosis, the backbone of deductive reasoning process and professional skill in clinical medicine, is widely recognized. Yet, for one or the other reason, the pediatric textbooks are not able to deal with this important aspect in a reasonably comprehensive way. A couple of books devoted exclusively to differential diagnosis are written by the European authors. These provide only very little information on problems relevant to the children of the developing countries and are, therefore, only of limited value in our settings.

The sustained and overwhelming demand from various quarters to fill this glaring "vacuum" has given birth to this new textbook, the first and the only one of its kind. I have designed it to provide a comprehensive up-to-date discussion on topics of day-to-day practical importance with special emphasis on problems encountered in the pediatric population in India and rest of the Third World.

As many as 48 topics ranging from *abdominal distention, abdominal pain or anemias* through *diarrhea, failure to thrive* or *hepatomegaly* to *splenomegaly, vomiting* or *wheezing,* are covered. Each topic organized alphabetically as a separate Section, starts off with an introductory note and sets out to highlight salient points in the history and physical examination having bearing on the differential diagnosis. Finally, I have discussed the various conditions that fall in the differential diagnosis, laying special stress on clinical features of particular diagnostic value. As and when indicated, a suitable reference is made to the investigative aspect.

All through this problem-oriented work, I have tried to be simple, straight-forward and lucid as also comprehensive

and yet-to-the point. Hopefully, the volume would fulfill its aims and objectives and provide stimulating and informative reading for clinical diagnosis to the readers.

The book is addressed primarily to the medical students (both undergraduates and postgraduates), pediatric residents, junior pediatricians, family doctors and general practitioners whose clientage includes infants and children.

The eminent pediatric teacher, Dr. N Sundaravalli, President, Indian Academy of Pediatrics, has done me great honour in writing the *Foreword* to this textbook at a time when she is extremely busy and preoccupied with, among the other things, affairs of the Academy. My salutation to her for recommending the volume so warmly!

The preparation of this textbook has needed cooperation of many people, including colleagues in and outside the country. I acknowledge my gratitudes to each one of them.

I record my sincere gratitudes to my parents and other family folks for providing generous help and encouragement while I was working on the manuscript. My wife, Shamma, daughter, Novy, and son, Manu, were gracious enough to make available to me the “time” that indeed needed to be spent with them. Their forbearance and understanding have contributed considerably to the entire endeavour taking the present solid shape.

Thanks are also due to the publishers, M/s Jaypee Brothers and their staff, for the excellent production qualities of the book.

Last, but in no way the least, any *feedback* for enhancing the practical utility of this textbook will be most welcome.

November 1986
"Gupte House"
60 Lower Gumat
Jammu 180001

Suraj Gupte MD

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- UNICEF for Figs 70 and 148
- Recent Advances in Pediatrics (Series) by Dr Suraj Gupte for Figs 63 and 64.
- The Short Textbook of Pediatrics, 11th edn, by Dr Suraj Gupte, for Fig 170
- Instructive Case Studies in Pediatrics, 5th edn, by Dr Suraj Gupte for Figs 11 and 20
- Dr EW Warner for Figs 157 and 189
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- Dr Novy Gupte for Fig 90
- Journal of Maternal and Child Health (Manila) for Figs 209-219
- Manu Gupte for discharging the responsibility of Executive Editor

Though all attempts have been made to acknowledge the source of information correctly here or in the text per se, error, if any, is unintentional and regretted.

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Differential Diagnosis of Common Pediatric Presentations

Chapter 1 Abdominal Distention

By definition, abdominal distention means enlargement or protuberance of abdomen out of proportion to the body size as a result of:

- Reduced tone of abdominal wall musculature
- Increased abdominal content, say fluid, gas or solid lump.

The term denotes a mere symptom that may not necessarily mean a disease. As for instance, many small infants swallow far-too-much of air when crying or during the course of a feed, particularly when sucking is quite prolonged for one or the other reason. A protuberant abdomen is a common finding in normal, healthy toddlers.

Ascites, i.e. fluid in the peritoneal cavity, tends to distend the abdomen both in flanks and anteriorly, provided that it is significantly large in quantity. In addition to fluid in the gut (usually from obstruction or imbalance between absorption and secretion), there is some accompanying gas as well (usually from swallowed air or action of endogenous bacteria or other flora). Audible gurgling noises may also be present.

Abdominal distention from gas in peritoneal cavity (pneumoperitoneum) which may be accompanied by a tympanic percussion note (yes, even on top of a solid organ like liver) points to a perforation of a viscera. Mobile, nontender fecal lumps, i.e. fecoliths, indicate severe constipation.

When confronting a child with abdominal distention, ask the respondent about the general health of the child. Has he been doing well, or not really been thriving satisfactorily? Is there history of chronic/recurrent diarrhea and/or passage of worms in stools? Does he has feeding problem? Any history of colic? Does he often

remain constipated? Any suggestion of swelling over face and legs? Is the mother aware of any lump within the abdomen? Any suggestion of emotional deprivation? Any drug intake?

Physical examination should aim at delineating if abdominal distention appears to be the result of poor tone of the abdominal wall musculature, or from gas, fluid or solid.

Abdominal Distention in the Newborn

The causes at this age include intestinal obstruction, rupture of stomach or some other member of alimentary tract, biliary, or urinary tract, tracheoesophageal fistula, congenital megacolon, septicemia, peritonitis or necrotizing enterocolitis, congenital nephrotic syndrome, tumors and cysts, congenital heart disease, urethral obstruction, gray baby syndrome, etc.

Abdominal Distention in Infancy and Childhood

Aerophagy, though decidedly common in infancy, may sometimes occur in older children as well and cause abdominal distention.

Obesity is uncommon in developing countries but needs to be borne in mind in the differential diagnosis of abdominal distention. *Flabby abdominal muscles*, are a common cause of abdominal distention, e.g. protein-energy malnutrition (both primary and secondary as in malabsorption syndrome), rickets (Fig. 1.1) hypothyroidism, Down's syndrome, floppy baby syndrome, cerebral palsy, etc. *Dehydration* with or without electrolyte imbalance, as in acute gastroenteritis, is an important cause of abdominal distention. *Ascites* as a cause of abdominal distention may occur in disorders involving the cardiovascular system (congestive cardiac failure) pericardium (constrictive pericarditis), kidneys (acute glomerulonephritis, nephrotic syndrome), liver (Indian childhood cirrhosis,

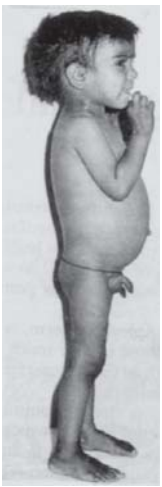

Fig. 1.1: Abdominal distention in a 4-year-old with growth retardation and vitamin D deficiency rickets. The primary diagnosis in this child was celiac disease.

portal hypertension), pancreas (chronic pancreatitis), inferior vena cava (thrombosis), lymphatics (tuberculosis, Hodgkin lymphoma) as also in hypoproteinemic states like nephrotic syndrome, protein-losing enteropathy, gross protein-energy malnutrition (kwashiorkor type), cystic fibrosis and malabsorption states (celiac disease).

Remember, ascitic fluid is generally a transudate with a low protein concentration resulting from low plasma colloid pressure (in hypoalbuminemia), from high portal-venous pressure or from both. Usually, development of ascites accompanies significant fall in serum albumin. Additional factors contributing to it include fluid leak from lymphatics and visceral peritoneal capillaries. Furthermore, as the ascetic fluid collects, sodium excretion in urine greatly falls. Thus, additional dietary sodium goes straight to the peritoneal cavity.

Infrequently, when ascitic fluid is an exudate, i.e. with high protein concentration, an inflammatory or malignant process must be suspected.

Drugs such as diphenoxylate HCl, loperamide and indomethacin are known to cause abdominal distention in some subjects.

Remaining causes include paralytic ileus, intestinal obstruction, perforation, mesenteric cyst, peritonitis, liver cysts and tumors, hydronephrosis, polycystic kidney, renal vein thrombosis, nephroblastoma (Wilms tumor), neuroblastoma, adrenal hemorrhage, anterior meningocele, pancreatic cyst, leukemia, tyrosinosis, Gaucher disease, porphyria, *H. pylori* infection, etc.

FURTHER READING

1. Wyllie. Major symptoms and signs of digestive tract disorders. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF (Eds): *Nelson Textbook of Pediatrics*, 18th edn. Philadelphia: Saunders 2008:1522-1528.
2. Green M. *Pediatric Diagnosis*, 6th edn. Philadelphia: Saunders 1998.

Chapter 2 Abdominal Pain

Abdominal pain may be acute or recurrent. The latter is encountered more frequently in pediatric practice. Mind you, acute abdominal pain does not imply that the pain has got to be continuous or persistent in all instances. As a matter of fact, it is characterized by pain-free gaps in most of the cases.

According to John Apley, the term, *recurrent abdominal pain*, should be restricted to 3 or more attacks of abdominal pain severe enough to cause interference in the routine over a period of at least 3 months.

In order to appreciate that abdominal pain may well be related to gastrointestinal motility which is under influence of autonomic nervous system, it is important to take a recourse to the gut-brain interaction (Fig. 2.1).

A meticulous history, though often it is second hand, is mandatory. Since when has the child been suffering from pain? Is it continuous or shows periods of relief in between the episodes of pain? Has there been previous attacks of abdominal pain over the months/years? Get details about the episodes/attacks.

What is the actual site of pain? Is it all over the abdomen or is restricted to paraumbilical area, epigastrium, etc.? Or, does it show change in site from time to time? Lack of localization rather goes against the organic cause. Likewise, closer the pain occurs to umbilicus, less is the chance of organic disease.

What is the nature of pain? Is it stabbing, colicky or dull? What is its behavior like? Is it getting worse or appears to be settling down?

It is important to know how pain started. Was there any preceding illness? Are there any associated symptoms like

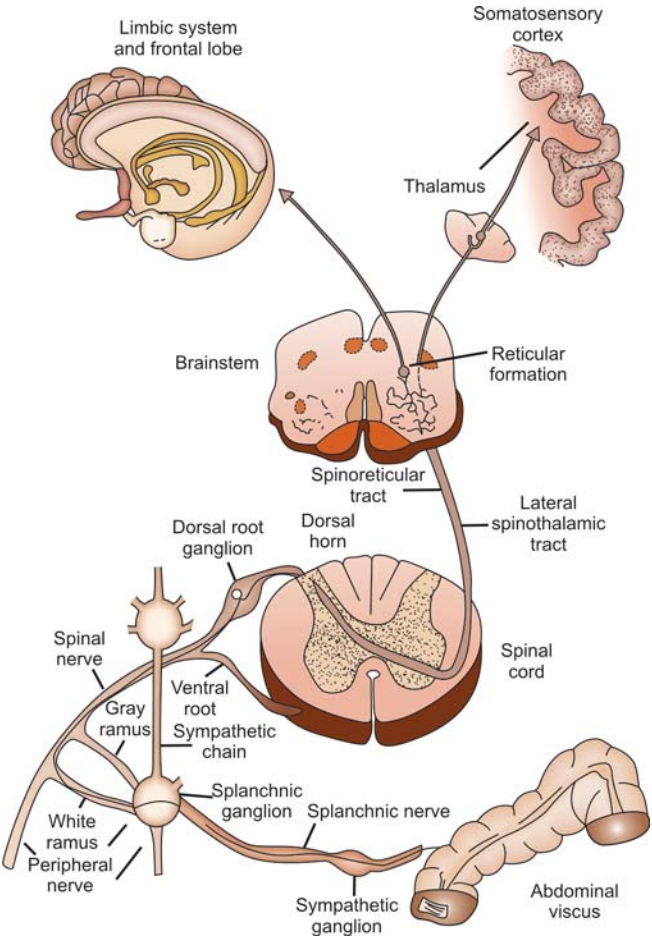

Fig. 2.1: Gut-brain intersection (Reproduced from Tomar BS: Recurrent abdominal pain. In: Gupte S (Ed): *Recent Advances in Pediatrics (Special Vol 6: Gastroenterology, Hepatology and Nutrition)*, New Delhi: Jaypee, 2000: 1-11).

headache, vomiting, diarrhea, fever, passage of worms in stools, portwine color of urine or dysuria?

Don't ever forget to ask, especially in the case of an infant, how he is being fed.

It is vital to obtain psychosocial history. How is the child doing in school and is he genuinely interested in going to school? Do rest of the family members have abdominal pain? Are the parents highly stung with tense personalities?

While examining the child with abdominal pain, remember to check the whole child, not just the abdomen. Quite a few cases of abdominal pain have this problem secondary to an extra-abdominal ailment (Table 2.1).

ACUTE ABDOMINAL PAIN

Table 2.2 provides the general rules/guidelines for localization of abdominal pain.

Table 2.3 provides the list of clinical differences among three major types of recurrent abdominal pain, namely functional, organic and dysfunctional.

Acute Appendicitis

This is the most common surgical cause of acute abdominal pain in infants and children. To begin with, pain is crampy and over

Table 2.1: Nondigestive tract causes of abdominal pain

- Pneumonia
- Endocarditis
- CAN
- School phobia
- Abdominal migraine
- Sickle-cell crisis
- SLE
- Porphyria
- Pelvic osteomyelitis
- Pelvic inflammatory disease (PID)
- Vertebral disc inflammation
- Angioedema
- Familial Mediterranean fever
- Drugs: NSAIDs like ibuprofen, mefanemic acid

Table 2.2: General rules/guidelines for localization of abdominal pain*

Embryologic origin	*Adult structure*	*Spinal segments*	*Clinical pain location*
Foregut	Distal esophagus, stomach, proximal duodenum, liver, biliary tree, pancreas	T5-T6 to T8-T9	Between xiphoid and umbilicus
Midgut	Small intestine, appendix, ascending colon, proximal two-thirds of transverse colon	T8-T11 to	Periumbilical
Hindgut	Distal one-third of transverse colon, descending colon, rectosigmoid	T11-L1	Between umbilicus and pubis

** Adapted from Gupta V: Recurrent abdominal pain. In: Gupte S (Ed) Recent Advances in Pediatrics (Special Vol 2: Tropical Pediatrics), New Delhi: Jaypee, 1998: 193-217.*

the periumbilical area. Later, it comes to be located over the right iliac fossa in case the organ is in the typical position. It may be felt in the hypogastrium or within the pelvis, if the position is pelvic, and in the loin if it is retrocolic. What is noteworthy is that pain is only rarely severe. Along with complaint of pain, there is severe tenderness over the appendix, pyrexia and tachycardia. Vomiting follows shortly. The child becomes anorexic. The only indication of acute appendicitis in infancy may be general irritability and inclination to lie quietly with hips flexed.

An inflamed appendix may cause diarrhea by irritation of the adjacent colon, urinary frequency and urgency by irritation of the bladder, and lumbar lordosis with some-what flexed hip by right psoas muscle spasm.

Remember, sudden relief in pain in a child with acute appendicitis may point to perforation.

Radiological visualization of fecolith in the appendix supports the diagnosis of appendicitis.

Acute Peritonitis

Acute primary peritonitis, a bacterial infection of the peritoneal cavity without demonstrable intra-abdominal cause, is characterized by fever, abdominal pain, vomiting and prostration. Abdomen is distended and shows diffuse tenderness with doughy resistance.

Table 2.3: Clinical differences among functional, organic and dysfunctional recurrent abdominal pain

Factors contributing symptom production	*Examples to*	*Diagnostic strategy*	*Therapeutic strategy*
Functional	School phobia Complaint modeling	Search for understanding of pain experience: Meaning of symptom to patient (significance)	Counseling (e.g., anticipatory guidance concerning developmental changes) Psychotherapy
	Loss of significant person	How symptom dealt with by patient, family, school	± Environmental manipulation
	Secondary gain	Affective meaning of pain experience (pleasant or unpleasant)	
Organic	Urinary tract infection Pyelonephritis Hydronephrosis	Search for cause classic signs and symptoms of organ disease	Specific treatment indicated by diagnosis or
	Hiatal hernia	Organic related questions	Surveillance for organ disease
	Lead intoxication	Screening for occult organ disease	Parental instruction reintercurrent organ disease
	Inflammatory disease of intestine	Staged, selective investigation	
Dysfunctional	Chronic stool retention (common)	Search for predispositions Constitutional factors (e.g., lactose deficiency)	Environmental manipulation (e.g., lactose free diet, contact with school health personnel)
	Lactose intolerance	Environmental factors (e.g., high milk intake)	Reassurance based on positive knowledge of known predispositions
	Generalized autonomic imbalance (± anxiety)	Interaction between 1 and 2	± Counseling
	Intestinal gas syndromes	Specific tests (e.g., abdominal radiograph, lactose tolerance test)	
	Heightened awareness of normal motitity	Patient as convestigator	
	Menses Mittleschmerz	Diary of associated events	

• Adapted from Gupta V: Recurrent abdominal pain. In: Gupte S (Ed): *Recent Advances in Pediatrics (Special Vol 2: Tropical Pediatrics)*, New Delhi: Jaypee, 1998:193-217.

Rebound tenderness and rigidity together with sluggish or absent bowel sounds establish the diagnosis clinically. Leukocytosis with 90% polymorphonuclear response is noteworthy.

Acute secondary peritonitis is usually due to entry of enteric bacteria into the peritoneal cavity from an inflamed appendix, intussusception, volvulus, rupture of Meckel's diverticulum, incarcerated hernia, peptic ulcer, ulcerative colitis, pseudo-membranous enterocolitis, meconium ileus, necrotizing enterocolitis, etc. Diffuse abdominal pain, fever, nausea, and vomiting are the usual presenting complaints. The physical findings include rebound tenderness, abdominal wall rigidity, sluggish or absent bowel sounds, and shock. Eventually, the child may develop progressive toxemia. Leukocytosis with predominance of polymorphonuclear cells is characteristic.

Mesenteric Lymphadenitis

This condition, in which there is swelling and inflammation of the mesenteric lymph glands in the ileocecal region in particular, may be clinically indistinguishable from acute appendicitis. Among the causative agents rank viruses, *Yersinia enterocolitica, E. coli, Salmonella* and *Shigella*.

The patient is usually a child above 3 years of age. Following an upper respiratory catarrh, he develops abdominal pain (periumbilical or in the right iliac fossa), nausea, vomiting, diarrhea or constipation (usually former) and fever. The pain is intermittent. The remissions last a few hours. During remission, the child is comfortable.

The following points may help in differential diagnosis from appendicitis.

1. Shifting of the point of maximum tenderness on turning the child on his side favors mesenteric adenitis.
2. Temperature tends to be higher in mesenteric adenitis than in appendicitis.
3. Tenderness is felt nearer the umbilicus and is less well localized in mesenteric adenitis than in appendicitis.
4. Muscle guarding/rigidity over the right iliac fossa in mesen-teric adenitis is not true but only voluntary.

5. In a proportion of cases of mesenteric adenitis, it may be possible to palpate the enlarged glands.
6. Leukocytosis is infrequent in mesenteric adenitis.

In doubtful instances, one may have to resort to laparotomy for establishing the diagnosis.

Finally, remember that appendicitis and mesenteric lym-phadenitis may well-coexist.

Acute Pancreatitis

Accompanying mild to severe abdominal pain are fever, vomiting, and abdominal tenderness. In advanced cases, paralytic ileus, shock, jaundice, blue discoloration of umbilicus and flanks, disseminated intravascular coagulopathy (DIC), renal failure and disturbances of potassium and calcium metabolism may complicate the picture.

In suspected cases, diagnosis needs to be established by demonstrating raised serum amylase. Plain X-ray abdomen shows ileus. Barium meal reveals duodenal displacement.

Remember that, though acute pancreatitis may result from several causes, including viral infection, trauma, drugs (corticosteroids, azathioprine, thiazides), and malnutrition, its most common cause in pediatric practice remains mumps. Manifestations of acute pancreatitis follow 3 or 4 days after the swelling of parotid gland(s).

Intussusception

This condition, characterized by telescoping of one of the portions of intestine into a more distal portion resulting in necrosis of the involved segment, is the most frequent cause of acute abdominal pain and intestinal obstruction during the first 2 years of life. *Clinical features* include episodic pain, vomiting and rectal passage of bloody mucus (current-jelly stools). Fever and prostration are usually present sooner or later. Abdomen is tender and distended. A sausage-shaped mass may be palpable in the upper abdomen in early stages. Rectal examination may show a cervix-like mass and blood on the examining finger. *Plain X-ray* abdomen may reveal absence of bowel gas in the right lower quadrant and dilated loops of small bowel.

Barium enema may reveal the intussusception as an inverted cap and an obstruction to the progression of barium. In the area of intussusception, there may be a ceiling-spring appearance to the column of barium. *Conservative hydrostatic reduction* gives good results in an overwhelming majority of the patients. It should be avoided in the presence of strangulation, perforation, or severe toxicity.

Surgical reduction may become necessary in some cases.

Acute Gastritis

In acute gastritis, regardless of origin, epigastric pain, tenderness and sensation of pressure and fullness, especially intensifying after food consumption, occur. Nausea, vomiting, belching and lack of appetite are other symptoms.

Viral Hepatitis

Nonspecific pain, localized in the right upper quadrant, may occur in some children at the onset of viral hepatitis. Accompanying features include anorexia, jaundice, tender hepatomegaly, and fatty food intolerance. If jaundice is yet to make its appearance but diagnosis of hepatitis is suspected, you must test urine for bile salts and pigments followed by other liver function test, if necessary.

Liver Abscess

Besides pain in the right hypochondrium (often referred to the right shoulder), the patient is febrile. The liver is enlarged and tender.

Screening shows raised and immobile diaphragm. Demonstration of E. histolytica in stool and aspiration of characteristic anchovy* sauce (chocolate colored) pus from liver swelling establishes the diagnosis of amebic liver abscess.

Subphrenic Abscess

Subphrenic abscess of whatsoever origin (usually it is bursting of a liver abscess, appendicitis, colitis) causes pain

* Small fish for the herring family having a strong flavor, it is used for sauce, paste, etc.

tenderness in the right or left hypochondrium with radiation to the corresponding shoulder. The subject is toxic. Screening reveals a raised and immobile diaphragm with gas under it. Aspiration of pus confirms the diagnosis.

Cholecystitis

Abdominal pain may rarely be a manifestation of cholecystitis in children. Tenderness and pain may be in the right upper abdomen, right lower abdomen, periumbilical area, or entire abdomen. Abdominal distention, vomiting, fever, anorexia, and slight icterus may also be present.

Pyelonephritis

Besides nonspecific pain in the loins (flanks) or suprapubic region, urinary tract infection may cause high fever (often accompanied by chills) urinary frequency, dysuria, vomiting anorexia and irritability. Demonstration of pyuria on microscopic examination establishes the diagnosis.

Acute Glomerulonephritis

The onset of acute glomerulonephritis may be heralded by flank or midline abdominal pain. Associated manifestations include periorbital edema, dark-colored urine, oliguria, low-grade fever and hypertension. There is preceding history of pharyngitis or impetigo. Urine microscopy shows hematuria and red cell and granular casts.

Anaphylactoid Purpura

Also called Henoch-Schönlein purpura, the disorder occurs most frequently about 5 to 6 years of age. Abdominal pain occurs in the Henoch type. Associated features include urticaria, petechiae over extensor surface of the limbs and around buttocks, bleeding from gut and nephritis. Hess capillary test, bleeding time, clotting time and platelet count are all normal.

Porphyria

In this disorder, colicky abdominal pain is precipitated on administering a barbiturate or sulfa drug. Most frequent site of abdominal pain is epigastrium or iliac fossa. Diffuse tenderness

of abdomen is present. Vomiting, fever and constipation usually accompany the abdominal pain. Leukocytosis is often present. Hoesch's test for PBG is positive.

Extra-abdominal Causes

Lower lobe pneumonia and pleurisy may cause referred upper abdominal pain synchronous with respiration.

Pleurodynia (Bornholm's disease, epidemic myalgia, devil's grip), a group B Coxsackie virus infection, may cause severe colicky abdominal pain. History of illness in other family members, especially during summer or fall, helps in arriving at this diagnosis. *Acute tonsillitis,* or other respiratory infections may cause abdominal pain.

Hiatal hernia may lead to reflux esophagitis and pain in the area of xiphoid process.

Severe coughing, vomiting and diarrhea may strain the abdominal muscles and cause pain.

Drugs and Heavy Metals

These include tetracyclines, erythromycin, lincomycin, cephalosporins, ethionamide, PAS, rifampicin, trimethoprim, vincristine, azathioprine, corticosteroids, niclosamide, dichloro-phen, amitryptaline, carbamazepine, chlordiazepoxide, ergotamine gentian violet, iodides, iron, nystatin, diphenyl hydantoin, piperazine, primidone, troxidone and lead.

Recurrent Abdominal Pain (RAP)

Colic

This is perhaps the most common cause of recurrent abdominal pain in infancy. The attacks come in paroxysms and are accompanied by severe crying.

Aerophagy or *excessive* Wind in the gastrointestinal tract, due to prolonged sucking, more so on an empty breast, far-too-narrow a hole in the feeding bottle teat, or inadequate burping, constitutes an important cause of abdominal pain.

Three-months colic, also called *evening colic*, is characterized by paroxysms of abdominal pain (mild to severe) lasting a few minutes at a time and occurring usually in the evening or late in the

afternoon. During the paroxysm, the face is often flushed, or there is circum oral pallor. The legs are drawn up over abdomen and the feet are cold and the hands clenched. The abdomen is tense and distended. The infant cries incessantly. The attack dies down only when the infant is exhausted or passes flatus or stools. This is followed by a quiet period in which he may have a nap only to be awakened by another paroxysm.

The observation that the paroxysms have characteristic rhythmic timing and one can hear loud borborygmi during their course strongly suggests that the condition has intestinal origin. Since the colic occurs late in the afternoon or in the evening, it has been suggested that events in the household routine, leading to excitement, anxiety, fear or anger, may have something to do with the occurrence of 3-months colic.

Cow's milk allergy may be responsible for colic in a small proportion of infants. Vomiting, diarrhea (usually watery), skin rash (infantile eczema or urticaria), rhinitis, otitis media, chronic cough with wheeze (just as in bronchial asthma), anemia and failure to thrive are the other accompanying manifestations. Smear from rectal mucus shows eosinophils. Withdrawal of cow's milk is followed by disappearance of the manifestations. Its reintroduction leads to reappearance of them within 48 hours.

Intestinal Worm Infestation

Intestinal infestation with *L. giardia, E. histolytica,* round-worm, hook-worm, *Strongyloides stercoralis, Trichuris trichiura*, or tapeworms constitutes by far the most frequent cause of recurrent abdominal pain in later infancy and childhood. Accompanying manifestations include change in bowel habit, change in appetite, failure to gain weight and even loss of weight. Each and every child with recurrent abdominal pain must have at least three (preferably five) meticulous stool check-ups on successive days to exclude worm infestation.

Helicobacter pylori Infection

That *H. pylori* may be responsible for recurrent abdominal pain in a proportion of children has been highlighted only recently. It appears that the spiral shaped gram-negative bacteria with

unipolar flagella, causes RAP through its remarkable ability to cause chronic gastric inflammation, i.e. chronic gastritis, and duodenal ulcer disease.

Diagnosis of RAP secondary to H. pylori infection can be confirmed by non-invasive investigations like urea breath test and serology. Nonetheless, the most reliable test is flexible gastrointestinal endoscopy to obtain biopsy of the gastric mucosa for histopathology, culture or rapid urease test.

H. pylori should particularly be suspected in cases of RAP from underprivileged communities with clustering in families and institutions for mentally retarded and orphanages.

Psychogenic Pain Abdomen

In a considerable proportion of children with recurrent abdominal pain, no organic cause may be detected despite painstaking investigations.

It has been argued that in some of these cases, abdominal pain may be simply a sort of *attention-seeking device*. The child senses parents' much-too-much anxiety over his tummy pain. He knows that his raising an alarm would bring the whole family around him, everybody wanting to do one or the other thing for him. This gives him immense joy and he wants to have more of it, again and again. This is the background of recurrence of pain.

Children whose parents frequently complain of one or the other bodily pain may demonstrate their anxiety as well as sympathy by imitating and feeling the same pain as that of the parent. This so-called *imitation pain* occurs far more than what is indeed appreciated.

Recurrent abdominal pain may well be related to worries and tension. In the so-called *Monday morning pain*, the child who has had a nice holiday a day before simply does not want to make it to school as the Monday morning comes and complains of pain in the tummy. The reasons for wanting to avoid going to school may include unpleasant experience such as bullying, teasing and beating by a teacher and/or school mates.

Periodic syndrome refers to periodic occurrence of certain symptoms such as colicky abdominal pain, nausea and vomiting, headache (often of migrainous type), diarrhea or constipation, marked pallor

or flushing, fever and prostration present in any combination. Premonitory visual, auditory, sensory or mental symptoms may be present. What is remarkable is that in between the attacks the child is perfectly all right. Most of the subjects are emotional, highly strung, obsessional and perfectionists. Their parents' expectations are far too lofty. A quarrel in the family or school examination often precipitates the attack. There is, as a rule, no evidence of infection. In a small proportion, there may be evidence of epilepsy.

Abdominal Epilepsy

Abdominal epilepsy is characterized by recurrent but sudden attacks of abdominal pain, lasting a few minutes and followed by sleep. The diagnosis may be collaborated by an EEG and/or gratifying response to diphenyl hydantoin sodium (phenytoin) in full therapeutic doses.

Constipation

Excessive drying of feces, leading to impaction and partial intestinal obstruction, may be responsible for recurrent abdominal pain. The constipated child certainly experiences some pain on passing a hard stool.

Food Allergy and Lactose Intolerance

Cow's milk allergy has been blamed for infantile colic in some cases. It has been postulated that such an allergy may be responsible for recurrent abdominal pain in childhood as well. Similarly, it has been argued that allergy to some other foods may also cause abdominal pain.

Recently, considerable evidence has accumulated in favor of the hypothesis that many a cases of recurrent abdominal pain may be related to lactose intolerance. Even sucrose intolerance has been blamed for such a pain.

Crohn's Disease

In this chronic inflammatory disorder of unclear etiology, full thickness of segments of bowel wall, usually terminal ileum, is involved. The disease occurs only infrequently in childhood.

When it manifests with abdominal pain, the latter is crampy and exacerbated by eating but somewhat reduced after defection.

Among associated features rank chronic diarrhea (at times with bloody mucopurulent stools), malnutrition, palpable abdominal masses, perianal lesions, aphthous stomatitis, polyarthritis, clubbing and erythema nodosum.

Diagnosis is confirmed by sigmoidoscopy, rectal biopsy, endoscopy, and radiologically, by upper and lower gastrointestinal barium studies.

Ulcerative Colitis

This is a chronic diffuse inflammatory and ulcerative disease involving mainly the mucosa and submucosa of colon and rectum. As with Crohn's disease, etiology is not yet known. The incidence is very low in childhood, particularly in the first year of life.

Abdominal pain in this disorder is in the form of intermittent mild crampy bouts related to the bowel movements. Other manifestations include bloody diarrhea, anorexia, anemia, weight loss, arthralgia, clubbing and growth retardation.

Diagnosis is confirmed by rectal examination, sigmoidoscopy, endoscopy and barium enema.

Sickle Cell Anemia

In this inherited abnormality of hemoglobin 'S' limited to colored population, the patient may suffer from repeated crises, lasting upto a week. During the crisis, the child may have severe abdominal pain, backache or joint pain with vomiting, anorexia and fever. Accompanying features of the disease include pallor, intermittent jaundice and hepatosplenomegaly (in older children, spleen is shrunk due to repeated infarctions, the so-called "autosplenectomy").

Diagnosis is corraborated by demonstration of sickle-shaped red cells in the blood film, reticulocytosis, increased resistance of red cells to osmotic lysis and an abnormal electrophoretic pattern showing dominantly hemoglobin S.

Urinary Tract Infection (UTI)

Despite claims that UTI may cause RAP, it appears that such a situation occurs only when UTI accompanies obstructive uropathy (usually pelviureteric).

Remaining Causes of Recurrent Abdominal Pain

Peptic ulcer, hydronephrosis, lead poisoning, periodic peritonitis, hereditary angioneurotic edema, chronic relapsing pancreatitis, porphyria, etc.

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Chapter 3 Ambiguous Genitalia (Intersex)

The term, a*mbiguous genitalia,* denotes discrepancy between the actual sex and the bizarre external genitalia (Box 3.1). The latter are characteristic of neither a male nor a female. The entity is also called *hermaphroditism* (*herm* referring to "good" and *aphroditism* to "goddess").

Ambiguity results from excessive virilization of a female (female hermaphroditism) or defect in masculinization of a male (male hermaphroditism).

Hermaphroditism must be suspected in any male child with a small penis, hypospadias and undescended testes. Any girl with a doubtful mass in the labia majora or groin needs to be examined to a certain if the mass could be testes.

The history should trace the presence of intersex siblings or such other close relatives and the mode of inheritance. A history of consanguinity is of vital importance. Was the mother on hormonal therapy during the pregnancy? What was the time sequence of appearance of secondary sex characters in the child with ambiguous sex problem?

The physical examination should confirm the presence or absence of testes (in the scrotum or inguinal canal), the degree of labioscrotal fusion, size of penis or clitoris, hypospadias, and uterus through rectal examination. Search should also be made for renal, anal and other congenital anomalies.

Presence of two labioscrotal masses confirms the existence of two testes. Possibility of female pseudohermaphroditism is thereby immediately rule out.

Investigations include buccal smear to know the real gonadal sex (negative in male hermaphroditism and positive in true

Box 3.1: Broad classification of ambiguous genitalia (intersex)

46,XX-Intersex (46,XX–Virilized)
Androgen Exposure
Fetal source —21-hydroxylase deficiency, 11 beta-hydroxylase deficiency
Maternal source—Virilizing ovarian or adrenal tumor, androgenic drugs
Ambiguous source—In association with genitourinary or gastrointestinal malformations

46,XYIntersex (46,XY – Undervirilized)
Testicular Differentiation Defects
WAGR syndrome
Denyas-Drash syndrome

Testicular Hormone Deficiency
Persistent mullerian duct syndrome
Receptor defects for anti-mullerian hormone
Leydig cell aplasia

Androgen Action Defect
Androgen receptor defects
Adrogen insensitivity syndrome, both partial and complete
Smith-Lemi-Opitz syndrome
5 alpha-reductase II mutations
True Gonodal Intersex
XX, XY, XX/XY chimeras

hermaphroditism and female pseudohermaphroditism), 17-ketosteroids and pregnantriol in urine, serum electrolytes, chromosomal studies and X-ray studies. Gonadal biopsy is a must when gonads are in the abdomen and in certain other vague cases. In many instances, laparotomy may be warranted to be certain of the diagnosis.

True Hermaphroditism

This condition is quite rare. A sheer over 500 cases are on record. In this state, both ovarian and testicular tissues are present either in the same or in the opposite gonads. The external genitalia are usually ambiguous. The pheno-type may, however, be male or female. Ovotestis is the most frequently seen gonad in true

hermaphroditism. The testicular tissue in such an ovotestis is, however, defective. As a result, secretion of androgens and antimullerian hormone is grossly inadequate. A true hermaphrodite is best brought up as a female with selective removal of testicular tissue.

Male Pseudohermaphroditism

This condition is generally characterized by male phenotype. The penis is small with hypospadias (Fig. 3.1). Testes are undescended. Labioscrotal folds are fused. A casual look gives an impression of female genitalia. The genotype is XY. Incomplete virilization of the external genitalia is the main problem. Its causes include defects intesticular differentiation (Camptomelic syndrome), pure gonadal dysgenesis (Swear syndrome), gonadal agenesis (embryonic testicular regression syndrome), and defects in

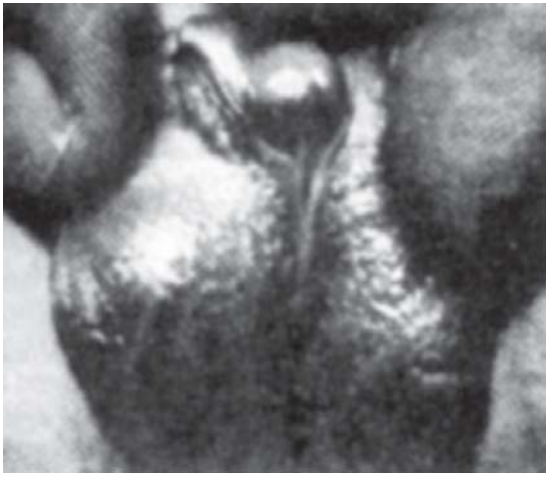

Fig. 3.1: *Male pseudohermaphroditism* Note that the external genitalia are confusing. Whether the child has a small penis with hypospadias or it is indeed a virilized clitoris is apparently not clear. What indeed clinched the diagnosis in this child was palpability of two testes in the so-called "labioscrotal" sac. Gonadal biopsy showed purely testicular tissue that was dysgenetic.

testicular hormones (uterine hernia syndrome), and defects in androgen action (5 alpha-reductase deficiency, testicular feminization syndrome, Reifenstein syndrome). In l/3rd male hermaphrodites, no cause is determined.

Female Pseudohermaphroditism

This is the most common type of hermaphroditism. It is characterized by masculinization of the genetically female child. Ovaries are present. Clitoris is large enough and looks like penis. Labia majora is large and may be fused, giving the appearance of a scrotal sac. Its causes include excessive intake of androgens by the mother, congenital adrenal hyperplasia and maternal virilizing tumors.

Congenital adrenal hyperplasia is by and large the most common cause of female hermaphroditism. Masculinization may be to the extent of development of a false penile urethra. The child looks a male with cryptorchidism. Degree of virilization is greater in salt-losers than non-salt-losers. It is highest with 21-hydroxylase and 11-hydroxylase defects.

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Chapter 4 Anemia

Anemia (Greek: an–not, haima–blood) is defined as a quantitative or qualitative deficiency of red cells or hemoglobin concentration in circulation. The term is, by no means, always synonymous with pallor. Many infants and children look pale though there is no anemia at all. The vice-versa too is true. Often in mild anemia, it is virtually impossible to be sure about the diagnosis unless and until hemoglobin level is ascertained.

The history should contribute to reaching the probable cause of anemia. Specific questioning should be done about loss of blood, dietary consumption, drug intake and infection. What is the roundabout length of time the child has been suffering from anemia? Is he tolerating it well? Or, does he get fatigued easily? Of late, is there history of dyspnea and development of edema over feet and legs? Any suggestion of worm infestation?

In the physical examination, one should specifically look for jaundice, petechiae, ecchymosis, hepatosplenomegaly, injuries, etc.

Table 4.1A presents clinical grading of anemia. WHO grading based on hemoglobin level is given in Table 4.1B.

Box 4.1 presents an excellent clinical approach to differential diagnosis of anemia in a child.

Nutritional Anemia

Iron deficiency is the most common etiologic factor in nutritional anemias. Firstly it is especially common in infancy because both breast and cow's milk are incapable of meeting infant's requirements of iron. Secondly, poor iron stores in premature babies predispose to further deficiency so that, at about third month (the time of maximal physiologic reduction of hemoglobin), there

Table 4.1A: Clinical grading of anemia

Grade	*Clinical parameters*
Mild	Pallor of conjunctiva and/or mucus membrane
Moderate	Above plus pallor of skin
Severe	Above plus pallor of palmar creases

Table 4.1B: World Health Organization (WHO) grading of anemia

Hemoglobin range	*Grade*
10 g/dL - cutoff point for ages*	Mild
7-10 g/dL	Moderate
Below 7 g/dL	Severe

* Below 2 wk 13 g/dL, upto 6 month, 9.5 g/dL. 6 months-12 yrs 11 g/dL. above 12 yrs 12 g /dL.

Box 4.1: Clinical approach to differential diagnosis of anemia in a child

Is anemia associated with other hematologic abnormalities ? If yes, consider
Aplastic anemia
Leukemia
Other bone marrow replacement disorders

Is anemia associated with reticulocytosis ? If yes, consider
Bleeding disorder
Ongoing hemolysis

Is there associated hyperbilirubinemia or increased serum lactate dehydrogenase ? If yes, consider
Hemolytic anemia
In this situation, review the peripheral blood film (PBF) for
Spherocytes: Hereditary spherocytosis, autoimmune hemolytic anemia, Wilson's disease
Sickle cells: Sickle-cell anemia/disease, sickle-beta-thalassemia
Target cells:Hemoglobin SC disease
Hypochromic RBC, nucleated RBC: Homozygous beta-thalassemia, Hgb E-beta-thalassemia
Microangiopathy: Hemolytic uremic syndrome, thrombotic thrombocytopenia
Bite/blister cells: G-6-PD deficiency

Is anemia associated with a lower than appropriate reticulocyte response? if yes,
Assess RBC size
Microcytic RBC: Iron deficiency, thalassemia trait, hemoglobin E disorder, lead oisoning
Macrocytic RBC: Folic acid/vitamin B_{12} deficiency, inborn error of metabolism (if neutrophil hypersegmentation, i.e. megaloblastic change)
Diamond-Blackfan anemia, congenital dyserythropoietic anemia, Pearson syndrome (if no such change)
Normocytic RBC: Anemia of chronic conditions, anemia of renal disease (renal failure), transient erythroblastopenia of childhood, anemia associated with hypothyroidism.

may result marked iron-deficiency in case they are not given iron supplements. Twins commonly become iron deficient.

In older children, causes include inadequate intake malabsorption, infection, and chronic blood loss as in hook-worm infection and cow's milk protein allergy. Nutritional anemia, dominantly iron-deficiency, nearly always accompanies vitamin D deficiency rickets and scurvy (Table 4.2).

Low mental development index (MDI) and low infant behavior record (IBR) as manifested by unhappiness, lack of cooperation and short attention span are noteworthy features of iron-deficiency anemia.

Clinical features include progressive pallor, irritability, anorexia, tiredness, failure to thrive, pica and koilonychia. Diarrhea is often present. Occasionally, especially in severe anemia, hepatosple-nomegaly may be detected. A hemic murmur (soft systolic, having maximal intensity over the base and changing with patient's position) is commonly heard.

Most infants and children learn to adapt to nutritional anemia of prolonged duration. Some, however, end up with congestive cardiac failure, more so in the presence of an added stress.

Anemia from Blood Loss

In the newborn, causes of anemia include placental/umbilical cord bleeding, feto-fetal transfusion (bleeding of one twin into the other), hemorrhagic disease of the newborn, cephalhematoma, and subaponeurotic hemorrhage.

Table 4.2: Causes of iron-deficiency anemia

Inadequate iron stores at birth
- Grossly undernourished mother
- LBW/prematurity/twinning
- Perinatal bleeding
- Far-too-early ligation of umbilical cord

Inadequate iron supply
- Delayed introduction or semisolids and solids
- Massive intestinal parasitosis (e.g., giardiasis, ancylostomiasis)

Inadequate iron absorption
- Persistent/recurrent/chronic diarrhea
- Malabsorption state preponderance of dietary components that inhibit iron absorption
  (tea, coffee, legumes, spinach, cereals, egg yolk, phytates, etc.
- Poor intake of vitamin C

Heightened requirements
- LBW exhibiting catch up growth

Heightened tosses
- Blood loss (both occult and overt)
- Massive ancylostomiasis or trichuriasis
- Cow milk protein (CMP) allergy
- Cow milk (unheated) consumption of first year, especially in first 6 months of life
- Recurrent diarrhea.

Trauma, epistaxis, esophageal varices, hiatal hernia, hemangiomas, ulcerative colitis, polyps, Meckel's diverticulum, cow's milk allergy, hematuria, Henoch-Schönlein purpura, hemophilia and malignancy are other causes of anemia due to blood loss.

Hookworm infestation is an important cause of chronic anemia in tropical settings such as ours. Each adult worm is claimed to suck the host of little over 0.1 to 0.5 ml of blood daily. The dominant clinical features are progressive anemia, anorexia, pain abdomen and malnutrition. Pica is often present. Advanced cases may have gross anemia with hypoproteinemia. leading to edema and even anasarca. Diarrhea, alternating with constipation, may also be present. Some degree of malabsorption, as a result of histological

as well as functional damage to the small intestinal epithelium, occurs in many cases.

Many drugs are known to be potent cause of gastrointestinal bleeding. These include aspirin, chlortetracycline, acetazolamide, thiazides, indomethacin, methotrexate and antimetabolites. In recent years, aspirin, when given frequently, has emerged as an important cause of gastrointestinal bleeding and anemia. Besides causing gastrointestinal bleeding, it may lead to hypoprothrombi-nemia or thrombocytopenia.

Hemolytic Anemia

Hemolytic anemia is characterized by sustained reticulocytosis above 2% (indicative of increased bone marrow activity in response to shortened peripheral survival of red cell) together with continued problem in the hemoglobin level. Associated findings may include light rise in serum bilirubin (indirect) but frank jaundice usually does not occur unless, of course, hepatic function too is significantly impaired, abnormal peripheral smear and splenomegaly with some hepatomegaly. In chronic hemolytic process only. striking X-ray changes may be observed in skull, long bones, metacarpals and phalanges.

Hemolytic disease of the newborn must be seriously considered if the newborn manifests anemia and jaundice on the very first day of life. Hepatosplenomegaly is present. In Rh hemolytic disease, the foremost investigation is to demonstrate that the mother is Rh negative whereas the baby is Rh positive. Direct Coomb's test on infant's red cells is positive and anti-Rh titer of mother is high. Other investigations show high serum bilirubin (indirect), reticulocytosis, and anti-Rh agglutinins and hypoglycemia.

ABO hemolytic disease is generally mild, manifesting as anemia, jaundice and hepatosplenomegaly. Jaundice is frequently delayed until 48 to 72 hours after birth, in the case of ABO incompatibility, mother's blood group is O and infant's A or B. Mother, depending on infant's group, develops anti-A or anti-B antibodies in her blood.

Hereditary spherocytosis (congenital acholuric jaundice, congenital hemolytic anemia) is characterized by family history

of acholuric jaundice or unexplained anemia, onset of anemia and jaundice in neonatal period or infancy, splenomegaly usually becoming evident after infancy, and characteristic spherocytic cell (which is smaller than the normal red cell and lacks the central pallor of the biconcave disk) and reticulocytosis. Osmotic fragility and autohemolysis tests are of immense value in establishing the diagnosis.

Remember that acquired spherocytosis may be encountered in autoimmune hemolytic anemia, hemolytic disease of the newborn from Rh or ABO incompatibility, and thermal injury to red cells as in extensive burns.

Thalassemia major (Cooley anemia) is characterized by progressive severe anemia with grow splenomegaly noticed during the second six months of first year and typical hemolytic facies due to thickening of the bones of face and skull (Fig 4.1). Blood picture shows a microcytic hypo-chromic anemia (usually the hemoglobin level between 4 and 9 g/dl range), anisocytosis. poikilocytosis, moderate basophilic stippling, nucleated and fragmented red cells (target cells), large number of normoblasts

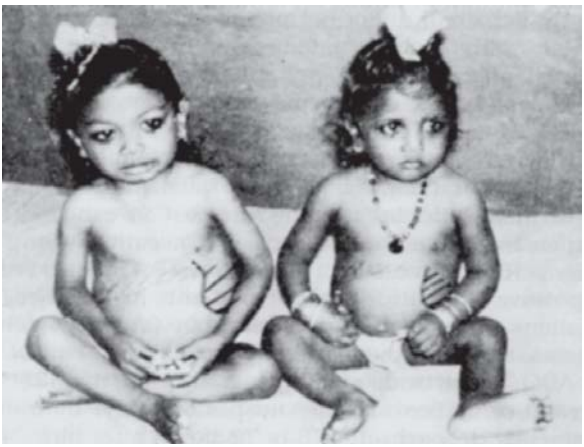

Fig. 4.1: Note the facial appearance and splenohepatomegaly in the two siblings suffering from chronic hemolytic anemia. Fetal hemoglobin in the child on the right was 60% and in that on the left 52%.

and striking reticulocytosis. Osmotic fragility test shows reduced fragility. Fetal hemoglobin usually exceeds 40%.

Radiologic findings include thinning of the cortex, widening of the medulla (due to marrow hyperplasia) and coarsening of trabeculations in the long bones, metacarpals and metatarsals. Skull X-ray shows the "hair-on-end" appearance due to vertical striations from widening of the diploic space and atrophy of the outer table (Fig. 4.2).

Sickle-cell anemia, is characterized by severe chronic hemolytic anemia, irreversible sickled cells in peripheral blood smear and a clinical course marked by episodes of pain (crises) on account of occlusion of small blood vessels by spontaneously sickled red cells. Spleen is significantly enlarged but usually shrinks in later childhood. Jaundice results from progressive impairment of liver function. Cerebral strokes, impaired renal function and gallstones together with greatly enhanced incidence of superadded infections, as severe as pneumococcal meningitis and septicemia, are the well-known features of patients with sickle cell anemia.

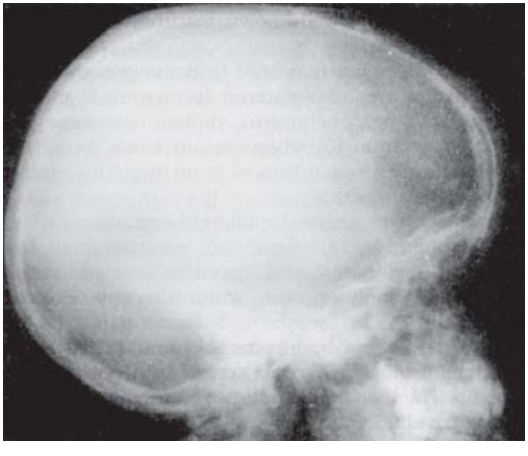

Fig. 4.2: X-ray of skull showing hair-on-end appearance (caused by vertical trabeculae) in thalassemia major. Also note that the diploic spaces are significantly widened. Such a roentgenographic picture may occasionally be seen in chronic iron-deficiency anemia (IDA).

G-6-PD deficiency may lead to hemolytic anemia when certain drugs are administered (primaquine, nitrofurantoin. furazolidine, phenacetin, diphenhydramine, sulfas, salicylates, vitamin K), when certain foods (broad beans) are eaten, and when infection (viral hepatitis, infections mononucleosis) occurs.

Drugs such as antimalarials, chloramphenicol, sulfas. cyclophosphamide, nitrofurantoin, penicillins, rifampicin, phenacetin, mefanamic acid, cephaloridine and vitamin K may cause hemolysis even when there is no G-6-PD deficiency.

Hemolytic uremic syndrome is characterized by hemolytic anemia, bloody diarrhea, renal failure and thrombocytopenia. The blood smear shows characteristic burr cells with bizarre shape.

Autoimmune hemolytic anemia result from production by the patient of abnormal antibodies directed against his own red cells. Direct Coombs' test is usually positive. The cause may be an underlying disease such as SLE, lymphoma or immunodeficiency, or drugs such as penicillin, cephalosporins, phenacetin, quindine and methyldopa. In around 20% instances, it is idiopathic.

In the acute transient variety, a respiratory infection precedes prostration, anemia, jaundice, fever, hemoglobinuria and splenomegaly. This variety occurs mostly in infants and young children and shows excellent response to corticosteroid therapy.

In the chronic variety, hemolysis goes on over prolonged period —months or a year. Response to corticosteroid therapy is variable.

Anemia from Inadequate Red Cell Production

This implies that bone marrow is unable to produce sufficient number of new red cells to replace those removed from circulation. Low reticulocyte count is the hallmark of this variety of anemia.

Congenital hypoplastic anemia may be of two types. The Fanconi's syndrome is characterized by presence of associated multiple congenital anomalies such as microcephaly, mental retardation, microphthalmia, squint, nystagmus, short stature, hypogonadism, defects of radius and thumb, brown pigmentation of skin, congenital heart disease, webbed neck and renal abnormalities. In congenital pure red cell anemia, called Blackfan-Diamond syndrome, profound anemia manifests by 2 to 6 months of age.

Associate congenital anomalies such as triphalangeal thumbs have been described in some cases. Without blood transfusions and or corticosteroid therapy, congestive cardiac failure and death are more or less a rule.

Acquired hypoplastic or a plastic anemia may result from viral, bacterial or parasitic infections, infiltration of marrow by malignant tissue as in leukemia. Niemann-Pick disease, Gaucher disease, osteoporosis (marble bone disease), irradiation, or chemicals and drugs (chloramphenicol, anti-metabolites, phenylbutazone, lead).

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Chapter 5 Ataxia

Ataxia (Greek: lack of order) means, lack of cooperation or coordination of separate muscles or groups or muscles in order to accomplish a definite act. The poorly coordinated drunken gait is, perhaps, the most common way in which ataxia manifests.

Enquiry should ascertain how it started. Was it preceded by a rash, ingestion of drugs, infectious illness or a neurologic disease involving sensorium and causing, among others, convulsions?

Physical examination should make it clear whether ataxia is cerebellar or sensory. In cerebellar ataxia, Romberg sign (failure to maintain standing attitude while standing on tip-toes and knees bent when eyes are closed) is usually negative whereas cerebellar signs like nystagmus, dysarthria, hypotonia and pendular jerks may be positive. The child's movements become slow, awkward and incomplete (adiadokinesia).

In sensory ataxia due to posterior column lesion, Romberg sign is positive and there may be other evidence of sensory loss.

Acute Cerebellar Ataxia

The condition usually occurs in 1 to 5 years age group, following a viral infection such as chickenpox, poliovirus type 1, influenza A and B, ECHO virus and coxsackie type B, or results from an autoimmune response to a variety of agents.

Onset of ataxia is always acute. In half of the cases, a nonspecific infection precedes it by about 3 weeks or so. The most dominant feature of the clinical picture is the severe ataxia, resulting in rapid deterioration of gait.

The disease is self-limiting, ataxia clearing in just a week or so in mild cases and in about 2 months in a large majority of the full-blown cases.

Drug Toxicity

Ataxia as a drug reaction may occur in case of piperazine, diphenylhydantoin, antihistaminics, chlordiazepoxide, diazepam, colistin, streptomycin, indomethacin, ethanol, vincristine and meprobamate. Solvent sniffing is now emerging as an important cause of ataxia amongst school children and adolescents even in our country.

Hypoglycemia

Ataxia resulting from hypoglycemia is accompanied by one or more of such symptoms as pallor, vertigo, diaphoresis, tachycardia, tachypnea, convulsions and coma.

Acute Labyrinthitis

Acute labyrinthitis after mumps is an important though rare cause of acute ataxia. In such cases, vertigo always coexists.

Encephalitis

Ataxia may occasionally be a manifestation of encephalitis. The accompanying manifestations include change in sensorium (varying from lethargy to coma), fever, vomiting, convulsions, bizarre behavior, altered speech, head-ache, irritability and feeding difficulty. An inflammatory reaction of meninges may produce some meningeal signs. Clinical picture shows rapid variation from hour-to-hour. CSF is essentially normal, except that it flows under high pressure.

Brain Tumors

Ataxia as a manifestation of brain tumors develops rather gradually. Accompanying manifestations may include vomiting headache, diplopia, personality changes, speech disturbances, irritability and decline in intellect. Papilledema and hydrocephalus are common findings.

Astrocytoma occurs in 3 to 8 years age group. It is characterized by unilateral cerebellar signs. Besides ataxia, the child may have nystagmus, hypotonia are flexia and tilting of the head to the side of lesion.

Medulloblastoma occurs in 3 to 5 years age group, mostly in males. Ataxia, usually, is severe.

Pontine gloima of brainstem occurs in 6 to 8 years age group. Besides ataxia, the child may demonstrate bilateral multiple cranial nerve involvement (usually 6th and 7th), pyramidal signs and absent or only minimal signs of raised intracranial pressure.

Friedreich Ataxia

This spinocerebellar degenerative disorder, usually manifesting in late childhood or adolescence, begins with a progressive gait defect. All too soon, incoordination of upper limbs follows. The classical triad of ataxia, positive Babinski's sign and absent ankle jerks is more or less pathognomonic.

The skeletal deformities encountered in this conditions include high arched foot (pes cavus), hammertoes, and scoliosis. CVS defects are cardiomegaly, arrhythmias and congestive cardiac failure.

Ataxia-Telangiectasia

This, another spinocerebellar degenerative disorder, manifesting in infancy, begins with delayed walking and ataxia. Later, other manifestations like progressive dysarthria, intention tremors, nystagmus and chorioathetosis appear. Involuntary eye movements are normal but control over voluntary movements is lost. Tendon reflexes are sluggish and may even be absent. Telangiectasia make appearance over bulbar conjunctiva and skin (ears, nasolabial folds, flexor creases of limbs) by 5 years of age. Variable immunologic deficiencies usually occur. By adolescence, the patient may develop dementia and malignancy.

Refsum's Syndrome

This inborn error of metabolism, manifesting usually in later childhood or adolescence, is characterized by progressive cerebellar ataxia, ichthyosis, retinitis pigmentosa, polyneuritis and deafness (Fig. 5.1).

Abetalipoproteinemia (Acanthocytosis, Bassen-Kornzweia syndrome)

This disorder is characterized by malabsorption (manifesting in infancy), slowly progressive ataxia (manifesting later in childhood), retinal degeneration (manifesting in adolescence) and red cells with multiple spiny projections.

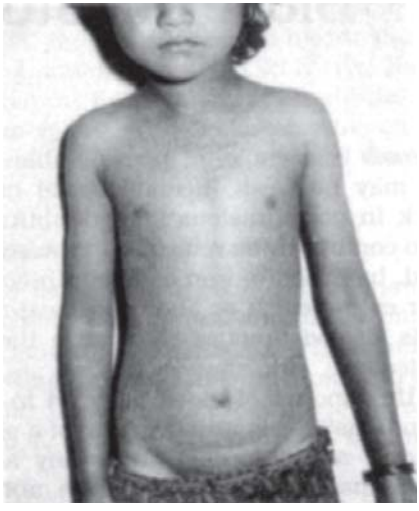

Fig. 5.1: *Refsum syndrome* Note ichthyosis in this girl with progressive ataxia (cerebellar). She also suffered from progressive deafness and polyneuritis. Fundoscopy showed bilateral retinitis pigmentosa.

Remaining Causes of Ataxia

Hypothyroidism, Hartnup disease, maple syrup urine disease, disseminated sclerosis, mumps, migraine, cerebral abscess, Guillain-Barré syndrome, cerebral palsy, hysteria, head injury, etc.

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Chapter 6 Blood in Stools

Blood in stools is a cause of considerable alarm to the parents. It may be fresh (hematochezia) or chemically-altered-black in color (melena*). In doubtful cases, it is important to confirm if the red color in the stools is indeed due to blood. Ingestion of iron or bismuth-containing preparations or eating earth or charcoal (pica) may simulate melena. It is a good practice to confirm the presence of blood chemically.

What is the amount of blood detected in stools? Is it mixed with mucus? Or, is it in the form of a simple coating or streaks over a well-formed stool. Any accompanying diarrhea, constipation, painful defecation, abdominal pain, vomiting, fever, epistaxis, or bleeding from other sites? Any history of worm infestation, pica, drugs or surgery' on tonsils?

Physical examination should determine, if the child is in shock due to excessive blood loss. Always look for evidence of portal hypertension, hemangioma, purpura, telangiectasia, intestinal obstruction and blood dyscrasias. Nasal passages should be carefully inspected for signs of epistaxis and anus and rectum for fissure, polyp and hemorrhoids. In case of acute abdomen, you must search for signs of abdominal trauma.

You must inspect not only the stools but also urine. Hematuria may well be the cause of blood staining of the napkin.

In case of evidence, favoring rectal polyp or colitis, it is advisable to do sigmoidoscopy.

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* Greek: melaina means black

Swallowed Maternal Blood

This is the most common cause of blood in stools in a newborn, particularly during the first 3 to 4 days of life. The blood is swallowed during delivery, or later while the baby sucks the nipple. It is usually red, intermingled in the meconium. The general condition of the baby appears fine.

To be sure if it indeed is maternal blood, you may filter the material and add one part of 0.25 N (1%) NaOH to five parts of supernatant fluid. In case of maternal blood, the color changes to yellow. If the color remains as such, it is fetal blood, pointing to the hemorrhagic disease of the newborn.

Hemorrhagic Disease of the Newborn

Blood in stools is accompanied by other manifestations like epistaxis, hematemesis and bleeding from umbilical cord and skin as also in the viscera. Prothrombin time is prolonged. Clotting time may also be prolonged in majority of the cases. The disease manifests on second or third day of life. Vitamin K deficiency appears to be the probable etiologic factor.

Necrotizing Enterocolitis

In this disorder, the baby (usually low birth weight, born before term) develops, besides bloody diarrhea, lethargy, vomiting, abdominal distention, hypothermia and apnea. The infant is extremely ill and may terminally go into cardiovascular collapse.

Predisposing factors include maternal fever, amnionitis, sepsis, respiratory distress syndrome (usually of mild type), umbilical artery catheterization in exchange transfusion, and oral feeding with high osmolar (hypertonic) stuff.

Diagnostic radiologic findings include air-fluid levels, dilated loops of gut, separation of loops of gut and linear streaks of intraluminal air, *pneumatosis intestinalis*.

Dysentery

In older infants and children, dysentery remains by far the most common cause of blood in stools.

The usual form results from *Shigella* infection. The accompanying tenesmus, toxemia, fever, abdominal pain and distention

are characteristic. Other bacilli causing similar but mild clinical picture include *Salmonella* and *E. coli*.

Intestinal infestation with *E. histolytica, L. giardia, H. nana, Strongyloides sterocoralis* and *T. trichiura* may manifest with dysentery. Bilharzia is a pre-eminent cause of bloody diarrhea in certain areas. Hookworm is an important cause of blood loss in stools (usually in melena) but not that of dysentery.

Gastritis

Gastritis (inflammation of gastric mucosa) may be responsible for blood in stools—fresh in young children and melena in older ones. Ryletube trauma and stress ulcer are well-known cause of gastrointestinal bleeding.

Polyp

Internal polyp, especially rectal polyp, usually causes moderate but painless bleeding. The diagnosis is by suspicion and should be lead to rectal examination, rectosigmoidoscopy and barium enema. The most common site is about 10 cm above the anus.

Intussusception

Rectal passage of bloody mucus is accompanied by episodic abdominal pain, vomiting, fever and prostration. Abdomen is tender and distended. A sausage-shaped lump may be palpable in the upper abdomen in early stages. Rectal examination may show a cervix like mass and blood on the examining finger.

Plain X-ray abdomen may show absence of bowel gas in the right lower quadrant and dilated loops of small bowel.

Barium enema may demonstrate the intussusception as an inverted cap and an obstruction to the progression of barium. In the area of intussusception, there may be a ceiling-spring appearance to the column of barium.

Conservative hydrostatic reduction gives good results in a large majority of the cases, provided that there is no evidence of strangulation, perforation or severe toxicity.

Meckel Diverticulum

In this condition, there is acute loss of large amount of blood (usually dark red) in stools. Abdominal pain, if present, is slight.

The patient, usually under 2 years of age, looks quite pale and may be in shock due to loss of lot of blood. Meckel diverticulum is frequently found in children with Turner syndrome. Diagnosis, highlighted by high sense of suspicion, can only be established by laparotomy.

Anal Fissure

If a child passes small amount of bright red blood that appears to form a sort of coating over the hard stools and the parents say that the child experiences painful defecation, you must seriously entertain the diagnosis of anal fissure. The condition may result either form hard stools or use of rectal thermometer. Diagnosis may be established one examination of the anus.

Blood Dyscrasias

Profuse blood loss in stools may occur in idiopathic thrombocytopenic purpura (ITP), anaphylactoid purpura (Henoch-Schönlein purpura), leukemias, hemolytic uremic syndrome and disseminated intravascular coagulopathy (DIC).

Remaining Causes of Blood in Stools

Cow's milk allergy, ulcerative colitis, Crohn disease, intestinal hemangiomas, hiatal hernia, esophageal reflux, esophageal varices, peptic ulcer, hypertrophic pyloric stenosis, intestinal duplication, hemorrhoids, foreign bodies.

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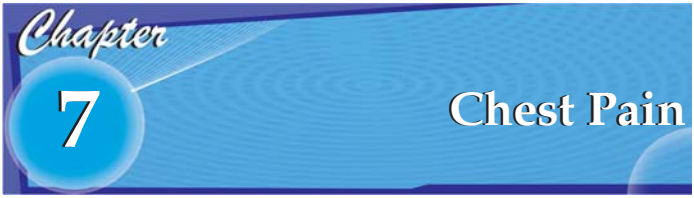

Most children complain of some kind of chest pain at one or the other time. Fortunately, in a vast majority of the cases, it is benign, either psychogenic or what is known as "stitch".

Symptomatic enquiry must include information on the exact site of pain. It is not infrequent for the child or the parents to point to the epigastrium and yet call it chest. Is the onset sudden or insidious? What does the pain seem like? Is it made worse by movements? Does it follow exertion after a meal? When does it occur; while working or during sleep? Any history of chest injury? Is there past history of surgery on the chest or disease such as bronchial asthma? Any family history of chest pain or heart disease?

An examination of chest wall may show skin lesion or musculoskeletal cause. One should always exclude a cardiac, pulmonary and abdominal pathology as a cause of chest pain.

Benign Chest Pain

Stitch

The condition refers to cramp-like pain on one side of the lower chest or upper abdomen. It occurs usually on exertion after meals. The cause is strain on peritoneal ligaments attached to the diaphragm.

Psychogenic

Older children with autonomic dysfunction may imitate anginal pain in a senior family member. The manifestations do not fit into any known pattern. Chest pain may be paroxysmal or recurrent. Just a distraction may cause relief. Other symptom include

palpitations, giddiness, and such breathing troubles as air-hunger and yawning. Psychogenic hyperventilation may often accompany in which case the condition is called *Da Costa or effort syndrome.*

In psychogenic chest pain, the problem seldom occurs during sleep or play period. Further, blood pressure may show a tendency to hypertension on a psychogenic basis. ECG is normal.

Organic Chest Pain

Skin

Herpes zoster is characterized by crops of vesicles (as a rule confined to a dermatone) and neurologic pain in the area of involved dermatone. Fever and local tenderness with regional lymphadenitis are usually present.

Muscles

Quite a common cause of chest pain in childhood, muscular pain may result from contusion secondary *to injury or viral myalgia*. The pain is sudden. It is usually "point pain" and tenderness may be present. There is no associated illness.

The well-known entity, *pleurodynia,* also called *epidemic myalgia, devil's grip or Bronholm disease* is caused by Coxsackie virus (group B). It is characterized by severe paroxysmal and stabbing or shooting pain that is aggravated with the respiratory movements. Muscles are frequently tender and swollen. Fever and headache may coexist. Rest of the family members may be affected.

Dermatomyositis, trichinosis or cysticercosis are responsible for a small proportion of cases of chest pain.

Skeleton

Crack or fracture of a rib, osteitis (usually costochondritis). *periostitis, osteomyelitis, hematoma or tumor* may cause localized pain and tenderness, swelling, redness and raised temperature, usually at the costochondral junction.

Tietze syndrome (costochondro osteopathicucostalis tuberosa) is characterized by painful, tender swelling of the costochondral junction, more so of the second, third and fourth ribs of the right side. There may be spontaneous pain during respiratory movements. It sometimes radiates to shoulder and arm. Paresthesia

may accompany it. A probable physical strain may well be the cause.

Diseases of vertebral column such as tuberculosis, rheumatoid arthritis, or osteomyelitis may cause neuralgia, leading to chest pain.

Pleura and Lungs

Pleurisy and pneumonia complicated by direct or indirect involvement of pleura cause severe knife-like stabbing pain that is worse on respiratory exertion and that may radiate to shoulder.

Pulmonary embolism/infarction, though rare in childhood, may cause substernal or pleuritic pain that radiates to the shoulder. Associated manifestations include tachycardia, tachypnea, dyspnea, bloody sputum and shock. If embolism is large enough, crepitations and pleural friction rub may be heard.

Cardiovascular System

Pericarditis, as in rheumatic fever, tuberculosis, or pyogenic infection, is the most common cause of precordial pain in children. The pain is usually dull and poorly localized and may be referred to shoulder or neck. It worsens on swallowing and on exaggerated respiratory movements. A friction rub may accompany the pain. The nib is synchronous with the heart beat. Neck veins are congested. Heart sounds are distant.

Myocarditis or pancarditis may also cause precordial pain through acute dilatation of the heart.

Angina, though rare in childhood, may cause dull persistent precordial pain which may occasionally be interrupted by stabbing sensation. It may be referred to the shoulder or arm.

Esophagus

Retrosternal or substernal pain may result from esophagitis secondary to ingestion of irritants, hiatal hernia, foreign body, peptic ulcer, esophageal ulcer or achalsia cardia. It is aggravated by swallowing, recumbant position or stooping forward. Associated symptoms include dysphagia, regurgitation hematemesis, melena and excessive salivation.

Remaining Causes of Chest Pain

Viral hepatitis, peritonitis, hemoperitoneum, diaphragmatic pain, gallbladder disease, sickle-cell anemia, cystic fibrosis, splenic or liver capsule rupture, stretching of renal capsule, pneumothorax, lung abscess, aortic valve disease (rheumatic), aortic stenosis, etc.

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Chapter 8 Child Abuse and Neglect (CAN)

Child abuse and neglect (CAN) is defined as maltreatment of children by the parents, guardians or other caretakers. Almost 75% of abuse recognized in the hospitals in physical. Rest of the 25% cases are of psychologic/emotional abuse, sexual abuse or nutritional deprivation leading to failure to thrive.

As and when you encounter a child in whom it is clear that the history of injuries, etc. narrated by the attendants is at variance with the actual observations made by you, you must suspect child abuse. In particular, consider this diagnosis when the child presents with multiple hematomas, multiple fractures and scars, multiple cuts, bruises and abrasions, burns, strap marks, cord marks, trauma to genitals, and malnutrition (in a child who appears to be unwanted). A large majority of parents who abuse their children are the ones who had experienced physical or other abuse as children. They are neither criminals or psychopaths, but just unhappy adults (because of some family crisis) living under tremendous stress and strain. The susceptible child is one who has negativism, a difficult temperament and such offensive behavior as enuresis, soiling, habitual crying and spilling. More often than not there is considerable delay in seeking medical advice.

Physical Abuse

The most important clue to physical abuse is that the injury is unexplained—often far-too-much for the history of a minor accident. Injuries usually seen include bruises, welts, lacerations and scars. The arms may reveal finger and thumb impressions of the abuser. Thrashing with a belt, sticks or ruler may leave lash marks on the body. Bite marks are seen as crescent-shaped bruises.

Slap marks are visible as two to three parallel bruises, usually over the cheeks. The neck may reveal choke marks. Strings or ropes tied round ankle or wrists leave circumscribed marks. Occasionally the shape of a bruise may point to the instrument used to cause it.

An important point to remember in physical injury as a result of abuse is that bruises are found at various stages of healing.

Inflicted burns are usually caused by holding the child forcibly in hot water as a punishment for bed wetting or failure in bowel control. A circular type of burn involving only the buttocks or thighs and waist is the most frequently seen in hot water injury. Cigarette burns, usually found overhands and feet, are seen as punched out circular lesions of nearly the same size. Hot solid burns produced by placing the child against a hot plate or heating develop characteristic shape.

Child abuse may result in as dangerous an injury as subdural hematoma, manifesting with convulsions and coma owing to the increased intracranial pressure. In half of the cases, skull fracture(s) may also be detected. Fundoscopy almost always shows presence of retinal hemorrhages. Since cases of subdural hematoma in battering are usually the result of violent shaking injuries, you may be able to locate grab mark bruises of upper limbs, shoulders and chest.

Another type of dangerous injury in battering is the blow injury over the abdomen, causing rupturing of liver or spleen. Infrequently, tear injury of duodenum or jejunum may occur. The child with intra-abdominal injury presents with recurrent vomiting, abdominal distention, tenderness, sluggish or even absent bowel sounds and shock.

Remember, it is advisable to have a good radiologic bone survey including skull, long bones, and thorax, and if indicated, pelvis and spine. Such findings as chip fractures or multiple bone injuries at various stages of healing due to repeated assaults are very helpful in reaching the diagnosis.

Sexual Abuse

Sexual abuse occurs from three sources. First, sexual maltreatment by a family member, usually the father or an uncle, on a child

who may well be an adopted or a step one. Second, sexual abuse by friends and acquaintances of the child or family. Third, sexual abuse by strangers. Molestation, intercourse and rape are the three types of sexual abuse encountered in practice. Since in a large majority of the cases of sexual abuse, there is no definitive physical findings, a sensitive and tactful handling of history-taking is needed. The physician ought to learn child's vocabulary and use dolls and pictures to clarify body parts and to build-up the story rug-by-rug. Skin, mouth, rectum and external genitals should be especially examined for signs of trauma. A hymenal opening of 5 mm or more is to be considered abnormal in a prepubertal girls.

Nonorganic Failure to Thrive

An unwanted and unplanned child's feeding may be terribly neglected. Emotional and nutritional deprivation eventually leads to malnutrition. The examination of such a child shows, besides signs of nutritional deficiencies, stark hygienic neglect as evidenced by a nappy rash, impetigo or scabies, unwashed skin, uncut finger and toe nails, and dirty clothing.

When such a child is admitted to the hospital and fed generously on a diet appropriate for age in the new setting and also given enough of love for at least a week, his weight gain becomes remarkably impressive.

D/D of CAN from Some Other Disorders

Scurvy, no doubt, produces subperiosteal hemorrhage in the lower third of the femur, leading to pain and pseudoparalysis and thus confusion with battering. The presence of spongy, swollen, bluish purple gums, scorbulic rosary, follicular hyperkeratosis with minute hemorrhages at the root of hair follicles together with radiologic bony changes* at and around knee joint are classical of scurvy. Moreover, signs in scurvy are usually bilateral.

Syphilis may manifest in the form of tender swelling in connection with bones and Parrot's pseudoparalysis as a result of osteochondritis. Radiologic findings include destruction,

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* Radiologic bony changes simulating scurvy are seen in Menke's Kinky hair disease as well.

thickening and irregular borders of metaphysis, destructive changes at diaphysis, transverse bands at metaphysis, and subperiosteal thickening with hyperostosis. Serological tests for syphilis are positive.

Caffey disease, also called *infantile cortical hyperostosis*, manifests with fever followed by marked swelling of soft tissues of face and jaws and progressive thickening of flat and long bones such as scapula, clavicle and tibia. The course is characterized by waxing and waning. After several years, spontaneous cure occurs.

Chronic hypervitaminosis A may present as tender swellings of bones. The accompanying symptoms include failure to thrive, anorexia, irritability, alopecia, seborrhea, angular stomatitis, craniotabes, desquamation of palms and soles, hepatomegaly and pseudotumor cerebri. History of excessive intake of vitamin A and hyperostosis of long bones, best seen about the middle of the shaft in X-ray, confirm the diagnosis.

Osteogenesis imperfecta tarda often presents with fractures resulting from minimal trauma. Presence of such findings as blue sclerae, skeletal deformities, short stature and deafness helps in reaching this diagnosis.

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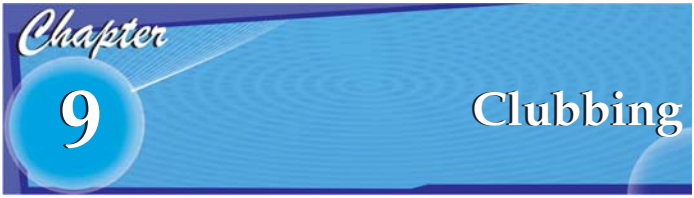

The term, *clubbing*, refers to loss of natural angle between nail plate and nailbed with boggy fluctuation of the nailbed. The depth of the finger at the base of nailbed becomes equal or more than that at the distal interphalangeal joint. In advanced cases, there is an increase in the curvature of the nail from top downward and swelling or enlargement of the distal end of the finger, giving it an appearance of a drumstick. The cause is altered prostaglandin metabolism, leading to an increase in the connective tissue. Hippocratic nails is its other name.

In doubtful cases, the following clinical maneuvers are helpful in demonstrating clubbing:

1. Normally, depth at the base of the nail is smaller than depth at the distal interphalangeal joint. If it becomes equal or more, digital clubbing is present. This is supposed to be the best method of identifying clubbing.
2. *Schamroth (Diamond) sign*. Normally, if we approximate the nails of two fingers, a diamond, i.e. rhomboid-shaped window is left out. Disappearance of window, indicates existence of clubbing. This sign is quite sensitive even for slight clubbing. The reason for disappearance of the window is hike in amount of soft tissue under the base of the nails.
3. *Lovibond's profile sign.* The increase of the angle between curved nail plate and proximal nail fold (viewed from lateral side) to 7180° from the normal < 160°.
4. *Curth's modified profile sign.* The decrease of the angle between middle phalanx and terminal phalanx at interphalangeal joint to < 160° from the normal = 180°.

5. *Fluctuation sign.* Clubbing may also be elicited by rocking the nail on its bed with examiner's index finger and thumb. It seems to float.

PULMONARY DISORDERS

Chronic Suppuration

Bronchiectasis

Clubbing in an important feature of bronchiectasis, which is usually associated with tuberculosis, congenital anomalies of bronchi or bronchioles, aspiration of a foreign body that remained unattended or chronic/recurrent chest infection in the presence of such a disease, as cystic fibrosis, ciliary dyskinesia or an immune system defect. The symptoms include chronic cough with purulent sputum, foul-smelling breath, i.e. halitosis, recurrent chest infection and failure to thrive. Auscultatory findings include wheeze and crepitations, which may be localized due to a foreign body or generalized (cystic fibrosis).

Empyema

Clubbing develops in case of long-standing empyema when anemia and other manifestations of malnutrition also co-exist. Manifestations are usually those of pneumonia, but they may be absent. Chest signs include diminished movements of the affected side, widening and dullness at times, (even edema) of the intercostal spaces, dull percussion note, diminished air entry and shift of the mediastinum to the opposite side. In addition to an X-ray chest, a diagnostic pleural tap must be done.

Lung Abscess

Clubbing may develop in a case of chronic lung abscess when the subject remains without appropriate treatment for a long time. Onset is usually insidious with fever, persistent cough and foul-smelling sputum. Occasionally, dyspnea and chest pain may occur. Chest signs are usually those of consolidation with bronchial breathing. X-ray of the chest shows characteristic opacities; the cavities reveal fluid levels.

Pulmonary Tuberculosis

Significant clubbing occurs in a proportion of children with progressive pulmonary tuberculosis, especially of fibrocaseous type.

Cystic Fibrosis

Presence of clubbing in association with gross malnutrition despite good appetite and good dietary intake, recurrent diarrhea and recurrent chest infections ever since early infancy, must arouse suspicion of cystic fibrosis. Steatorrhea is notably pancreatogenous. Demonstration of high sweat chloride (over 60 mEq/L) clinches the diagnosis.

Other Pulmonary Causes

Pulmonary alveolar proteinosis, alveolar-capillary block syndrome, Hammen-Rich syndrome, chronic fibrosing alveolitis, emphysema, chronic pneumonia, mesothelima, and malignancy, especially of bronchus.

CARDIOVASCULAR DISORDERS

Infective Endocarditis

Clubbing is an important feature of infective endocarditis in which it is often accompanied by tender transient swellings which are pea-sized, in the pulp of fingers and toes (Osler nodes) and also splinter hemorrhages, beneath the nails. Anemia, splenomegaly, low-grade fever and microscopic hematuria are also present. Diagnosis is established by positive blood cultures which are taken every 6 hours for 36 hours, and by demonstration of the vegetations by echocardiography in advanced cases. Underlying lesion is always rheumatic or congenital heart disease.

Cyanotic Congenital Heart Disease

In transposition of great arteries (TGV), the child usually develops some clubbing by 6 months. In Tetralogy of Fallot (TOF), it takes almost 2 years for clubbing to be noticeable.

GASTROINTESTINAL DISORDERS

Steatorrhea

Clubbing may be encountered in some children suffering from significant steatorrhea such as celiac disease, tropical sprue, gross

protein-energy malnutrition, iron-deficiency anemia and ancy-lostomiasis.

Ulcerative Colitis

Clubbing is an important component of the extraintestinal manifestations of ulcerative colitis which include arthralgia, erythema nodosum, pyoderma gangrenosa, iritis, hepatitis, peripheral hypoproteinemic edema, phlebitis, hemolytic anemia.

Crohn Disease (Regional Ileitis)

Clubbing, as in the case of ulcerative colitis, may figure among the extraintestinal manifestations of this inflammatory bowel disease, which is usually characterized by segmental transmural involvement of distal ileum and colon.

Multiple Polyposis

In this disease with involvement of the colon, clubbing may coexist with painless bright red rectal bleeding, usually after the age of 3-5 years. Even after surgical excision through a sigmoidoscopy, 25% subjects show recurrence. Some patients may develop malignancy.

HEPATIC DISORDERS

Clubbing may be seen in cases of biliary cirrhosis, i.e. extrahepatic biliary atresia, cystic fibrosis and chronic active hepatitis.

Other Causes of Clubbing

Congenital (idiopathic), thyrotoxicosis, Hodgkin's lymphoma.

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Chapter 10 Coma

Coma (Greek: *koma*—a deep sleep) is a state of profound and prolonged unconsciousness from which the individual cannot be aroused except for short periods.

Four stages of depressed consciousness are recognized:

Stage 1 (Stupor): The patient can be aroused for brief periods, during which he may be able to make simple verbal and voluntary motor responses. Stupor (unconsciousness) may alternate with delirium (mental confusion, disorientation, irrational conversation and motor excitement).

Stage 2 (Light Coma): The patient cannot be aroused, except with painful stimuli. However, moaning and semipurposeful avoidance movements may be noticed.

Stage 3 (Deep Coma): Painful stimuli now fail to produce a response, or they lead to extension and pronation of arms (decerebrate posturing).

Stage 4 (Brain Death): The patient is flaccid and apneic. All brainstem functions are lost though some spinal reflexes may still be intact.

The modified glasgow coma scale (Table 10.1) is of considerable help in evaluating progress of the child with altered consciousness.

The history has got to be second hand. Yet, pertinent information obtained rapidly helps in arriving at provisional diagnosis. Interrogate about any recent trauma or accident (head injury), poisoning, drug overdose and prior disease such as diabetes mellitus, epilepsy, CNS disease, liver disease, kidney disease, etc. A history of acute febrile illness, especially if accompanied by convulsions, points to meningitis, encephalitis, cerebral malaria,

Table 10.1: Modified Glasgow coma scale

Score	Over 1 year	Under 1 year
		Eyes opening
4	Spontaneous	Spontaneous
3	To verbal command	To shout
2	To pain	To pain
1	No response	No response
		Best motor response
6	Obeys	Spontaneous
3	Localizes pain	Localizes pain
4	Flexion-withdrawal	Flexion-withdrawal
3	Flexion-abnormal (decorticate rigidity)	Flexion-abnormal (decorticate rigidity)
2	Extension (decerebrate rigidity)	Extension (decerebrate rigidity)
1	No response	No response

Score	Over 5 years	2 to 5 years	0 to 23 months
		Best verbal response	
5	Oriented and converses	Appropriate words and phrases	Smiles, coos appropriately
4	Disoriented and converses	Inappropriate words	Cries, consolable
3	Inappropriate words	Persistent cries or screams	Persistent inappropriate crying or screaming
2	Incomprehensible sounds	Grunts	Grunts, agitated or restless
1	No response	No response	No response

or typhoid encephalopathy. Coma in association with hyperpyrexia in hot weather may mean heatstroke.

Physical examination should be rapid, focussing on the following:

Respiration Cheyne-Stokes: Involvement of thalamus (deep cerebral or diencephalon lesion)

Irregular hyperventilation: Damage to brainstem (midbrain or pons)

Slow and deep: Raised intracranial pressure, CNS infection, or after a convulsive episode

Ataxic: Damage to medulla. Respiratory arrest usually follows *Slow, shallow and periodic:* Narcotics
Acetone smell: Diabetic ketoacidosis
Foul breath: Uremia
Blowing out of one check only: Ipsilateral facial paralysis
Deep, rapid, gasping: Acidosis
Pattern of Pupillary Reaction
Widely dilated but fixed: Third nerve paralysis, resulting from tentorial herniation
Widely dilated but reactive: Postictal state or deep plane of anesthesia
Pinpoint: Drug intoxication (opiates, barbiturates) or brain-stem involvement
Unilateral dilated, fixed: An expanding lesion on the same side (it may well be a false localizing sign)
Midposition fixed: Midbrain lesion
Roving nonconjugate deviation: Light plane of anesthesia *Conjugate deviation:* Cerebral lesion of same side or an irritative process on the opposite side
Nystagmoid movement: Posterior fossa lesion of same side.

Eye movements are tested by what is known as *doll's head maneuver* or *doll's eye phenomenon*. Turn the head briskly from side to side while patient's eyes are open. You would notice that the eyes move conjugately to the opposite side. Absence of the response, (*oculocephalic response),* or its depression implies that the lesion is at the level of brainstem or midbrain. If this results in deviation of the eye down and laterally, 3rd nerve dysfunction due to tentorial herniation must be considered. Oculocephalic response needs 3rd, 6th and vestibular component of 8th nerve intact.

Head and Body

Quickly examine for injury marks and evidence of ingestion of poisonous agents.

Limbs

Failure to move one side or asymmetrical movements suggest paralysis/paresis. Remember that, in hemiplegia, the paretic leg lies in external rotation and moves less than the other leg,

spontaneously as also in response to painful stimuli. When lifted and allowed to fall back, it drops limply.

Decorticate posturing, characterized by arms which are flexed over the chest, hands which are fisted, and legs which are extended, points to severe, diffuse cerebral cortex lesion.

Decerebrate posturing, characterized by rigid extension and pronation of arms and extension of legs, as such or in response to pain, suggests midbrain lesion. Unilateral decerebrate posturing, often accompanied by contralateral 3rd nerve paralysis, is usually a sign of tentorial herniation.

Fever

Hypothermia indicates possibility of barbiturate or alcohol intoxication, or shock.

High fever suggests acute infection, toxic encephalopathy, heat stroke, intracranial hemorrhage or postictal state.

Neck Rigidity

It suggests meningitis. Subarachnoid hemorrhage or herniation of cerebral tonsils may also manifest as nuchal rigidity. However, remember that it may be absent in a comatosed child though he is decidedly suffering from one of the above said causes.

Reflexes

Absence of corneal reflex or tonic neck reflex suggests severe brain damage.

A consistently positive Babinski sign may be of value.

Fundoscopy

Fundoscopic examination is a must for evidence of papilledema. Since papilledema takes some 24 to 48 hours to manifest, its absence on examination cannot be taken to exclude raised intracranial pressure. Early signs of high intracranial pressure are absence of venous pulsations and distention of retinal veins.

Detection of preretinal hemorrhages points to the probability of subarachnoid or subdural bleeding.

Diagnostic possibilities, depending upon presence or absence of focal signs and raised or normal intracranial pressure, may be categorized as follows:

Focal Signs Present

a. Raised Intracranial Pressure
Trauma: Subdural, epidural or intracerebral hemorrhage, subdural contusion
Intracranial tumor
CNS infection: Brain abscess, subdural empyema, encephalitis *Vascular lesion:* Arteriovenous malformation
b. Normal Intracranial Pressure
Vascular lesion: Cerebral arterial occlusion
CNS infection: Encephalitis
Trauma: Cerebral contusion
Epilepsy: Postictal state with Todd paralysis

Focal Signs Absent

a. Raised Intracranial Pressure
Metabolic encephalopathy: Lead poisoning, water intoxication, Reye syndrome, severe anoxia.
CNS infection: Meningitis, encephalitis
Trauma: Subdural hemorrhage in infants, subarachnoid hemorrhage
Intracranial tumor
Hydrocephalus
b. Normal Intracranial Pressure
Metabolic encephalopathies: Most of them *Drug intoxication*
CNS infection: Meningitis encephalitis
Trauma: Concussion
Epilepsy: Postictal state.

Diabetic Ketoacidosis

There may or may not be positive history of diabetes mellitus. Other manifestations may include nausea, vomiting, dehydration with always dry skin, weakness, polyurea, confusion, tachypnea, soft eyeballs, and convulsions. Tendon reflexes are absent or poorly elicited. The diagnosis is established, if there are smell of acetone in breath, slightly flushed

Nonketotic Hyperosmolar Coma

This rare but important entity is characterized by minimal or absent ketoacidosis, very high blood sugar, severe dehydration (hypematremic) and rising BUN (azotemia). High CSF sodium content causes cerebral edema which is responsible for coma and convulsions.

Hypoglycemic Shock

Hypoglycemia, usually from overdose of insulin, reduced glucose intake or excessive exercise in a known diabetic patient, may cause coma which requires to be differentiated from that resulting from ketoacidosis. An enquiry reveals that coma was preceded by change in personality with temper tantrums, crying or outbursts of laughing, dizziness, headache, sudden hunger, flushing, convulsions or transient squint. In contrast to the picture in diabetic ketoacidosis, eyeballs are rather tense and tendon reflexes active to exaggerated.

Head Injury

Here, history of injury is available. Progressive focal neurologic signs suggest intracranial bleeding, say subdural hematoma. Periods of unconsciousness/amnesia following injury suggest concussion.

Seizure Disorder

Coma in seizure disorder may occur in the following situations:
(i) postictal state in which coma may occur in association with Todd paralysis, (ii) status epilepticus, and (iii) overdose of antiepileptic drug(s).

Drugs and Poisons

Drugs and poisons which may cause coma only when consumed in large amount include barbiturates, opiates (morphine), alcohol, carbon monoxide (exposure to coal smoke in a closed, stuffy room during winter), kerosene oil, lead, tricyclic antidepressants (haloperidol), diphenoxylate, salicylates, amphetamines, antihistaminics, phenothiazines, organophosphates, piperazine, diphenylhydantoin sodium, and solvent sniffers.

It is advisable to make a note of the signs which indicate poisoning. For instance, small constricted pupils point to opiate, barbiturate or phenothiazine poisoning. Dilated pupils may mean belladona, amphetamine or antihistamine poisoning. Odor of alcohol is obvious in breath, whereas perspiration may suggest salicylate, organophosphate or LSD. A hot dry skin may be a sign of belladona poisoning. Hyperventilation with respiratory alkalosis may point to salicylate poisoning. Needle marks, especially in adolescents, suggest narcotic poisoning as a part of drug abuse. Nystagmus may point to barbiturate or diphenylhydantoin poisoning.

CNS Infections

Cerebral malaria, typhoid encephalopathy, meningitis and encephalitis are important causes of coma. Pointers in clinical profile together with investigative findings contribute in arriving at specific diagnosis.

Dehydration and Electrolyte Imbalance

Dehydration and electrolyte imbalance, especially in tropical climate, may *per se* cause loss of consciousness in early childhood. The most common cause is undoubtedly gastroenteritis. But a cause likely to be forgotten is diabetes insipidus in which inadequate fluid intake may result in coma due to hyperosmolarity.

Liver Disease

Viral hepatitis and Indian childhood cirrhosis may end up in a coma. There usually is history suggestive of liver disease preceding coma. The presence of smell of raw liver, called "fetor hepaticus", hepatosplenomegaly, ascites, and hemorrhagic tendency assist in arriving at the diagnosis.

Reye syndrome is characterized by sudden onset of vomiting, irritability and coma preceded by a mild respiratory infection. Liver is palpable. In spite of marked liver dysfunction, jaundice is, as rule, minimal or absent. Hypoglycemia is always present. Preceding h/o administration of aspirin to the child with an exathemanta (chickenpox) is usual.

Uremic Coma

There usually is a fairly long preceding history of renal disease. Before coma manifests, such signs as pallor, puffiness of face, pretibial edema and fetid odor of breath become apparent. Often, it is the routine detection of hypertension that points to the renal origin of coma before suggestive urine findings, high BUN or creatine results are available.

Hysteria

Absence of organic disease on clinical work-up and investigations, especially in prepubertal girls demonstrating alteration in consciousness, may suggest the probability of dissociative type of hysterical neurosis. One must demonstrate positive evidence of hysteria—at least that the subject has psychopathic personality— before finally reaching this diagnosis.

Syncopal Attacks

During such an attack, the subject loses consciousness only for a brief period. The history of labile vasomotor system, as indicated by earlier attacks induced by cough, strain or emotions, helps in establishing this diagnosis. One must rule out a cardiac disorder, including paroxysmal tachycardia.

Remaining Causes of Coma

Gram-negative septicemia, anaphylaxis, hypovolemia, etc.

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Chapter 11 Constipation

Constipation (Latin: constipare–to press together) refers to passage of small hard, dry stools that contain mainly solids and minimal water. Infrequency of defecation is usually associated. But that is not always so. The commonly-held belief that constipation means infrequency of defecation is, therefore, not correct.

It is of value to understand that all pelvic and abdominal muscles play an important role in defecation. Nevertheless, three muscular sphincters surrounding the anus and the rectum (internal and external sphincters and puborectalis) are the most important (Fig. 11.1). When the conditions are condusive for defecation, the striated muscles of the pelvic flow and external sphincter are relaxed voluntarily, the anorectal angle is diminished and the abdominal muscles contract to facilitate the downward passage of stools. The main propulsive activity come through the nonperistaltic mass contraction of the colon.

Two fundamental factors contributing to constipation are:
(i) defects in emptying the rectum, (ii) defects in filing the rectum.

Defects in emptying the rectum, leading to stool retention, may result from interference with defecation reflex initiated by pressure receptor in the rectal muscles. Lesions of the rectal muscles, sacral spinal cord afferent fibers, and the pelvic floor and abdominal muscles, and lesions that prevent adequate relaxation of anal sphincter fall in the group.

Defective rectal filing may be encountered whenever there is poor gut peristalsis (hypothyroidism, diphenoxylate, loperamide oropiate use), or there is mechanical structural lesion (Hirschsprung disease).

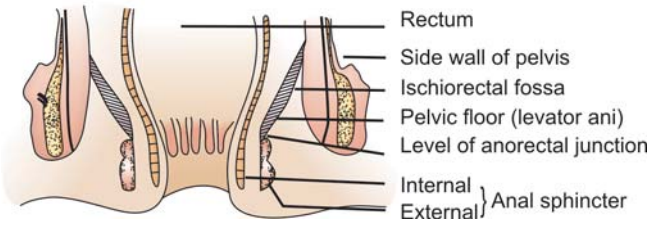

Fig. 11.1: Muscle involved in defecation (Reproduced from Sarin YK, Kaur G, Singh T: Constipation. In: Gupte S (Ed): *Recent Advances in Pediatrics (Special Vol 6: Gastroenterology, Hepatology and Nutrition)*, New Delhi: Jaypee 2000: 213-226).

Both in defective emptying and filling, excessive drying of the stools follows. Hard, dry stools are rather painful to evacuate, leading to further retention. Thus a vicious cycle is set up. Constipation, therefore, tends to be self-perpetuating.

It is the anxiety on the part of the parents that may render constipation to have adverse effects (primarily on child's emotional health) and not the constipation per se.

The following clarifications in the history are helpful in reaching the diagnosis: How long has the problem of constipation been? Is it ever since birth or occurred later? What is the child's usual bowel habit and in which way has it changed? What is the frequency and consistency of motions? What are the feeding habits? Can the constipation be explained by the kind of diet? Any relationship with drugs, particularly laxatives or purgatives? Is there any associated pain with defecation or in the abdomen? What is the color of stools? Is there any vomiting? Any history of passage of worms in stools? Any fecal incontinence?

It is important to examine the abdomen for palpable numerous hard masses (fecolith). Anus and rectum in particular need to be inspected.

NEONATAL AND EARLY INFANCY

Benign

Breastfeeding

In the later neonatal period and early infancy, breastfed babies may pass stools only once in a few days. But, mind you, these stools are rather loose (like those the breastfed infant passes in early neonatal period) and seldom dry and solid. In true sense, this is not constipation.

If a breastfed infant's mother is consuming much-too-much of fats and proteins, his stools may be firmer and pultaceous.

Artificial Feeding

- Inadequate fluid intake, especially in hot weather
- Excessive sweating due to over clothing
- Inadequate sugar in the milk feed.

Delayed Weaning

Inadequate or delayed introduction of semisolid foods.

Medication

Abuse of laxatives/purgatives over a prolonged period by the parents obsessed by the desirability to have daily bowel movement, causing diarrhea alternating with constipation.

Drugs like isoniazid, chlordiazepoxide, imipramine, amitryp-taline and vincristine may cause constipation.

Organic

Obstructive/Mechanical Lesions

Imperforate anus is characterized by a cutaneous collection of meconium in the perineal region, presence of an anal fissure in place of opening and usually a fistulous opening in the perineum, into vulva or urethra.

Anorectal stenosis occurs usually in association with other congenital anomalies and in preterm infants. There may be history of passage of stools resembling expelled toothpaste. A rectal examination needs to be done to confirm the diagnosis.

Ectopic anus placed anteriorly may well be a common cause of constipation.

Meconium plug syndrome is characterized by passage of a sticky white plug of mucus followed by flatus and liquid meconium or delay in passage of meconium beyond 36 hours. Insertion of the little finger into the rectum release the *meconium plug*.

Meconium ileus, a common presentation in cystic fibrosis of pancreas, is characterized by feeding difficulty, abdominal distention, bilious vomiting between 34 to 48 hours of birth and fecal pellets (Fig. 11.2). Abdominal examination may reveal a palpable lump. X-ray abdomen (plain film) may show uneven dilated loops of bowel, air-fluid levels and a bubbly granular density. Barium enema may show micro colon from disuse.

Small left colon syndrome, resembling *meconium plug* syndrome, may occur mostly in infants of diabetic mothers and is due to disturbance of peristalsis.

Functional ileus of the newborn is characterized by manifestations of intestinal obstruction in the absence of any anatomical obstruction. It is secondary to septicemia, pneumonia, electrolyte imbalance and certain metabolic abnormalities. The condition is purely functional and occurs more often in the preterm infants.

Hirschsprung disease usually manifests in the first week of life with failure to pass meconium, abdominal distention, bilious

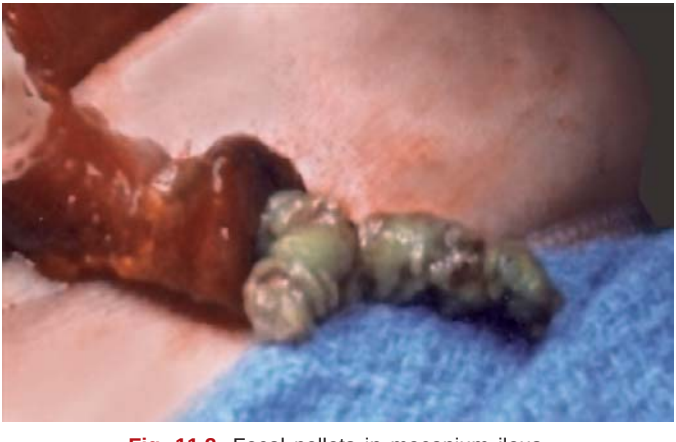

Fig. 11.2: Fecal pellets in meconium ileus.

vomiting and feeding difficulty. Later, the pictures may be complicated by diarrhea secondary to enterocolitis. The infant fails to thrive satisfactorily. Rectal examination shows no fecal matter and the canal may feel narrow and tight. X-ray abdomen (plain film) shows gaseous distention whereas barium enema reveals a narrow distal segment and a dilated proximal segment of the colon and residual barium that may be detected 12 to 48 hours after the initial examination. The characteristic radiologic changes may manifest after 6 weeks of life. The diagnosis needs to be confirmed by rectal biopsy which demonstrates aganglionosis,
i.e. absence of ganglion cells of the submucous (Meissner's) and intramural (Auerbach's) plexuses.

Pseudo-Hirschsprung disease is a very rare cause of constipation in infancy. It usually manifests some years afterbirth. It results from poor tone of the colon, leading to dilatation but, unlike true Hirschsprung disease, here the rectum is full, bowel does not have a narrow segment and aganglionosis is not seen. Encopresis (fecal soiling) is an important manifestation.

Severe vomiting, as encountered in congenital pyloric stenosis or possetting, may also cause constipation.

Polyurea as in diabetes insipidus (nephrogenic), renal acidosis or hypercalcemia usually due to hypervitaminosis D, renal tubular defects or hyperparathyroidism.

Hypokalemia may be responsible for constipation in infants who suffer from dysclectrolytemia following an attack of diarrhea.

Hypothyroidism should be suspected in an infant who is constipated and also has feeding difficulty, prolonged physiological jaundice, hypothermia, hypotonia, poor mother activity and umbilical hernia with or without facial features of the disease. Retarded bone age radiologically and T help to reach the diagnosis.

Severe hypotonia as in prune-belly syndrome characterized by congenital absence of the abdominal muscles.

Lead poisoning should be suspected in infants exposed to lead (say, lead paint flakes, artist's paints, kajal or surma, fumes from batteries) and suffering from constipation in association with transient pain abdomen, resistant anemia, weight loss, irritability,

vomiting, headache, personality changes and ataxia. A lead line over the gums is typical. Urine lead level of more than 85 mcg/ 24 hours is diagnostic.

LATER INFANCY AND CHILDHOOD

Benign

Poor Dietary Intake

Inadequate dietary roughage and large amounts of milk are by far the most common cause of constipation in later infancy and childhood. A therapeutic trial can demonstrate it.

Abuse of Laxatives and Purgatives

Parents, eager that the child must have a bowel movement daily, indulge in frequent administration of laxatives or purgatives to the child. As a result, he begins to be dependant on such a medication and unless it is given as a daily "ritual" he may pass constipated stools.

Poor Toilet Training

Parents, overanxious about the daily bowel movement, may force the child to sit on the "pottie" far too long against child's wish. Others may examine each and every stool that the child passes quite critically, inducing the child to refuse to empty his bowels. Reactive constipation secondary to poor toilet training is most often seen in children whose mothers are overprotective, tense, anxious and indulgent and having tendency to use coercive methods. The fathers, on the other hand, are fond of exerting excessive discipline.

Organic

Intestinal Parasitosis

Though most parasitic infestations are known to cause diarrhea, at least L. giardia and hookworm may well cause constipation alternating with diarrhea. Since both the infestions are quite common in tropical settings, intestinal parasitosis should always be excluded in cases of constipation unless, of course, the cause is very obvious.

Anal Fissure

An anal fissure causes pain during defecation and thus, may lead to withholding of the stools. Later, even if the child tries he finds it difficult to empty such a heavily loaded rectum. There may follow dilatation of the colon proximal to it. Anal fissure may result from hard scybala per se.

Hirschsprung Disease

See Page 129.

Pseudo-Hirschsprung Disease

See Page 130.

Hypothyroidism

See page 130.

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Chapter 12 Convulsions

The term, *convulsion* or *seizure*, denotes a temporary disturbance of brain function manifested by involuntary motor, sensory, autonomic or psychic phenomenon, alone or in any combination. Some change in sensorium is usually present. Though a wide variety of CNS disorders can cause convulsions, the fundamental defect remains irritation of the CNS in each one of them.

Convulsions are relatively more common in infancy and childhood than at any other period of life, the peak incidence occurring during the first 2 years. The overall incidence in childhood is stated to be 8%, among mentally retarded children (except those with Down's syndrome) 20%, and among those suffering from one or the other type of cerebral palsy 35%. In a retrospective study, we found an overall incidence of 15% (inpatients) and 11% (outpatients) in the Govt. Children Hospital, Jammu.

Clinical workup must, in the first place, clarify if what has been described as convulsion is indeed convulsion or not. Disorders simulating recurrent convulsions include breath-holding spells, narcolepsy, abdominal epilepsy, hysterical fits, syncope, apneic spells and migraine.

In the newborn, it is infrequent to see convulsions in the form of typical tonic-clonic movements. On the other hand, such apparently minor manifestations as twitching, conjugate deviation of eyes, hypertonus in a twitching limb, irregular jerky movements and nystagmus, startling, pallor and hypotonia, slow and irregular respiration with periods of apnea and feeble cry, and cyanotic attacks may well mean convulsions.

Symptomatic enquiry should include all the details about the attack: Was the onset sudden or gradual? Were the convulsions local or generalized? Where did they begin? In which fashion did they progress to rest of the bodily parts? Did the child micturate or defecate during the attack? How long did the attack last? Was there fever preceding or following the attack? Did he sleep after the attack? Or, did the attack lead to headache, automatism or paralysis? Any associated manifestations like neck stiffness, vomiting, behavioral problems, or discharging ear?

In case of recurrent convulsions, ask the attendants to give a clinical account of the first attack and the age at which it occurred. What is the minimal and maximal gap between the attacks? Is there any aura preceding the attack? Does the attack ever occur during sleep? Does the child bite his tongue, injure himself, micturate or defecate during convulsions? Does he lose consciousness? Are there any such manifestations as persistent headache, automatism or pseudoparalysis (Todd paralysis) after the episode?

In recurrent convulsions secondary to organic brain damage, you must look for evidence of such conditions as tuberous sclerosis, hydrocephalus, Sturge-Weber syndrome, cysticercosis, toxoplasmosis, syphilis, mental retardation, cerebral palsy, etc.

CONVULSIONS IN THE NEWBORN

You need to consider the following conditions when encountering convulsions in the newborn:

First and second day: Perinatal problems such as birth injury, asphyxia, hypoxia, intracranial (especially intraventricular) hemorrhage; drug withdrawal syndrome; pyridoxine dependency; accidental injection of anesthesia into baby's scalp during labor; inborn errors of metabolism such as phenylketonuria.

Third day: Hypoglycemia

Fourth day and onwards: Fulminant infections such as septicemia, meningitis; hypocalcemic tetany, hypo- or hypernatremia, hypomagnesemia; kernicterus; tetanus; congenital malformations like arteriovenous fistulae, pomocephaly; intrauterine infections like toxoplasmosis, rubella, cytomegalic inclusion disease, herpes simplex (TORCH/STORCH).

Perinatal Problems

Birth trauma, following difficult delivery, may result in anoxia together with cerebral edema and microhemorrhages in low birth weight newborns and massive hemorrhages in mature babies. In the former situation, convulsions may present as tonic spasms preceded by some clonic jerks on first day only. In the later situation, convulsive manifestations usually appear between 2 to 7 days of birth. These are unilateral and are accompanied by retinal hemorrhages, dyspnea, bulging anterior fontanel, skull fracture and cephalhemaloma, and blood-stained or frankly bloody CSF.

Hypocalcemia

Hypocalcemic tetany, the most common biochemical cause of neonatal convulsions, occurs usually in babies on cow's milk formula rich in phosphates. Manifestations occur either on first day or about the seventh day of birth. These include, besides convulsions, jitteriness, laryngeal spasm, tremors, muscular twitching and carpopedal spasm. The infant remains all right in between the attacks.

Serum calcium is invariably under 8 mg% and phosphorus high.

Intravenous administration of calcium gluconate (5 to 10 ml of 10% solution) leads to dramatic response.

Hypoglycemia

Convulsions due to hypoglycemia are likely to occur in infants who suffer from intrauterine growth retardation, in infants of toxemic mothers, in infants of diabetic or prediabetic mothers, in smaller of the twins, and in infants with idiopathic respiratory distress syndrome, kernicterus, Beckwith syndrome, infections, adrenocortical hyperplasia and glycogenosis.

Manifestations include, besides convulsions, tremors, twitching, cyanosis and apneic spells.

Blood glucose level is under 30 mg% in term infants and 20 mg% in preterm ones.

Infections

Pyogenic meningitis as such or as a complication of septicemia is an important cause of neonatal convulsions. The most common complaint is that the infant is just not well with refusal to feed,

lethargy, irritability and restlessness. Umbilicus is often septic. Neck stiffness is usually absent and anterior fontanel may or may not be bulging. Lumbar puncture is essential to establish the diagnosis.

Tetanus is likely to occur in newborns in whom umbilical cord is cut under septic conditions and mud, dung or such other harmful substances are applied to the navel at birth or soon after it. It usually manifests at 5 or 6 days after birth with difficulty in sucking, stiffness of jaws, and generalized spasticity, spontaneously or in response to external stimuli. Risus sardonicus is a classical manifestation.

Malaria in neonatal period, though rare, may manifest with convulsions either on account of cerebral involvement or hyperpyrexia.

Pyridoxine Dependency

The newborn of a mother who has had prolonged administration of pyridoxine during pregnancy may develop convulsions which are resistant to various treatments. Such a pyridoxine dependency may also occur in newborns suffering from a hereditary metabolic defect leading to unusually large needs of pyridoxine.

The infant is restless between convulsive attacks, reacting to external stimuli (acoustic and mechanical) with twitching. He blinks the eyes, moving in an uncoordinated fashion.

A dramatic response to a 25 mg dose of pyridoxine is a rule.

Drug Withdrawal Syndrome

The newborn of a mother addicted to narcotics (morphine, heroin) or alcohol is prone to develop withdrawal symptoms which include convulsions, irritability and excessive drooling.

Accidental Injection of Anesthesia

During labor, as the mother is being given paracervical block, baby's scalp may be accidentally injected. Such a newborn develops intractable convulsions.

Electrolyte Imbalance

Both hypo- and hypernatremia, following dehydration or its incorrect treatment with parenteral fluids and electrolytes, may cause severe convulsions with permanent neurologic damage.

Hypomagnesemia

A newborn with convulsions associated with established hypocalcemia not showing response to calcium therapy must arouse suspicion of hypomagnesemia.

Metabolic Disorders

You must consider possibility of an inborn error of metabolism if convulsions are resistant and there is a history of such a disorder in the family.

Galactosemia is characterized by occurrence of convulsions following ingestion of milk. Presence of jaundice and hepatosplenomegaly supports the diagnosis.

Fructose intolerance is characterized by occurrence of hypoglycemic convulsions or coma immediately after ingestion of such foods as contain fructose, say carrot, fruits juices, milk formulas containing sucrose, or cane sugar.

Maple syrup urine disease (MSUD) is characterized by hypoglycemic convulsions in association with feeding difficulty, marked metabolic acidosis, progressive neurologic and mental deterioration and odor of maple syrup in urine.

Congenital Malformations of CNS

A newborn presenting with convulsions and facial asymmetry, microcephaly or any other obvious malformation should be suspected of an underlying developmental defect of CNS, say arteriovenous fistula, congenital hydrocephalus, porencephaly, microgyria, corpus collosum agenesis or hydrancephaly.

The newly-recognized entity, Aicardi syndrome, is characterized by trio of infantile spasms resistant to therapy, chorioretinopathy and agenesis of corpus callosum. Additional features include mental retardation and vertebral and costal abnormalities. Its cause appears to be a newly-mutated X-chromosomal-dominant gene lethal to males in utero. Naturally, all patients are females. Prognosis is poor, most subjects dying in early life.

Drugs

If mother has had large doses of phenothiazine(s) as a part of management of toxemias of pregnancy, the newborn may suffer

from phenothiazine poisoning. Though jitteriness is the most common manifestation, he may have convulsions with generalized spasticity including opisthotonos.

Such drugs as nikethamide, administered for neonatal asphyxia, if given even in a marginally higher than the recommended doses, may be responsible for convulsions.

CONVULSIONS IN LATER INFANCY AND CHILDHOOD

Acute (Nonrecurrent) Convulsive Disorders

Febrile Convulsions

The term refers to seizures occurring at the onset of acute extracranial infection or in association with high environmental temperature.

This is the most common cause of convulsions between 6 months to 3 years of age. Outside this age range, it is infrequent to have febrile convulsions. Boys are affected nearly twice as frequently as girls. Family history of convulsions, and higher incidence in twins and children born of consanguinous unions are noteworthy. *The remaining salient features of the condition are:* • It is usually associated with rapid rise in body temperature. There is, therefore, preceding history of the child having been unwell a few hours prior to the onset of convulsions.

• Generalized rather than focal convulsions are nearly a rule. • The attack lasts less than 10 minutes and in no case more than 20 minutes • There is no recurrence before 12 to 18 hours of the attack accompanying rapid rise of body temperature.

• There is no residual paralysis of a limb following the attack
• CSF after the attack is normal.
• EEC after the attack is normal.

Convulsions associated with fever (not of CNS infection) but not satisfying the above criteria are often labeled "atypical" rather than "typical" febrile convulsions. This condition is now considered a precursor of idiopathic epilepsy.

CNS Infections

Pyogenic meningitis may manifest suddenly with convulsions in association with high fever, restlessness, irritability, vomiting,

headache and neck stiffness. Cranial nerve palsies and papiledema are present in some cases. The presence of a generalized purpuric rash points to meningococcal meningitis.

Encephalitis manifests with change in sensorium (varying from lethargy to coma), fever and vomiting in addition to convulsions. Whereas an infant may show gross irritability, headache is a common symptoms in older children. Remaining manifestations may include peculiar behavior, hyperactivity, altered speech and ataxia. There is rapid variation in the clinical picture from hour-to-hour.

Cerebral abscess (Fig. 12.1) is characterized by headache, vomiting and visual disturbances from high intracranial pressure, focal neurologic manifestations such as convulsions, cranial nerve palsies, ataxia, visual field defects and hemiparesis from local pressure, high or low irregular fever, chills, rigors and leukocytosis

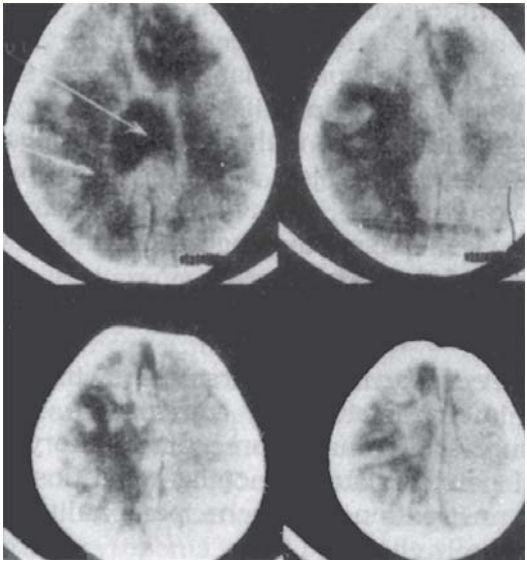

Fig. 12.1: CT scan showing multiple cerebral abscesses in an infant suffering from suppurative otitis media (SOM).

from toxemia, and irritability, behavioral problems, drowsiness, and weight loss from intracranial suppuration. The presence of a septic focus such as otitis media, lung abscess, empyema, bronchiectasis, infective endocarditis, orcyanotic congenital heart disease lends support to the diagnosis.

Cerebral malaria, a life-threatening complication of Plasmodium falciparum infection, is characterized by meningeal signs, convulsions and coma. CSF is more or less within normal limits.

Toxic Factors

Tetanus has a sudden onset with muscle spasm and cramps, particularly about the location of inoculation, back and abdomen. In the next 48 hours, clinical picture worsens. Neck rigidity, positive Kerning sign and trismus become prominent. The face assumes atypical expression, "risus sardonicus", which consists of clenching of jaws, laterally-drawn lips and raised eyebrows. There is increasing stiffness of upper limbs and legs. The former are kept flexed and the latter hyperextended.

A typical tetanic spasm lasts 5 to 10 seconds and consists of agonizing pain, stiffness of the body which gets almost arched backward with retraction of head (opisthotonos) and clenching of jaw. As the disease progresses, a very simple stimulus also precipitates an attack. In advanced cases, spasms may become almost a continuous and constant phenomenon.

High fever is uncommon but a low grade fever is usually present.

Lead encephalopathy, occurring late in the course of plumbism is characterized by convulsions, high intracranial pressure and coma. A preceding history of transient abdominal pain, resistant anemia, weightloss, irritability, vomiting, constipation, headache, personality changes and ataxia is usually elicitable.

A lead line over the gums is characteristic of plumbism. Urine lead level of over 80 mcg/d/24 hours is diagnostic. *Shigellosis,* which usually manifests in the form of bacillary dysentery, may also cause in one in 10 subjects convulsions together with such CNS symptoms as headache, delirium, neck stiffness and fainting.

Nontyphoidal salmonellosis, though commonly a cause of gastroenteritis (particularly the outbreaks occurring in late summer and early fall), may also be responsible for very high fever, headache, confusion, change in senorium, meningismus and convulsions.

Anoxia

Anoxic state, as a result of such factors as inhalation anesthesia or sudden severe asphyxia, may cause convulsions.

Biochemical Defects

Hypocalcemic tetany in the postneonatal period occurs in subjects suffering from such predisposing conditions as vitamin D deficiency rickets, malabsorption syndrome, alkalosis or hypoparathyroidism which may be idiopathic or secondary to operative damage in thyroidectomy done for thyrotoxicosis.

The diagnosis of tetany associated with rickets is not difficult. The patient shows usual evidence of rickets such as delayed closure of anterior fontanel, rachitic rosary and widening of wrists. X-ray wrist shows cupping, fraying and fragmentations of the epiphyseal ends of radius and ulnar and increased distance between the epiphysis and carpal bones. Senim alkaline phosphatase and phosphorus are elevated. Serum calcium is low.

In idiopathic hypoparathyroidism, tetanic convulsions occur in infants suffering from defective dental enamel, brittle nails, cataract, recurrent diarrhea susceptibility to fungal infection, hypocalcemia and hyperphosphatemia. This combination is named DiGeorge syndrome. Remarkable lymphocytopenia and immunologic deficiencies constitute its hallmark.

In another form of idiopathic hypoparathyroidism, hypo-calcemic convulsions are superimposed on such associations as short stature, mental retardation and shortening of the ulnar metacarpal bones so that the index finger becomes the longest finger. This form is tended pseudohypoparathyroidism.

Hypomagnesemia tetany must be suspected if in spite of adequate therapy with calcium, the patient's hypocalcemic state fails to respond clinically, biochemically or both.

Hypoglycemia in the postneonatal period may be due to insulin overdose, hyperplasia of islets of Langerhans, hypopituitarism,

adrenocortical insufficiency, liver disease, glycogenoses or fractose intolerance.

Manifestations include early morning convulsions preceded by pallor, sweating and weakness.

Electrolyte Imbalance

Hypo- or hypernatremia, usually in association with dehydration or its careless correction, may cause convulsions even in later infancy and childhood as in neonatal period.

Cerebral Edema

Convulsions may complicate the clinical profile in a child with acute nephritis, burns or allergic edema of the brain. The development may well be related to cerebral edema.

Drugs

A large number of drugs are suspected of causing convulsions. The list includes phenothiazines, aminophylline, antihistamines, acetazolamide, diphenoxylate, strychnine, propoxyphenes, hexachiorophene, steroids, amitryptalline, amphetamine, imipramine, pyrimethamine, chloroquine, carbamazepine, nalidixic acid, metoclopramide, and isoniazid.

Chronic or Recurrent Convulsive Disorders

Epilepsy

The term refers to "various symptom complexes characterized by recurrent, paroxysmally attack of unconsciousness or impaired consciousness, usually with a succession of tonic or clonic muscular spasms or other abnormal behavior". It may be organic (secondary or symptomatic) or idiopathic.

Organic epilepsy: It is frequently accompanied by cerebral palsy, mental retardation and ECG abnormalities. Various conditions that may cause it are: • *Post-traumatic:* Direct damage to brain tissue • *Posthemorrhagic:* Injury to brain at birth or afterwards, bleeding diathesis, rupture of miliary aneurysm, pachy meningitis • *Postanoxic:* An after-effect of severe neonatal asphyxia • *Postinfec-tious:* Meningitis, encephalitis, cerebral abscess, sinus thrombophlebitis

- *Post-toxic:* Kernicterus, chronic poisoning with lead, arsenic, etc.
- *Postmetabolic:* Hypoglycemic brain damage • *Degenerative:* Intracranial neurofibromatosis, cerebromacular degeneration, subacute sclerosing panencephalitis (SSPE)
- *Congenital:* Arteriovenous aneurysm, Sturge-Weber type of vascular anomaly, cerebral aplasia, porencephaly, hydrocephalus, tuberous sclerosis
- *Parasitosis:* Cysticercosis (Fig. 12.2), hydatid disease, ascariasis, toxoplasmosis, syphilis.

Idiopathic epilepsy: Also called cryptogenic, primary, essential or genuine epilepsy, it may be of genetic or acquired type.

Grandmal epilepsy is characterized by generalized tonic-clonic convulsions which are predominantly tonic during infancy. The attack in one-third cases preceded by an "aura", manifests suddenly. During the tonic phase, lasting less than 20 to 40 seconds, the child usually loses consciousness. His face becomes pale and gets distorted with rolling of the eyeballs upward or to one side. The pupils dilate and corneas become insensitive to touch. The head is thrown backward or to a side. Rapid contraction of jaw muscles

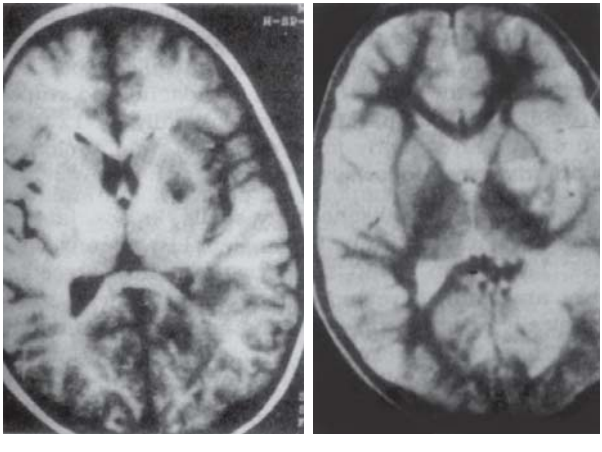

Fig. 12.2: *Neurocysticercosis* MRI, T1- and T2-weighted axial images, showing degenerating parenchymal cysts.

may cause biting of the tongue. Rapid contraction of the diaphragm and intercostal muscles may force the air out of the lungs through the closed glottis, causing a characteristic "starving cry". Rapid contraction of abdominal muscles may cause micturition, and less often, even defecation. As the tonic phase progresses, inadequate respiration results in cyanosis.

The clonic phase, which may not be quite perceptible in infancy, follows tonic phase, lasting over a variable period.

After the attack, the patient usually sleeps. The post-convulsive sleep is followed by the so-called "postictal reactions" in the form of confusion, headache and stupor. Occasionally, todd paresis/ paralysis (usually for 12 to 24 hours but infrequently for a week or so), and prolonged automatism may follow.

Petit mal epilepsy (absences, dizzy spells, lapses, fainting turns) is characterized by brief transient loss of consciousness, lasting up to 30 seconds, without any preceding aura, any convulsive movements or any postictal sleep. Classically, a child, busy in writing or reading, suddenly stops the activity, resuming it after the attack is over in some seconds, usually less than 20 to 30 seconds. During the attack, he is likely to drop the pen or notebook held in hand. Falling on ground, as in the case or grand mal seizures, is rare. The child is usually unaware of the attack. Factors that precipitate an attack include exposure to blinking light and hyperventilation. The frequency may be one or two episodes a month, or hundreds of them a day.

Typically, petit mal seldom occurs before the age of 3 years and often settles without any treatment by puberty. The peak incidence in childhood occurs between 4 to 8 years. The incidence in girls is higher than in boys.

EEG shows a characteristic 3 per second spike and wave pattern.

Focal epilepsy, though usually of postorganic origin, may occasionally be idiopathic. It may be sensory or motor, the latter being the dominant variety seen in childhood.

In the motor variety, called Jacksonian epilepsy, convulsions are typically clonic, involving muscles that are usually brought into action or voluntary movements. Thus, hands, face and tongue are more frequently affected than feet and trunk. By the term "Jacksonian march" is meant that focal convulsions in a particular

part progress too others in a fixed pattern. For instance, convulsions beginning in thumb would spread to fingers, wrist, arm, face and leg on the same side in this fixed order. A point meriting mention is that, in focal epilepsy, consciousness is usually not affected unless, of course, when its spread is rapid and extensive.

Psychomotor epilepsy (temporal lobe epilepsy) is characterized by visceral symptoms like nausea, vomiting or epigastric sensations, followed by short period of increased muscular tonicity and, later, semipurposive movements during a period of impaired consciousness or amnesia. Vasomotor manifestations such as circumoral pallor are frequently present. Some children may have slight aura in the form of a "shrill cry" or an indication for "help". The episode usually remains for 1 to 5 minutes. The postictal period is often marked by a brief spell of sleep or drowsiness. Thereafter, the child resumes normal activity.

EEG is often normal, except during the episode of seizure.

Infantile myoclonic epilepsy (infantile spasm, salaam seizures, lightning major, jacknife epilepsy, West syndrome) is characterized by massive attacks of sudden dropping (flexion) of the head and flexion of the arms, once or as many as several hundred times a day. The affected child is under 2 years of age, usually under 6 months. Significant developmental as well as mental retardation is more or less a rule in both primary (seizures occurring before 4 months or developmental level low right from beginning as in congenital cerebral defect) and secondary (following unrecognized encephalitis or an underlying defect in cerebral metabolism) types.

EEG changes are in the form of random high-voltage slow waves and spikes, suggesting a disorganized state. *Hypsarrhythmia* is the name given to this EEG pattern.

Epilepsy-Simulating States and Epileptic Equivalents

Narcolepsy

This disorder, simulating epilepsy, occurs only rarely in childhood. Boys suffer more often than girls. The attack is characterized by diurnal episodes of irresistible sleep, usually precipitated by sudden emotional upheaval. The patient, while working, talking, swimming,

asleep. The sleep is shallow and he can easily be aroused. After waking up, he is quite alert.

Narcolepsy usually becomes chronic though spontaneous cure, or, at least, improvement occurs more often in it than in the case of true epilepsy.

Hysteria

Also called hysterical fits or psychogenic epilepsy, the condition occurs in children usually above 6 years, with a typical neurotic background. During the attack, such characteristic features of true epilepsy as dilation of pupils, pallor of skin and mucous membrane, true loss of consciousness, loss of sphincter control and bodily injury are absent. Further, the attack lasts fairly long (half-an-hour or so) and during its course the patient exhibits bizarre crying, moaning and irrelevant talk.

Breath-Holding Spells

This common condition of early childhood with onset between 6 to 18 months of age is sometimes accompanied by tonic and clonic convulsions in which case differentiation from true epilepsy becomes essential. First, in breath-holding spells, an obvious precipitating factor such as a disciplinary conflict between the child and the parents (which may manifest in one or the other form) can invariably be elicited. Secondly, cyanosis in spells precedes convulsions whereas in epilepsy it appears after the convulsions have progressed. Thirdly, EEG in spells is invariably normal.

Syncope

Simple fainting spell, often complicated by tonic and clonic convulsive reactions involving face and arms, may follow a pinprick, a sudden fright or some such situation, provided that the child is in sitting or standing position. Such a subject has a defect in reflex regulation of the vascular system. As a result, with precipitation from one of the factors, sudden relaxation of the visceral venous system occurs, leading to bradycardia and hypotension. Note that if you have the child lie flat on table, or if you make him cry vigorously before and during a minor surgical procedure such as drawing a blood sample, chances are that he would not have fainting spell.

Remaining causes of fainting, chiefly due to transient cerebral anemia, include hyperventilation in upright position, Stokes-Adams syndrome, paroxysmal tachycardia, hyperactive carotid sinus reflex (as in sick sinus syndrome resulting from myocarditis or cardiac surgery), posterior fossa tumor, cough syncope (as in asthma) and extension of neck in a child with fused cervical vertebrae.

Migraine

Some authorities regard migraine as a variant of epilepsy on account of its episodic nature often preceded by an aura, its chronicity, its genetic features, its occurrence in association with epilepsy in the same family, and occasional replacement of migraine by typical epilepsy in due course.

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Chapter 13 Cough

The term, *cough*, refers to the violent and noisy expulsion of air from the lungs. Ordinarily, it is a normal reflex and aims at clearing the tracheobronchial tree. In the presence of a pathological condition, it may assume a magnitude that is quite disturbing, both to the sufferer and the people around.

The stimulus for producing cough is of two types. First, exogenous as in smoke, dust, or foreign body. Second, endogenous as in bronchitis, bronchiolitis, pneumonia, respiratory airway edema, excessive production of mucus, and stimulation of vagus nerve by mediastinal tumors, aneurysms or aortic arch anomalies.

Cough may be acute or chronic in nature

The diagnostic possibilities are narrowed down considerably from clarification on the following points in the history: Is the cough acute or chronic? Acute episodes of cough may accompany acute bronchitis, bronchiolitis or pneumonia. If hoarseness and cough coexist, viral laryngo-tracheobronchitis is a sound possibility. Is the cough productive or nonproductive? What is description of sputum? When did cough start? Is it barking or brassy? Is it accompanied by wheezing? Any associated fever or other constitutional manifestations? Any relationship to food? Any upper respiratory congestion? Is there any history of allergy, heart disease, asthma or tuberculosis?

Physical examination should, among other things, pointedly find out if the chest, nose and throat are normal or abnormal. Inspiratory stridor indicates laryngeal disease. Widespread rhonchi indicate major airway obstruction (bronchospasm). Fine crepitations favor pneumonia or pulmonary edema in which fluid

fills the alveoli. Is there any localized or generalized lymphadenopathy? Any evidence of congenital or acquired heart problem? Whether liver and spleen are palpable? Whether there is rhinorrhea, blocked nose or tonsilitis?

Upper Respiratory Tract Infections

Acute infection of the upper airway (frequently viral: adenovirus, enterovirus, myxovirus) is often accompanied by dry cough. Other symptoms include blocked or running nose, earache or sore throat. Chest examination usually reveals no abnormal finding, except for conducted sounds from the upper respiratory tract. Usually the disease is self-limited.

Lower Respiratory Tract Infections

Pneumonias, both bacterial and viral, are invariably accompanied by cough. Fever, varying degrees of respiratory distress, prostration and, on auscultation, crepitations may be present. Decreased breath sounds with localized crepitations and dullness of percussion note favor consolidation. Remember, manifestations in viral pneumonia are not as severe as in bacterial pneumonia.

Acute bronchitis is characterized by dry cough that is worst at night, mild constitutional symptoms and wheezing. Cough may become productive in a span of about 5 days. Some tachypnea and widespread rhonchi and coarse crepitations are present.

Acute bronchiolitis usually follows an upper respiratory tract infection and is characterized by onset of rapid shallow breathing and prostration. Cough is usually mild; so is the fever. Marked dyspnea may lead to cyanosis, dehydration and respiratory acidosis. Chest signs include intercostal and suprasteroal retraction, hyperresonant percussion note, diminished breath sounds, characteristic wheezing and crepitations at the end of inspiration and early expiration.

Bronchial Asthma

Attack is characterized by marked dyspnea, bouts of cough and expiratory wheezing. Cyanosis, pallor, sweating, exhaustion and restlessness are often present and the pulse is rapid. The disease should be seriously considered if the cough occurs in the early

morning hours because of exposure to house dust, before the child falls asleep or is induced by, physical exertion, particularly if cough has a paroxysmal pertussis-like character.

Pleuritis

It may present as dry cough. But, then, there usually is a unilateral pain or friction rub.

Mouth-Breathing

In case of adenoids or thumb sucking, it may be accompanied by dry cough. At night, cough becomes worse since the air breathed through the mouth is neither filtered nor moistened and irritates the tracheal mucosa, causing cough and susceptibility to superimposed recurrent infection.

Congestive Cardiac Failure

It may lead to congestion of the pulmonary circulation. This causes dry cough to begin with but, as pulmonary edema increases, cough too becomes productive.

Neuropathic State

It may lead to compulsive dry cough as an attention-seeking device. It is a sort of "tic".

I see about a dozen of such cases a year. Of course, I make sure organic etiology (especially, bronchial asthma) is carefully excluded.

Bronchiectasis

It is characterized by an insidious onset with persistent or recurrent cough productive of copious, mucopurulent sputum which is foul-smelling and has postural relationship. In advanced cases, dyspnea, cyanosis, clubbing and hemoptysis may also be present. Classical auscultatory finding is the "localized crepitations" repeatedly found over the affected area. Other signs suggestive of collapse-consolidation may also be present.

Lung Abscess

Acute abscesses may develop during the course of staphylococcal pneumonia.

Chronic abscesses have insidious onset with fever, persistent cough and foul-smelling sputum. At times, dyspnea and chest pain may occur. Clubbing develops in a patient who has remained without adequate treatment over a prolonged period. Chest signs are usually those of consolidation with bronchial breathing.

Foreign Body

Aspiration of peanut, almond, popcorn, groundnut seed, grains or pulses may cause a sudden paroxysm of cough in a subject who was earlier otherwise well. There is congestion of the face and a state of almost suffocation. Partial obstruction of the main bronchus results in massive emphysema; the complete obstruction causes massive collapse. A few days later, the child may be brought to the hospital with signs and symptoms of pneumonia. Further delay may lead to development of lung abscess or bronchiectasis. Diagnosis is from history of a sudden paroxysm of violent cough, clinical findings of pneumonia, collapse, emphysema, etc. bronchoscopy and radiology.

Pertussis (Whooping Cough)

Three stages, each stage lasting around 2 weeks, are known. The first, i.e. catarrhal stage, consists of catarrhal manifestations in the form of rhinitis, sneezing, lacrimation, fever and irritating cough that is nocturnal to begin with but later becomes diurnal. The second, i.e. paroxysmal (spasmodic) stage is characterized by severe paroxysmal coughing which consists of repeated series of coughing (expiratory), followed by sudden deep, violent inspiration with characteristic crowing sound called "whoop" due to laryngospasm. There is associated suffocation, congested face with or without cyanosis, anxious look and bulging of eyes. Sweating, congestion of neck veins and confusion may follow the spells. Periorbital edema, subconjunctival hemorrhages, ulcer of frenulum of tongue, exhaustion, dehydration and convulsion may complicate the clinical picture. The third, i.e. convalescent stage, is characterized by slow resolution of the paroxysms. The so-called "habit pattern of coughing" may, however, linger on and on over subsequent weeks and months. Remember, in previously immunized infants and in children below 6 months of age, the characteristic symptom-complex may not be encountered.

Remaining Causes of Cough

Smoking, cystic fibrosis tracheoesophageal fistula, hiatal hernia, stenosis of esophagus, megaesophagus due to achalasia, congenital heart disease, alpha-1-antitrypsin deficiency, repeated aspiration as in cerebral palsy, compression of trachea by enlarged mediastinal glands or vascular anomalies.

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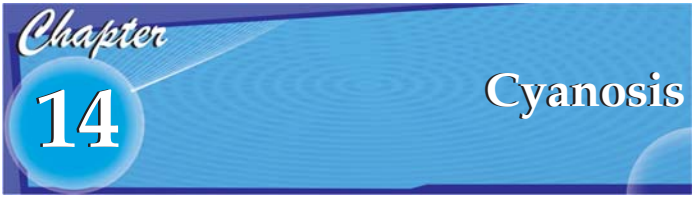

Cyanosis means bluish discoloration of the skin and mucous membrane due to an increase in the level of reduced hemoglobin of arterial blood (congenital heart disease), or accumulation of abnormal hemoglobin (methemoglobinemia).

It is of value to ascertain whether cyanosis in a given patient is central or peripheral. Central cyanosis is the result of inadequate oxygenation of blood (congestive cardiac failure, certain lung conditions), or mixture of arterial and venous blood (right to left shunt, venous-arterial shunt). Such a cyanosis is generalized though the involvement of tongue is characteristic. Peripheral cyanosis is due to high reduction of oxyhemoglobin occurring in capillaries as and when blood flow is slow (cold injury, heart failure, venous obstruction). In this situation, tongue remains unaffected and limb is cold. Remember that cyanosis associated with heart failure may well be of mixed type.

It is worth noting that since cyanosis is recognized when at least 5 g/dL of reduced (unsaturated) hemoglobin is present in the systemic arterial blood, one may fail to detect it in individuals with severe anemia. On the other hand, subjects with polycythemia may manifest it more easily. Skin color and thickness as also blood flow also influence the determination of cyanosis.

While examining a patient for cyanosis, it is a must to do so in good light (preferably daylight) and also to have a normal control for comparison. Once it is clear that the subject has central cyanosis, it needs to be found out if it is secondary to a cardiac or a respiratory disease.

Cyanosis of Respiratory Disease

Upper Airway Obstruction

Deficient oxygenation of arterial blood may occur in congenital anomalies of larynx, trachea and vascular ring, or from aspiration/ inhalation of amniotic fluid, mucus or foreign body. Inspiratory stridor and suprasternal and intercostal retraction are characteristic.

Defect in Diffusion

Acute respiratory distress syndrome, including hyaline membrane disease, is the most important cause of cyanosis in the newborn.

Pneumonia may cause cyanosis from diffusion defect at any age.

Wilson-Mikity syndrome causes cyanosis and respiratory distress a week or two after birth.

Cyanosis of Heart Disease

Congenital Heart Disease

Transposition of great arteries (TGA) is the most common congenital heart disease that causes marked cyanosis right at or soon after birth. Dyspnea, congestive cardiac failure and failure to thrive occur later. Clubbing also develops in few months.

It occurs predominantly in male infants (male-female ratio 4 : 1). These infants are of relatively large birth weight though they gain poorly subsequently. Incidence of diabetes mellitus in the grandparents is high.

Examination reveals a remarkably enlarged heart. Auscultation shows no classical pattern of murmurs which are usually related to the type of coexisting communication without which TGV is incompatible with life.

Radiology shows enlarged heart (not on the first day but by the end of first week) which may appear "egg-shaped", and plethoric lung fields.

ECG reveals right ventricular hypertrophy (RVH), right axis deviation and often P-pulmonale. Signs of left ventricular hypertrophy (LVH) may be seen in case of accompanying pulmonary hypertension or ventricular septal defect (VSD).

Cardiac catheterization and selective angiography are necessary to confirm the diagnosis of exact type of transposition.

Tetralogy of Fallot (pulmonary stenosis, ventricular septal defect, right ventricular hypertrophy, dextro position and overriding of aorta) is the most common cause of persistent cyanosis that usually begins after the third month of life. Alongwith cyanosis, the infantal so has dyspnea. As he grows, he feels comfortable in squatting or lying-down position only. Anoxic, hypoxic or cyanotic spells may occur due to cerebral anoxia. Such spells consist of dyspnea and cyanosis with or without unconsciousness. By the age of 2 years, some clubbing becomes obvious.

Auscultation reveals a loud short systolic murmur that is best heard at left sternal border in the third space. The louder or harsher the murmur, the less is the degree of severity of the disease. The murmur is usually not accompanied by a thrill. P2 is usually single.

Blood studies show polycythemia

X-ray chest reveals oligemic (poorly vascularized due to diminished pulmonary blood flow) lung fields, a small boot-shaped heart with the tip of the boot turned up above the diaphragm (because of right ventricular hypertrophy), and concavity of the pulmonary artery segment (small pulmonary conus). Aortic arch is on right side in 20 to 25% of the cases.

ECG shows right ventricular hypertrophy (RVH) and beaked P waves.

Two-dimensional echocardiography reveals anterior-superior displacement of the outflow ventricular septum, causing stenosis of the subpulmonic right ventricular outflow.

Cardiac catheterization and selective angiocardiography are of vital importance to elucidate anatomic anomalies in doubtful cases.

Tricuspid atresia is characterized by appearance of severe cyanosis together with dyspnea and hypoxic spells shortly after birth.

Auscultation reveals a systolic or continuous murmur at the base or the apex due to atrial or ventricular septal defect.

ECG shows P waves, left ventricular hypertrophy with left axis deviation and A-V block.

X-ray chest shows oligemic lung fields. There is marked predominance of the left heart. The base of the heart is narrow and right border is straight because of absent or hypoplastic right ventricle, provided that right atrium is not markedly dilated.

Truncus is characterised by presence of marked cyanosis at birth. Auscultation reveals a loud systolic murmur.

X-ray shows cardiomegaly and oligemic lung fields, provided that associated pulmonary atresia is not present.

Total anomalous pulmonary venous return (TAPVR) is characterized by marked cyanosis as a result of right-to-left shunt. ECG reveals right ventricular hypertrophy. Incomplete bundle branch block may or may not be present.

Eisenmenger complex is characterized by reversal of the shunt from left-to-right to right-to-left in cases of such defects as ventricular septal or patent ductus arteriosus, thereby causing marked cyanosis. The condition carries poor prognosis.

Congestive Heart Failure

Here, cyanosis is predominantly peripheral as a result of delayed venous return. Remaining manifestations of heart failure are: right-sided raised JVP, hepatomegaly, splenomegaly in infants, edema, basal crepitations; left-sided tachypnea, orthopnea, chest retraction, cough, sweating over head in infants.

Cyanosis Related to Abnormal Hemoglobin

Methemoglobinemia may produce a blue tint that is less bright and more leaden than cyanosis encountered in respiratory or cardiac disease. Its causes in infants include poisoning from nitrite, aniline dyes or drugs like phenacetin, sulfonamides and dapsone. In older children, nitrobenzene-containing drugs may be responsible for methemoglobinemia.

There is a condition, familial congenital methemoglobinemia, that results from abnormal hemoglobin M. Inheritance shows autosomal dominant pattern.

Deficiency of NADH — methemoglobin reductase (diaphorase) is an autosomal recessive disorder with cyanosis.

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Chapter 15 Deafness

The term, *deafness*, denotes inability to hear with or without amplification. The term, *hearing loss*, means impairment of hearing ability. The deafness is rarely complete. The disability may have significant effect on normal speech and social development of the child. The overall incidence of hearing impairment is around 1–2/1000 children. In our busy pediatric OPD at Jammu, I was, on an average, seeing a dozen cases or so a week. Admittedly, a much larger number apparently goes to the ENT OPD or remains undetected. According to a conservative estimate, in India alone, there are around 35 million children with hearing impairment of varying grades.

Deafness may well be congenital or acquired, temporary or permanent, organic or nonorganic, peripheral or central, condutive or conductive, and mild, moderate or profound.

It is customary to think of deafness as central or peripheral. Central deafness results from auditory deficit originating along central nervous system from the proximal eighth nerve to the cortex from such insults as seizures, tumors, demyelinating disease, Landau syndrome, etc.

Peripheral deafness refers to dysfunction in sound transmission through the external or middole ear as also its conversion into neural cavity at the inner ear and eighth nerve. It may be of three types:

1. Conductive in which the disease affects the sound conducting mechanism of the ear, say middle or the external ear as in impacted wax, foreign body, perforation of tympanic membrane, otitis media with effusion, cholesteatoma, osteosclerosis, etc.

2. Sensorineural in which the disease involves the perceiving apparatus, say cochlea, eighth nerve or any other area up to the brainstem as in lesion of acoustic division of eighth nerve or destruction of hair cells in inner ear.
3. Mixed in which condutive and sensorineural deafness coexist. Remember, only around 6% hearing impaired children have

profound hearing loss. Others manage to retain some hearing. Nevertheless, even mild or unilateral deafness has a detrimental effect on development and performance of the child. In particular, deafness occurring early in life is likely to affect the development of speech, behavior, attention, academic attainment, social development and emotional development.

All infants and children suspected of deafness may not really be deaf. For instance, a child may apparently appear to be deaf just because he is unmindful of commands from his intense involvement in play or certain such activities. Such a response may also be encountered in a child with bad manners and indiscipline. A mentally subnormal child may well be slow in his hearing response though he may not actually be deaf. Inadequate social responsiveness, as in autism, often makes the child appear deaf.

Early identification of deafness is through high index of suspicion (high risk register criteria) and screening methods. For this, it is important to have a sound knowledge of the timetable of development of normal hearing and speech (Table 15.1).

History should include information on maternal infections (STORCH), consumption of drugs by the mother during pregnancy, birth asphyxia, severe hyperbilirubinemia, septicemia, meningitis, administration of ototoxic drugs during neonatal period, etc. Developmental delay, particularly in speech, should be a wakeup call for evaluation for hearing loss. In a young child, it is important to exclude wax in the external ear employing an auroscope.

As a rule, all infants, especially the high-risk ones (various in utero infections like rubella, use of ototoxic drugs during pregnancy, perinatal hypoxia, congenital deafness in the family, CNS infections), should be screened in early weeks of life and, in any case, by 3-4 months of age. The usual neonate responses include a loud noise by a startle reaction, a facial grimace, blinking,

Table 15.1: Timetable of development of various phases of hearing and speech

0 - 3 months	Startles to loud noise, awakens to sounds, blink reflex or eye widening to noise
3 - 4 months	Quietens to mother's voice, stops playing and starts listening to new sounds, looks for source of new sounds that are not in sight
6 - 9 months	Enjoys musical toys, coos and gurgles with inflection, says “mama”, “papa”
12 -15 months	Responds to his name, responds to "no", follows simple requests, develops an expressive vocabulary of 3-5 words, imitates certain sounds
18 - 24 months	Knows body parts, develops expressive vocabulary at least 20-50 words, uses 2-word, half of speech intelligible for strangers
36 months	Develops expressive vocabulary of 500 words, uses 4 - 5 word sentences, speech 80% intelligible for strangers, understands some words

gross motor movements, quieting of crying or cying when quiet, opening the eyes when closed, inhibiting suckling responses, a catch in respiration, and a change in the heart rate. A 3-4 month infant responds by turning his head towards the sound. A good screening test consists in a rattle held 25 cm away from the neonate's ear, on a level with the ear the movements of the eyes or head in response to sound are noted.

Following screening procedures, a resort to sophisticated audiographic evaluation in a diagnostic setting is warranted. It comprises of auditory brainstem response (ABR) test/brainstem electric response audiometry (BERA) in which electrical signals are picked up by surface electrodes originating from acoustic signs passing to the brainstem from the cochlear nerve.

CONGENITAL DEAFNESS

Genetic

Familial (early onset)

Syndromal: Waardenburg syndrome, characterized by white forelock, lateral displacement of inner canthi, broad nasal bridge, heterochromia of iris and deafness (Fig 15.1), is an important cause

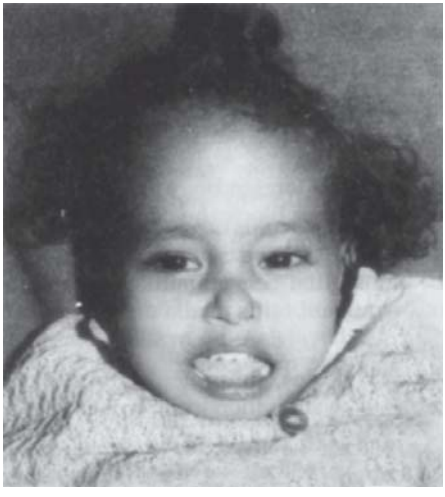

Fig. 15.1: *Waardenburgs[1] syndrome (type 1)* Note the white forelock, lateral displacement of inner canthi, broad nasal bridge and heterochromia. The child had sensorineural deafness as well.

of congenital deafness. Other syndromes accompanied by deafness include Pendred, Usher, Treacher Collins, Pierre-Robin, Crouzon, Klippel-Feil, trisomy 13 (Pataou), 16 (Edward), and 21 (Down).

Congenital defects: Association with cleft palate

Nongenetic

Drug teratogenicity: Quinine, thalidomide, aminoglycosides, vancomycin, neomycin, irradiation.

Intrauterine infections: Rubella, CMV, syphilis, HIV. About one-third infants of mothers who had rubella in the first three months of pregnancy are likely to suffer from hearing impairment which may well be unilateral or partial. Just because no history of rubella during pregnancy is forthcoming is not a good reason to exclude this infection.

Metabolic/endocrinal: A proportion of infants with hypothyroidism (Fig. 15.2) may suffer from hearing impairment.

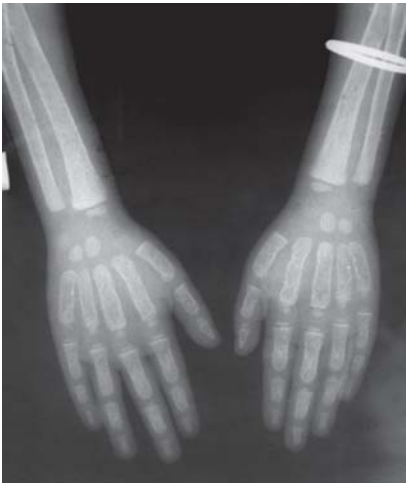

Fig. 15.2: *Hypothyroidism* Note that only 2 carpal bones are visualized in this 2½ years old child (who presented with delayed milestones, coarse facial features and hearing loss). Bone age is therefore just 1 year retarded. Diagnosis of hypothyroidism was supported by T_3, and TSM levels.

POSTNATAL

Genetic

Familial (late onset)

Syndromal: Hunter-Hurler, von Recklinghausen, Alport, Alstrom.

Nongenetic

Mechanical: Wax and foreign body are important causes of partial deafness. These block the conduction of hearing by mechanical obstruction.

Infections: Meningitis, encephalitis, measles, mumps, syphilis, and recurrent otitis media are important causes of acquired deafness.

Drugs: Aminoglycosides, ibuprofen, quinine, chloroquine, salicy-

Toxic: Severe neonatal hyperbilirubinemia, regardless of the etiologic factor, is a potential precurssor of deafness. Though it is usually accompanied by other signs of kernicterus such as athetosis, at times deafness may be the only finding.

Brain damage: Cerebral palsy, mental retardation, VLBW, severe asphyxia, and prolonged mechanical ventilation are frequently accompanied by deafness. According to one estimate, one-fifth to one-fourth children with cerebral palsy suffer from hearing loss, the incidence being higher in athetotic than in spastic cerebral palsy.

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Chapter 16 Delayed Puberty

The term, *delayed puberty*, denotes absence of onset of puberty (signs of sexual development in the form of increase in volume of testes in boys and breast budding in girls) by 14 years in boys and 13 years in girls. We were seeing a case or two in a fortnight in our busy pediatric outpatient at the SMGS Hospital attached to the Govt. Medical College, Jammu.

Mind you, environmental and genetic factors have significant influence on onset of puberty. In America, for instance, white girls have relatively delayed puberty compared to their white counterparts. The group of girls in whom strenuous physical exercise and slimness are the hallmark (e.g. atheletes, sports girls, gymnasts, ballet dancers) are known to have quite delayed puberty.

History and physical examination should obtain information on significant nutritional deficiencies (both primary and secondary), chronic illnesses such as chronic diarrhea/ malabsorption, tuberculosis, asthma, anosmia, etc. Chronic consumption of such drugs as steroids, family history of delayed puberty (CDGP, the short of constitutional delay in growth and puberty) as also testicular size, phalic size, pubic hair, breast development, growth velocity, etc. Whereas growth velocity is all right for child's chronologic age, it is subnormal in hypo-gonadotrophic hypogonadism. In the latter, pubertal progression too is slow compared to the normal in CDGP.

It is of value to record Tanner's pubertal staging, height measurement, body proportions, weight, etc. as also to identify accompanying obesity, if any.

Special investigations include determination of bone age, endocrinal studies with special reference to basal levels of

hormones, gonadotrophins, adrenal androgens, prolactin GnRH stimulation and hCG stimulation tests, karyotyping, testicular biopsy and pelvic ultrasonography and vaginal smears in girls.

Constitutional Delay of Growth and Puberty (CDGP)

Genetic factors may cause delayed development and delayed puberty because of slow onset in gonadotropin release. There is frequently a positive history of "late maturers" in the pedigree chart of the index case. In due course, maturation begins to proceed normally. There is, therefore, as a rule, no role of any therapy, except for the psychotherapy for the associated psychological problems usually secondary to the associated short stature.

Delayed Puberty Associated with Chronic Systemic illnesses

Chronic systemic disorders such as chronic malnutrition, chronic diarrhea/malabsorption syndrome (celiac disease, tropical sprue, cystic fibrosis), chronic anemia, and anorexia nervosa.

Hypogonadotrophic Hypogonadism (Failure of GnRH and/or Low FSH, LH)

Two varieties are recognized. In the congenital/genetic variety, lack of gonadotrophin causes delayed testicular maturational. The subjects with this condition are tall but have small histologically immature testes. It is encountered in Kallmann syndrome (eunuchoid stature, infantile genitalia, color blindness, anosmia, Leydig cell hypofunction), Pasqualini syndrome or fertile eunuch (eunuchoid stature, normal genitalia or a normal penis with small testes and reduced number of Leydig cells), Laurence-Moon-Biedl syndrome. Congenital anomalies, and primary gonadotrophin deficiency (hypopituitarism).

In the acquired variety, the operative factors include intracranial tumors, inflammatory and traumatic lesions, irradiation of hypothalamic-pituitary region, hypothyroidism (Fig. 16.1) and hyperprolactinemia.

Hypergonadotrophic Hypogonadism/ Primary Gonadal Failure (High FSH, LH)

In the congenital/genetic variey, etiologic conditions include Turner syndrome (45 XO), Klinefelter syndrome (47XXY) and Noonan syndrome.

In the acquired variety, causative factors include mumps-related orchitis, anticancer therapy for gonads, vanishing testes syndrome, testosterone biosynthetic defects, infiltrative or autoimmune diseases of gonads.

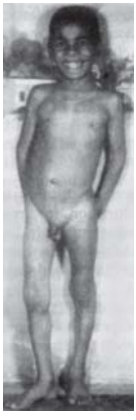

Fig 16.1: Delayed puberty of acquired variety in the 17-year-old boy with hypothyroidism.

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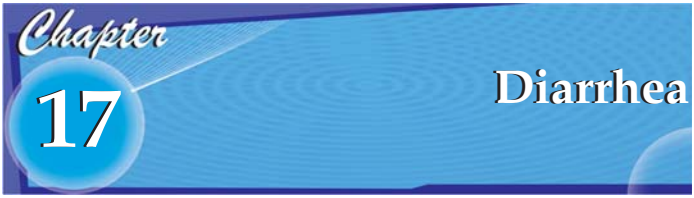

Acute diarrhea is defined as an increase in frequency, fluidity and volume of stools of short duration. It is responsible for around 20% of pediatric admissions in India and other developing countries. In the peak diarrheal season (summer and rainy season), 75% of pediatric beds may be occupied by children suffering from it.

Diarrhea ranks among the "three chief killers" of our infants and children. Almost 10% of preschool mortality and 25% of infant mortality is ascribed to diarrhea. The magnitude of the morbidity too is considerable.

History must, in the first place, verify the main complaint of diarrhea for its accuracy. Are stools indeed several in number with increased fluidity and volume? Subjects with loose watery stools exceeding 10/24 hours in number are in danger of developing dehydration, particularly if intake is restricted.

Remember that often diarrhea is overdiagnosed in newborns and infants who are entirely on breastfeeding. Babies on only breast milk not only pass frequent motions–frequently after each feed; at times even 24/24 hours–but the stools are also loose (unless he is suffering from Hirschsprung's disease). The color of stools may be bright green. There may also be curd in stools in early weeks.

Many babies are brought to the doctor with complaint that they pass frequent green small motions. The cause is almost always underfeeding. Hence, the name "starvation stools". They need to be adequately fed rather than managed with antidiarrheal drug(s).

How long has the child had diarrhea? Any vomiting? Any blood in stools? Is there any abdominal pain? Any relationship with feeding? Did it start following any special food item, say icecream? Any history of fever? Does he pass worms in stools or vomitus?

Is there any weight loss, drowsiness, abdominal distention, oliguria or anuria? Information on these points is important to evaluate severity of dehydration, if any.

Always enquire if there is previous history of recurrent diarrhea? The apparently acute diarrhea may well be related to the chronic problem such as malabsorption syndrome, intestinal infestations or irritable bowel syndrome.

Acute episode of diarrhea that persists beyond two weeks is termed *persistent (protracted) diarrhea.*

Chronic diarrhea has been differently defined by various authorities. There is, however, some consensus that this designation should be restricted to "diarrhea of at least two weeks duration, or 3 attacks of diarrhea during the last three months". Malabsorption is usual in this condition.

Though the list of etiologic factors remains more or less the same as described in the western textbooks, the order of relative frequency in India and other developing countries is decidedly different. Hence, the clinical approach also has got to be different.

The importance of a carefully-taken history cannot be overemphasized. Most valuable pointers and clues are likely to be obtained from answers to the following question:

1. Did the symptoms appear early in infancy (cystic fibrosis), or after the first six months of life (celiac disease)?
2. Was there any relationship between onset of symptoms and introduction of supplementary feeds (lactose intolerance), or cereals (celiac disease)?
3. Is there a family history of chronic diarrhea (cystic fibrosis, celiac disease, hereditary lactose intolerance)?
4. Is there any history of intolerance to an item of food, i.e. wheat, barley, rye (celiac disease), or milk (lactose intolerance)?
5. Was the child failing to thrive from early infancy, or did he start growth failure after introduction of a semisolid food? The latter situation is very much suggestive of celiac disease?

6. How is the appetite? It is generally increased in cystic fibrosis and in some children suffering from giardiasis. In celiac disease, it is invariably lost. Mothers of celiacs often express surprise "as to how children who eat so little can pass such voluminous stools".
7. Does the mother feel that the child eats like a glutton? When, in spite of this observation, the child is suffering from failure to thrive, one must entertain the possibility of cystic fibrosis. We have encountered this situation in some children suffering from symptomatic giardiasis as well.
8. What do the stools look like? Large, pale, frothy and very foul-smelling stools are highly suggestive of steatorrhea. Characteristically, white, fatty stools with plenty of undigested material are most often a feature of giardiasis.
9. Was the persistent diarrhea preceded by an attack of acute gastroenteritis? This situation is highly indicative of secondary lactose intolerance. The condition is fairly common and the stools in it are watery, profuse, accompanied by excess of flatus, and have very foul odor. The perianal area appears raw and red in a great majority of these children.
10. Is there history of excessive consumption of fluids (carbonated soft drinks, fruit juices, etc.)?

Every child with chronic diarrhea must have meticulous microscopic examinations of stools at least on 3 (preferably 5) consecutive days before one rules out presence of intestinal infestations.

The presence of numerous large fat globules, after staining with Sudan-III or eosin, is indicative of steatorrhea.

Chemical examination of stools for 24-hour stool fat is, however, a more reliable index of steatorrhea.

Remaining tests include D-xylose test, peroral or endoscopic jejunal biopsy, intestinal radiology, Schilling test, sweat chloride test, tryptic activity, lactose tolerance test, etc. The choice of test(s) is dictated by the clinical situation.

ACUTE DIARRHEA

Infective Diarrhea

Enteric infections are undoubtedly responsible for a large majority of pediatric diarrhea cases.

Enterobacterial responsible for diarrhea include *escherichia coli* (such strains as enteropathogenic, diarrheagenic, enterotoxigenic and enteroinvasive), *Shigella*, *Salmonella*, *Staphylococcus*, *Vibrio cholera*, *Yersinia enterocolitica*, *Campylobacter*, *Clostridium difficile*, *Klebsiella*, and *Pseudomonas aeruginosa*.

Such antibiotics as lincomycin, clindamycin and ampicillin may precipitate pseudomembranous enterocolitis, often from growth of clostridium. difficile. Manifestations are sudden onset of diarrhea (as such or bloody), abdominal distention and fever. Gross fluid loss kills 50% of the patients in spite of treatment.

Virus such as rotavirus, Norwalk-like agent, Hawaii virus, adenovirus, astroid virus, calcivirus, coronavirus, enterovirus and minirotavirus have been found to be responsible for majority of the cases of acute infective diarrhea.

Rotavirus is the most frequently encountered virus in diarrheal stools in nearly all areas in which it has been pointedly looked for. The peak incidence occurs in the age group 9 to 12 months. Excepting newborns, it has been observed to have a predilection for winter months in India as well as abroad. Transmission is by feco-oral route. The incubation period is usually less than 48 hours (range I to 7 days). The average duration of illness is 5 to 7 days. Its important clinical feature is that vomiting usually precedes the onset of diarrhea. About 30 to 50% cases show slight fever, 25% mucus in stools and just an occasional case blood in stools.

Norwalk and Norwalk-like agents are associated with outbreaks of generally mild gastroenteritis occurring in school, community or family settings. The incubation period is around 48 hours. The attack is usually mild and self-limited, lasting 12 to 24 hours in majority of the cases. Vomiting, abdominal pain, anorexia, headache, myalgia and malaise are important features of diarrhea associated with these viruses.

Parasites responsible for acute diarrhea include *L. giardia* and *Entameba histolytica*.

The usual presentation in symptomatic giardiasis is with vague abdominal pain, acute on chronic diarrhea, poor appetite, failure to thrive and nutritional deficiencies. Occasionally, acute dysentery-like manifestations may occur. Even transient ulcerative colitis has been described.

In amebiasis, the symptoms range from mild gastrointestinal upset to acute diarrhea/dysentery or chronic colitis. Unlike adults, who may have only loose motions, children usually pass mucus (free of pus) together with blood. The latter is generally not mixed with fecal matter or mucus. Abdominal pain and tenesmus may also accompany.

Cryptosporidiosis in immunocompromized hosts may cause severe diarrhea.

Strongyloidiasis, though uncommon in our country, may manifest with severe diarrhea, pain abdomen, mild itching and ulticaria at the site of penetration into the skin and chest manifestations simulating Loeffler syndrome.

Trichuriasis is characterized by prolonged diarrhea with bloodstreaked stools, right lower abdominal pain, tenesmus, malnutrition with anemia, rectal prolapse and allergic manifestations like eosinophilia, and Charcot-Leyden crystals in stools. In case of heavy infestation, numerous worms may be seen on the surface of the prolapsed rectal mucosa.

Dwarf tapeworm (H. nana) infestation may manifest with sudden onset of mucus or bloody diarrhea with abdominal pain.

Severe ascariasis may cause allergic necrotizing hemorrhagic enteritis. Manifestations include diarrhea, abdominal pain, vomiting and gross flatulance.

Fungi such as Candida albicans may cause acute diarrhea in children suffering from a serious illness, particularly when on prolonged antibiotic therapy.

Parenteral diarrhea may occur secondary to such infections as URI, otitis media, tonsilitis, pneumonia, urinary tract infection, malaria, septicemia, or peritonitis especially accompanying appendicitis.

Antibiotic-associated diarrhea (pseudomembranous colitis) may result from growth of *Clostridium difficile*, *Staphylococcus aureus* or *Clostridium perfringens*, following therapy with clindamycin, ampicillin, penicillin or cephalosporins. All antibiotics with exception of vancomycin stand implicated in its etiology.

Non-infective Diarrhea

Dietary factors include overfeeding, starvation, food allergy and food poisoning.

Osmotic diarrhea may occur in infants consuming a very large amount of sugar in the feed. The overwhelming osmotic load in the intestine pulls lot of water into the lumen, causing diarrhea. Such a diarrhea, unless it is allowed to become protracted, causes no such problem as dehydration or under nutrition.

Drugs causing diarrhea include ampicillin, iron, PAS, phenothiazines, nalidixic acid, thiabendazole, carbamazepine, niclosamide, dichlorophen and overdose of thyroxine. Antibiotic-induced pseudomembranous enterocolitis, in which clostridum. difficile is usually cultured, is described under "infective diarrhea" on page 106.

PERSISTENT DIARRHEA

The risk factors for an acute attack of diarrhea or gastroenteritis persisting beyond two weeks period include: • Six months to 1-year-age group of patients • LBW, prematurity and malnutrition, especially when accom

panied by vitamin A deficiency • Artificially-fed infants • Diarrheal episode accompanied by blood and mucus in stools,

e.g. disease caused by enteropathogenic or aggressive adherent *E. coli*, *Shigella*, *Campylobacter* jejuni and Rotavirus, especially in infants under three months.

- Indiscriminate administration of ORS, especially with high content of sugar
- Lactose intolerance
- Cow milk protein (CMP) allergy
- Septicemia and other systemic infections

- A preceding diarrheal episode in the recent past. Deterioration in nutritional status, insult to small bowel mucosa, contamination of artificial formula feed and osmotic diarrhea, are some of the factors that may singularly or in combination contribute to causation of persistent diarrhea
- Intestinal parasitosis: Heavy giardiasis is an important factor in tropical settings.

Three clinical patterns of persistent diarrhea have been recognized. These are:

- Several motions/day without any adverse effect on nutritional status growth and development
- Several motions without dehydration, malnutrition, growth and development
- Several motions with dehydration that is difficult to control. In second and third category of subjects, such manifestations

as progressive weight loss, malnutrition, anorexia; malabsorption and secondary infections are remarkable.

Diagnosis is largely clinical. The screening laboratory investigations include: • A meticulous stool microscopy for ova and cysts for at least

six successive days • Stool culture • Reducing substances in stools in case of acid • Fat stools balance studies, if stools appear fatty • Sweat chloride estimation in case of persistent diarrhea,

accompanied by recurrent chest infection • Serum zinc levels in case of persistent diarrhea, accompanied

by skin lesions.

CHRONIC DIARRHEA Protein-Energy Malnutrition (PEM)

This is by far the most common cause of chronic diarrhea in developing countries. The causes of diarrhea in PEM include:

1. Recurrent superimposed GIT infections, including infestations;
2. Effect of PEM *per se* on intestinal mucosa, causing reversible

disaccharidase (mainly lactase which results in disaccharide intolerance (mainly lactose), and damage to pancreas; and

3. Iron deficiency anemia (a common accompaniment of PEM) which can, on its own, lead to enteropathy by damaging the intestinal epithelium.

Iron-Deficiency Anemia

As I said earlier, chronic iron-deficiency anemia (no matter whether it occurs as such or in association with PEM) is capable of causing villus atrophy, resulting in absorptive defect and chronic diarrhea.

Intestinal Parasitic Infestations

L. giardia, Ent. histolytica, H. nana and Ancylduodenale are now known to be responsible for a significant proportion of cases of chronic diarrhea. In addition, Trichuris trichiura, Str. Stercoralis, T. solium, T. saginata and, infrequently Asc. lumbricoides may account for a small proportion to cases.

The widespread occurrence of PEM, iron-deficiency anemia and intestinal infestations in our settings demands that, in our approach to chronic diarrhea in pediatric practice, these three causative entities are carefully excluded. Then, and only then, the child should be subjected to a battery of investigations, most of which are cumbersome.

Endemic Tropical Sprue

Classically, the patient is a grown-up child with chronic diarrhea, malabsorption, considerable malnutrition and anemia.

Steatorrhea is usually moderate to gross. D-xylose test shows poor intestinal absorption. Partial or subtotal villus atrophy is present. Schilling test is almost always abnormal, indicating that intestinal mucosal atrophy and absorptive dysfunction are not limited to the upper gut but are present in the ileum as well.

Response to folic acid, tetracyclines, or both are gratifying.

Celiac Disease

Though one of the most common causes of chronic diarrhea in the West, celiac disease is relatively less frequent in pediatric population in our settings.

Also termed gluten-sensitivity and gluten-induced enteropathy, the disorder usually manifests a few months after introduction of gluten-containing foods-often a wheat preparation in the feeding program. Chronic diarrhea with large, pale, highly-foul-smelling stools which stick to the "pottie" growth failure, anemia and other vitamin and nutritional deficiencies, pot-belly, irritability and anorexia are the classical presenting features.

To establish functional and histologic defect of small intestinal mucosa, you must demonstrate abnormally high 24-hour stool fat, poor absorption in D-Xylose test, and villus atrophy in peroral jejunal biopsy. Serologic markers are now being increasingly employed in screening and diagnosis of CD.

Responses to elimination of gluten from diet and, later, to gluten challenge are essential to establish the diagnosis.

Cystic Fibrosis

This condition is a common cause of chronic diarrhea, beginning fairly early in infancy, in the European countries. Its recognition in Oriental children is a recent happening.

In this genetic disorder, involving the exocrine pancreas and other exocrine glands, the child manifests with chronic/recurrent diarrhea and respiratory infections (especially from early infancy), failure to thrive despite exceptionally good appetite, and multiple nutritional deficiencies. Stools are characteristically steatorrheic but may be loose. An obstinate catarrhal cough or "frog in the throat" may be present ever since first week of life. Abdominal distention, palpable liver, clubbing and higher incidence of rectal prolapse and nasal polyps are the other findings.

An important observation by the mother is "a line of salt on the forehead after sweating" or "the baby tastes salty when kissed".

Clinical suspicion must lead to fat balance studies and D-xylose test to establish that steatorrhea is not enterogenous in origin. Poor tryptic activity lends support to clinical diagnosis. But, a high sweat chloride (>60 mEq/L) is a "must" to confirm the diagnosis.

Carbohydrate Malabsorption

Disaccharide malabsorption, secondary to such conditions as acute gastroenteritis, PEM, cow's milk allergy, cystic fibrosis, celiac

disease or drugs like neomycin, has emerged as a common cause of protracted diarrhea. Besides watery diarrhea (stools contain very little solid matter and are acidic), the patient has excoriation of perianal area and buttocks, abdominal distention and abdominal pain. Response to withdrawal of the offending sugar from the diet, points favorably to this diagnosis.

Confirmation of Diagnosis is from:

1. Low pH of stools (<6) while the patient is on modest dietary intake of the offending sugar(s)
2. Presence of reducing substances in stools
3. Disaccharide (usually lactose) tolerance test
4. Breath test involving measurement of H^+
5. Barium meal: The suspected sugar is added to a barium meal. Defect in its absorption causes fluid retention in intestinal lumen, intestinal hurry and coarsening of the mucosal folds
6. Peroral jejunal biopsy for assay of the enzyme(s).

Monosaccharide malabsorption, secondary to several conditions, has also been emerging as an important factor in causation of protracted diarrhea. Exclusion of glucose and galactose from diet with IV feeding for some days in serious cases gives gratifying response.

Cow's Milk Allergy

About 1 to 2% infants may have hypersensitivity to cow's milk (beta lactoglobulins in most; casein, lactalbumin, bovine serum globulin and albumin in some).

Manifestations include protracted diarrhea (usually watery), vomiting, colic, skin rash (eczema or urticaria), rhinitis, otitis media, chronic cough with wheeze, anemia and poor weight gain.

Eosinophilia, glucosuria, sucrosuria, lactosuria, aminoaciduria, renal tubular damage, and acidosis may occur in some cases. Smear from rectal mucus shows eosinophilia.

Response to omission of cow's milk from feeding regime is excellent.

Irritable Bowel Syndrome (Toddler's Diarrhea)

The term refers to a group of children, aged 1 to 3 years, who suffer from recurrent diarrhea and abdominal pain. Yet, they thrive well.

Since recurrences occur at the time of psychologic stress and strain (say, departure of mother on a journey), and in view of a strong familial tendency, the condition is believed to be of psychogenic origin.

Crohn's Disease

This occurs rarely in children. Manifestations, besides chronic diarrhea, include crampy abdominal pain (worse on eating and reduced after defecation), malnutrition, palpable abdominal masses, perianal lesions, aphthous stomatitis, polyarthritis, clubbing and erythema nodosum.

Sigmoidoscopy, rectal biopsy, endoscopy and upper and lower GI barium series are needed to establish the diagnosis.

Ulcerative Colitis

In this rare disorder of childhood, manifestations include recurrent bloody diarrhea, intermittent bouts of crampy abdominal pain, anorexia, weight loss, arthralgia and growth retardation.

Rectal examination, sigmoidoscopy, endoscopy and barium enema are required to confirm the diagnosis.

Acrodermatitis Enteropathica

Also called Brandt's syndrome, this familial condition, manifesting at the time of weaning, is characterized by chronic diarrhea, symmetrical bullous lesions, paronychia and loss of hair. Skin lesions are most marked over the buttocks as also around anus and mouth, blephritis and conjunctivitis are frequent accompaniments.

Acquired Immunodeficiency Syndrome (AIDS)

Diarrhea in association with anorexia and malnutrition is often a serious problem in children with AIDS and other immunodeficiency disorders. Microorganisms (pathogenic opportunistic as well as otherwise nonpathogenic under ordinary circumstances) play an important role in the causation of chronic

diarrhea and malabsorption. Cryptosporidium, an intestinal protozoan, has now emerged as an important cause of chronic diarrhea in AIDS. To begin with, diarrhea is produced watery; it tends to become chronic with unrelenting severity. Cryptosporidiosis is confirmed by identifying oocytes in feces following acid-fast staining, or in stained jejunal biopsy as round eosinophilic bodies. No drug shows encouraging anti-cryptosporidium effect.

FURTHER READING

1. Gupte S, Singh UK, Gupta RK. Antibiotic-related diarrhea. In: Gupte S (Ed): *Recent Advances in Pediatrics -12*. New Delhi: Jaypee 2002: 41-48.
2. Horvath K. Chronic diarrhea and malabsorption. In: Gupte S (Ed): *Recent Advances in Pediatrics-13*. New Delhi: Jaypee 2003:1-22.
3. Vohra P. Inflammatory bowel disease. In: Gupte S (Ed): *Recent Advances in Pediatrics -12*. New Delhi: Jaypee 2002: 23-39.

Chapter 18 Dyspnea

The term, *dyspnea*, refers to an uncomfortable awareness of difficulty in breathing. Quite often, it is noticed by the parents. Respiratory distress is a better term in case of dyspnea in infants and young children.

According to the New York Heart Association, dyspnea is graded as fellows:

Grade 1: Dyspnea on unaccustomed exertion

Grade 2: Dyspnea on ordinary exertion

Grade 3: Dyspnea on < ordinary exertion

Grade 4: Dyspnea at rest.

The term, *orthopnea*, denotes dyspnea in recumbent position but relieved as soon as the subject sits upright. The modes operandi revolves around ↑ venous return causing fall in vital capacity and ↑ diaphragm causing fall in end-expiratory volume during recumbent posture. The term, platypnea, denotes dyspnea in sitting position. The term, *trepopnea,* means dyspnea in decubitus position. The change to the opposite side, however, causes relief. It points to a unilateral lung disease say pleural effusion ↑ empyema or a foreign body.

History should ascertain whether it is present at rest or occurs only on exertion. In the latter situation, what is the degree of exertion that is necessary to produce it? Does it compel the patient to sit up? Is there any cough? Is there any chest pain or fever? Any edema feet?

It is pertinent to ask for aspiration of a foreign body. Any recent trauma? Any ingestion of large amounts of agents such as salicylates?

Has there been any prior history of similar dyspnea, asthma, allergy, heart disease, trauma and drugs?

In case of the newborn, find out the precise postnatal "time" of occurrence of dyspnea. Is it accompanied by frothy bloody oozing from mouth and nose? Was it a difficult delivery? Is the baby preterm or fullterm? Any history of maternal diabetes, drug intake, or febrile illness? Any history of premature prolonged rupture of membranes? Is there a suggestion of aspiration of amniotic fluid, blood or meconium?

Physical examination should, in particular, evaluate the respiratory, cardiovascular and central nervous systems.

World Health Organization has in recent years been laying considerably stress on the usefulness of respiratory rate threshold for identifying pneumonia. Respiratory threshold are set at 60 for infants under 2 months, 50 for 2 to 12 months and 40 for 1 to 5 years. Remember that whereas respiratory rate is a useful predictor of lower respiratory infection in young infants, subcostal retration is more useful predictor of hypoxia.

DYSPNEA IN THE NEWBORN

Idiopathic Respiratory Distress Syndrome (IRDS)

Also called *hyaline membrane disease (HMD)*, this condition, supposed to result from absence or reduction of surfactant, occurs in preterm babies, in babies born by cesarean section, and in babies of diabetic mothers.

It usually manifests within the first hour of birth with progressively increasing respiratory distress. Grunting respiration, flaring of alae nasi, retraction of ribs and sternum and cyanosis are usually prominent. Low blood pressure, hypothermia and hemorrhagic manifestations may complicate the clinical picture.

Auscultatory findings include poor air entry and widespread crepitations over both lungs.

X-ray chest shows a characteristic picture ground-glass appearance and prominence of bronchial air shadows, the so-called "air bronchogram" pattern (Fig. 18.1). Generalized but patchy atelectasis occurs little later. In advanced stage, X-ray may reveal a completely opaque picture. Table 18.1 gives the grading of

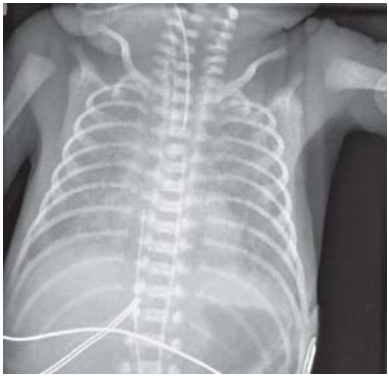

Fig. 18.1: Hyaline membrane disease (HMD). Note the classical picture: bell-shaped chest, reticulogranular mottling, air-bronchogram.

Table 18.1: Grading of chest X-ray findings in HMD

Grade	*Observation*
1	Fine reticulogranular mottling with good lung expansion
2	Mottling with air-bronchogram
3	Diffuse mottling, heart borders just discernible, prominent discernible airbronchogram
4	White-out lung in which there is a bilateral confluent opacification of lung

findings of chest X-ray in HMD. Table 18.2 gives differential diagnosis of HMD.

Gastric shake test is negative.

Massive Aspiration

Prenatal or natal aspiration of massive amount of amniotic fluid, blood or meconium occurs in such situations as postmature infants, SFD infants, infants delivered by forceps or breech (fetal hypoxia, or asphyxia), prolonged labor, antepartum hemorrhage (APH), placental insufficiency, cord prolapse, and passage of meconium *in utero*.

At birth, the baby is asphyxiated and shocked. Within 3 to 4 hours, she becomes dyspneic with inspiratory intercostal recession

Table 18.2: Differential diagnosis of HMD*

Condition	*Gestational age*	*History*	*Examination*	*Time of presentation*	*Chest X-ray*
HMD	Preterms	Onset within 4 hours of birth	Tachypnea, chest indrawing, grunting, cyanosis	< 6 hours	Hypounflation, air-bronchogram, reticulogranular mottling
Transient tachypnea	Term > preterms delivery	Often operative in drawing	Tachypnea	< 6 hours	Hyperinflation, prominent chest perivascular markings, interlobar septal edema
MAS	Term, post-term aspiration	Meconium stained liquor at resuscitation	Meconium stained baby with respiratory distress	< 6 hours	Reticulonodular opacities in lower zone
Pneumothorax	Term > preterms	Resuscitation at birth	Transillumination test +ve, mediastinal shift	> 6 hours, rarely < 6 hours	Hyperlucence with collapsed lung
Pulmonary hemorrhage	Any-mostly preterms	Asphyxia, heart failure, bleeding tendency	Crepitations with marked pallor	> 6 hours, rarely < 6 hours	Unhelpful, white-out
Infection	Any	Temperature instability	Not helpful	Any	Patchy changes
Congenital malformation	Term > preterms	Usually normal delivery	Depending on the malformation	< 6 hours, rarely > 6 hours	Diagnostic
Congenital heart disease	Term > preterms	Usually normal delivery	Cyanosis, murmurs, shock ±	> 6 hours	Useful in some cases

** Adapted from Vishnu Bhat B, Serane VT. Hyaline membrane disease (HMD). In: Gupte S (Ed) Recent Advances in Pediatrics, (Special Vol 8: Emergency Pediatrics). New Delhi: Jaypee 2001:348-65)*

and expiratory grunt. High pitched cry and absent or brisk, Moro response may be noticed, pointing to brain damage. Complications include atelectasis and/or emphysema, leading to pneumothorax, often with pneumonia.

Postnatal aspiration may occur in situations where the baby can suck well but his swallowing is inadequate (glossoptosis as in Pierre-Robin syndrome, macroglossia, cleft palate, esophageal tumor, pharyngeal membrane, retropharyngeal tumor).

During a feed, the baby gets choked or regurgitates. This is followed by sudden dyspnea and cyanosis. Chest examination shows localized crepitations and evidence of collapse.

Meconium Aspiration Syndrome (MAS)

The condition refers to the symptom-complex as a result of aspiration of meconium into the lungs *in utero,* during delivery or soon after birth.

In addition to respiratory distress persisting for days to weeks, the baby (usually postmature, SFD) has staining of nails, skin and umbilical cord with meconium.

Complications include air-leak syndromes (pneumothorax, emphysema, pneumomediastinum, pneumopericardium, pneumoperitoneum), HIE, PPH, pulmonary or cerebral hemorrhage, superadded sepsis and subglottic stenosis. X-ray chest shows over-inflation (air trapping, focal emphysema), diffuse opacities (nodular), bilateral pneumonia, flat diaphragm and retrosternol lucency. There may be evidence of air-leek syndromes (Fig. 18.2).

Acute (Adult) Respiratory Distress Syndrome (ARDS)

This condition is caused by a diffuse lung injury (triggering factors include shock, near-drowning, septicemia, drug overdose, aspiration, inhalation injury, DIC, etc.) and may be encountered in as young an infant as 1-2 week-old neonate.

Manifestations include initial mild respiratory distress and hyperventilation giving way in 4-24 hours to hypoxemia, enhanced respiratory distress, cyanosis and inspiratory crepitations. At this point, a large intrapulmonary shunt may be demonstrated. Without assistance from supplementary oxygen and/or mechanical ventilation, fatality may follow because of increasing hypoxemia and hypercapnia.

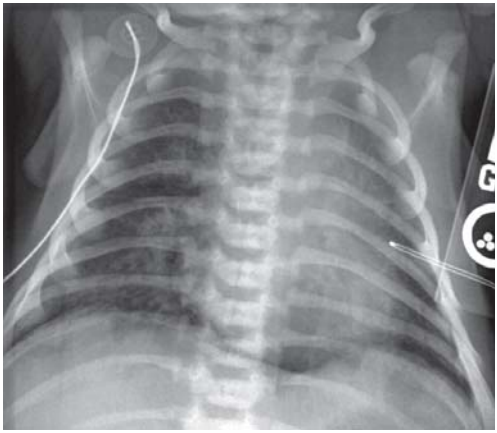

Fig. 18.2: *Meconium aspiration syndrome (MAS)* Note the diffuse, coarse, nodular opacities, air-trapping and areas of focal emphysema.

Pneumonia

Intrauterine pneumonia may occur in babies with history of prolonged premature rupture of membranes, febrile maternal illness, difficult delivery and birth asphyxia.

The baby is ill, depressed and lethargic at birth, and shows very little inclination to suck, she may vomit. Temperature is raised or subnormal. About 12 to 48 hours after birth, she becomes dyspneic without any cough. Respiration is often grunting.

Gastric aspirate cytology shows more than 5 polys per high power field or polys count more than three times the epithelial cell count.

Postnatal pneumonia, usually the result of aspiration from defective nasopharyngeal mechanism, or as a part of septicemia, occurs 48 hours after birth. Dyspnea, grunting respiration and intercostal recession should warrant an immediate X-ray chest.

Group B Streptococcal Infection

When such an infection occurs early in neonatal period, the respiratory distress may result. The predisposing factors include prematurity, prolonged premature rupture of membranes, and maternal febrile illness.

The baby manifests the disease by the time she is 3 hours old with dyspnea, apnea and shock.

X-ray chest shows findings similar to those seen in IRDS with or without coarse lower lobe opacities and exaggerated interstitial markings.

Gastric aspirate cytology shows polys and cocci.

Transient Tachypnea of Newborn

Also termed *type II RDS* and *wet lung disease,* it occurs in some 1% of neonates, both term and preterm.

This is more or less a benign condition and is characterized by occurrence of slight respiratory distress in a full-term baby a few hours after birth. The general condition of the baby remains good and he becomes all right within 2 to 3 days. Infrequently, the condition may be accompanied by myocardial failure, pulmonary hypertension or right-to-left shunt.

Typical findings in the chest film are hyperinflated lung fields, perihilar opacities, exaggerated vascular markings, fluid in transverse fissure and a minimal pleural fissure and a effusion (Fig. 18.3)

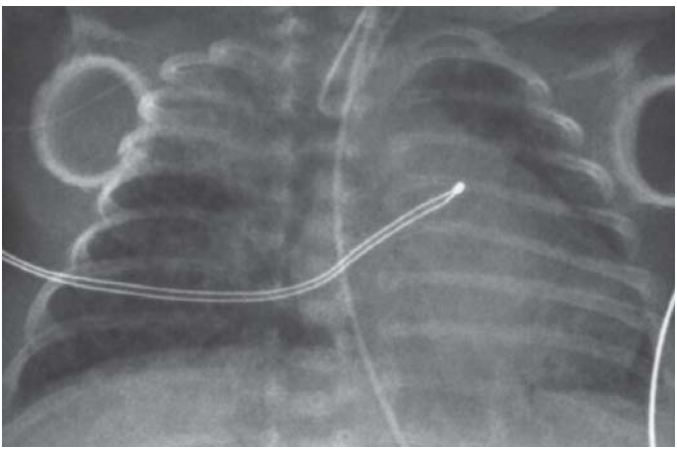

Fig. 18.3: *Transient tachypnea of the newborn* Note the hyperaeration (against the hypoaeration of HMD) and reticulogranular densities that disappear following ventilation (against HMD where disappearance takes a few days).

Massive Pulmonary Hemorrhage

This more or less fatal condition occurs in situations like intrauterine growth retardation, Rh incompatibility, IRDS, maternal diabetes, DIG, acute left heart failure leading to hemorrhagic pulmonary edema and injection soda bicarbonate (hyperosmolar) leading to capillary insult.

The manifestations include abrupt onset of dyspnea (sometimes just apneic attacks) with frothy blood oozing from mouth and nose.

Wilson-Mikity Syndrome

This self-limited condition of uncertain etiology is characterized by occurrence of non-progressive dyspnea, cyanosis, cough and wheeze in a low birth weight infant (under 1,500 g) a week or two after birth. The condition subsides without any treatment in the next few weeks or months.

Pneumothorax

Pneumothorax occurs in the newborn more often than at any other age. The predisposing factors include fetal distress or difficult delivery leading to aspiration of meconium, and/or over enthusiastic resuscitation, IRDS, and pneumonia.

Manifestations include occurrence of dyspnea and cyanosis soon after breathing gets established. At times, the baby seems to be in pain.

Clinical signs include mediastinal shift away from the affected side, hyper-resonance, poor air entry, widened intercostal spaces and depressed diaphragm.

X-ray chest (PA and lateral films with the baby supine) shows a large pneumothorax as translucent air shadow without any lung marking, collapse and air in anterior mediastinum (Figs 18.4 and 18.5). A small pneumothorax is often missed.

Pleural Effusion

Its most common cause in a newborn is chylothorax though it may also accompany pneumonia, hydrops fetalis or Turner's syndrome. The infant presents with dyspnea shortly after birth.

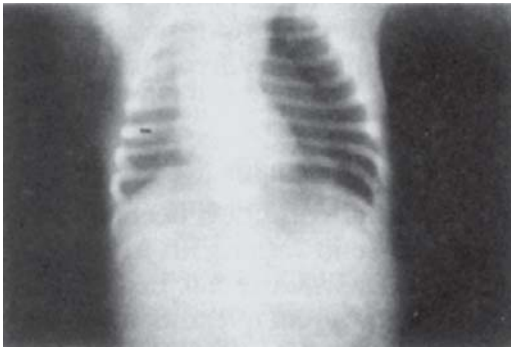

Fig. 18.4: *Neonatal pneumothorax* Note pneumothorax with collapse and shifting of the mediastinum.

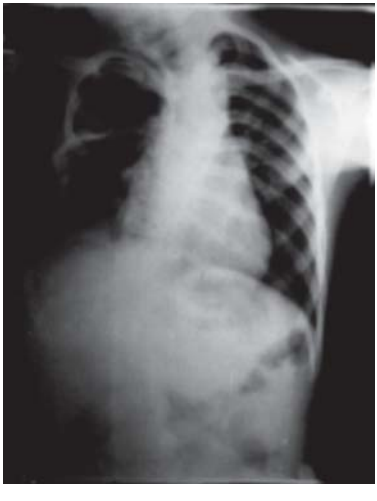

Fig. 18.5: Pneumothorax

Heart Failure

Heart failure (secondary to fibroelastosis, congenital heart disease, myocarditis, heart block, paroxysmal tachycardia, septicemia, glycogen storage disease) may well present with dyspnea.

Remaining manifestations include feeding difficulty, cyanosis in excess of dyspnea and showing worsening on crying, edema as evidenced by puffness or sudden weight gain, cardiomegaly, significant heart murmur(s) and enlarging liver.

Paralysis of Diaphragm

It may develop as such but is associated with Erb's paralysis in a vast majority of the cases. Mostly, right side is involved.

The usual story is that following a difficult breech delivery, the newborn develops respiratory distress. On the affected side, respiratory movements are diminished. Mediastinum tends to be displaced to the opposite side.

Screening chest shows paradoxical movements of the paralyzed leaf of the diaphragm with each respiration.

X-ray chest may show slight elevation of the involved dome of diaphragm with heart displaced to the opposite side.

Choanal Atresia

In this condition, posterior nasal airway is blocked by a bony or membranous septum. It is the bilateral complete atresia that presents as a respiratory emergency in the newborn. There is absence of nose breathing despite considerable respiratory efforts, leading to cyanosis. Momentarily, the baby then takes a few galloping inspirations through mouth, thereby lessening the cyanosis temporarily. Asphyxia often causes death.

Diagnosis is supported by the presence of thick jelly-like nasal contents and absence of breath sounds while listening over the nostrils with a stethoscope. It is confirmed by inability to pass a fine catheter through each side of nose.

Diaphragmatic Hernia

A large diaphragmatic hernia, usually left-sided and through posterolateral segment, is an acute emergency, causing severe respiratory distress (Fig. 18.6). There is difficulty in establishing spontaneous breathing at birth. Right at birth or later, the baby develops labored gasping breathing and cyanosis.

The chest appears overfilled whereas abdomen may be flat or scaphoid. The air entry is diminished and one may be able to hear

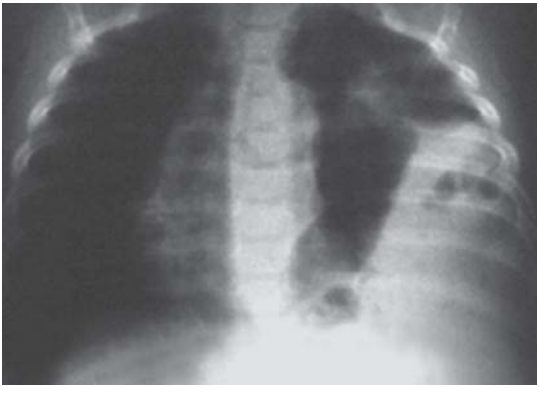

Fig. 18.6: A large diaphragmatic hernia.

tinkling peristaltic sounds on the left side of chest. The heart is shifted to the right.

X-rays chest (PA and lateral) shows fluid and air-filled bowel loops in the thorax. The mediastinum is shifted to the opposite side.

Tracheoesophageal Fistula

It nearly always occurs in association with esophageal atresia. Incidence of accompanying congenital heart disease and other GIT anomalies is high. There is often maternal hydramnios and single umbilical artery.

The newborn develops excessive drooling (salivation), the so-called "blowing bubbles", coughing, gagging, and even choking and cyanosis on the very first feed. The milk and saliva may regurgitate and enter into the lungs, causing aspiration pneumonia.

Once this diagnosis is suspected, a stiff radio-opaque rubber catheter should be passed into the stomach. It gets arrested at a distance of 8 to 10 cm from mouth. This may be demonstrated radiologically as well. Gas in the form of an air bubble is seen in the stomach in C type of fistula in which there is a communication between trachea and lower part of esophagus.

Pulmonary Agenesis

Unilateral agenesis, particularly involving right side, may cause cyanosis, dyspnea and feeding difficulty in the newborn. The chest appears asymmetrical.

X-ray chest reveals an abnormal opacity occupying the lung site with the mediastinum and the other lung shifted to the empty hemithorax. The diagnosis is confirmed on bronchoscopy branchography and angiography.

Bilateral pulmonary hypoplasia usually occurs with renal agenesis, the so-called Potter's syndrome. The additional features of the syndrome are antimongoloid slant, low-set ears, depressed bridge of nose and retrognathia (Potter's facies).

Unilateral pulmonary hypoplasia is usually associated with congenital diaphragmatic hernia.

Congenital Pulmonary Lymphangiectasia

In this disease, lymphatic ducts in the whole of the lung are greatly dilated as a primary defect (type I), secondary to pulmonary venous obstruction (type II) or as a part of generalized disease (type III).

It is usually symptomatic with respiratory distress and cyanosis in the neonatal period.

X-ray chest shows punctate and reticular densities. Short of lung biopsy, diagnosis remains equivocal.

Congenital Lobar Emphysema

In this disease, a part or all of a lobe (usually left upper) gets involved from a check-valve type of obstruction of congenital origin. It may cause gross dyspnea and cyanosis in the newborn. X-ray chest reveals a radiolucent lobe and mediastinal shift to the opposite side.

Persistent Pulmonary Hypertension of the Newborn (PPHN)

PPHN, previously termed as *persistent fetal circulation (PFC)*, may be associated with such primary factors as anatomic malformations (alveolar capillary dysplasia, pulmonary hyperplasia), genetic differences in pulmonary smooth muscle development, chronic intrauterine stress, intrauterine closure of ductus or abnormal levels

of vasoactive agents. It may be secondary to CHD, infections, polycythemia or upper airway obstruction.

Manifestations in a term neonate become apparent in first 12 hours. These include respiratory distress with retractions, grunting and nasal flaring, cyanosis, tachypnea and hypoxia. Hypoxia may be refractory to oxygen therapy. Hypocalcemia and hypoglycemia may complicate the picture.

Chest X-ray reveals only minimal changes, which are no match to the severe respiratory distress. Cardiomegaly (due to right ventricular afterload caused by pulmonary hypertension) or characteristic findings of MAS, may be seen.

Prognosis is bad. Survivors, following treatment with such modalities as high oxygen therapy, assisted ventilation, high frequency ventilation, extracorporal membrane oxygenation ECMO, vasodilator drugs (tolazine), inhaled nitric oxide, and phosphodiesterase inhibitors are usually left with neurologic deficit. This may be in the form of impaired neurologic development, cerebral infarction, IVH, neurosensory loss and convulsions.

Lung Cysts

Newborns with congenital lung cysts, believed to result as a developmental defect of the bronchial buds, may present with respiratory distress and tachypnea at birth or later, or with recurrent or persistent pneumonia.

More often, lung cysts are acquired, rather than congenital, following an infection (usually staph.) or over-inflation causing rupture of alveoli. Symptomatology and behavior remain similar in both types of cysts.

DYSPNEA IN POSTNEONATAL PERIOD

Pulmonary Causes

Bronchial Asthma

In this disorder, temporary narrowing of the bronchi by bronchospasm, mucosal edema and thick secretions leads to characteristic bouts of dyspnea.

The onset of a paroxysm is usually sudden, often occurring at night. Occasionally, it is preceded by the so-called asthmatic aura in the form of tightness in chest, restlessness, polyuria or itching.

A typical attack consists of marked dyspnea, bouts of cough and expiratory wheezing. Cyanosis, pallor, sweating, exhaustion and restlessness are often present. Pulse is invariably rapid. The attack may subside in a hour or so, sometimes with vomiting or "coughing up" of viscid secretions. Some expiratory wheezing may persist for several days though the child is otherwise comfortable.

Acute Bronchiolitis

This serious inflammatory disease of bronchioles, in all probability of viral origin, occurs in infants with the peak incidence around 6 months of age (Fig. 18.7).

Following upper respiratory catarrh, the child develops dyspnea and prostration. The breathing is rapid and shallow. Cyanosis and mild to moderate fever are usually present. Dehydration and

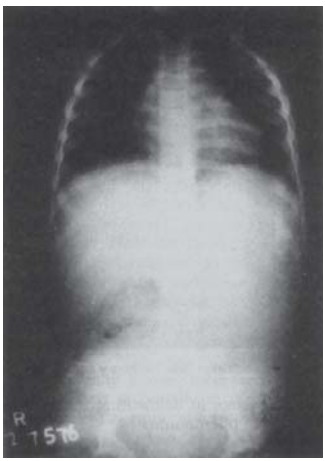

Fig. 18.7: *Acute bronchiolitis* Note the massive air trapping and hyperinflation of the lungs. The lateral view in this condition is likely to show increased anteroposterior diameter of the chest. In a proportion (1/3rd) of the cases, presence of scattered areas of consolidation may render differentiation from earely bronchopneumonia difficult.

respiratory acidosis frequently supervene. Cough, if present, is minimal.

Chest signs include intercostal and suprasternal retraction, hyperresonant percussion note, diminished breath sounds and crepitations, rhonchi and wheeze. Upper border of liver is often pushed down as a result of emphysema.

With prompt care, prognosis is very good.

Pneumonia

Dyspnea of sudden onset, if accompanied by high fever, chills, and cough, may mean pneumonia. In this situation, child may show active movements of alae nasi, grouting expiration and lower costal recession with some cyanosis.

Chest signs include dullness, diminished breath sounds, bronchial breathing and crepitations. In case of lobar pneumonia, the signs are restricted about the consolidation.

X-ray chest assists in delineating the exact type (Figs 18.8 to 18.12) and extent of pneumonia.

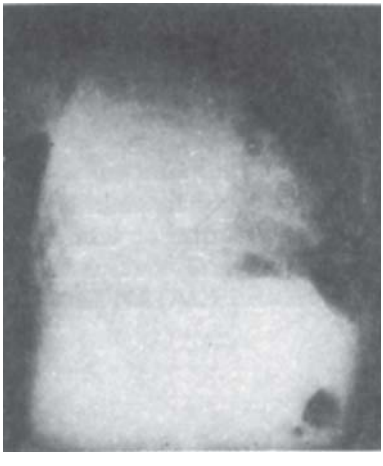

Fig. 18.8: *Massive consolidation* Note that there is no shift of the mediastinum.

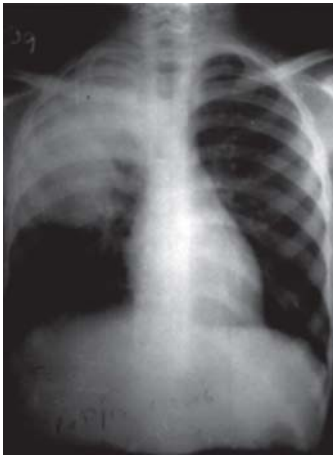

Fig. 18.9: Pneumonic consolidation of right upper lobe.

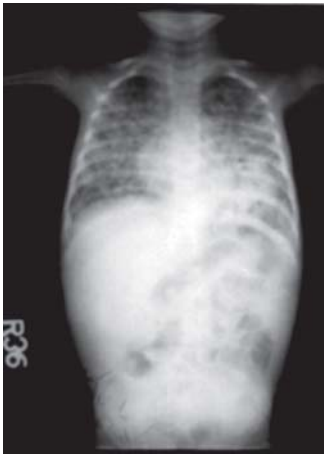

Fig. 18.10: Bronchopneumonia

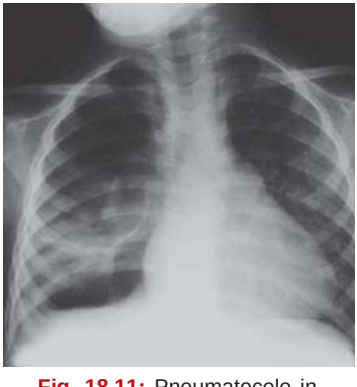

Fig. 18.11: Pneumatocele in staphylococcal pneumonia.

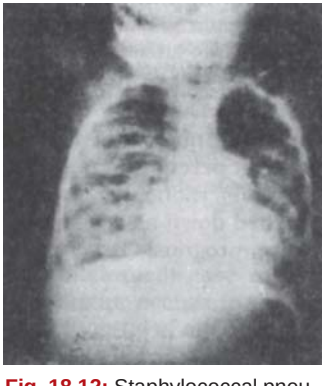

Fig. 18.12: Staphylococcal pneumonia with multiple pneumatoceles.

Asthmatic Bronchitis

Dyspnea may be a feature of asthmatic bronchitis. The disorder usually occurs in first two years of life. With an upper respiratory catarrh, child develops significant bronchospasm (manifested as "wheeze") and exudation similar to those encountered in older children with bronchial asthma.

Tropical Eosinophilia

This disease, probably an allergic response to filarial infection, may manifest in children beyond one year of age with some exertional dyspnea, persistent cough, wheeze, low fever, anorexia, growth failure and malaise. At times, vague abdominal manifestations may be present together with enlargement of liver and lymph nodes. These manifestations tend to persist for months at a stretch without any significant systemic disturbances.

Total eosinophil count varies between 4,000 to 50,000/cmm. X-ray chest usually shows increased reticular markings, coarse mottling (especially at the bases) and hilar prominence with clear peripheral lung fields.

Pleural Effusion

Almost always occurring in children beyond 5 years of age, it is supposed to result from discharge of caseous material of a peripheral (subpleural) primary focus or enlarged regional lymph node.

Symptoms other than dyspnea include fever, weight loss and chest pain.

Decreased chest movements, mediastinal shift towards the opposite side, dullness of percussion note, pleural rub, decreased breath sounds and vocal fremitus and resonance are reliable signs of pleural effusion.

X-ray chest reveals a uniform opacity with a curved fluid line (Fig. 18.13) which may become horizontal when air is also coexisting.

Aspiration of fluid confirms the presence of effusion. Straw colored fluid with mostly lymphocytic response strongly favors tuberculous pathology.

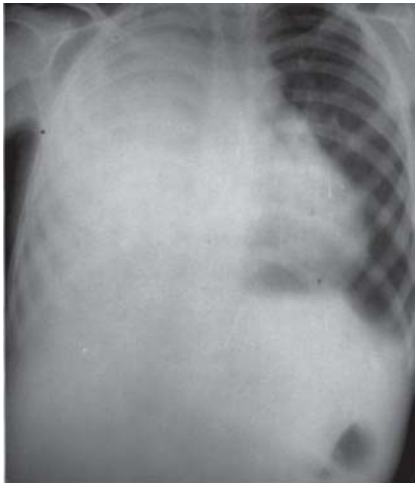

Fig. 18.13: Massive pleural effusion (right).

Empyema

Collection of thick pus in the pleural cavity (usually of staphylococcal etiology) may present with dyspnea, fever, cough, chest pain (which may be referred to the abdomen) and toxemia. In case of marked dyspnea, cyanosis may develop. Long-standing cases may have associated clubbing, anemia and other manifestations of malnutrition.

Chest signs include diminished movements on the affected side, widening and fullness (at times edema) of the intercostal spaces, stony dull percussion note, diminished air entry and mediastinal shift to the opposite side.

X-ray chest shows diffuse density. In most cases, opacities are basal and costophrenic angle is obliterated. Loculated empyema may occur in fissures or at apex.

Diagnostic tap is needed in order to obtain pus for biochemical and bacteriological examination.

Löffler's Syndrome

Also called eosinophilic pneumonia, it manifests with paroxysmal attacks of coughing, dyspnea and, often, little fever and hepatomegaly. It is most often a manifestation of allergy produced by helminths, say Asc. lumbricoides.

Blood eosinophilic count may be as high as 70%.

X-ray chest shows widespread infiltration which may mimic miliary tuberculosis.

Atelectasis

A large atelectasis, particularly when it develops suddenly, may manifest with dyspnea, tachycardia and cyanosis.

Chest appears flat over the affected area/side. Also, respiratory movements are decreased and the area is dull on percussion unless compensatory expansion of adjacent lung tissue has occurred.

Auscultation reveals decreased or absent breath sounds. X-ray chest establishes the diagnosis.

Emphysema

Congenital lobar emphysema, as I said on page 126, usually causes dyspnea in newborn. Infrequently, however, it may manifest in later months and even after several years. The child may present with dyspnea and cyanosis following compression of the normal lung by the emphysematous lung. The mediastinum may be displaced to the opposite side.

X-ray chest shows a radiolucent lobe and a mediastinal shift.

Generalized obstructive emphysema, occurring mostly in infants suffering from respiratory infections, cystic fibrosis of pancreas, aspiration of zinc stearate powder, congenital heart disease with CCF, and miliary tuberculosis, manifests with expiratory dyspnea. Besides cyanosis, there is overaction of the accessory muscles of respiration, leading to suprasternal, supraclavicular, intercostal and subcostal retraction.

Chest examination shows a hyper-resonant percussion note, a relatively prolonged and roughened expiratory phase and fine or medium crepitations.

X-ray chest shows low and flattened diaphragm, widening of intercostal spaces and poor density of lung fields.

Screening shows restriction in movements of diaphragm.

Pneumothorax

Except in the neonatal period, pneumothorax is uncommon in childhood. When it occurs, the predisposing factor is thoracentesis, pneumonia, empyema, lung abscess, emphysema lung gangrene or cyst, foreign body bronchial asthma, cystic fibrosis of pancreas, Ehlers-Danlos disease or Marfan's syndrome. Spontaneous pneumothorax is infrequent. It is nearly always unilateral. Associated serous effusion will make it hydropneumothorax (Figs 18.14 and 18.15) and a purulent effusion pyopneumothorax.

Manifestations of an extensive pneumothorax include dyspnea, chest pain and cyanosis.

Besides chest retractions, breath sounds are diminished over the affected lung and percussion note is tympanic. Mediastinum is shifted to the opposite side.

X-ray chest shows air in the affected pleural cavity with partial collapse of the related lung and shift of the mediastinum to the unaffected side.

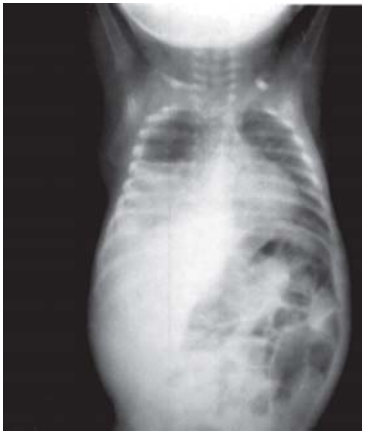

Fig. 18.14: Hydropneumothorax

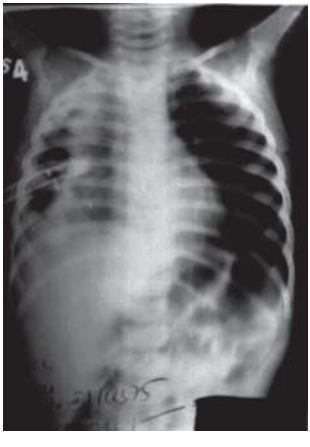

Fig. 18.15: Hydropneumothorax with pulmonary collapse.

Aspiration of Foreign Body

Sudden coughing, choking or dyspnea in a healthy child should always raise the probability of aspiration of a foreign body such as peanut.

Examination reveals signs of collapse.

X-ray chest may reveal an area of collapse or a radio-opaque foreign body.

Diaphragmatic Hernia

Congenital diaphragmatic hernia usually manifests soon after birth as a medical-surgical emergency. Infrequently, it may become symptomatic in infancy and childhood with vomiting, colicky abdominal pain, discomfort after eating and constipation, as also dyspnea. Even intestinal obstruction may occur.

Obesity

In extreme exogenous obesity, fat accumulation on chest wall causes elevation of the diaphragm and restriction in expansion of the thoracic wall. As a result, alveolar hypoventilation with fall in pulmonary, tidal and expiratory reserve volumes leads to severe cardiorespiratory distress. Pickwickian's syndrome (after the obese boy in Charles-Dicken's "Pickwick papers") is the name given to this disease.

Manifestation includes shortness of breath, cyanosis, periodic somnolence, and apneic spells. Cardiomegaly with or without congestive cardiac failure and polycythemia are common.

Over or Hyperventilation

Hyperventilation syndrome is characterized by dyspnea, tightness or stabbing pain in chest, headache, abdominal pain, muscle pains, paresthesia, palpitations, dryness of mouth, vertigo, choking, weakness, blurred vision, confusion and syncope. The manifestations appear in episodes.

Hyperventilation may also be a feature of uremia, hyper-natremic dehydration, diabetic ketoacidosis, Reye's syndrome and salicylate poisoning.

Chest Deformity

Severe chest deformity, irrespective of the cause, may be responsible for dyspnea.

Alpha-1-Antitrypsin Deficiency

This rare but important cause of pulmonary disease (panacinar emphysema) may manifest in childhood with dyspnea, wheeze and cough on top of growth failure and clubbing.

Anteroposterior diameter of chest is increased. Percussion note is hyperresonant presence of infection may cause crepitations. Liver and spleen are palpable.

X-ray chest shows overinflation and depressed diaphragm.

Serum trypsin inhibitory capacity is low.

Low alpha-antitrypsin level is confirmed by immunoassay.

Hamman-Rich Syndrome

Also called idiopathic diffuse interstitial fibrosis of the lung, this rare disease has an insidious onset with dyspnea and cough (dry or productive of blood) followed by anorexia, weight loss easy-fatigability, cyanosis, clubbing and CCF (corpulmonale). Death occurs from a fulminant intercurrent infection.

X-rays chest shows progressive widespread granular or reticular mottling, or small nodular opacities.

Pulmonary Hemosiderosis

In this group of disorders (idiopathic or secondary), abnormally large amounts of hemosiderin are accumulated in the lungs.

Manifestations of idiopathic pulmonary hemosiderosis include chronic iron deficiency anemia refractory to iron therapy, cough, dyspnea and wheeze, hematemesis, melena or hemoptysis, clubbing, intermittent jaundice, and hepatosplenomegaly. Cardiac involvement (left bundle branch block) may occur in some patients.

Laboratory investigations show hypochromic anemia, eosinophilia, reticulocytosis, positive fecal occult blood and excessive number of iron-bearing macrophages (siderocytes or siderophages) in sputum, gastric washings or lung biopsy.

X-ray chest shows infiltration simulating miliary tuberculosis.

Pulmonary Alveolar Proteinosis

In this very rare condition, occurring in association with immunologic deficiencies, tuberculosis and mycosis, eosinophilic protein and phospholipid-containing material occupies the alveoli, causing extensive consolidation.

Several months period of nonspecific symptoms like weight loss and anorexia is followed by cough, dyspnea and cyanosis.

X-ray chest shows a feathery density of butterfly distribution. Lung biopsy confirms the definitive diagnosis.

Pulmonary Alveolar Microlithiasis

This rare familial disorder is characterized by deposition of minute chalky calculi in the alveoli.

Symptoms of progressive respiratory failure and cor pulmonale only infrequently appear in later childhood.

X-ray chest shows bilateral, fine granular infiltrates.

Pulmonary Veno-occlusive Disease

This rare disease is characterized by pulmonary venous thrombosis and recanalization with intimal fibrosis.

Manifestations include exertional dyspnea and orthopnea, weight loss, fainting and ankle edema.

Physical findings include signs of pulmonary hypertension, CCF and tricuspid incompetence.

ECG shows right atrial and ventricular hypertrophy.

X-ray chest shows cardiomegaly, pulmonary arterial dilatation and pulmonary edema.

Cardiac catheterization reflects pulmonary arterial hypertension.

High Altitude Hypoxia

High altitude above 3,000 meters (over 9,000 ft) may cause pulmonary edema in some subjects within hours of exposure.

Manifestations include cough, shortness of breath, chest pain and vomiting. Within 48 hours, recovery occurs.

X-ray chest shows bilateral patchy infiltration.

Pulmonary Embolism and Infarction

Pulmonary embolism in children may occasionally occur in association with surgical procedures, IV infusion, prolonged immobilization (inactivity), sickle-cell anemia, cyanotic congenital heart disease, severe dehydration, infective endocarditis, therapeutic bypass, shunts for hydrocephalus, accidental bone trauma, and long-standing nutritional deficiency states.

Clinical manifestations include sudden chest pain, dyspnea, tachycardia, hemoptysis and collapse.

A sufficiently large infarct may cause impaired resonance and a pleural friction rub, distant or absent breath sounds, and moist crepitations.

Mortality rate is high.

Cardiac Causes

Paroxysmal Atrial Tachycardia (PAT)

If a paroxysm of atrial tachycardia (usually in the range of 300/minute) ends up in congestive cardiac failure, lasting 6 to 24 hours or more, the infant becomes acutely ill. Dyspnea, cyanosis, restlessness, and irritability dominate the picture. In addition, there may be hepatomegaly, fever and leukocytosis.

Congestive Cardiac Failure (CCF)

CCF, a common pediatric emergency, may result from several disease. Besides dyspnea at rest (orthopnea) or on exertion, child has tachycardia, raised JVP, tender hepatomegaly, bilateral basal crepitations, edema, peripheral cyanosis, and gallop rhythm.

Myocarditis

Clinical manifestations are similar in myocarditis of bacterial, viral, fungal, protozoal, parasitic, toxic or allergic origin. These include dyspnea, fever, malaise, arrhythmias (heart block-partial or complete) and CCF.

X-ray chest shows cardiomegaly.

Congenital Heart Disease

Large ventricular septal defect (VSD) causes exertional dyspnea besides recurrent chest infections, congestive cardiac failure and

failure to thrive. Heart is moderately or grossly enlarged (usually biventricular). The characteristic murmur is loud pansystolic, best heard over the left sternal border (3rd, 4th and 5th spaces). A thrill usually accompanies it. Pulmonary second sound (P_2) may be split and accentuated due to pulmonary hypertension. A pulmonary diastolic murmur (Graham Steell's murmur) may also be heard. X-ray chest shows a large left to right shunt with enlarged heart (both ventricles and left atrium), enlarged pulmonary artery and plethoric lung fields (overvascularity) with or without hilar dance (Fig. 18.16).

Atrial septal defect (ASD) in older children may manifest with dyspnea, chest infection, bulging of the chest (due to enlargement of right ventricle) and growth failure. The typical murmur is ejection systolic, soft, and best heard over upper left sternal border (usually second space). It is preceded by a loud first sound and

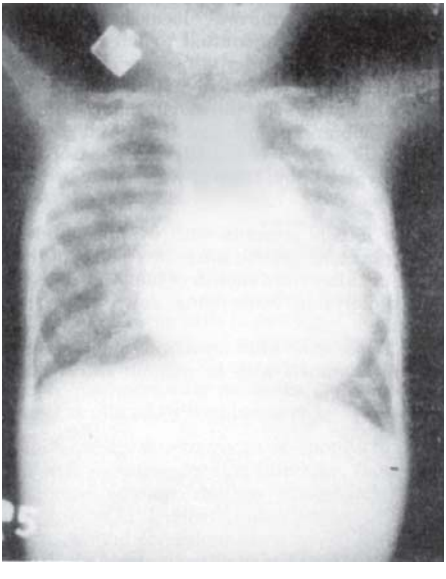

Fig. 18.16: *Ventricular septal defect (VSD)*
Note the cardiomegaly with pulmonary plethora.

may be radiated to the apex and back. P_2 is widely split and fixed. X-ray chest shows atrial and ventricular enlargement, increased pulmonary vascularity, enlarged pulmonary artery and rather small left ventricle and aorta. ECG shows RVH and right axis deviation.

Patent ductus arteriosus (PDA) may manifest with exertional dyspnea, left ventricular failure, CCF and growth retardation. Occasionally, precordial pain and hoarseness (due to involvement of recurrent laryngeal nerve) may be present.

Pulse pressure is wide. As a result, water-hammer pulse and prominent arterial corrigan pulsations in the neck may be present. Differential cyanosis, in which left arm and both feet are involved, may be observed. A classical machinery murmur localized to second left inter-costal space or transmitted to left clavicle or lower down, i.e. left ster-nal border is usually accompanied by a thrill. There may be paradoxical splitting of P_2.

X-ray chest shows biventricular enlargement, prominent aortic knob and pulmonary artery and plethoric lung with hilar dance. ECG is usually normal but may show ventricular hypertrophy. Deep Q-waves may be seen in left ventricular leads.

Tetralogy of Fallot presents with dyspnea and cyanosis that usually become evident after the closure of the ductus arteriosus,
i.e. after third month of life. As the child grows, he feels comfortable while lying down or in squatting position only.

Anoxic, hypoxic or blue (cyanotic) spells consisting of dyspnea and cyanosis with or without unconscious may occur due to cerebral anoxia. By the age of 2 years, the child has usually developed some clubbing. CCF is unusual (Fig. 18.17). The typical murmur is loud short systolic, at left sternal border in third space. It is generally not accompanied by a thrill. P_2 is usually single.
X-ray chest shows oligemic lung fields (poorly vascularized), a small boot-shaped heart with the tip of the boot turned up above the diaphragm (because of RVH) and concavity of the pulmonary artery segment (small pulmonary conus). One in every 4 to 5 cases has right aortic arch. ECG shows RVH with beaked P waves.

Transposition of great vessels (TGV) presents with severe
cyanosis (differential with legs being less cyanotic than the arms)

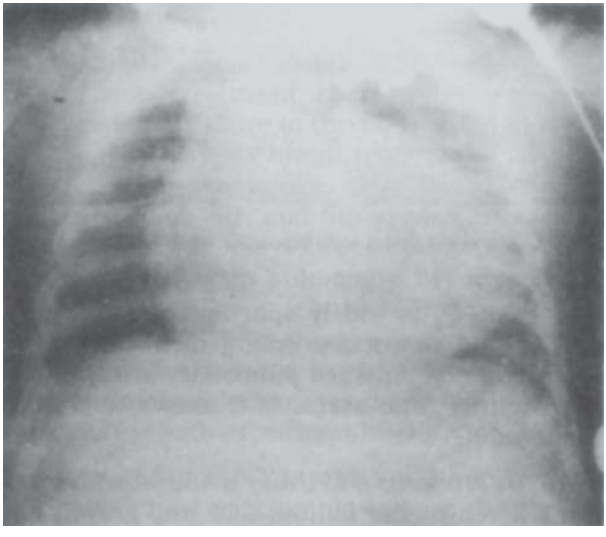

Fig. 18.17: CCF in a child with tetralogy of Fallot. Differential diagnosis of this unusual association includes presence of iron-deficiency anemia, restrictive VSD with TOF, hypertension, valvular regurgitation, infective endocarditis, myocarditis, additional shunt, valvular regurgitation and absent pulmonary valve.

at or shortly after birth followed by dyspnea and CCF. It constitutes hallmark of TGV. Clubbing takes a few months to develop. Clinically, heart is always enlarged. Murmurs are dependent on the coexisting communication. X-ray chest shows cardiomegaly and grossly pelthoric lung fields. ECG shows RVH, right axis deviation and often P-pulmonale.

Coarctation of aorta syndrome of "preductal" type may manifest with dyspnea, feeding difficulty, failure to thrive, pitting edema, gallop rhythm and rarely differential cyanosis due to PDA. Heart murmurs, depending on the associated cardiac conditions such as VSD may be heard. A systolic murmur is usually heard over the inter-scapular area. In "postductal" type, manifestations developing in later childhood may include fatigue, cramps,

intermittent claudication, headache, weakness and exertional dyspnea. In some cases, overgrowth of upper limbs and chest may occur. The most dependable physical finding is the weak, delayed, and even absent femoral arteries compared to the strong brachial arteries. The blood pressure in the arms is much higher than in the legs, provided the child is beyond 1 year of age. Occasionally, due to involvement of the left subclavian artery, left brachial pulse may be weaker and the blood pressure in the left arm lower than on the right side. Dilated and tortuous colaterals may be seen over the interscapular area in older children. This is called Suzman's sign. An ejection systolic murmur (grade 2/6) is heard at the aortic area and the lower left sternal border. A systolic murmur in the interscapular area is considered pathognomonic.

X-ray findings include some left ventricular enlargement, notching of the ribs caused by intercostal colaterals and "E" sign on barium swallow. ECG may suggest RVH, particularly in infants.

Aortic stenosis of significant severity may be responsible for exertional dyspnea. Remaining manifestations include easy fatigability, precordial pain induced on exercise and spells of unconsciousness. CCF may occur early in infancy. Systolic blood pressure and pulse pressure are low. A systolic thrill is present. Auscultation reveals a loud, harsh murmur in the second or third right intercostal space with transmission to neck. X-ray shows slight left ventricular enlargement. ECG may reflect LVH in some cases.

Valvular pulmonic stenosis may manifest after the age of two years with dyspnea, easy-fatigability and, in a few cases, cyanosis. A thrill is palpable. A loud, harsh systolic murmur is heard in second, third and fourth left intercostal spaces. X-ray shows dilatation of main pulmonary artery and right ventricular enlargement. ECG is consistent with RVH.

Cardiomyopathy may manifest with dyspnea plus other signs and symptoms depending on the type (whether dilated, hypertrophic or restrictive). X-ray chest, ECG and echocardio-graphy (Figs 18.18 and 18.19) are needed to confirm the diagnosis.

Rheumatic Heart Disease

Rheumatic carditis may manifest with dyspnea but the symptom is more often the result of CCF rather than carditis as such.

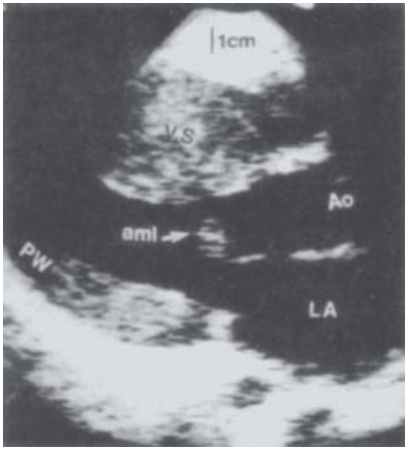

Fig. 18.18: *Hypertrophic cardiomyopathy* Note that the posterior wall of the left ventricle (PW) is thickened though the interventricular septum (VS) is highly thickened. As a result there is asymmetrical septal hypertrophy. In addition, anterior mitral valve leafelet (aml) shows a systolic anterior motion.

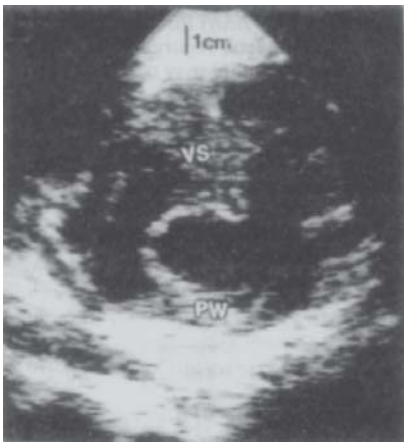

Fig. 18.19: *Hypertrophic cardiomyopathy* Note the asymmetrical septal hypertrophy in the echocardiography.

Rheumatic pericarditis may manifest with dyspnea and chest pain. The former results from accompanying CCF.

In chronic rheumatic heart disease (mitral stenosis, mitral regurgitation and aortic regurgitation), dyspnea, palpitations, and easy-fatigability may occur.

Drugs

Salicylates, acetazolamide, aminophylline, nitrofurantoin rifampicin, PAS, isonex, penicillin, streptomycin, sulfas, methotrexate, cyclophosphamide, vincristine, imipramine, etc.

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Chapter 19 Dysuria

The term, *dysuria*, refers to discomfort or pain on micturition. It may be primary or secondary. In primary dysuria (the predominant), the etiologic factors are confined to the urinary tract per se. In secondary dysuria, discomfort occurs because of involvement of the urinary tract in some systemic diseases.

History must determine if other symptoms related to the urinary tract are present. Is there accompanying frequency, urgency or incontinence? Is the amount passed excessive or scanty? Is there any hematuria? Is there any pruritus ani or itching about the external genitals? Any history of passage of threadworms? How is the urinary stream: forceful or dribbling? Is the child febrile? Does he suffer from any systemic disease? Has he been on such drugs as sulfonamides?

Physical examination must include local, genital and perineal region inspection. Perianal rash with obvious marks from itching points to infection with Entrobius vermicularis. Perineal irritation from a diaper rash may be responsible for painful urination. Soreness of vulva is responsible for dysuria in many instances. Congenital anomalies such as meatal stenosis, urethral valves, etc. may also cause this symptom.

Never miss watching the child as and when he passes urine. Because of real dysuria, the child may deliberately withhold urine. An infant may cry on passing urine. If hematuria coexists, diaper may be stained with bloody urine.

Physiologic Dysuria

Concentrated urine as a result of inadequate intake of fluids in hot months, or febrile conditions may cause dysuria.

Urinary Tract Infection (UTI)

Besides dysuria, described by the child as burning, difficult, painful or hot urination, manifestation may include urgency, frequency, dribbling, foul-smelling urine, enuresis or daytime incontinence of recent onset, fever, anorexia, abdominal pain, irritability and vomiting. Mucous membrane of external genitalia may be inflamed. Hematuria, jaundice and a picture of sepsis may occur.

A positive urine culture is essential for establishing the diagnosis. Just pyuria is not a sufficient evidence of UTI to warrant chemotherapy.

Urinary Lithiasis

Irritative symptoms of dysuria along with urgency and frequency may be encountered in calculus lodged in the distal ureter. In case of the calculus in the urethra, dysuria and difficulty in voiding may occur.

Acute Glomerulonephritis

Dysuria may occasionally be a symptom of acute glomerulone-phritis. The onset is usually abrupt. Following pharyngitis or impetigo, the child develops gross hematuria, periorbital edema, abdominal pain, general malaise and irritability, fever, oliguria and hypertension. Characteristic urinary findings are a gross hematuria and mixture of casts (mostly red cell and granular). With the clinical recovery, gross hematuria disappears, in about a week. But, microscopic hematuria may persist for 4 to 8 weeks.

Local Factors Involving Urethra, etc.

Anterior urethritis may results from a nonspecific infection, gonorrhea, irritation by a wet diaper, local injury (say accidental, intentional as in battered baby syndrome, or iatrogenic), an extension of balanitis (inflammation of glans), or posthitis (inflammation of prepuce), severe vulvitis, urethral carbuncle, or Enterobius vermicularis. Symptoms include dysuria and postvoiding spotty urethral bleeding.

Prostatitis, occurring mostly in adolescents, may cause dysuria together with frequency and urgency of micturition, fever, purulent discharge per urethra and perineal or low backache. Rectal examination reveals an enlarged and tender prostate. It may result from gonococcal and other microorganisms.

Meatal stenosis, resulting from perimeatal inflammation (diaper rash) or ulceration following circumcision, may cause dysuria, terminal hematuria or urinary spotting. Inspection shows a narrow looking meatal orifice and, more importantly, a urinary stream that is typically needle-like and dorsally deflected.

Urethral valves, hyperplastic folds of tissue located mostly in posterior urethra, are usually symptomatic in male neonates, infants and toddlers. Manifestations include dysuria, weak dribbling urinary stream, distended bladder hematuria, urinary tract infection, azotemia, and hydronephrosis or hydroureter. Voiding cystourethrogram clinches the diagnosis.

Drugs

Sulfas, isonex, chlordizepoxide, imipramine, amitriptyline, etc.

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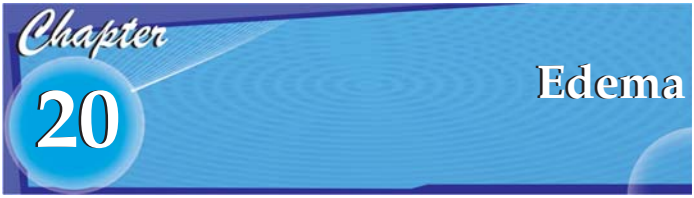


The term, *edema*, denotes an increase in the extravascular component of the extracellular fluid volume. Before clinically recognizable edema becomes apparent, a considerable rise in the extravascular component occurs, resulting in an appreciable weight gain.

Two major forms of edema are generally recognized: localized and "generalized". The gross generalized edema is often termed "anasarca". Examples of localized edema include ascites, hydrothorax (which may be secondary to a systemic disease), excessive crying, conjunctivitis, insect bite, Milroy's disease, etc. Examples of generalized edema include kwashiorkor, nephrotic syndrome, cirrhosis of liver, congestive cardiac failure (CCF), etc.

The patient's history is important in the formulation of a differential diagnosis. In case of generalized edema of the newborn, specific questioning should include information on blood group incompatibility (hemolytic disease of the newborn). Any suggestion of congestive cardiac failure (as manifested by dyspnea, cyanosis, etc. besides edema), fulminant infection, cold injury, over-hydration/hypernatremia or maternal diabetes?

After the neonatal period, history should aim at specifically excluding malnutrition (both primary and secondary), renal disease, congestive cardiac failure and liver disease as the most potent causes of generalized edema. Also, is there any history of allergy to aspirin or some other agent? Any history of subcutaneous bleeding with abdominal pain or arthritis (anaphylactoid purpura)? Has there been excessive intake of sodium or fluid? Any predisposition to sodium retention (steroids)? Has the patient been recently started on treatment for diabetes mellitus?

In localized edema, specific questioning depends upon the site affected. For instance, edema of the face must elicit such information as excessive crying, excessive rubbing of the eyes, conjunctivitis, blephritis, allergy to eyedrops or some other agent, "congress" grass, i.e. perthinium), acute sinusitis, dental abscess, orbital cellulitis or cavernous sinus thrombosis. Is there any accompanying facial palsy with furrowed tongue (Melkersson's syndrome)?

An edematous arm may be the result of arm presentation or its isolated exposure in cold environment.

Edema over feet and legs ever since birth is usually due to Milroy's disease, or Turner's syndrome.

GENERALIZED EDEMA

Generalized Edema in Newborn

Hemolytic Disease of Newborn

In the severest form of Rh hemolytic disease, *hydrops fetalis*, the baby is remarkably edematous with effusion in serous cavities and massive hepatosplenomegaly. He is usually born preterm and may die shortly after birth as a result of severe anemia and congestive cardiac failure. In case of death in utero, the baby is macerated. The placenta is invariably large and edematous.

Alpha-thalassemia may present as fatal hydrops fetalis or hemoglobin H disease in which only Bart hemoglobin and hemoglobin H are present.

Congestive Cardiac Failure (CCF)

Infrequently, generalized edema involving the feet, legs, sacrum and eyelids may be a sign of CCF in the newborn. The accompanying manifestations include tachypnea, irritability, feeding difficulty, poor weight gain, weak cry, tachycardia, hepatomegaly, cardiomegaly and gallop rhythm. A common finding is pneumonitis with or without collapse of a part of the lung. A clinical assessment of JVP is rather difficult because of the shortness of the neck and difficulty in securing a relaxed state in case of newborns.

Even in the absence of a murmur, the probability of newborn's CCF being secondary to congenital heart disease should be seriously considered.

Cold Injury

Neonatal cold injury occurs most often in low birthweight infants as a result of exposure to freezing cold, or following a resuscitation procedure or a cold snap.

Clinical features include a low body temperature (30 to 35°C or even less), cold skin (color may, however, remain pink giving an erroneous impression of good health), lethargy, refusal to accept feed, oliguria and bradycardia. Over areas of edema, skin may become hard and fixed to the underlying structures. The so-called sclerema, may be confused with scleredema.

Complications of cold injury include hypoglycemia, acidosis and hemorrhagic manifestations, such as massive pulmonary hemorrhage.

Electrolyte Imbalance

Overhydration, excessive administration of sodium through oral or intravenous rehydration therapy or concentrated milk formula, and inadequate excretion of sodium by immature kidneys in preterm newborns may be accompanied by clinically detectable edema.

Hypokalemia also is likely to cause edema in association with other manifestations such as muscular weakness.

Excess solute load as a result of high protein formula may also be responsible for clinical edema, more so in a preterm infant.

Hypoallergenic formula in cystic fibrosis may result in edema in neonatal period.

Nutritional Edema

Anemia with hypoproteinemia, idiopathic hypoproteinemia and vitamin E deficiency may manifest with neonatal edema. Whereas idiopathic hypoproteinemia occurs in term infants, the remaining two conditions usually are encountered in preterm infants.

Renal Edema

In congenital nephrosis, the newborn may present with hypoproteinemia and edema. Two major types (1.Infantile microcytic disease—Finnish type, 2. Membranous nephropathy of congenital syphilis) are recognized.

Remaining causes include congenital toxoplasmosis, congenital rubella, nail-patella syndrome, etc.

Maternal Diabetes

The newborn of a diabetic mother is usually remarkably heavy, plump, full-faced, plethoric and covered with lot of vernix caseosa. He is prone to develop hypoglycemia, hypocalcemia, idiopathic respiratory distress syndrome (hyaline membrane disease), hyperbilirubinemia, renal and adrenal vein thrombosis and polycythemia. Incidence of congenital malformations is high.

Generalized Edema after Neonatal Period

Nutritional Disorders

Gross protein-energy malnutrition (PEM) in the form of kwas-hiorkor is by and large the most common nutritional disorder causing generalized edema in children, usually between the ages of l to 4 years (Fig. 20.1).

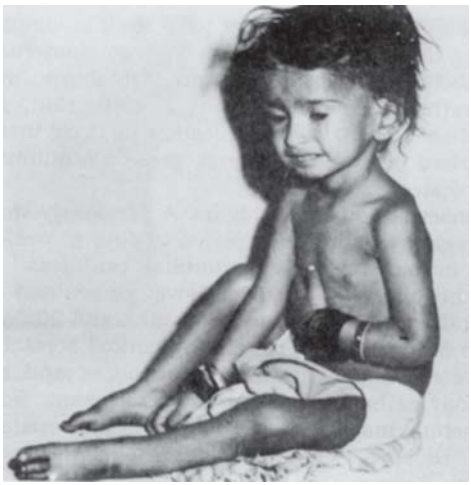


Fig. 20.1: *Kwashiorkor* Note the pedal edema, listlessness, muscle wasting with retention of some subcutaneous adiposity and growth retardation (weight 8.5 kg, height 72 cm) in this 2-year-old girl.

The fundamental nutritional inadequacy is primarily of proteins though energy deficiency and deficiencies of several vitamins and minerals also coexist. The essential features of the disease are growth retardation as evidenced by significantly low weight and height for age, gross muscle wasting with retention of some subcutaneous fat, mental apathy and edema (at least over pretibial region) with serum albumin less than 2.5 g%. The variable (nonessential) features include dermatosis, diarrhea, hepatomegaly, superimposed infections, hair changes and vitamin and mineral deficiencies. Marasmic-kwashiorkor refers to the state in which the child has gross wasting of muscles as well as subcutaneous fat (in short he looks marasmic), and also has developed edema.

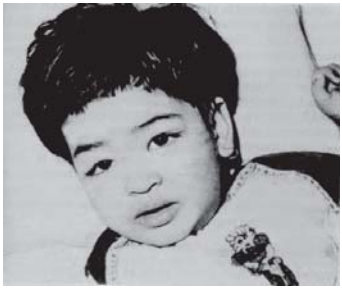
Such conditions as celiac disease, cystic fibrosis, edemic tropical sprue, tuberculosis, hookworm disease and protein-losing enteropathy may cause secondary malnutrition and hypo-proteinemic edema.

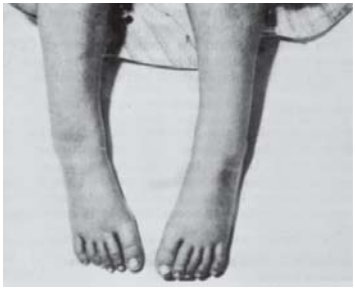
Renal Disorders

Nephrotic syndrome, no matter whether it is idiopathic or secondary to such conditions as chronic glomerulonephritis, diabetes mellitus, renal vein thrombosis, systemic lupus erythematosus (SLE), malignant hypertension, amyloidosis, Plasmodium malarial infection HIV, HB or drug toxicity, is characterized by massive edema, gross albuminuria and hypercholesterolemia.

The onset is usually insidious. A previously well child begins to gain weight over a period of days to weeks. This may be accompanied by periorbital puffiness. In due course, he presents with massive generalized edema involving the face, extremities (Figs 20.2 and 20.3), trunk, abdomen, and genitalia, especially marked scrotal edema almost resembling hydrocele. Hydrothorax and massive ascites may cause respiratory embarrassment. Edema of gut epithelium may result in diarrhea. Some hepatomegaly is usual. Blood pressure usually remains within normal range.

Acute nephritis is characterized by acute onset of fever, edema (most marked over face) and smoky or frankly bloody urine. Oliguria and hypertension are usually present. Occasionally, the





Figs 20.2 and 20.3: *Nephrotic syndrome* Note the periorbital puffiness and pedal edema. Urinalysis showed gross proteinuria Serum albuminuria was 2 g% and cholesterol 218 mg%.

child may present with hypertensive encephalopathy. Acute renal shutdown and CCF are other serious complications. Preceding these manifestations by I to 2 weeks is a streptococcal (beta-hemolyticus type 12) infection of throat or skin. Urinalysis reveals few to numerous red cells, many granular casts and mild to moderate albuminuria.

Remember that edema of acute nephritis is due to impaired function of the capillary wall. It, therefore, does not follow the hydrostatic pressure and does not accumulate in the dependent parts. Its characteristic sites are face, pretibial region and ankles.

Cardiovascular Disorders

Congestive cardiac failure may at times manifest with generalized edema. Remaining evidence of CCF in the form of dyspnea, basal crepitations and hepatomegaly should be looked for. Raised JVP is certainly an important finding but it may be quite difficult to detect it in infants.

You must ascertain the probable cause of CCF. The causes include congenital heart disease, rheumatic carditis, viral carditis, fibroelastosis and severe anemia.

Liver Disorders

Ascites, jaundice and hepatosplenomegaly characterize edema of Indian childhood cirrhosis, particularly in the second stage. Liver

is typically firm with a sharp leafy margin. Superficial abdominal veins are quite prominent. Hematemesis or bleeding from other sites as a result of thrombocytopenia may occur. Anemia is quite pronounced.

Remaining Causes of Generalized Edema after Neonatal Period

Beginning of treatment of diabetes mellitus, overhydration and hypernatremia, aspirin sensitivity.

LOCALIZED EDEMA

Localized Edema in the Newborn

Head

Caput succedaneum is an edematous swelling, as a result of serosanginous collection from pressure over the presenting part between the pericranium and scalp tissue. It is present at birth, crosses the suture-line and disappears within a few hours to a day or so. It should not be confused with cephalhematoma in which swelling results from collection of blood between skull bone and overlying pericranium. It is, therefore, limited by suture lines. Regression takes a few weeks.

Face

Excessive crying, infections such as conjunctivitis or boils, and drugs (say sensitivity to eyedrops) may be responsible for edema of face and eyelids.

Limbs

Edema of an arm may well be due to arm presentation or exposure of the arm to low temperature. It may last several hours.

Non-pitting or pitting edema, often unilateral, present over legs ever since birth is in all probability Milroy's disease (Fig. 20.4). It is predominantly lymphatic.

A characteristic edema of the dorsum of bands and feet in association with loose skin folds at the nape is a feature of gonadal dysgenesis, also termed Turner’s syndrome. Other manifestations of this 45, 'X' disorder at birth include a significantly low birthweight and low crown-heel length.

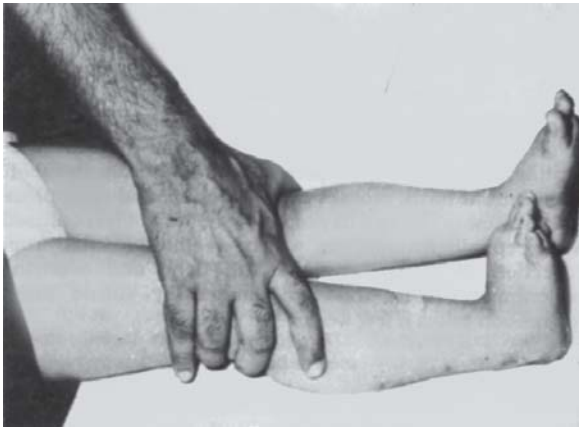


Fig. 20.4: *Milroy's disease* The nonpitting edema in this child was present ever since birth.

Genitalia

Edema involving genitalia is a common finding in newborns. It is physiological and disappears without any intervention.

Some newborns develop a transient edema of scrotum. It may well be allergic in origin (say, sensitivity to detergents employed for washing the nappies), or due to insect bite or superficial cellulitis accompanying a pustule or abrasion. The edema and erythema tend to spread beyond the scrotum into the groin and perineum. As a rule, the manifestations are unilateral. This condition is accompanied by eosinophilia and usually responds to an antihistaminic agent like cetrizine. This poorly understood entity has been termed "idiopathic scrotal edema".

Abdominal Wall

Edema of abdominal wall may accompany peritonitis, necrotizing enterocolitis and appendicitis in newborn. Edema in the last-named situation is localized to the right flank. At times, there is an associated erythema. Remaining manifestations include abdominal distention, irritability, vomiting and pyuria.

Fig. 20.5: *Lymphedema precox* Note the lower extremity edema in a 12-year-old girl without any obvious cause, even on usual investigations. This condition of progressive lymphedema is usually encountered in females between 10 to 25 years of age

Localized Edema after the Neonatal Period

Excessive crying, excessive rubbing of the eyes, conjunctivitis, blephritis and sensitivity to eyedrops or certain other drugs are common causes of edema about the eye.

Angioneurotic edema or Quincke edema results from an immune deficiency or secondary to a number of allergens including such agents as tatrazine (coloring matter in foods and drugs), disodium cromoglycate, demeclocycline and clonidine.

Face edema as a part of drug reaction may also occur in case of aspirin, cotrimoxazole, penicillin, nitrofurantoin, chlordi-zepoxide, cephaloridine, amitriptyline, clonazepam, etbosuximide, imipramine, primidone, troxidone and vitamin A toxicity.

Infections and inflammations such as boils, sinusitis, dental abscess, orbital cellulitis, chronic lymphangitis, resection of regional lymph nodes, filariasis, etc. are well known causes of localized edema (Fig. 20.5).

Mumps may be accompanied by edema over the manubrium (sternal edema) and upper chest wall as a result of lymphatic obstruction. It manifests some 5 days after the appearance of parotid swelling and lasts for almost an equal period.

Epidemic dropsy Infrequently, edema may result from adverse effect of a toxic substance. In epidemic dropsy which caused panic in Delhi and several other States of India in August-September 1998, consumption of an oil (usually mustard oil) adulterated with argemonex oil is the etiologic factor. The adulterant acts through a toxic alkaloid, sanguinarine, and interferes with oxidation of pyruvic acid that accumulates in blood. The seeds of the wild Argemone mexicana (the so-called "prickly poppy") very much resemble the mustard seeds. The former has a tendency to grow in the thick of the latter. The intermixing of the two types of seeds, therefore, is understandable. In addition to its being accidental, it may also be done deliberately by unscrupulous elements.

Manifestations of epidemic dropsy include development of an acute non-inflammatory swelling in both legs, nausea and vomiting, diarrhea, dyspnea and congestive cardiac failure. A small number of subjects may develop flaucoma. Mortality in severe disease is high.

Diagnosis is primarily clinical and by exclusion of other causes of the clinical picture seen in dropsy. Two laboratory tests are available for establishing the diagnosis namely:

- *Nitric acid test:* It consists in adding nitric acid to a suspected sample. If argemone is present in at least 0.25% proportion, the sample will turn brown to orange-red.
- Paper chromatography It is the most sensitive and dependable parameter, gives positive result when mustard or some other oil contains as low when mustard or some other oil contains as low as
  0.001% of argemone.
  Treatment of dropsy is by and large symptomatic and supportive.

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Chapter 21 Encopresis

Encopresis, also termed *fecal soiling*, means involuntary passage of feces. Until the age of 4 to 5 years, it may well be a developmental variation. Thereafter, it is considered indicative of a disorder such as severe chronic constipation, mental retardation, neurologic defects like progressive degenerative disease, or anal and rectal abnormalities.

History should seek information whether fecal incontinence is of recent onset or it has been like that since long as a part of unsuccessful toilet training. What is its frequency? Is there any relationship with time of the day? Is the child constipated? Is the constipated stool accompanied by streaks of blood? Is constipation indeed painful? Is the child mentally normal? Any neurologic disease he is known to suffer from?

Clinical examination should focus on psychological, developmental and neurological evaluation. Rectal examination is imperative.

Chronic Constipation

In severe chronic constipation, associated with fecal impaction or painful defecation, the mother may complain that the child simply soils or that he has diarrhea with soiling. In actuality, the so-called "diarrhea" is the liquid fecal matter that spills round the edges of a solid fecal mass situated either in the rectum or low in the colon. Rectum is found to be full of large fecal lumps.

This type of encopresis (the so-called "overflow" type) is responsible for a vast majority of the cases encountered in pediatric practice. For some unexplained reason, it occurs dominantly in boys.

Emotional Disturbance

In some children, such emotional disturbances as separation from parents (usually the mother), starting school, or arrival of a younger sibling, may manifest with fecal soiling. There is evidence that these children seldom have had right bowel training. In fact, they rarely, if ever, have controlled the bowel.

Encopresis in these children reflects uncontrolled anger and defiance at the subconscious level.

The offensive odor from the child makes him a target of rebuke and scorn at home as well as at school. Naturally, his social relationship as also school performance and attendance suffer considerably.

Mental Retardation

Adequate bowel control needs normal anatomical relationships, an intact voluntary and involuntary nervous system, and consciousness of the urge to defecate.

Since all these requirements may not be met with in many mentally retarded children, encopresis is a common observation in them.

Neurological Defects

Fecal soiling may well be an important manifestation of such neurological abnormalities as degenerative diseases, meningo-myelocele, lipoma of the spinal cord, tumors of the spinal cord and trauma to the spinal cord. In such lesions, the urge to defecate is simply absent.

Local Defects

Absence of external and internal sphincter mechanisms may be responsible for encopresis in a small proportion of cases.

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Chapter 22

Enuresis

The term, *enuresis*, denotes occurrence of involuntary voiding of urine after the age at which volitional bladder control should have been established. Usually, 5 year age is considered the cut-off line for evaluation.

Enuresis may be diurnal or nocturnal. In the former, lack of bladder control occurs during waking hours. It should not be considered abnormal if it occurs less than twice a week. During the first several years after being toilet trained, some children occasionally wet themselves while awake since they remain preoccupied with play and postpone emptying the bladder. Nocturnal diuresis is relatively more common and often a cause of considerable anxiety to the parents.

Enuresis may be primary or secondary. *Primary enuresis* means that the child has never been able to have control over voiding during night. This is also termed "persistent enuresis". *Secondary or regressive enuresis* means that wetting occurs after the child has attained the normal bladder control. Whereas persistent enuresis is often the result of poor toilet training, the most important cause of regressive enuresis is a precipitating stressful situation like parental quarrelsomeness, arrival of a sibling, or a family tragedy. Organic pathology is found in only a small proportion of cases in both types of enuresis.

History should include a detailed interview with the parents as well as the enuretic child to find out the natural history of the problem, and possible etiologic or at least precipitating emotional factors. Obtain information about child's fluid intake and urinary output. Is there any history of associated fever or dysuria? Any worm intestation?

Physical examination should particularly exclude presence of neurological and spinal abnormalities. The possibility of chronically distended abdomen should be evaluated by abdominal and rectal examination after the child has voided. It is advisable to watch the child for force and quality of urinary stream during the act of micturating.

Most children need no investigations but for the routine urine, stool and hemogram. In a limited number of cases where organic pathology is suspected, an X-ray of lumbosacral spine, a micturating urethrogram or a test dictated by the merits of the case may be carried out.

PRIMARY (PERSISTENT) ENURESIS

Poor Toilet Training

Mismanagement of toilet training, especially when the child is about the stage of maturation that enables him to control micturition, can delay the acquisition of control, causing enuresis. Over enthusiastic parents make a significant error in far-too-early "potting", compelling the child to sit on pottie for too long and smacking him for not using the pottie.

Familial

In some families, enuresis occurs as a familial trait. There is delay in the maturation of the relevant components of the CNS. Hence, children are late in attaining bladder control. Undoubtedly, additional psychological overlay may complicate the problem.

Anatomical Defects

Such anatomical anomalies as bladder-neck or urethral obstruction, ectopic ureter entering the vagina, diverticulum of the anterior urethra, sacral agenesis, etc. may infrequently be responsible for primary enuresis.

Mental Retardation

Just like delay in walking and talking, a mentally subnormal is likely to acquire bladder control significantly late. Understandably, this is related to the delayed maturation of the nervous system.

Emotional Deprivation

An emotionally deprived child, particularly if he is brought up in an orthodox type of institution, is likely to suffer from delayed acquisition of bladder control.

SECONDARY (REGRESSIVE) ENURESIS

Psychological

Secondary enuresis is most often a manifestation of family conflict and maladjustment, e.g. too strict parents, rejection, sibling rivalry, quarrelsomeness between the parents, problems at school, acute anxiety, etc.

Worm Infestation

Heavy threadworm infestation (enterobiasis or oxyuriasis) is frequently associated with enuresis. Eradication of the infestation leads to regression in frequency of enuresis and in some even full recovery from it.

Metabolic Disorders

Enuresis may well be the first manifestation of diabetes mellitus or diabetes insipidus in a child who had till recently been dry. The child with diabetes mellitus may also suffer from such additional manifestations as excessive thirst (polydypsia), polyuria, excessive hunger (polyphagia), weight loss, general weakness, tiredness and bodily pains. Fainting attacks due to spontaneous hypoglycemia, vulvitis, abdominal pain, nausea and vomiting, irritability and deterioration in school performance.

In diabetes insipidus, enuresis is accompanied by polydypsia and polypuria.

Neurogenic Bladder

Such congenital conditions as meningomyeloceic, lipomeningocele, sacral agenesis, or other spinal abnormalities may cause neurogenic bladder and resultant enuresis. In addition, cerebral palsy, CNS tumors, repair of imperforate anus or excision of sacrococcygeal teratoma may lead to abnormal innervation of bladder and sphincters, resulting in urinary incontinence.

Urinary Tract Infection

Urinary tract infection is an important cause of secondary enuresis, especially when it is accompanied by fever and dysuria. Besides urinalysis, it is advisable to do the urine culture.

Neurogenic Bladder

Occasionally certain acquired diseases and traumatic lesions of the spinal cord may cause enuresis.

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Chapter 23 Epistaxis

Epistaxis, also called *nosebleeds* or nasal bleeding, is a common symptom after the first year and up to puberty, causing considerable anxiety to the sufferer as well as the parents. In our experience, it occurs in 10% of children. In a vast majority of the cases, blood loss is small. Of course, it appeals quite large to the parents. Moreover, the episode is frequently transient, stopping spontaneously or after application of little pressure.

Irrespective of the basic cause of bleeding, the fact remains that the site of epistaxis usually is the antero-inferior part of the cartilaginous nasal septum which has a rich vascular plexus (Kiesselbach plexus, area or triangle the anastomotic site for a number of terminal arterioles, 0.5 cm within the nose and above the nasal floor) followed by the mucosa lining the anterior portion of the turbinates. Notably, even in such bleeding disorders as leukemias, purpuras or hemophilia, this is the usual location of epistaxis.

In clinical history-taking, it is vital to determine if there has been any sort of physical injury to the nose with special reference to nose picking. Is the patient a habitual nose picker? Any history of foreign body, overexposure to solar radiation, allergic rhinitis, upper respiratory catarrh, pertussis, cystic fibrosis, etc.? Enquire if the subject is suffering from such diseases as uremia, hypertension, or liver disorder. A child who manifests epistaxis along with throbbing headache may well be suffering from hypertension. Any relationship with menses?

When you encounter epistaxis in association with bleeding from one or more additional sites, remember to exclude blood dyscrasias like leukemias.

A careful search for a bleeding disorder in family members (say, in maternal uncles in case of hemophilia A) points to a genetically determined etiology.

The most important part of physical examination is detailed and careful examination of the nose for deformity, a bleeding point, a telangiectasia spot over Kiesselbach's area, congestion or pallor of mucosa, foreign body, polyp, ulceration, etc. Is there any evidence of sinusitis in the form of local sinus tenderness and/ or purulent discharge oozing out of the sinus opening in the nose. Look for purpuric lesions over skin or active bleeding from other sites. What is the blood pressure? Any organomegaly, particularly with reference to liver, spleen and lymph glands?

Trauma

Nose picking is the most common cause of epistaxis in childhood. The location of trauma is usually the anterior portion of the nasal septum, about the Kiesselbach's area. The bleeding spot can frequently be inspected after cleaning the area of the clots. A careful examination may reveal presence of dried blood under the patient's fingernails. This kind of nosebleed is termed epistaxis digitorum.

Nasal trauma, say from other causes like a hard blow over the nose, may cause laceration of the mucosa, deformity and fracture in association with epistaxis.

Basal skull fracture may manifest as epistaxis with CSF rhinorrhea.

Foreign Body

As and when recurrent epistaxis accompanies unilateral nasal obstruction, foul discharge, particularly in a child with older sibling who is in the habit of inserting nuts, beads, crayons, plastic pieces or similar objects into the patient's nose during play, a foreign body must be suspected. A careful examination usually enables visualization of the foreign body.

Solar Radiation

Though this factor as a cause of epistaxis has generally been neglected in the western literature, there is little doubt that it is an important and common cause of recurrent epistaxis in India and other tropical countries.

Solar radiation induces, sudden nosebleed in individuals with very thin-walled anastmotic vessels over the Kiesselbach's area.

Nasal Polyposis

Recurrent epistaxis in association with manifestations of nasal obstruction, including mouth breathing, hyposmia, postnasal drip, persistent cold and sneezing should arouse suspicion of nasal polyposis. Visualization of pedunculated hypertrophied edematous nasal mucosa confirms the diagnosis.

Incidence of nasal polyposis is particularly high in cystic fibrosis.

Upper Respiratory Infection/Allergy

Such states as adenoidal hypertrophy/adenitis, allergic rhinitis, atrophic rhinitis, hypertrophic rhinitis, sinusitis, etc. may be accompanied by epistaxis.

In nasal diphtheria, besides blood-stained and mucopurulent discharge, the anterior nares show excoriation. Whereas in acute form toxemic symptoms are dominant, a grayish-white membrane is the hallmark of chronic form.

Physical and Emotional Stress and Strain

Violent exertion, vigorous blowing, sneezing, paroxysmal and forceful cough as in pertussis or cystic fibrosis, excitement, etc. are also known to foster nosebleeds.

Congenital Vascular Defect

Rendu-Osler-Weber disease, which usually manifests with epistaxis, is characterized by presence of telangiectasia on nasal mucosa (septum and turbinates) as also on oral mucosa, on skin and under fingernails. Family history is usually positive for epistaxis/telangiectasia. The cause of bleeding is increased capillary fragility. There is no defect/deficiency of platelets or coagulation factors.

Systemic Diseases

Hypertension, uremia, cirrhosis of liver, rheumatic fever, acute nephritis, anemia, enteric fever, measles, etc. may well be complicated by epistaxis.

Bleeding Disorders

In leukemias, purpuras, hemophilia von willebrand disease and DIC, epistaxis may be the presenting features. Remaining features of these bleeding disorders aided by specific investigations help to reach the precise diagnosis.

Remaining Causes of Epistaxis

Tuberculosis, syphilis, leprosy, fungal infections, tumors, puberty, high altitude, scurvy, vitamin K deficiency, sickle-cell disease, brucellosis, prolonged use of phenylephrine nasol drops, juvenile angiofibroma of the nasopharynx, lymphoepithelioma, etc.

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Chapter 24 Failure to Thrive (FTT)

The term, *failure to thrive (FTT)*, refers to infants and children who fail to gain weight proportional to length or height and may even lose it though there is no superficially apparent cause for it. The anthropometric index used for FTT should be weight for length or height. Emperically, the observation period should be at least one month. At best, it is a descriptive and not a diagnostic term. In other words, a thorough clinical, investigative and follow-up evaluation is needed in subjects given this designation.

A "constitutionally light child" with weight below 3rd percentile but showing an appropriate weight gain should not be labelled "FTT" (Fig. 24.1). Fig. 24.2 depicts three patterns of FTT:

- Fall-off in weight
- Static weight
- Weight loss.

History-taking in this particular situation brings out more important information if it is conducted by different interviewers at different times.

A detailed information on child's dietary intake is crucial. How is his appetite? Does he eat enough and yet is not gaining adequate weight ? Or, is it that poor appetite is responsible for a significantly poor intake? Make a rough calculation of his actual calorie and protein intake and assess it in relation to the recommended intake for his age. I often come across 2 or 3-year-old fed only on milk (which means enough of proteins but inadequate calories) and the parents wondering why, in spite of such a nutritious diet, the child is not thriving well.

Fig. 24.1: Growth chart showing "constitutionally light child" with weight <3rd, percentile but weight gain at an appropriate rate. This should not be considered as "failure to thrive (FTT)".

Is there any history of intestinal parasitosis—direct or indirect? Any chronic diarrhea? Any suggestion of malabsorption? In celiac disease, tropical sprue, etc. not only reduced appetite causes reduced intake, whatever is eaten is only poorly absorbed. In cystic fibrosis, appetite is usually voracious. But the ingested food

Fig. 24.2: Growth chart showing 3 patterns of failure to thrive (FTT) i.e. fall-off in weight gain, static weight and weight loss.

becomes available only in a small proportion for body building because of presence of pancreatogenous steatorrhea.

Any family history of tuberculosis? Failure to thrive may well be the only apparent manifestation of primary complex.

Any physical handicap? At times, physical handicap such as cerebral palsy, partial cleft palate, etc. may be contributing to child's inability to thrive well.

Every effort must be made to trace the adverse factors in child's family environment. Any evidence of maternal deprivation? Is there any suggestion of child abuse and neglect? What is the parent-child conflict precisely, if any?

Physical examination should aim at assessment of the nutritional status and finding the known cause that may be operating in the case under reference. Study of growth chart (Fig. 24.3), if constructed, and a developmental flow sheet assist in identifying the physical or environmental factor(s) responsible for failure to thrive.

In case clinical work-up suggests disturbance in a particular organ system, appropriate screening tests must be carried out. However, before resorting to sophisticated and cumbersome investigations, it is important to carry out meticulous microscopic examinations of stools, at least on three successive day (preferaldy, on 5 or 6 successive days), treat intestinal parasites if detected in stools, and give a trial of feeding for at least 2 weeks, in the hospital *per se*.

Nutritional Deprivation

In the developing world, this appears to be the most important factor in causation of the syndrome of failure to thrive. Gross deficiency of protein and energy intake, no doubt, clearly leads to overt syndromal states of kwashiorkor and marasmus. In the present context, our concern is the mild-to-moderate deficiency, usually resulting from ignorance about nutritional needs of the child (see Fig. 24.3). For instance, slow, chronic borderline dietary inadequacy starting fairly early in life may not cause overt picture of kwashiorkor or marasmus. The child rather slows down in gaining height as well as weight. Seemingly, his weight for height is nearly all right though it is significantly less than expected for actual age. This state is termed nutritional dwarfing (Figs 24.4 and 24.5).

Nutritional dwarfing is a common problem in our settings. But the cases are not as often detected. The condition seems to be a kind of "adaptation" to poor diet (not as grave as to cause frank kwashiorkor or marasmus) over a prolonged period. The affected

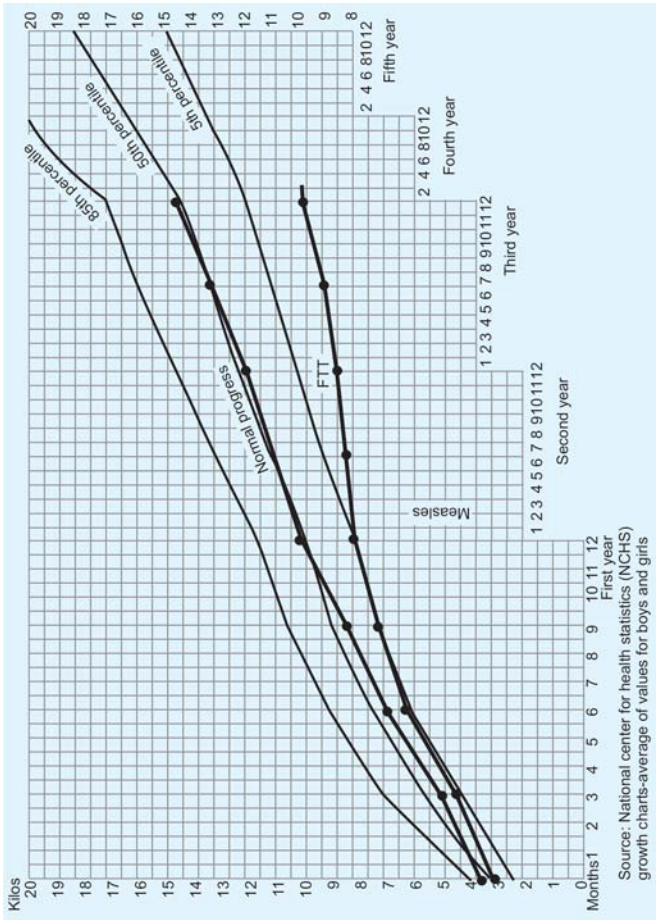

Fig. 24.3: "Road to Health" card showing progress of a child with failure to thrive against a healthy child with normal progress in weight gain. Note that the FTT child was doing fine during the first 6 months. Then his progress slowed down, probably secondary to negligible intake of semi-solids. An attack of measles at age 15 months further proved a setback. This is reflected in the growth becoming almost flat and falling below 5th percentile.

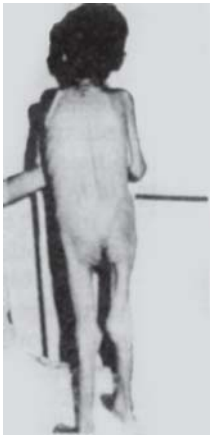

Fig. 24.4: *Acute or chronic malnutrition* This 8-year-old boy who had not been thriving well over the years on account of inadequate dietary intake weight 17.5 kg, (height 107 cm) suffered further following an episode of acute diarrhea 2 months prior to admission. During this episode, he had been nearly semistarved. His weight on admission was only 13 kg.

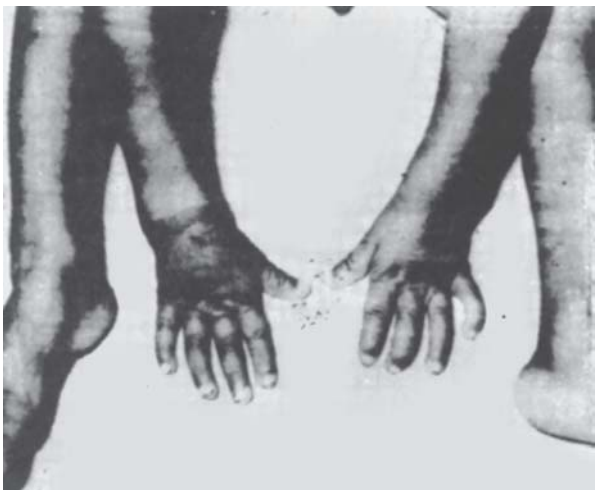

Fig. 24.5: *Vitamin D-deficiency rickets in a child with FTT* Note the remarkable widening of the wrists. The child was plump-looking and yet anemic (hemoglobin 8 g%). Frontal bossing of head, a widely open anterior fontanel and rachitic rosary were also present in this 18-month-old boy. Dietary history revealied:that he was on almost entirely bottlefeeding, consuming about 1.5 to 2 kg cow's milk daily.

child is less active and less lively and is more susceptible to diarrheal disease, pneumonia, tuberculosis or other infections prevalent in the region.

Maternal/Social/Environmental Deprivation

Emotional deprivation resulting from psychosocial circumstances (often not quite obvious) may affect child's intake, absorption or utilization of food considerably. In the affluent countries where primary nutritional deprivation is not much of a problem, this factor is known to be the most common cause of failure to thrive. In fact, some authorities believe that the term, failure to thrive, psychosomatic growth failure, and maternal deprivation syndrome may be considered synonymous. No doubt, emotional deprivation does play considerable role in our infants and children too. Nevertheless, I maintain that nutritional deprivation takes the major share of etiologic factors in failure to thrive in our setup.

The circumstances of the parents that may contribute to the syndrome include general immaturity of one or both parents, irresponsible/antisocial behavior, drug abuse, economic stress and strain, marital disharmony, dislike of children, low tolerance for stress, single parenthood, etc.

Intestinal Parasitosis

Though not a significant factor in the etiology of failure to thrive in the developed regions, intestinal parasitosis decidedly occupies pride of place among the leading causes of the syndrome in India and other developing regions because of continued poor personal, water, food and environmental hygiene.

Chronic giardiasis is characterized by, besides failure to thrive, vague upper abdominal pain, recurrent diarrhea (stools are generally steatorrheic and often whitish with lots of undigested material), and nutritional deficiencies. Occasionally, there may be acute dysentery like presentation. Even transient ulcerative colitis has been observed.

Chronic amebiasis is characterized by failure to thrive, chronic diarrhea which may be accompanied by mucus and blood, recurrent abdominal pain and tenesmus. The complications include hepatitis, liver abscess, partial or complete intestinal obstruction,

intussusception, perforation of colon, peritonitis, rectal ulcers and fistula and empyema.

Ascariasis is characterized by, in addition to growth failure, abdominal distention and pain, anemia vitamin deficiencies and voracious appetite. Pica, sleeplessness, irritability, urticaria, diarrhea and eosinophilia are encountered in a proportion to the cases. Occasionally, intestinal obstruction may occur. Migration of larvae may cause ascaris pneumonia (Löffler's pneumonia or syndrome), asthma-like manifestations, hepatosplenomegaly, or encephalopathy.

Ancylostomiasis is characterized by progressive anemia, anorexia, pain abdomen and malnutrition. Pica is often present. With the development of severe anemia and hypoproteinemia, the child may have edema which could become massive and generalized (anasarca). Diarrhea alternating with constipation may also be present. Some degree of malabsorption, as a result of histologic as well as functional insult to the small intestinal mucosa, occurs in many cases. The ground itch as a result of larval skin invasion over feet (buttocks in infants) is often mild and unnoticed. Occasionally, it may be seen as an irritant papulovesicular rash or even as cutaneous larva migrans.

Strongyloidiasis, relatively infrequent in India, resembles ancylostomiasis in many a way. Mild itching and urticaria at the site of penetration into the skin, pain abdomen, severe diarrhea, malabsorption, malnutrition and chest manifestations simulating Löffler's syndrome are the chief presenting features.

Trichuriasis, though seen quite infrequently in most parts of India, may well be responsible for failure to thrive in the sufferer. Remaining manifestations include prolonged diarrhea with blood-streaked stools, right lower abdominal pain, tenesmus, malnutrition with anemia, rectal prolapse, eosinophilia and Charcot-Leyden crystals in stools. In heavy infestation, worms may be seen over surface of prolapsed rectal mucosa.

Oxyuriasis, could well be responsible for failure to thrive in some of its sufferers. Of the various manifestation, proritus ani tops the list. In some giris, vulvovaginitis may be present. Irritability, restlessness, sleep disturbances, behavior problems like bruxism,

masturbution and enuresis, abdominal pain, diarrhea and poor appetite are encountered in some cases. Rarely, serious complications like appendicitis and salpingitis may occur.

Tapeworms may contribute to growth failure. In case of Tenia solium (pork tapeworm), most often the parents bring the child for 1 to 2 cm long segments (proglattides) passing in stools or crawling over the perianal area. Growth failure despite voracious appetite, abdominal distention and pain, and recurrent diarrhea may be the presenting manifestations in some.

Cysticercosis may lodge anywhere in the body. Brain involvement, manifesting as calcification in the skull X-ray, may cause convulsions. Calcified nodules may be palpable in the muscles.

Tenia saginata (beef tapeworm) causes manifestations that are similar to those of Tenia solium. It is less likely to cause cysticercosis. Absorption of the neurotoxin may, however, cause paresthesia and squint. Calcification may be detected in X-ray skull.

Hymenolepis nana (dwarf tapeworm) causes abdominal pain, loss of appetite, chronic diarrhea and growth failure.

Malabsorption States

Celiac disease (gluten sensitivity or gluten-induced enteropathy), is an abnormal response to the gliadin fraction of gluten present in wheat, rye and barley resulting in villus atrophy and absorptive defect. It manifests a few months after the introduction of gluten-containing foods (often a wheat preparation) in infant's feeding schedule. Chronic diarrhea with large, pale, highly foul-smelling stools which stick to the pan, failure to thrive, anemia and other nutritional deficiencies, abdominal distention, irritability and anorexia are usual presenting features.

In order to confirm the diagnosis, you must establish existence of significant rise in daily stool fat excretion with normal D-xylose absorption, histological abnormality of the small intestinal mucosa in peroral jejunal biopsy, and positive response to gluten-free diet followed by recurrence of the manifestations as also biochemical and histological defect following gluten challenge.

Cystic fibrosis (fibrocystic disease or mucoviscidosis), has only recently been documented in Indian children. It is characterized

by such manifestations as chronic/recurrent diarrhea together with recurrent respiratory infections since early infancy, failure to thrive despite exceptionally good appetite, and multiple nutritional deficiencies. Stools are characteristically steatorrheic but may be loose. An obstinate catarrhal cough or "frog in the throat" may be present ever since the first week of life.

Abdominal distention, a palpable liver, clubbing and higher incidence of rectal prolapse and nasal polyposis are other associated findings. A noteworthy finding by the mother is "a line of salt on the forehead after swealing", or "the baby tastes salty when kissed".

Diagnosis is established by demonstrating existence of chemical steatorrhea, a normal D-xylose absorption, poor tryptic activity, and a high sweat chloride.

Endemic tropical sprue is characterized by chronic diarrhea, malabsorption, considerable malnutrition, and anemia typically in a grownup child. Steatorrhea is usually moderate to severe. Partial or subtotal villus atrophy is present. D-xylose test shows poor intestinal absorption. Schilling's test is invariably abnormal, indicating that the intestinal mucosal atrophy and absorptive defect are not limited to the upper gut but are present in the ileum too.

These subjects do not respond to gluten-free diet or to gluten challenge as is remarkable of celiac disease. However, response to folic acid, tetracyclines, or both is gratifying.

Tuberculosis

Undiagnosed primary complex may be responsible for a good proportion of cases of failure to thrive in developing world, including India. In such instances, failure to thrive may be accompanied by such vague symptoms as malaise, fatigue, weight loss and low grade fever. A recent Mantoux text conversion, a positive BCG test and routine X-ray chest often clinch the diagnosis.

Remaining Causes of Failure to Thrive

Cirrhosis of liver, congenital megacolon, congenital heart disease, rheumatic heart disease, bronchial asthma, bronchiectasis, renal rickets, diabetes mellitus, cleft palate, chronic rumination, cerebral palsy, mental retardation, primordial dwarfism, constitutional dwarfism, AIDS, etc.

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Chapter 25 Feeding Problems

Infants frequently suffer from such preventable feeding problems as regurgitation, vomiting, sucking and swallowing difficulties, dehydration fever, excessive crying, "3-month colic", change in bowel habit, underfeeding, overfeeding, or bottle addition. Among the causative factors rank poor mothering characterized by too little feed, too heavy feed, wrong feeding technique, poor respect to bottle hygiene, etc.

History should be addressed to information whether the infant is being breast or bottle fed, or both. Is it demand or time schedule? Is the feeding technique correct? Does the mother meaningfully do burping? In case of artificial feeding, find out if the dilution and hygienic precautions are adhered to as per recommendations. Is the hole of the nipple the adequate one? Does the mother indulge in forced feeding or too inadequate feeding? Is the infant satisfied after feed, i.e. he sleeps after consuming the feed. Has the mother introduced semisolids? How is the mother's own diet? Is she highly strung?

Physical examination should particularly assess the nutritional status of the infant: whether he is normal, overweight or underweight? How is the hydration status? Look for any congenital defects such as cleft lip, cleft palate, or glossoptosis. Any thrush, abdominal distention or tight anal sphincter?

You must always ensure observing the actual act of feeding and the child's subsequent behavior. This is, by and large, the gold-standard for establishing the true nature of the feeding problem (Figs 25.1 and 25.2).

No investigations are, as a rule, required.

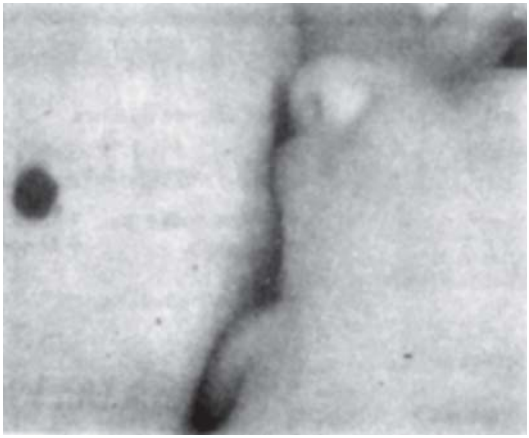

Fig. 25.1: Initiation to breastfeeding shortly after birth with support from the family and the health workers contributes considerably to safeguarding against feeding problems.

Fig. 25.2: Mothers need to be sufficiently guided about the proper attachment of baby's mouth at the breast. Watching the mother feeding the baby may give you a clue to the baby's feeding problem.

Regurgitation

The phenomenon of bringing up a little of the swallowed feed along with the swallowed air is termed "regurgitation", "posseting" or "splitting up". In case of some infants, this becomes a habit. They enjoy bringing back some feed and chewing it like a cow chews the cud. This habit, termed "rumination", is harmless. Nonetheless, this makes the baby somewhat smelly and he runs the risk of aspirating the stuff into the airway. In order that the infant does not inhale any bit of regurgitated milk, he should be placed on his side rather than on the back. This position also interferes with his regurgitation as also rumination.

Since regurgitation results from swallowing excess air by the infant, remedy lies in guiding the mother about the proper technique of feeding.

Vomiting

More complete emptying of stomach by the infant, particularly after some time of feeding, is termed "vomiting". It may be due to overfeeding, too much of swallowed air, gastroenteritis, gastroesophageal reflux (GER), cow's milk protein intolerance (CMPI), raised intracranial pressure, pyloric stenosis, etc.

In the last named condition, the infant shoots milk halfway across the room (projectile vomiting). Manifestations begin between 2 to 6 weeks of age, typically in a premature first-born male infant.

Sucking and Swallowing Difficulties

During the first few days of birth, some sucking difficulty is expected since this is the period in which both the infant and the mother are endeavouring to master the technique.

Certain mechanical problems, say cleft lip, cleft palate, large tongue and nasopharyngeal block as in chaonal atresia, may interfere with sucking. Local conditions of the breast like cracked nipple, retracted nipple, engorgement or abscess also cause sucking problems.

Prematurity predisposes the infant to sucking and swallowing difficulties. Cardiac or respiratory diseases accompanied by tachypnea, intracranial hemorrhage and hyperbilirubinemia figure among several causes of feeding difficulties.

Dehydration Fever

Occasionally, on the second, third or fourth day of life, an infant with low intake of fluids or high environmental temperature, say in an incubator, phototherapy unit, or in a bassinet close to a radiator or in the sun, may develop disinclination to feed, fever (38 to 39°C), restlessness and drowsiness. In addition, there may be weight loss. Urinary output and frequency of voiding diminishes and the skin loses some of its elasticity. Anterior fontanel may be slightly depressed. What is remarkable is that, despite poor feeding, the infant takes fluid avidly.

This condition, the so-called "dehydration fever", responds dramatically to administration of oral or parenteral fluids and/ or lowering the environmental temperature.

Even in an infant with dehydration fever, especially if he appears quite sick, the possibility of local or systemic infection must be considered, more so when he fails to respond within 12 to 24 hours to the aforesaid suggested measures.

Transient neonatal hyperthermia with feeding disinclination, hot and dry skin, flushing and apathy followed by stupor, grayish pallor, convulsions and coma may infrequently occur both in neonates and older infants when they are wrapped in heavy woollens for outdoor cold that does not prevail in their immediate indoor surroundings. This condition may be complicated by hypernatremia, leading to brain damage, sudden infant death syndrome (SIDS), hemorrhagic shock or encephalopathy syndrome.

Excessive Crying

Crying in a neonate is invariably a signal that the infant is hungry or thirsty, he is feeling uncomfortable because of heat or cold, he is wet, or he indeed needs the mother. Repeated crying may begin to get on the mother's nerves. An insecure mother fails to develop the much needed warm emotional relationship with such an infant. She may indulge in battering. It is not uncommon to hear such a mother shouting: "What can you do with such a rascal? He does not let me relax for a minute".

Irritability of the infant during mother's "periods" is a well-known observation. Whether it is related to fall in the supply of

breast milk, mother's irritability, or some substances in the breast milk during menstruation that cause discomfort to the infant remains speculative.

Colic

Some infants begin crying soon after birth, particularly towards the afternoon or evening, and keep doing so till the age of 3 months. The attack begins suddenly. The cry is nearly continuous and loud. The face is flushed or shows circumoral pallor, abdomen is distended and tense, the legs are drawn up over the abdomen, and the hands are clenched. The attack may last for a few hours, terminating with passage of feces or flatus, or when the infant has fully exhausted himself.

The cause of the so-called "3-month colic" or "evening colic" remains elusive. Excessive intestinal activity, borne out by exaggerated bowel sounds, exists during the paroxysm. It has been postulated that, perhaps, events in the household routine (worry, anger, excitement, fear, etc.) cause this problem in infants just as they cause vomiting in older children.

No single treatment consistently gives satisfactory relief. Provision of a stable emotional environment with reassurance to the mother, improvement in feeding technique especially in relation to burping, and identification of possibly allergenic agents in infant's or mother's diet are valuable preventive measures. For relief of the actual attack, holding the infant upright, placing him prone across the mother's lap or hot water bottle, pushing a suppository into the rectum for passage of fecal material, or sedation of the infant may provide variable help. Antispasmodic agents and carminative mixtures are not much effective.

Change in Bowel Habit

Constipation Infants on artificial feeding, especially if underfed and given inadequate fluids and sugar, may pass stools of very hard consistency that cause good deal of straining and discomfort. As a result, the fear of pain leads to retention. The passage of such a stool on its own or following rectal examination may lead to anal crack or fissure which could also cause constipation. Some infants begin to have spurious diarrhea.

Most constipated neonates respond to addition of water, some brown sugar, honey or glucose to the feed. Enema, suppository or milk of magnesia should be reserved for unresponsive or severely constipated infants. Liquid paraffin is best avoided since it places the infant at risk for xerophthalmia and lipid pneumonia. Tighter spastic anal sphincters, causing constipation from birth or soon after, usually get corrected by finger dilatation.

If obstinate constipation is present since birth, cretinism, anal stenosis and congenital megacolon (Hirschsprung disease) should be suspected.

Diarrhea In a breastfed infant, stools are naturally soft (not formed) and frequent, the color varying from green-brown to bright-yellow. This is, by no means, diarrhea. Nonetheless, when stools are consistently watery, very frequent and foul smelling, the probability of infective etiology must be considered.

In artificially-fed infants, overfeeding, formula that is too concentrated or too high in sugar content, food contamination with pathogenic organisms, etc. may contribute to occurrence of diarrhea.

Underfeeding (Poor Weight Gain)

A highly diluted formula, often due to ignorance on the part of the parents or economic considerations, is a well-known cause of failure to thrive (FTT). Such a baby takes his feed quickly, is restless and crying, and shows poor weight gain, or even an actual loss. Constipation and failure to sleep are common observations. As a result of superimposed gastrointestinal infections, his nutritional status may further deteriorate. Eventually, he may turn into overt malnutrition involving not just energy and proteins but also minerals and vitamins. This is what is termed as "bottle baby disease".

Test weighing, i.e. weighing the infant before and after each feed over 24 hours (using an accurate machine), yields the volume of milk being taken by him. But it may cause undue anxiety to the mother, thereby reducing the milk supply. A recommended alternative is

- A careful check on baby's weight gain over time
- Behavior between feeds
- Infrequently, outcome of formula supplements.

The management lies in instructing the mother in the art of feeding and correcting the deficiency states in the infant.

Overfeeding (Excessive Weight Gain, Obesity)

Some mothers manage to push into the baby larger amounts of feeds. This sort of overfeeding is a common cause of regurgitation and vomiting as also irritability, excessive crying and fatty diarrhea. Often, such an infant develops obesity which, at any time in life, is bad.

Bottle Addiction

Some children continue sticking to "bottle feeding" even when they are 2 or 3 years of age. The cause, in actuality, is rooted in mothers' failure to have replaced the bottle by cup and spoon at about 6 months of age or little earlier. Though bottle feeding is seldon good, it is particularly unwise to continue with the bottle after the first-year of life.

Choking

During the first few days of life, history of choking on feeds is relatively common. Usually, the cause is poor feeding technique. If choking persists, gastroesophageal reflux (GER) could be responsible for it. However, anatomical lesions of esophagus, trachea or larynx (say tracheoesophageal fistula, hiatal hernia or laryngeal cleft) should be excluded.

Poor Mothering

Some mothers are sadly lacking in self-confidence and are ignorant about the mother craft, particularly the art of feeding. They are apprehensive, worrying too much. Their nervousness is reflected in the baby. As a result, he becomes more demanding and cries a lot to mother's further annoyance. The resultant unhealthy relationship between the mother and the infant leads to varied feeding and other problems.

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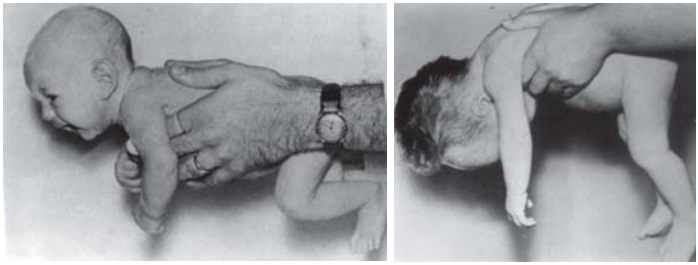
Chapter 26 Floppy Baby Syndrome

The term, *floppy baby syndrome*, denotes flabby muscles in an infant. A large number of conditions may be hidden behind this symptom complex, ranging from the benign congenital hypotonia through Down syndrome to Werdnig-Hoffmann disease.

Interrogation must clarify if the floppiness has been there ever since birth or it occurred later. Is it stationary, improving or progressing? Any feeding problem, respiratory difficulty, lethargy, hoarseness, prolongation of physiologic icterus, or anemia unresponsive to usual therapy? Is there any mental and/or developmental retardation? Any history of birth trauma or asphyxia? Any seizures? Any suggestion of a preceding illness? Has any other sib or family member suffered from such an illness? Did the mother experience absence or reduction of fetal movements in utero? Is she suffering from myasthenia gravis?

Physical examination must, in first place, confirm, if the baby is indeed floppy with remarkable hypotonia of all his muscles, especially skeletal muscles. Observations on ventral suspension (Figs 26.1 and 26.2) and on "pull-to-sit" provide good idea about hypotonia. What is the state of affairs regarding tendon reflexes? Any sensory involvement? Any mental or developmental retardation and its extent? Any involvement of tongue, jaw and face muscles? Are extraocular muscles or sphincters spared? Any respiratory muscle involvement? Are there any facial features which may be compatible with Down syndrome or cretinism? Is he obese? Is he grossly malnourished? Any evidence of rickets or scurvy?



Figs 26.1 and 26.2: *Floppy baby* Note the remarkable hypotonia (weakness) of limbs, trunk and neck on ventral suspension (Fig. 26.2) and the normal response in a healthy infant (Fig. 26.1).

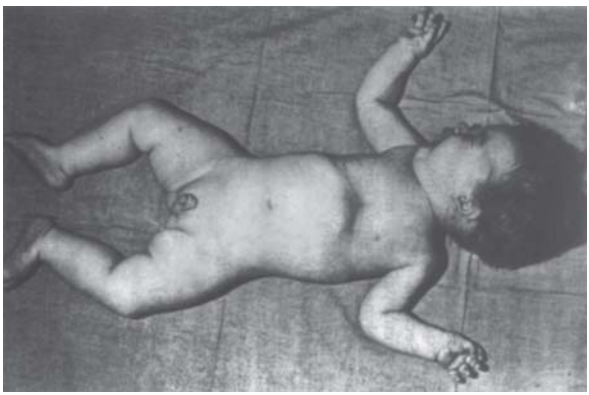


Fig. 26.3: *Spinal muscular atrophy (SMA) type I (Werdnig-Hoffmann disease)*. Note the characteristic posture (the so-called frog-leg posture) of lower limbs and external rotation at the shoulders together with chest retraction.

Benign Congenital Hypotonia

This condition, familial in some instances, is characterized by presence of gross hypotonia and delayed motor development. The infant's muscles are soft and flabby, allowing remarkable range of movements. Some tendon reflexes are elicitable whereas others are absent. Spontaneous movements are prominent. Intellectual development is always normal.

The disease may take one of the three courses. First: it may remain stationary and nonprogressive. Second: some children may develop contractures though joints always remain hypermobile. Third: most subjects recover fully by the age of 8 to 10 years.

Spinal Muscular Atrophy

Spinal muscular atrophy may be of four types:

SMA type I (acute infantile SMA, Werdnig Hoffman disease)
SMA type II (Chronic infantile SMA)
SMA type III (Chronic juvenile SMA)
SMA type IV (adult SMA)

Werdnig-Hoffmann disease, also called *spinal muscular atrophy* (type I), an autosomal recessive disorder, is characterized by a positive family history, absence or reduction of fetal movements in utero, and manifestations occurring before the age of 2 years and, frequently, right at birth.

Classically, gross hypotonia with areflexia manifests early in infancy. The legs assume the so-called "frog leg position" with abduction at hips and flexion at knees. Intercostal and bulbar muscles are involved whereas diaphragm is more or less spared, resulting in characteristic paradoxical respiration with inward movement of the chest on inspiration. Fasciculations or fibrillations are visible in the tongue which may also show atrophy. The mental development, on the contrary, is remarkably normal. The infant tends to be obese in initial stages.

In a large majority of the cases, the disease progresses rapidly, proving fatal during infancy *per se*. The cause of death is neurologic involvement of muscles of thorax, respiratory failure, aspiration of food and/or fulminant infection. The survivors, infrequently reaching adolescence and, rarely, adulthood, are in a completely helpless state.

The diagnosis is mainly clinical. Muscle biopsy shows classical features of denervation atrophy with large patches of small atrophic fibers with residual muscle fibers with or somewhat enlarged diameter.

Myasthenia Gravis

This disorder, occurring secondary to an autoimmune reaction against acetylcholine receptors, may be responsible for floppiness in the newborn. Two types are recognized:

First type: Transient neonatal myasthenia gravis which the baby acquires from the mother with established, mild or even unrecognized disease. The infant is floppy and weak with poor feeding, feeble cry, feeble respiratory effort, lots of oral secretions and ptosis. However, he appears alert with normal deep tendon reflexes. Response to edrophonium/neostigimine (intramuscular) is excellent. Even without therapy, many infants show spontaneous recovery within 3 to 4 weeks.

Second type: Persistent neonatal myasthenia gravis, occurs without any evidence of the disease in the mother. Chances of occurrence of the condition in other sibling(s) are high. Besides manifestations of the transient form, the eyelids and extraocular muscles are severely affected. It is likely to persist throughout life.

Cerebral Palsy

Two forms of nonprogressive central motor deficit dating to events in prenatal, natal or perinatal period (most often cerebral anoxia) are accompanied by floppiness.

Atonic diplegia is characterized by hypotonia, motor disability, and, usually, severe mental retardation. Tendon reflexes are easily elicitable. These may well be rather brisk. As the child grows, some degree of spasticity develops.

Congenital cerebellar ataxia, a rare form of cerebral palsy, is characterized by hypotonia, hypoactive tendon reflexes, and later, gait ataxia with intention tremors. Slight mental retardation and nystagmus may develop.

Congenital Hypothyroidism

The hypothyroid infant often attracts attention in the neonatal period only because of hypotonia, lethargy, sluggishness, hoarse cry, feeding difficulty, oversleeping, persistent jaundice, persistent constipation, abdominal distention with umbilical hernia, cold, rough, dry and thickened skin, a thickened protruding tongue, very large posterior fontanel, and anemia that responds poorly to hematinics. The infant is usually large and heavy at birth.

The classical features of certainism take a few weeks (8 to 12) to manifest (Fig. 26.4). The facies are characteristic a large tongue protruding from large open mouth with thick lips, puffy eyelids, depressed nasal bridge, pseudohypertelorism and wrinkled forehead with sparse eyebrows and the hairline reaching very low over it. Neck is short and there is often a pad of supraclavicular fat. Scalp hair is scanty, rough, dry and brittle. Skin is rough, thick, dry and cold. Anterior fontanel and coronal sutures are often widely open. Voice is hoarse. Dentition is delayed. Floppiness is virtually a rule. Abdomen is often distended and an umbilical hernia of variable size is present. Hands are broad with short fingers. Constipation, not responding to courses of laxatives and changes in feeding regimes, is usual.

Also, mental retardation and physical and growth retardation invariably coexist. The upper/lower segments ratio may continue to be infantile, i.e. 1.7:1.

The diagnosis may be confirmed by X-ray studies for bone age and epiphyseal dysgenesis, elevated serum cholesterol, low serum alkaline phosphatase, low PBI, low radioactive iodine (^{131}I), high plasma TSH3 and most importantly, low T_3 and T_4.

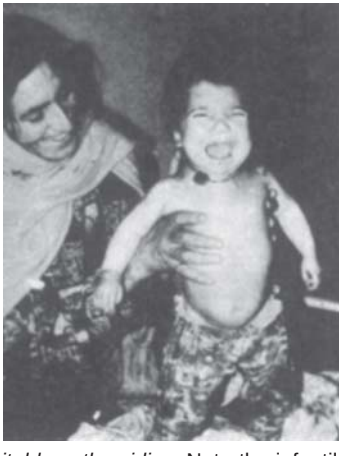
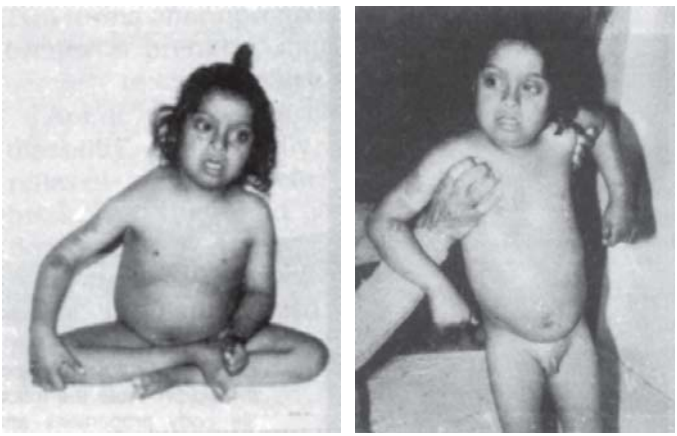


Fig. 26.4: *Congenital hypothyroidism* Note the infantile body proportions and characteristic coarse facial features with short neck in this mentally and physically retarded child.

Down Syndrome

Like congenital hypothyroidism, it is not difficult to make diagnosis of Down syndrome, the 21 trisomy, in a floppy infant because of the classical stigmata, including obvious features and mental retardation.

Apparently, the infant is a cheerful idiot with microcephaly, low hairline and short neck (Figs 26.5 and 26.6). Facial features include upward slant of the eyes, epicanthal folds and, occasionally, Brushfield spots. Nose is short with flattened bridge, which, together with epicanthal folds, gives an impression of increased distance between the eyes, the so-called "pseudohypertelorism". Tongue is protruded from small buccal cavity and may be furrowed, the so-called "scrotal tongue". Ears are low-set and may be deformed. High-arched palate and malocclusion of teeth may be present. Hands are short and broad with a single palmar crease (Simian crease) and an in curved little finger due to rudimentary middle phalanx. Feet show wide gap between the big and second toes and, at times, a deep crease starting between them and extending on to the sole.



Figs 26.5 and 26.6: *Down syndrome* Note cheerful idiocy, microcephaly, upward slant of eyes, epicanthal folds, depressed bridge of nose, widely apart eyes, and short neck and hypotonia. IQ was just 30. He also had VSD, Simian crease (bilateral), and in curved little finger (bilateral).

There is a significantly enhanced incidence of congenital heart disease, duodenal atresia, Hirschsprung disease and leukemia in subjects with Down syndrome.

Prader-Willi Syndrome

Floppiness is an important feature of the multisystem disorder, Prader-Willi syndrome. The remaining features of the syndrome include obesity, hypotonia, hypogonadism, strabismus and tendency to diabetes mellitus.

Marfan Syndrome

In this congenital disorder of the connective tissues, manifestation in the neonatal period and early infancy may include muscle floppiness, arachnodactyly (spider fingers) and hyperextensibility of the joints. Lenticular subluxation and dilatation of the aorta may also develop early in life.

Drugs

Diazepam, tricyclic antidepressants, kanamycin, colistin sulfalc, cycloserine, ethionamide, gentamicin, nitrofurantoin, neomycin, INH, cyclophosphamide, 6-MP, meprobomate, lead, vincristine.

Remaining Causes of Floppy Baby Syndrome

CNS Kernicterus, chromosomal defects, Lowe (oculocerebrorenal) syndrome, cerebral lipidosis, mucoviscidosis.

Spinal cord: Trauma, epidural abscess, shock phase of transverse myelitis, extensive poliomyelitis.

Peripheral nerves: Guillain-Barré syndrome, extensive diphtheritic paralysis, arsenical neuropathy, familial dysautonomia, congenital sensory neuropathy.

Neuromuscular junction: Infantile botulism

Muscles: Congenital muscular dystrophy, myotonic dystrophy, Pompe type of glycogen storage disease, central core disease, nemaline myopathy, mitochondrial myopathies, polymyositis, arthrogryposis multiplex congenita.

Miscellaneous: Advanced protein-energy malnutrition, rickets, scurvy, acrodynia, Ehler-Danlos syndrome, cutis laxa, etc.

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Chapter 27 Frequency of Micturition

The term, *frequency of micturition*, points to an increase in the number of "voids" regarding urination in a day. Whether or not there is an increase in urine volume is immaterial for qualifying to have this designation. As a matter of fact, in a significant proportion of the cases, volume of urine voided is rather smaller than the subject's usual output.

While taking history, it is important to know if the complaint has been there for quite sometime with waxing and waning, or the phenomenon is essentially of a very recent onset. Does the subject drink unusually large amounts of fluid and whether the amount of urine produced is very much? Are there any such accompanying symptoms as dysuria, urgency, hematuria etc.? Is frequency of micturition accompanied by a triad of polyuria, polydipsia and polyphagia? Or, are polyuria and polydipsia accompanied by anorexia rather than polyphagia?

Physical examination should specifically exclude presence of periorbital puffness and edema, pyrexia, hypertension, palpable bladder and hydronephrosis.

Unusually Large Fluid Intake

When a child consumes unusually large amounts of fluids, he is bound to have frequency of micturition. He also produces large volume of urine. Otherwise, he is fine.

Cystitis

Urinary tract infection, particularly when there is cystitis, may manifest as frequency of micturition together with urgency, dysuria, dribbling, nocturnal enuresis, fever, irritability, anorexia,

abdominal pain, vomiting, jaundice and hematuria. A word of caution: avoid counting totally on symptoms for diagnosis of UTI; you must have laboratory confirmation of the diagnosis before starting the therapy.

Diabetes Insipidus

Frequency of urination with polyuria may be indicative of diabetes insipidus, a chronic disorder that, in a vast majority, occurs from a defect of the neurohypophyseal system. More precisely called vasopressin-sensitive diabetes insipidus, the condition is characterized by an inability to concentrate urine, polyuria of 5 to 20 liters/day and corresponding polydipsia. Frequency and polyuria may disturb sleep. Polydipsia may be severe enough to force the patient to resort to drinking his own urine at times. Restriction of free fluid intake may lead to severe dehydration, dyselectrolytemia and weight loss.

The causes of damage to neurohypophysis include craniopharyngioma, optic gliomas and other tumors, histiocytic infiltration, reticuloendotheliosis, leukemia, encephalitis, tuberculosis, sarcoidosis, actinomycosis, and operative procedures or trauma about the base of the skull. The genetic forms of the disease (autosomal dominant and X-linked recessive) are also known.

Investigations reveal 24-hour urine output as high as 4 to 10 (or even more) liters, the specific gravity varying between 1,000 to 1,005 and the osmolality 50 to 200 mOsm/kg water. The 3-hour water deprivation may cause rise in plasma osmolality though the urine osmolality remains less than that of the plasma. Administration of vasopressin raises urine osmolality. Radioimmunoassay, showing vasopressin plasma level under 0.5 pg/ml, is a highly sensitive and more dependable test.

Diabetes Mellitus

Frequency of micturition may accompany the classical manifestations of diabetes mellitus such as polydipsia, polyuria and polyphagia, weight loss, general weakness, tiredness, and bodily pains. Fainting episodes due to spontaneous hypoglycemia, vulvitis, pain abdomen, nausea and vomiting, irritability and deterioration in school performance may also occur.

For confirmation of the diagnosis, you must carry certain investigations. First, urine examination for sugar and acetone by Benedict test/Diastix and ferric chloride and Rothera test/ Ketodiastix respectively. Secondly, blood sugar above 160 mg/ dl (fasting) is a diagnostic test. A level above 130 mg/dl is strongly suggestive whereas between 100 and 130 mg/dl is suspicious. Thirdly, glucose tolerance test is indicated in doubtful cases.

Posterior Urethral Valves

In this condition, the child may suffer from frequency since he nearly always has a feeling of unsatisfactory emptying. The amount of urine passed each and every time is naturally quite small. The child may also suffer from dribbling and hematuria. Often, the urinary bladder is palpable, so are the kidneys due to hydronephrosis.

Attention Seeking Device

The toddlers, upset for want of adequate parental security, may behave as though they have frequency of micturition to seek attention. The child, virtually every few minutes, demands to pass urine. The mother suddenly gets startled, may drop whatever she is holding, and then rushes the child to the wash basin or his potty.

Drugs

Demeclocycline, carbamazepine, hypervitaminosis D, anti-his-taminics, fenfluramine.

Remaining Causes of Frequency of Micturition

Pelvic appendicitis, nephritis, meatal stenosis, renal failure, adrenal cortical hyperplasia, etc.

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Chapter 28 Gingivostomatitis

Gingivostomatitis, meaning inflammatory lesions involving the gums and buccal mucosa, may occur as an isolated entity or secondary to a systemic disease. It causes considerable distress to the child.

While recording the history, make sure if the child is a known case of such systemic illnesses as diabetes mellitus, epilepsy on diphenylhydantoin sodium (phenytoin), or allergy to certain agents. Is he an habitual sufferer from such mouth lesions? Are his teeth in good shape ? Any intercurrent illnesses? Any bleeding from sites other than gums, or any other manifestations of scurvy? Is he on any drug(s)?

Physical examination should identify the exact lesion(s) in the mouth, what is the status of the teeth? Is there localized or generalized lymphadenopathy? Is the child a mouth breather?

Infections

Herpes gingivostomatitis is a frequent cause of mucosal lesions in the mouth in children 1 to 3 years of age. Such manifestations as pain in the mouth, fever, salivation, fetor oris, irritability and refusal to eat are followed in 1 to 3 days by appearance of a vesicle which rupture very soon, leaving a residual lesion, 2 to 10 mm in diameter and covered with a yellow-gray membrane. A true ulcer becomes apparent once the membrane has sloughed. Submaxillary lymphadenitis is present.

Coxsackie stomatitis is characterized by very minute, painful shallow yellowish ulcers most commonly on the posterior buccal and pharyngeal mucosa. Anterior tonsillar pillars are particularly involved.

Vincent angina is characterized by occurrence of necrotic ulcers on tip of papillae, gums and tonsils in debilitated children. A fetid smell is present. Demonstration of spirochetes in a smear from the lesions confirms the diagnosis.

Cancrum oris, also called noma or gangrenous stomatitis, is caused in hosts with compromised resistance by infection with fusospirochetal and other organisms. A small ulcer grows into a gangrenous area, greenish-black in color, on gums, buccal mucosa and mucocutaneous junctions. Soon, it slowly spreads to perforate the cheek and denude the jaws.

Oral thrush (moniliasis) appears as irregular white plaques, resembling curds of milk, on oral mucosa. The plaques are difficult to remove with a swab and often leave raw, friable bleeding area underneath on strenous attempt.

Staphylococcal gingivitis, occurs usually in children sick from another condition.

Streptococcal gingivitis causes bright red gums.

Avitaminosis

Riboflavin deficiency manifests as fissuring, cracking, ulceration and dry scaling of vermilion surface of the lips and angles of the mouth (cheilosis or perleche) together with glossitis. Other manifestations include keratitis, photophobia, conjunctivitis, lacrimation and remarkable vascularization of corneas. Seborrheic dermatitis is a common accompaniment, so is a normocytic-hypochromic anemia with bone marrow hypoplasia.

Niacin deficiency may be responsible for sore tongue and stomatitis. The classical triad of dermatitis, diarrhea and dementia, the sheet-anchor of the disease pellagra, is diagnostic.

Pyridoxine (B_6) deficiency may be responsible for cheilosis, glossitis and seborrhea. In infancy, more so during the neonatal period, pyridoxine dependency may be the cause for convulsions. In B_6 dependent anemia, red cells are microcytic-hypochromic.

Scurvy typically produces bluish-purple spongy swelling of the gums, usually over the upper incisors. Rest of the manifestations include excessive irritability, petechiae, scorbutic rosary, pseudoparalysis, subperiosteal hemorrhages, follicular hyper-keratosis, anemia and delayed wound-healing.

Aphthous Ulcers

Also called “canker sores”, these are painful lesions of the oral mucosa, including gingivobuccal groove, tongue and palate. The ulcers are essentially superficial and consist of highly sensitive "crater" surrounded by erythema. The lesions usually occur singly but, in stress situations, are prone to multiply. They take 1 to 2 weeks to heal. No scar is left.

Aphthous ulcers, as a rule, occur periodically in a given host. The etiology is essentially not yet known. Viruses, endocrinal factors, obstinate constipation, emotional disturbance and autoimmune reaction have been incriminated from time-to-time.

Stevens-Johnson Syndrome

This disease causes vesiculobulbous lesions in the mouth as well as conjunctivae, nares, anorectal junction, vulvovaginal region, and urethral meatus. An erythematous papular skin rash that involves all the cutaneous surfaces, excepting scalp, is characteristic. The skin rash enlarges by peripheral expansion with a central vesicle. Fever and severe prostration are a rule. Incidence of pulmonary complications is high.

Stevens-Johnson syndrome is believed to be related either to mycoplasma infection or to such drugs as sulfas, anticonvulsants, penicillin, aspirin, rifampicin, quinine or clindamycin.

Fibromatosis Gingivae

This familial condition is characterized by gingival hyperplasia in association with mental deficiency and hypertrichosis. Gum hyperplasia may be so pronounced as to lead to protrusion of lips and displacement of the tongue.

Drugs

Diphenylhydantoin sodium is well-known to cause varying degree of gingival hyperplasia which is dose dependent. The gingivitis takes 3 to 6 months to subside after the drug is withdrawn.

Other drugs that may cause stomatitis include sulfas, actinomycin D, methotrexate, 6-mercaptopurine, vincristine, troxidone, tetracyclines, lincomycin, ethosuximide, griseofulvin, gold salts, and niclosamide.

Local application of aspirin or camphor to oral mucosa may cause chemical burn.

Dental Defects

Dental defects such as carious teeth, malocclusion, or sharp broken edges may cause chronic irritation, resulting in gingival infection and stomatitis.

Chronic Mouth Breathing

The child with chronic mouth breathing, as in case of adenoids or chronic nasal obstruction, is likely to develop dry, friable oral mucosa that begins to bleed easily. The tongue, in particular, becomes furrowed.

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Chapter 29 Halitosis

The term, *halitosis* (Latin halitus means breath), means offensive odor of the breath. Also called *malodorous breath, oral malodor, fetor oris or bad breath*, the symptom is not as uncommon in pediatric practice as the various textbooks and the professional journals would have us believe. In my busy outpatients clinic, I could find 46 cases over a period of 3 months. Of course, halitosis is only occasionally the chief presenting feature. Most often, the complaint is projected only on specific symptomatic enquiry. The factors considered responsible for the symptom in my assessment are: bad orodental hygiene 18%, chronic rhinitis 9%, foreign body in the nose 7%, tonsillitis 6%, diphtheria 1%, bronchiectasis 2%, lung abscess, 1.5% and garlic/onion consumption 2%.

History-taking should seek whether it is a chronic or acute complaint. What kind of eating habits does the child command? Does he take care of orodental hygiene? Does he take spicy foods, garlic or onion? Any history of sore throat, rhinorrhea, sneezing, sinusitis or foreign body in the nose? Any chronic cough with copious expectoration, particularly having postural relationship? Any dyspepsia or ulcers in the mouth or over the gums? Is there a family history of halitosis of unknown etiology?

Physical examination must in particular aim at excluding orodental conditions which may explain halitosis, foreign body in the nose, chronic rhinitis, acute or chronic tonsillitis diphtheria, etc. Lung abscess and bronchiectasis, once suspected from the history, can convincingly be excluded or confirmed by chest examination and radiology.

Bad Orodental Hygiene, etc.

The causes of halitosis secondary to bad orodental hygiene include septic tooth, dental canes (which may entrap the food debris), gingivitis, stomatitis, etc. Habitual failure to brush the teeth and wash mouth, particularly after main meals, may also contribute to bad breath.

Chronic Rhinitis

Chronic rhinitis, particularly, atrophic and allergic, may be responsible for halitosis.

In atrophic rhinitis, fetor is often a remarkable feature. Interestingly, it is taken congnizance by the relatives or the examiner. The patient is virtually unaware of it because of anosmia. The remaining manifestations include dryness and obstruction of nose with formation of crusts in nasal cavities. The nostrils are widened and the nose broadened. Nasal mucosa appears congested and atrophic.

Foreign Body in the Nose

Halitosis along with unilateral nasal discharge and obstruction make a strong case for a foreign body such as a piece of food, crayon, plastic, bead, etc. in the nose. In addition, there are manifestations like sneezing, local discomfort and purulent maladorous or bloody discharge. The foreign body is situated in the beginning anteriorly but is later forced deeper way back in the nose.

Infections

Halitosis may be encountered in some cases of acute or chronic tonsillitis, diphtheria, Vincent's angina, and infectious mononucleosis.

Vincent's angina, caused by usual oral flora and heavy overgrowth of fusiform bacilli and spirochetes in chronically ill and malnourished children, is characterized by remarkable fetid odor, fever, malaise and oral lesions consisting of gray necrotic membrane and tiny ulcers over tender, congested gingivae.

Bronchiectasis

Halitosis is a prominent feature of bronchiectasis which is characterized by permanent dilatation of the bronchi and bronchioles as a result of obstructions and/or infection, leading to cavitation of bronchial wall and tissue destruction.

The other manifestations of bronchiectasis include persistent or recurrent cough, productive of copious, mucopurulent sputum which is foul-smelling and has postural relationship. Some fever and recurrent attacks of respiratory infections are frequent. In advanced cases, there may be dyspnea, cyanosis, clubbing and hemoptysis.

The characteristic auscultatory findings include "localized crepi-tations" repeatedly found over the involved area.

Diagnosis is confirmed through radiologic examination. X-ray chest shows increased bronchovascular markings, extending towards the base of the lung. Later areas of cavitation may become apparent. Bronchography, preceded by bronchoscopy, is essential to localize and establish the extent of bronchiectasis.

Lung Abscess

Pulmonary abscess not only produces foul-smelling sputum but frequently halitosis as well. The other symptoms of chronic abscess which usually develops insidiously include fever, persistent cough, and at times, dyspnea and chest pain. Clubbing develops, if the child remains without treatment over a prolonged period.

Chest signs are those of consolidation with bronchial breathing. X-ray chest shows characteristic opacities; the cavities may show fluid levels.

Remaining Causes of Halitosis

Intake of onion, garlic, spicy foods, low fat diet, alcohol, chronic gastrointestinal disease such as dyspepsia, achlorhydria or lowered gastric acidity, esophageal diverticuli, cirrhosis, poisoning with lead, mercury, iodide or bismuth. Occasionally, it may be a familial trait. The family members emit an unusual body odor.

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Chapter 30 Headache

HEADACHE

Headache, a very common symptom in later childhood and adolescence, conventionally means "unpleasant sensations in the region of the cranial vault." Most often, it is benign, reflecting minor tension or fatigue. Only exceptionally does it reflect a serious intracranial disease. The symptom is unusual in infancy and early childhood. When it indeed occurs in this age group, chances of its being an expression of a serious illness are high.

History-taking should aim at getting the relevant information that may contribute to reaching the exact diagnosis. When did it start? What is its intensity? What is its quality? Does the patient complain of a particular definable sensation? What is its location? How long does it last? What are the factors that make it worse or better? Does it have a relationship with any biological event(s) or physical environmental changes. Any relationship with head injury in the past? Is there any vomiting, dizziness, visual disturbance, or sweating that accompanies it? Is the patient myopic or having some other visual defect and whether he uses glasses? In adolescent girls, do remember to ask about menses and whether headache precedes the onset of the period every month. In case of headache along with a febrile illness, is there a history of neck stiffness, drowsiness, excessive irritability, etc.? Any associated seizures? Any personality changes and behavioral problems?

A persistent or recurrent headache is a strong indication for carrying out a complete neurologic examination as also for excluding visual defects, sinusitis and hypertension.

Remember, most pediatric tumors arise either in posterior fossa or suprasellar region. Neurologic examination should, therefore, emphasize tests of coordination (including gait and ocular function), eye movements, visual acquity, field of vision and optic fundi. A dependable sign of posterior fossa tumor is presence of a head tilt.

Migraine and Other Vascular Headaches

Also termed hemicrania, this vascular type of headache is due to vasodilatation of cranial vessels, those of scalp in particular. The abnormal vasodilatation and pulsations are supposed to stimulate the pain fibers in the vessel wall. In an overwhelming majority of the patients, a positive family history is present.

Classically, a grown-up child gets an "aura", consisting of zigzag lines and scintillating scotomate moving gradually across the visual field, diplopia, or transient ataxia, vertigo, hemisensory loss, hemiparesis, or aphasia. Shortly, the aura is followed by throbbing headache (usually unilateral) with nausea or vomiting. The best means of getting rid of the attack is to go for sound sleep. Response to analgesics is poor. Stress is known to increase the frequency of attacks.

Interestingly, more common than the classical form is what is called *partial migraine* in which aura is absent, headache is bilateral and vomiting does not occur.

Fever may also produce a throbbing headache due to peripheral vasodilatation and increased cerebral blood flow. There is ample evidence as to the cause of fever, say acute tonsillitis, malaria, enteric fever, pneumonia, or heat stroke.

Hypertension is another cause of vascular headache. Though, by no means, a common cause, it should always be excluded in children suffering from recurrent headache.

Headache Related to Epilepsy

In grand mal epilepsy, headache may occur as a part of aura or as a postictal event.

In autonomic seizures, headache during the attack *per se*, together with pallor, tachycardia or pupillary dilation, constitutes an important feature.

Headache Secondary to Changes in Intracranial Pressure

The child complaining of morning headache with nausea and vomiting should always arouse suspicion of raised intracranial pressure secondary to brain tumor (Fig. 30.1). Occipital headache is usually a sign of posterior fossa tumor (Fig. 30.2).

In benign intracranial hypertension, irrespective of the cause, there may be an acute onset of headache in association with sixth cranial nerve involvement and papilledema. Loss of consciousness does not occur.

Low CSF pressure headache is a common observation after lumbar puncture. The headache occurs on assuming upright position. On lying down, it disappears.

Tension Headache

Tension headache may occur in adolescents as dull, steady pain which grows as the day advances. After sleep, it is over.

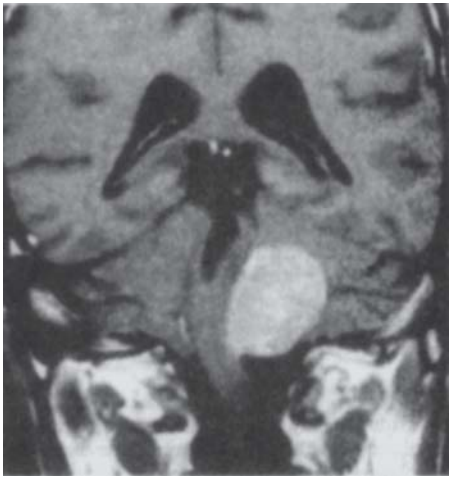

Fig. 30.1: *Meningioma* This slow-growing tumor, originating in the arachnoidal space, may present with severe headache defying precise diagnosis on simple evaluation.

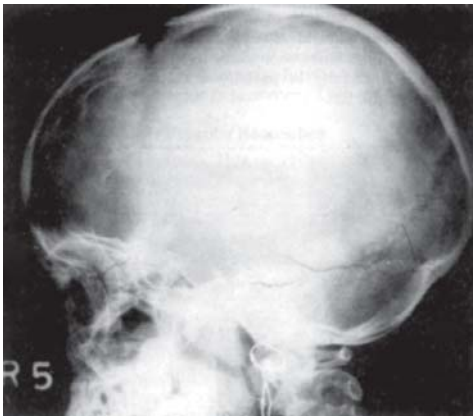

Fig. 30.2: X-ray skull showing sutural diastasis in ICSOL (posterior fossa tumor). The boy was hospitalized for severe intractable headache (occipital).

The probable cause appears to be persistent contraction of neck and temporalis muscles, resulting in localized ischemia of these structures.

Headache Related to Psychologic Problems

At times, young children (much before they reach adolescence) may also immitate the adults with headache and complain of headache. This age group may also use complaint of headache as an *attention-seeking device,* or as a pretext for not going to school or taking permission from the teacher to return home.

Headache Related to Psychiatric Disease

Unlike intermittent headache in an organic illness, headache in psychiatric illness such as depression is continuously present. Other manifestations of depression include miserable facial expression, anorexia, speech reduced to a sheer whisper, insomnia and constipation.

Headache Related to Eye Problems

Persistent and prolonged eye strain in a child with myopia, hypermetropia or problems of accommodation and

may be responsible for headache though the cause and effect relationship is yet to be confirmed.

Glaucoma is a well-known, though rare, cause of headache. The child with congenital glaucoma has highly hyperemic conjunctivae.

Headache Related to Sinusitis

Infrequently, sinusitis may be accompanied by headache. Other signs and symptoms of sinusitis include continuous purulent nasal discharge or continuous postnasal drip between attacks. Transillumination and radiology help to confirm the diagnosis of sinusitis.

Drugs

Antihistaminics, acetazolamide, amitriptyline, diazepam, chlorpromazine, ephedrine, carbamazepine, vincristine, ethusuximide, ethambutol, troxidone, trimethoprim, tetracyclines, thiabendazole, griseofulvin, sulfas, valproate, isoniazid, indomethacin, niclosamide, diphenylhydantoin, nalidixic acid, nitrofurantoin.

Other Causes of Headache

Otitis media, toothache, lead poisoning, pheochromocytoma, hypoglycemia, hunger, von Recklinghausen's disease, diabetes, leukemia, Sturge-Weber syndrome, basilar impression syndrome, sickle-cell disease, caffeine (caffeine-induced headache), etc.

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Chapter 31 Heart Murmurs

By definition, *murmurs* are audible sounds arising from the flow of blood through blood vessels, valves or heart chambers evincing turbulance. In children, because of proximation of the heart to the thin chest wall, murmurs are relatively more easily heard. As a rule, narrower the blood vessel or opening, or higher the turbulance of flow, louder is the murmur. Murmurs are usually classified as systolic, diastolic, and continuous.

Systolic murmurs may be ejection, pansystolic or late systolic. An ejection systolic murmur rises to a crescendo in midsystole. It is, as a rule, coarse. Examples of such murmur are aortic stenosis, aortic coarctation, pulmonary stenosis and atrial septal defect. A pansystolic murmur occurs all through systole. It is caused by flow of blood through a septal defect (ventricular septal defect, or an incompetent mitral or tricuspid valve (mitral incompetence, tricuspid incompetence, or a patent ductus arteriosus. A late systolic murmur is heard well beyond the first sound and stretches to the end of systolic phase (mitral valve prolapse). According to intensity, systolic murmurs are categorized into six grades (Table 31.1).

Diastolic murmurs may be (i) a high-pitched blowing along the left sternal border, indicating aortic insufficiency or pulmonary valve insufficiency; (ii) early short, lower-pitched protodiastolic along the left mid and upper sternal border, indicating pulmonary valve insufficiency or after repair of pulmonary outflow tract in such conditions as tetralogy of Fallot; (iii) an early diastolic at the left mid and lower sternal border, indicating atrial septal defect or atrial valvular stenosis; (iv) rumbling mid-diastolic at the apex after the third heart sound, indicating large right to left shunt or

Table 31.1: Six grades of systolic murmurs (Keck's classification)

Grade	Characteristics
1	Faintest, requiring very careful auscultation in noise-free environments (consultant's murmur); innocent
2	Soft though slightly louder; usually innocent
3	Moderately loud without a thrill; may be innocent or organic
4	Loud, accompanied by a thrill; always organic
5	Very loud, accompanied by a thrill, still needs stethoscope in contact with chest; always organic
6	Loudest possible, accompanied by a thrill heard with stethoscope not necessarily in contact with the chest; always organic.

mitral insufficiency; (v) a long diastolic rumbling murmur at the apex with accentuation at the end of diastole (presystolic), indicating anatomical mitral stenosis.

A continuous murmur (machinery murmur) is a systolic murmur, best heard over the second and third left parasternal spaces, that extends into diastole. It indicates a patent ductus arteriosus. It must be differentiated from a pericardial friction rub, as also from a venous hum.

Remember, over 30% children may have a murmur without significant hemodynamic abnormalities. Typically, the so-called "innocent murmur" is heard in the age group 3 to 7 years, occurs during ejection, is musical and brief, is attenuated in the sitting position and is intensified by pyrexia, excitement and exercise. As the child grows, such murmur shows a tendency to be less well heard and may regress fully.

History-taking of a child with a murmur (potentially a cardiac case) must focus on cyanosis, squatting, fatigue, orthopnea, nocturnal dyspnea, feeding difficulty or problem, sweating during feeding, and chest pain. Any history of a generalized disorder affecting the heart as well? Any suggestion of a known congenital malformation syndrome, e.g. fetal-alcohol syndrome (ASD, VSD), VATER association (VSD, TOF, ASD, PDA), Down syndrome (endocardial cushion defects, VSD, and ASD).

Physical examination must assess the growth and development of the child at the very outset. Presence of cyanosis, clubbing,

edema, chest deformity, engorgement of neck veins, tachypnea, and hepatomegaly needs to be specially observed. Pulse or cardiac rate and character of pulses provide valuable information. Blood pressure should preferably be recorded in the arms as well as in the legs. For this purpose, flush method is most feasible in restless infants.

Cardiac examination must in particular be very careful, noting the presence of a precordial bulge, substernal thrust, apical heave or a hyperdynamic precordium, thrills (both systolic and diastolic), aortic bruits, etc.

Auscultation of the precordium requires patience, first concentrating on the characteristics of the individual heart sounds and then on the murmurs. An accentuated or loud first heart sound over the mitral area suggests tachycardia, hyperkinetic heart syndrome, hyperthyroidism or mitral stenosis. In mitral regurgitation and myocarditis, the first heart sound over the mitral area is particularly faint. In tricuspid atresia, the first heart sound over the tricuspid area is accentuated or loud. The second sound is split little beyond the peak of inspiration; it closes with expiration. A wide splitting is encountered in pulmonary stenosis, tetralogy of Fallot, atrial septal defect, total anomalous venous return and Ebstein's anomaly. A narrow splitting points to pulmonary hypertension. The third sound is best heard with the bell at the apex in middiastole, especially if the child assumes a left lateral position. It is of significance in the presence of signs of congestive cardiac failure and tachycardia in which situation it may merge with the fourth sound. The latter, coinciding with atrial contraction, may be heard a little before the first sound in late diastole. The phenomenon of poor compliance of the ventricle with an exaggeration of the normal third sound associated with ventricular filling is termed “gallop rhythm”.

After the heart sounds, attention should be focused on clicks. Aortic systolic clicks, best heard at the left lower sternal border, occur in aortic dilatation as in aortic stenosis, tetralogy of Fallot, or truncus arteriosus. Pulmonary ejection clicks, best heard at the left midsternal border, occur in pulmonary stenosis. In prolapse of the mitral valve, a midsystolic click precedes a late systolic murmur at the apex.

Murmurs need to be described as to their timing, intensity (Table 31.1), pitch, area of highest intensity and transmission. Whether a particular murmur is just functional (innocent with no significance) or has a pathological origin (congenital heart disease) must be decided. This may need additional investigations such as ECG, X-ray and/or echocardiography, etc. In certain cases, cardiac catheterization may be required, particularly as a part of preoperative evaluation.

It is of help to apply the time-honored Nada's criteria for presence of heart disease in suspected cases (Table 31.2).

SYSTOLIC MURMUR

Ejection Systolic Murmur

Aortic stenosis In this condition, a harsh systolic murmur, usually accompanied by a thrill, is heard in the second intercostal space near the right sternal border. It is radiated to the neck. In young children, this murmur may be best heard on the left rather than the right side. A normally split second sound points to a mild stenosis whereas a single or a faint second sound suggests severe stenosis.

Additional findings include an apical impulse, poorly palpable peripheral pulse and low blood pressure. ECG shows left ventricular hypertrophy.

Table 31.2: Nada's criteria for presence of heart disease

Major	Systolic murmur, Grade III or more, always pansystolic
	Diastolic murmur
	Cyanosis (primarily central)
	Congestive cardiac failure
Minor	Systolic murmur, less than Grade III
	Abnormal second heart sound
	Abnormal ECG
	Abnormal X-ray
	Abnormal blood pressure

Note: Heart disease is indicated when one major or two minor criteria are present.

X-ray shows cardiomegaly with rounding of the left cardiac border as also poststenotic dilatation of the aorta in valvular stenosis, the most common type.

Catheterization and angiography are needed in order to differentiative between different types of aortic stenosis, i.e. whether it is valvular, subvalvular or supravalvular. Notable clinical clues for suspecting supraventricular stenosis are peculiar fades with hypertelorism, prominent forehead, macrostomia, microstomia, microdontia, dental malocclusion and hypo-gonadism. The association is termed Beuren syndrome.

Coarctation of aorta: A left parasternal ejection systolic murmur in the third to fourth intercostal spaces, radiated to the paravertebral area at the back is heard in this condition.

Salient accompanying features include poorly palpable femoral pulses and elevated blood pressure in the upper parts of the body.

ECG shows left ventricular hypertrophy.

X-ray shows cardiac enlargement and notching of the ribs.

Pulmonary stenosis: The characteristic murmur is a loud ejection systolic murmur best heard in the second or third left intercostal space. The loudness of the murmur is directly proportional to the severity of stenosis. Second sound is little more widely split and pulmonic sound is faint. Asystolic thrill in the suprasternal notch is usual. A pulmonary ejection click may also be audible in upper left sternal border.

ECG shows right ventricular hypertrophy.

X-ray shows mild cardiomegaly with poststenotic dilatation. Catheterization and angiography are essential for differentiating valvular from pulmonary stenosis.

Atrial septal defect: The characteristic murmur in this entity is a soft systolic ejection murmur at the upper left sternal border. An associated soft mid-diastolic murmur at the lower left sternal border is also present. A widely-split second sound that does not change with respiration is noteworthy.

ECG shows partial right bundle branch block and right axis deviation in the common ostium secundum defect, and left axis deviation and right bundle branch block in ostium primum defect. Signs of biventricular hypertrophy may exist.

X-ray shows cardiomegaly.

Pansystolic Murmur

Ventricular septal defect typically, the murmur is loud pansystolic, best heard down the left sternal border (third, fourth and fifth interspaces). It is usually accompanied by a thrill. A functional diastolic murmur, due to large blood flow across the mitral valve may also be present. In the presence of pulmonary hypertension, second sound, which is split, becomes accentuated. In such a situation, a pulmonary diastolic murmur may also be found (Graham Steell murmur).

ECG shows biventricular hypertrophy in well-established cases, with or without incomplete right bundle branch block. In small defects, it may be normal or show left ventricular hypertrophy.

X-ray is usually normal or shows minimal cardiomegaly with slight increase in pulmonary vascularity. In large VSD, it shows a large left-to-right shunt with enlarged heart (both ventricles and left atrium), enlarged pulmonary artery, and plethoric lung fields (over-vascularity) with or without hilar dance.

Two-dimensional echocardiography shows volume overload of the left ventricle and left atrium and the position and size of the septal defect.

Cardiac catheterization and selective angiography are of much help in locating the exact site of the shunt.

Mitral incompetence The typical auscultatory finding is a moderately loud, blowing pansystolic murmur at the apex. It may be referred to the left axilla, to the back, or upwards to the left parasternal area. The murmur shows increase in intensity with respiration. The first heart sound is soft or normal but never loud. A soft, low-pitched mid-diastolic murmur at the apex may also be present,

ECG shows a wide bifid P wave (p mitrale) along with findings consistent with ventricular hypertrophy.

X-ray shows enlargement of the left ventricle.

Tricuspid incompetence: In this condition, the murmur is pansystolic in the fourth right intercostal space.

ECG shows right ventricular enlargement.

X-ray shows right ventricular enlargement.

DIASTOLIC MURMUR

Aortic Incompetence

The characteristic murmur is early diastolic. It is blowing in nature and best heard over the pulmonary area with radiation to the mitral and aortic areas. It is advisable to auscultate for this murmur when the patient is leaning forward and during expiration. Sometimes, associated functional mitral stenosis (transitory) may produce mid-diastolic or presystolic murmur, termed Austin-Flint murmur.

X-ray chest and ECG confirm presence of right ventricular hypertrophy.

Pulmonary Incompetence

Typically, there is a decrescendo diastolic murmur at the second left intercostal space.

X-ray chest shows right ventricular enlargement and dilated pulmonary vessels.

ECG shows right ventricular hypertrophy.

Tricuspid Stenosis

The characteristic murmur in this condition is a diastolic murmur in the third, fourth and fifth intercostal spaces on the right side.

X-ray chest shows right atrial dilatation.

ECG shows right atrial hypertrophy with tall, wide P waves.

Mitral Stenosis

The characteristic murmur of mitral stenosis is mid-diastolic, filling most of the diastole. It may be presystolic or diastolic with apparent presystolic accentuation. It is usually best heard with the bell of the stethoscope while the patient is lying on the left or soon after some exercise. Its intensity is maximal at the apex and it is low pitched or rumbling. Pulmonary second sound (P_2) is accentuated.

Associated pulmonary insufficiency may result in a blowing diastolic murmur down the left sternal border. Association of both mitral stenosis and incompetence, the so called "double mitral", will lead to combined murmurs. Remaining auscultatory findings include a loud first heart sound at the apex and an opening snap.

CONTINUOUS MURMUR

In patent ductus arteriosus, the classical murmur begins immediately after the first heart sound and reaches its peak at the end of the systole. It continues during the most of diastolic phase, gradually disappearing in the later part. This is what has been described as machinery murmur. It is harsh and may be localized to second left intercostal space or transmitted to left clavicle or lower down, i.e. left sternal border. It is usually accompanied by a thrill. There may be paradoxical splitting of the P_2 in PDA.

Associated findings in PDA include a wide pulse pressure, a water-hammer pulse, prominent arterial corrigan pulsations in the neck and differential cyanosis.

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Chapter 32

Hematemesis

Hematemesis means appearance of blood in vomitus, usually as a result of bleeding from esophagus, stomach or duodenum. Fresh bright-red blood in vomitus is indicative of either quite a proximal origin of bleeding or a massive blood loss. Dark blood, resembling coffee-grounds, is indicative of effect of gastric or intestinal juices.

While obtaining history, it must be ascertained at the very outset if what is stated to be blood in vomitus is indeed blood or some food or drink ingested sometimes back. At times, what is thought to be altered blood may turn out to be chocolate. It is a good practice to confirm presence of blood chemically.

What is the amount of blood loss? How often has hematemesis occurred? Any history of bleeding from other sites? Any epistaxis? Any abdominal pain? Any surgery on tonsils? Is there any jaundice?

Physical examination must evaluate if the child is acutely sick. Is he in shock due to massive blood loss? How are the vital signs? Always look for evidence of epistaxis, blood oozing from gums or pharynx, evidence of portal hypertension hemangioma, purpura, telangiectasia, blood dyscrasias, etc.

HEMATEMESIS IN THE NEWBORN

Swallowed Maternal Blood

During delivery, or at the time of breastfeeding, the newborn may swallow maternal blood (from cracked nipple in the latter situation). Such an infant may manifest with hematemesis during the first few days of birth. This may also be accompanied by melena.

That blood in vomitus is indeed that of the mother can readily be confirmed by the Apt's test. To 1 ml of vomitus, add 5 ml of tap water and centrifuge or filter the suspension. To the supernatant, add 1 ml of 0.25 N NaOH and mix. On observations for 5 minutes, the color turns brownish-yellow in case of maternal blood and remains pink in case of baby's blood. The principle underlying this test is that fetal hemoglobin is relatively resistant to denaturation by sodium hydroxide, the alkali.

Hemorrhagic Disease of the Newborn

This disorder, representing a deficiency of vitamin K leading to defective coagulation, particularly as a result of prolonged prothrombin time, may manifest with hematemesis. Such signs and symptoms of bleeding in the form of melena or hematochezia are usually present.

The Apt's test comes handy in confirming that the blood in vomitus is indeed that of the infant and not the mother.

Drugs

Such drugs as salicylates, anticoagulants and diuretics given to the mother during pregnancy.

Remaining Causes of Hematemesis in Newborn

Hemorrhagic gastritis, stress, ulcer, nasogastric tube trauma, hiatal hernia, esophageal or duodenal atresia.

HEMATEMESIS IN LATER INFANCY AND CHILDHOOD

Hiatal Hernia

This is by far the most common cause of hematemesis (usually blood-streaked vomitus) during infancy. In the most common type, the so-called "sliding variety" (the other being "paraesophageal variety"), the gastroesophageal junction and some of the stomach come to lie within the chest. A gastroesophageal reflux is a common accompaniment and responsible for many a manifestations.

The infant usually presents with vomiting or regurgitation (if blood is present, it is usually in the form of streaks), failure to thrive and anemia.

Chalasia

Also termed gastroesophageal reflux, it is characterized by incompetence of the lower esophageal sphincter resulting in exposure of the esophageal epithelium to refluxed gastric contents. Next to hiatal hernia, it is the most frequent cause of hematemesis in infants.

Besides hematemesis, manifestations include anemia, dysphagia, growth failure and aspiration pneumonia.

Diagnosis is confirmed by barium esophagogram done under fluoroscopic control, and/or, still superior investigation, esophagoscopy.

Swallowed Blood

In childhood, the most common cause of hematemesis is the regurgitation of swallowed blood resulting from epistaxis, acute tonsillitis, tonsillectomy, adenoidectomy, or dental work. Blood streaking of vomitus is usually a result of oozing from gingivae or pharynx in this category of hematemesis.

Peptic Ulceration

Peptic ulceration (duodenal or gastric) is an important though rather infrequent cause of hematemesis. Such ulceration occurring secondary to infection (Cushing's ulcer), thermal injury (Curling's ulcer), CNS injury, etc. are often accompanied by copious bleeding in the GIT. As a matter of fact, acute massive painless bleeding is often the first and the only manifestation of stress ulcers which are responsible for almost 75% of peptic ulceration in the first 5 years of life.

Esophageal Varices

In children above 2 years of age, esophageal varices are perhaps the most common cause of massive hematemesis. Evidence of portal hypertension is available in the form of history of umbilical sepsis, or exchange transfusion by an umbilical vein catheter, together with splenomegaly, prominent superficial abdominal veins, ascites, etc.

Diagnosis is from barium meal studies and esophagoscopy which is a far better tool. Endoscopy is the best method for detecting

esophageal varices. Presence of red spots over varices and large size of varices are strong predictors of hemorrhage.

Fig. 32.1: Esophageal varices as seen in a barium swallow X-ray film.

Foreign Body in the Esophagus/ Stomach

Such sharp-edged foreign bodies as nail, pin, bone, etc. may ulcerate esophageal or gastric mucosa and cause hematemesis. Though plain X-ray neck, chest or abdomen easily detects radiopaque foreign bodies, identification of plastic or glass foreign bodies is often a tedious matter and is facilitated by barium swallow (Fig. 32.1).

Violent Retching

Severe retching may cause a tear in the esophageal mucosa and submucosa, leading to streaking of vomitus with blood. This is what is known as Mallory-Weiss syndrome. The condition is self-limited, usually responding to a blood transfusion.

Corrosive Esophagitis

Such corrosive agents as hydrochloric acid, sulfuric acid, strong bases and bleaches, if ingested accidentally, may cause dysphagia and hematemesis. The symptoms clear in 2 to 4 weeks. An asymptomatic period of weeks or months is followed by esophageal obstruction from formation of strictures, resulting in dysphagia and vomiting.

Blood Dyscrasias

Infrequently, hematemesis may be a presenting symptom in leukemias and consumptive coagulopathy. The diagnosis is reached by high sense of suspicion in the presence of some other features of the diseases and through certain investigations.

Drugs

Salicylates, aminophyline, ferrous sulfate, and boric acid. Remaining causes of hematemesis in postneonatal period telangiectasia, hemangioma, tumor, intragastric trauma by Ryle's tube.

FURTHER READING

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Chapter 33

Hematuria

Hematuria is the appearance of blood-red cells in excess of 5 per high power field in the sediment of a 10 ml of centrifuged fresh specimen-in urine.

Hematuria may be "gross" (macroscopic) or "microscopic". In gross hematuria, the color of urine varies from bright red to dark brown. Whereas bright red urine reflects that the source of blood is in the lower urinary tract, brown or tea-colored urine is suggestive of a renal origin. In microscopic hematuria, the color of urine remains normal and detection of hematuria is only by microscopic examination, or dipstick if available. Note that microscopic hematuria need not essentially be a sign of renal or rest of the urinary tract disorder. It may result from heavy exercise, viral or bacterial respiratory infections, various febrile conditions, gastroenteritis with dehydration, and contamination by red cells from menstrual blood, urethral meatal ulcer, or some other such condition of the external genitalia. Association of proteinuria and tubular casts with hematuria is nearly always suggestive of a glomerular disorder.

It is of value to identify if hematuria is "total", "initial", or "terminal". Total hematuria is indicative of a lesion above the bladder neck. Initial hematuria points to the source of blood along the urethra. In terminal hematuria, areas last to be emptied of urine-trigone, bladder neck, or prostate-are the source of bleeding. A spotting of blood on the undergarments shows that blood is coming from urethra distal to the sphincteric mechanism.

While recording history, make sure the patient is not taking any drug, that is responsible for coloring his urine. Is there accompanying dysuria? Any fever, periorbital edema, and back

or abdominal pain? Has there been any recent trauma? Any history of insertion of a foreign body into the urethra. Did the patient have a systemic infection recently? Any preceding suggestion of skin or upper respiratory infection that could be a precursor of acute nephritis? Any bleeding disorder in the patient or family member(s)?

A complete physical examination, including blood pressure determination, is important. Never miss looking for edema. The perineum and urethral meatus need to be thoroughly inspected.

The presence of red cells in urine must be demonstrated microscopically since red color of urine may well be secondary to hemoglobinuria, myoglobinuria, beeturia and metabolic products of some drugs or poisons.

Nephropathy

Acute poststreptococcal nephritis. Though now infrequent in European countries, acute nephritis continues to be a common cause of hematuria in tropics and subtropics. This immune-mediated disease typically follows a streptococcal infection (beta-hemolyticus type 12) of throat or skin. There is acute onset of fever, puffness of the face, more so around the eyes, and smoky or frankly bloody urine together with, in many cases, vomiting, headache, malaise and oliguria. Variable degree of hypertension is usual. Acute renal shutdown, CCF and hypertensive encephalopathy may occur as complications.

Urine examination reveals, besides few to several red cells, mild to moderate albuminuria and many granular casts.

IgA nephropathy: Also called idiopathic recurrent macroscopic hematuria, Bergar's disease, focal proliferative glomerulonephritis, or benign recurrent hematuria, this condition is characterized by episodes of gross hematuria precipitated by mild upper respiratory infection, febrile episodes or, less frequently, strenous exercise, predominantly in boys after the age of 2 years. The patient may also complain of lethargy, malaise, low backache or abdominal pain. Episodic gross hematuria disappears in 2 to 4 days though microscopic hematuria may continue over several years. Spontaneous cure occurs in 50% cases.

A renal biopsy is eminently indicated in subjects suspected of this diagnosis, more so in the presence of persistent hematuria.

SLE nephropathy: Hematuria secondary to nephritis is an important manifestation of systemic lupus erythematosus (SLE).

Three types are known

1. Focal proliferative lupus nephritis is characterized by microscopic hematuria with red cell casts and proteinuria. Generally, the renal involvement is nonprogressive.
2. Diffuse proliferative lupus nephritis is characterized by, in addition to microscopic or gross hematuria, massive albuminuria, azotemia, hypertension and edema. In short, the picture is that of nephritic-nephrotic disease. Left unattended, the disease invariably progresses to renal failure.
3. Membranous lupus nephritis which, as a rule, manifests as nephrotic syndrome, may also present with hematuria, hypertension and slight azotemia. Gradually, renal failure occurs in cases who are not appropriately treated.

Nephritis associated with systemic bacterial infections: In a variety of bacterial infections such as septicemia, coagulase-positive staphylococcal osteomyelitis, infected shunts for hydrocephalus, bacterial endocarditis and chronic suppuration, hematuria occurs secondary to mixed nephritic-nephrosis. Presence of red cell casts in urine, proteinuria, azotemia and hypertension are additional findings. The clinical evidence of bacteremia or sepsis (say fever and hepatosplenomegaly) preceding the renal symptoms and signs together with the clinical evidence of the primary predisposing condition helps to reach the diagnosis.

Henoch-Schönlein purpura: Microscopic hematuria or episodic gross hematuria may well occur in children with Henoch-Schönlein purpura having nephritis, usually within one month of onset of the syndrome. Clinical features of nephritis are generally, however, overshadowed by the typical rash, and abdominal and/or joint manifestations.

The nephritis associated with Henoch-Schönlein purpura is usually self-limited. It becomes inactive within 6 months of onset. No residual damage, except for minor abnormalities in urine sediment,

Urinary Tract Infection

Slight hematuria may accompany urinary tract infection. The presence of fever with chills, urinary frequency, painful micturition, pain in the loin, vomiting, etc. assists in seriously considering pyelitis as the cause. The characteristic finding in the urine is pyuria. Slight proteinuria may also be present. It is appropriate to do urine culture.

Hemolytic-Uremic Syndrome

Hematuria may occur in hemolytic-uremic syndrome. This disorder is characterized by the presence of hemolytic anemia secondary to acute renal failure, thrombocytopenia and in most cases, consumptive coagulopathy.

Clinical manifestations are widespread. Onset, usually in children between 6 months to 2 years, is acute but almost always preceded by diarrhea or respiratory infection. Besides the signs and symptoms of bleeding diathesis, hemolysis and nephropathy, involvement of the CNS may cause progressive drowsiness and seizures.

Nephrotic Syndrome

Transient slight hematuria may be present in some cases of nephrotic syndrome. The characteristic clinical profile of nephrotic syndrome together with demonstration of massive albuminuria and hypercholesterolemia leave little doubt as far as the exact diagnosis is concerned.

Henoch-Schönlein Purpura

Hematuria may well be encountered in Henoch-Schönlein purpura because of vasculitis. Presence of widespread purpuric lesions (especially urticaria-like skin lesions) with involvement of abdominal viscera and/or joints clenches the diagnosis.

Renal Vein Thrombosis

This condition, occurring in high risk infants, (usually newborns), is characterized by sudden onset of hematuria, oliguria and a lump in a flank with fast deterioration in general condition. Such manifestations as fever, shock and vomiting are common. In some cases edema and hypertension may occur.

The predisposing factors include maternal diabetes, dehydration, shock, septicemia, severe pyelonephritis, asphyxia, congenital renal anomaly, right-to-left congenital heart shunt, and angiography for congenital heart lesion.

Laboratory findings reveal anemia, leukocytosis, thrombo-cytopenia, metabolic acidosis and azotemia. Valuable diagnostic information is obtained from IVP, ultrasonography and radionuclide studies.

Renal Calculus

Hematuria may be a manifestation of renal calculus which is, of course, less common in childhood than in adulthood. Other symptoms and signs include colicky abdominal pain (usually over the flank), repeated urinary infections and history of passage of small chunks of the calculus. Infrequently, urethral obstruction may occur.

Renal Tuberculosis

Hematuria, together with persistent sterile pyuria, fever, wasting, dysuria, flank tenderness, and frequency of micturition, usually suggest renal tuberculosis which has a tendency to involve rest of the urinary tract as well.

Radiologic findings may include calyceal cavities, calcification, and stenosis of the excretory tract with dilatation above the stenosis and contraction of the bladder. X-ray chest to demonstrate primary complex, gastric lavage/sputum for AFB, and Mantoux/BCG diagnostic test must always be done.

Wilms' Tumor

Hematuria may occur in Wilms' tumor, also called nephroblastoma. The most important clinical finding in this tumor of embryonal origin is a large unilateral intra-abdominal lump often accompanied by abdominal pain, vomiting or fever. The lump usually does not cross the midline. Hypertension occurs in about half of the cases.

In a small proportion cases, the tumor may have one of such congenital anomalies as ambiguous genitalia, undescended testes, hypospadias, duplication of ureter or kidney, horseshoe kidney, aniridia, hemihypertrophy and Beckwith syndrome.

Diagnosis is confirmed by plain X-ray abdomen and IVP which show a large soft tissue opacity displacing the gut in the area of the kidney, and distortion of calyces by a mass within the kidney. X-ray chest is indicated to detect any metastasis.

Hemorrhagic Cystitis

Gross hematuria may result from acute nonbacterial cystitis, either of viral (adenovirus type 11 and 21) origin or due to chemical irritation of the bladder mucosa by cyclophosphamide.

Foreign Body

It is possible for a child to push a foreign body through the urethra, rarely right into the bladder. This may be responsible for hematuria, dysuria and urethral obstruction. A foul-smelling purulent discharge is usually present.

Trauma to Perineum

Occasionally, as a part of child abuse and neglect, the mother may cause tear(s) of the perineum, including external urethral opening, leading to contamination of the urine with blood.

Urethritis/Urethral Carbuncle/Meatal Ulceration

Bright-red blood, in small amounts, may be passed in urine in this situation. Dysuria and hesitancy are usually present.

Bleeding Diathesis

Blood disorders that cause hematuria include leukemias, purpuras, hemophilia, sickle-cell anemia, hemorrhagic disease of the newborn, and consumptive coagulopathy.

Drugs

Anticoagulants, aspirin, methicillin, thorazine, acetazolamide, cyclophosphamide, sulfas, diphenylhydantoin sodium, troxidone, PAS, kanamycin, cephalosporins, bacitracin, aminophylline.

Factitious Hematuria

Rarely, a mother may add blood to the child's urine and then report it as hematuria. This condition is termed Munchausen syndrome by proxy or simply Meadow's syndrome.

The fabricated illness causes unnecessary investigations, hospitalization and medication. The involved parent frequently has a medical background and is under gross emotional strain.

Remaining Causes of Hematuria

Nail-patella syndrome (hereditary onychoosteodysplasia) scurvy, telangiectasia.

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Chapter 34 Hemoptysis

Hemoptysis, meaning the spitting of blood or blood-stained sputum, is a rather infrequent symptom in pediatric practice. I see one or two cases in several weeks. At times, it is indeed hematemesis that is erroneously considered hemoptysis by the parents. In some instances, it is red coloration of the sputum by rifampicin that is confused with hemoptysis, causing undue anxiety to the parents and unnecessary investigations.

History must ascertain whether what is described as hemoptysis is really blood in the sputum or just color of a drug, say rifampicin. If it is indeed blood, is it coming from the lung or is simply secondary to epistaxis, bleeding from the gums, etc.?

Once established to be real hemoptysis, enquiry must attempt at arriving at the cause. Is the sputum entirely blood, or is it streaked or speckled with blood? Is it bright red in color or altered? Any history of chronic or violent cough, foreign body, chest pain, pyrexia, or dyspnea? Is the child a known case of rheumatic heart disease? Any suggestion of tuberculosis in the family? Any bleeding from other sites?

Physical check-up should, in particular, exclude ecchymosis, petechiae, and nasal, pharyngeal or oral lesions. Are there chest findings consistent with bronchiectasis or lobar pneumonia?

Bronchiectasis

Hemoptysis is a feature of advanced bronchiectasis, the disease characterized by permanent dilatation of the bronchi and bronchioles as a result of obstruction and/or infection followed by cavitation of the bronchial wall and tissue destruction. Along with hemoptysis, the child has dyspnea, cyanosis and clubbing.

This picture is on top of the characteristic persistent or recurrent cough productive of copious, mucopurulent sputum which is foul-smelling and has postural relationship. Likewise, patient's breathing also carries bad smell. Some fever and recurrent attacks of respiratory infections are frequent.

The characteristic auscultatory finding is the "localized crepitations" repeatedly found over the affected area. Other signs of collapse-consolidation may also be present.

X-ray chest reveals increased bronchovascular markings extending towards the base of the lung. In advanced stage, areas of cavitation may become apparent. Bronchoscopy followed by bronchography are essential to localize and establish extent of bronchiectasis.

Foreign Body

An aspirated bronchial foreign body may be responsible for blood-streaked sputum together with cough and metallic taste in case of metallic foreign body. Generally, the foreign body is aspirated in to the right lung because of the convenient position of the right bronchus. An enquiry usually reveals that the patient sometime ago had a sudden attack of choking and paroxysmal coughing while eating or while handling small objects during play.

The degree of lung involvement depends upon the extent of obstruction caused by the foreign body. An obstructive foreign body may produce obstructive emphysema, obstructive atelectasis or, if either is allowed to remain unattended, chronic pulmonary disease.

Whooping Cough

Rarely, whooping cough may be responsible for slight hemoptysis. Remaining results of forcefulness of the paroxysm include epistaxis, subconjunctival hemorrhages, spinal epidural hemorrhage, melena, tear of frenulum of the tongue, hematoma, rupture of diaphragm, umbilical hernia, inguinal hernia, rectal prolapse, and rupture of alveoli leading to interstitial or subcutaneous emphysema.

Diagnosis of whooping cough is virtually clear in the paroxysmal stage, particularly in the presence of contact with a

known case. Leukocytosis with absolute lymphocytosis support the diagnosis. Recovery of organism on Border-Gangou medium confirms the diagnosis,

Remaining Causes of Hemoptysis

Lobar pneumonia, trauma to chest (e.g. broken rib), cystic fibrosis, tuberculosis, mitral stenosis, CCF, uremia, pulmonary hemosiderosis, enterogenous cyst, blood dyscrasias, telangiectasia, paragonimiasis.

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Chapter 35 Hepatomegaly

Hepatomegaly, meaning actual enlargement (not just palpability of the liver), is a frequent observation in pediatric practice. Quite often, it is detected by the doctor incidentally while examining the child for some other problem.

In order to be sure that it is true hepatomegaly and not sheer apparent hepatomegaly, you must percuss the upper margin of liver. Normally it should be located within 1 cm of the fifth intercostal space in the right midclavicular line. Liver may be pushed down, thereby becoming palpable, though not enlarged, in such conditions as pneumothorax, emphysema, pleural effusion, emphyema and subphrenic abscess. In thoracic deformity, say narrow costal angle, liver may become palpable by over 2 cm though its size remains within normal limits. Relaxation of the abdominal musculature and laxity of the ligaments as in rickets or generalized visceroptosis may also be responsible for apparent he-patomegaly. Remember that in healthy children too, liver may be palpable upto 2.5 cm in infancy and 1 to 2 cm in later years.

Normal liver span varies from 4.5 to 5.0 cm at 1 week of age to 7 to 8 cm in boys and 6.0 to 6.5 cm in girls by 12 years of age.

Clinical assessment of hepatomegaly does not end with determination of its size. You must examine the organ for any tenderness, consistency (whether soft or firm), type of border (whether rounded or shalp), type of surface (whether smooth, granular or nodular), and any bruits. You must also carefully examine the abdomen for a palpable spleen, other masses, etc.

Pertinent extrahepatic finding should also be looked for. For example, presence of cataracts in an infant with hepatomegaly may point to the diagnosis of galactosemia, microcephaly to intrauterine infections, neuromuscular abnormality in the form of tremors or

flaccidity to lipid storage diseases, and telangiectasia to hereditary hemorrhagic telangiectasia. In later age group, pruritus accompanying hepatomegaly may mean the existence of chronic cholestasis, hemangioma the hemangiomatosis of the liver, caroteinemia the hypervitaminosis A, Kayser-Fleisher rings, the Wilson's disease, neuromuscular abnormalities again the Wilson's disease, glossitis the cirrhosis, enlarged kidneys polycystic disease or congenital hepatic fibrosis, and arthritis with erythema nodosum the liver disease with chronic inflammatory bowel disease.

HEPATOMEGALY IN THE NEWBORN

Congestive Cardiac Failure

Hepatomegaly almost always occurs in congestive cardiac failure which is rather difficult to recognize in newborns. Remaining manifestations may include tachypnea, poor-feeding, excessive sweating, irritability, weak cry, tachycardia and cardiomegaly. Gallop rhythm is usual. Shortness of the neck and difficulty in securing a relaxed state in the newborn make it rather impracticable to comment on the jugular venous pressure (JVP). Edema, if present, is generalized. Hepatic pulsations may be felt. In longstanding cases, splenomegaly may occur.

Neonatal Hepatitis

In this disorder, liver becomes grossly enlarged, at times filling the whole of the right half of the abdomen. Its consistency is distinctly firm. In one-half of the cases, spleen is moderately enlarged. Accompanying manifestation include jaundice appearing in first week, feeding difficulty, vomiting, anemia, high-colored urine and intermittent loss of the pigment in stools. Occasionally, there may be thrombocytopenic purpura. The infant appears really sick.

For more details, you may refer to Chapter 39.

Extrahepatic Biliary Atresia

Marked hepatomegaly with firm consistency occurs in extrahepatic biliary atresia only when it has progressed (Fig. 35.1). Accompanying features include persistent jaundice which keeps deepening and lightening alternately, deep-colored urine, clay-colored stools, bronze olive-green skin, splenomegaly, and vitamin

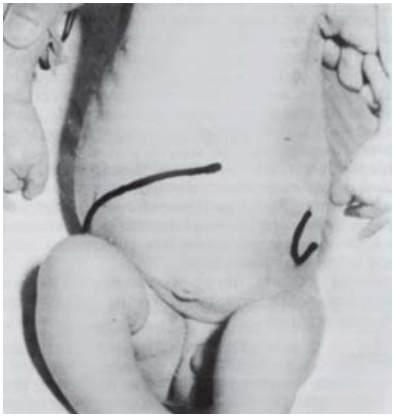

Fig. 35.1: *Extrahepatic biliary atresia* Besides firm hepatomegaly, the infant had persistent icterus which showed waxing and waning, splenomegaly and vitamin K responsive hemorrhagic tendency.

deficiencies, especially hemorrhages due to vitamin K deficiency. Unlike the sick-looking infant with neonatal hepatitis, the infant with biliary atresia looks well enough during the neonatal period and for a few months that follow.

Also, see Chapter 39.

Erythroblastosis Fetalis

Both ABO and Rh incompatibility are known to cause hepatomegaly in association with splenomegaly, anemia and jaundice.

In the severest form of Rh hemolytic disease-hydrops fetalis-infant is usually born preterm with gross edema, effusion in serous cavities and massive hepatomegaly with splenomegaly. Jaundice is absent at birth.

Also, see Chapter 39.

Intrauterine Infections

Intrauterine infections such as toxoplasmosis, cytomegalic inclusion disease and rubella, as discussed elsewhere (see Chapter 39), as also congenital syphilis and malaria may be responsible for

hepatomegaly in combination with other manifestations such as neonatal jaundice.

In early congenital syphilis, manifestations other than hepatomegaly include snuffles, skin and mucosal lesions such as rhagdes, mucous patches, ulcerations and fissures in the mouth and anus, anemia, splenomegaly, jaundice, fever, failure to thrive, lymphadenopathy and chorioretinitis.

Painful osteochondritis and/or periostitis may cause pseudoparalysis (Parrot paralysis). Meningovascular syphilis may cause such manifestations as permanent brain damage, hydrocephalus and optic atrophy. Syphilitic nephrosis may be responsible for periorbital puffness and pedal edema. Serious complications like pneumonia alba and hepatic failure may prove fatal.

Neonatal malaria may be responsible for fever, hepatosplenomegaly, irritability, feeding difficulty and, at times, even seizures.

Septicemia

Hepatomegaly together with jaundice appearing between third and seventh postnatal day, splenomegaly, poor feeding, vomiting, irritability, listlessness, poor activity, abdominal distention, and fever or hypothermia, particularly in the presence of septic umbilicus or aseptic focus elsewhere, strongly suggest the probability of neonatal septicemia.

Also see Chapter 39.

Galactosemia

In this rare autosomal recessive disorder, hepatomegaly occurs fairly early in association with jaundice, poor feeding, vomiting and fatigue to thrive which follow introduction of milk. Development of splenomegaly takes some more time. Pseudotumor cerebri may occur in some subjects. Delay in withdrawal of milk and its products results in mental retardation and cataracts.

Alpha-1-Antitrypsin Deficiency

This defect presents with hepatomegaly and jaundice in neonatal period or first 3 months of life. Serum alpha-1-antitrypsin level

is just 10 to 20% of the normal. Serum bilirubin, SCOT, SGPT and alkaline phosphatase levels are elevated. Pathologically, the characteristic finding is PAS-positive diastase-resistant granules restricted to peri-portal liver cells in the beginning and later spreading to the midzone.

Gangliosidoses (GM1 or Generalized Type)

A severe lipidoses with onset soon after birth, it is characterized by edema, weakness, grotesque facial features, hepato-splenomegaly, hyperacusis and cherry-red spot of the macula. The disease proves fatal by the second birthday.

Cholesterol Storage Disease

It is characterized by hepatomegaly, dwarfism, persistent blood loss from gastrointestinal tract, chronic anemia and hyperlipemia. Neurologic manifestations, if present, are minimal. Bone marrow shows foam cells and lamina propria of the intestine shows the lipids. These subjects are prone to atherosclerosis.

Wolman's Disease

Also called primary familial xanthomatosis, an autosomal disorder, it causes storage of lipid in histiocytic foam cells, thereby producing hepatosplenomegaly. Accompanying manifestations include vomiting, diarrhea, abdominal distention and gross failure to thrive. Bone marrow examination shows a large number of lipoid cells and X-ray abdomen the enlargement and calcification of adrenals.

HEPATOMEGALY IN LATER INFANCY AND CHILDHOOD

Infections and Inflammations

Hepatomegaly is a common accompaniment of such infections and inflammations as viral hepatitis, amebic hepatitis/abscess, ascariasis, cholangitis, hydatid disease, tuberculosis, malaria, kala-azar, enteric fever, brucellosis, septicemia, infectious mononucleosis, leptospirosis and histoplasmosis, besides neonatal/ intrauterine infections already dealt with in this very section.

Viral hepatitis, be it infective, serum, non-A-non-B, or delta and its complication (chronic persistent hepatitis and chronic aggressive hepatitis) is almost always accompanied by liver enlargement.

The onset may be insidious or acute with fever, anorexia, malaise, nausea, vomiting, headache, upper abdominal pain (particularly in the right upper quadrant and/or epigastrium), tender hepatomegaly, constipation/diarrhea, and high-colored urine. This is followed by appearance of jaundice of varying intensity. With appearance of jaundice, fever and anorexia begin to subside.

About 25% cases have just slight jaundice and abdominal pain. A few may have rapidly fulminant course with hepatocellular failure and hepatic coma. Attempt should be made to delineate whether the child's illness was infective hepatitis (hepatitis A) or serum hepatitis (hepatitis B). In infective hepatitis, incubation period varies from 28 to 42 days. Gastrointestinal tract is the probable portal of entry, though infrequently hepatitis. A virus can gain entry via blood as well. During early stages of the disease, virus can be isolated in blood as well as stools. It continues to pass in stools as long as complete recovery has not occurred (Table 35.1).

In serum hepatitis, incubation period is much longer 60 to 150 days. Transmission is nearly always via in apparent parenteral route, e.g. blood transfusion, injection, vaccination, or skin/ mucosal abrasion.

Recently, convincing evidence has accumulated for the hepatitis viruses other than A and B. The best known viruses are hepatitis C, D and E.

Fulminant hepatitis, or acute yellow atrophy, occurs due to remarkably high virulence of the virus or high host susceptibility as in subjects with immunologic deficiency disease or on immunosuppressant drugs. In one form, the disease proceeds in a rapidly fulminant course with increasing jaundice, ascites shrinking liver, worsening of the laboratory indices and coma. The other form starts as a benign hepatitis. After apparent improvement, the patient suddenly starts worsening in the second week of the disease, eventually ending up in hepatic coma, sepsis, hemorrhage or cardiorespiratory arrest.

Chronic persistent hepatitis is unresolved viral hepatitis characterized by portal inflammation. Liver is enlarged but soft in consistency. The disease runs a slow and benign course.

Table 35.1: Hepatitis A vis-a-vis hepatitis B

Parameter	*Hepatitis A*	*Hepatitis B*
Etiologic agent	RNA virus	DNA virus
Mode of transmission	Feco-oral Parental (occasionally)	Parental Sexual Feco-oral infrequently Skin (child to child)
Incubation period	28-42 days	60-150 days
Duration of viremia	3-5 days (transient)	7-8 weeks prolongation
Onset of symptoms	Sudden	Gradual
Duration of acute illness	6 to 12 weeks	6 to 12 weeks
Incidence of relapse	5-10%	A carrier state goes on and on.
Chronic carrier state	Note at all	90% neonates and up as carriers
Cause of mortality	Acute fulminant hepatitis	Cirrhosis Malignancy
Preventive vaccine	Hepatitis A vaccine Havrix	Hepatitis B vaccine, both genetically-engineered and plasma-derived available (Engeriz B, Shanvac B)

Chronic active hepatitis is an uncommon sequelae of viral hepatitis and is characterized by widespread loss of lobular architecture, portal and periportal inflammation, piecemeal necrosis and active septa. In addition to jaundice, firm hepatomegaly is present (Fig. 35.2). Spleen is usually enlarged. Ascites is present. The course is rapidly progressive and downhill.

Amebic hepatitis causes diffuse liver enlargement, a serious manifestation of disseminated infection, usually accompanying intestinal amebiasis. Liver is palpable and distinctly tender.

Amebic liver abscess is the better defined clinical entity associated with hepatic amebiasis. Manifestations, besides enlarged tender liver, include fever, abdominal pain and distention, and toxemia. Upper border of the liver is at a higher level.

Diagnosis is confirmed by finding *Entamoeba histolytica* in stools (mind you, stool examination may be negative for ameba in over half of the cases of documented amebic abscess), elevated and immobile diaphragm on screening, by aspiration of anchovy-sauce (chocolate colored) pus, and by localization of the abscess cavity (usually in the right lobe) through hepatic ultrasonography and isotope scans.

Fig. 35.2: *Chronic active hepatitis* In addition to the findings of a firm hepatomegaly and splenomegaly, the patient had icterus and ascites.

Pyogenic hepatitis/abscess may occur secondary to septice mia, osteomyelitis, infected burns, pyodermas, etc. particu larly in children with immuno logic defects or on inadequate antibiotic therapy. *Staphylococcus aureus* is the most common causative organism. Abscesses are usually multiple. There is marked toxemia. Liver is enlarged and tender; the upper border too is at a higher level.

Ascariasis, when heavy and chronic, may cause persistent hepatomegaly in tropical children as a result of the continuous transhepatic passage of larvae which is, in any case, normal migration of larvae. That ascariasis indeed is responsible for hepatomegaly is purely conjunctural. There is no direct proof to this effect.

Hydatid disease involving the liver is rare in childhood. It gives rise to a smooth rounded swelling with hydatid fremitus and fluctuation. Diagnosis in suspected cases is made by Casoni test. X-ray and ultrasonic studies and, finally, by exploratory laparotomy.

Tuberculosis may cause hepatomegaly by isolated or disseminated hematogenous spread. For establishing the diagnosis,

it is important to identify the primary lesion in the lungs or elsewhere. A liver biopsy may reveal tuberculous granulomatous lesion of the liver.

Malaria, particularly when chronic, may be responsible for significant enlargement of liver. More than hepatomegaly, the child demonstrates enlargement of spleen (Fig. 35.3). There are also accompanying anemia and malnutrition. Interestingly, in the cases of repeated attacks, temperature is often normal though, at times, low-grade fever occurs.

Kala-azar is an important cause of slow enlargement of liver in endemic areas. Accompanying manifestations include persistent fever (mild to moderate) with rapid enlargement of spleen in just 2 weeks' time, malnutrition, pigmentation of skin, and sparse, falling and brittle scalp hair. Appetite remains good. Diagnosis is made by serologic tests like aldehyde (formal gel) test and Chopra's antimony test, complement fixation test which is positive in 90% of the cases in third week after onset, and blood and bone marrow smear for LD bodies.

Enteric fever may cause hepatomegaly though most often it is the spleen which becomes palpable. Accompanying features include fever (not necessarily of step-ladder pattern), marked malaise, anorexia, headache, vomiting and abdominal distention and pain. Some cloudiness of consciousness is invariably present. Diarrhea occurs more often than constipation. Abdomen has a characteristic doughy feel. Eosino-penia or complete absence of eosinophils is a reliable finding. Leukopenia with relative lympho-cytosis, described as an important

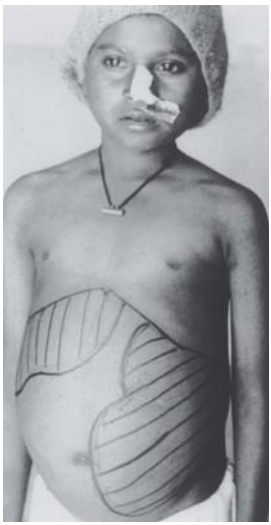

Fig. 35.3: *Chronic malaria* Note the hepatomegaly with massive splenomegaly in this 12-year-old with anemia, malnutrition and low-grade fever.

feature of enteric fever, is most often absent in children. Widal test showing "0" antibody titer of 1 in 250 or more is quite suggestive though a rising titer over a period of 7 to 10 days is of greater value. Blood and bone marrow culture for S. typhi is the most reliable diagnostic measure under ideal conditions.

Brucellosis may be responsible for hepatomegaly in association with splenomegaly and cervical and axillary lymphadenopathy. Remaining manifestation include prodromal symptoms like easy fatigability, weakness, headache, myalgia, constipation and anorexia, followed by high fever with chills and diaphoresis, epistaxis, abdominal pain, cough and weight loss. Diagnosis is established by brucella agglutination test which shows liters over 1 in 160 in acute illness.

Septicemia, implying that bacteremia is severe enough to make the patient critically ill, may be responsible for hepatomegaly with multisystem involvement. It should be suspected in the presence of unexplained fever, involvement of quite a few systems/organs and serious state of the subject, particularly when septic focuses such as pneumonia, osteomyelitis, abscess, endocarditis are, etc. apparent.

Infectious mononucleosis, caused by the Epstein-Barr virus of the herpes group, may lead to hepatomegaly in one-third of cases. Accompanying signs include splenomegaly and lymphadeno-pathy, particularly in the posterior cervical region. The symptoms include malaise, fever, sore throat, headache, nausea or vomiting. At the junction of hard and soft palate, petechiae may be seen. Peripheral blood shows a typical lymphocytes. Hetrophilic antibody response is positive.

AIDS is beginning to emerge as a noteworthy cause of hepatomegaly. Additional manifestations vary with the type of AIDS. In case of infants born to mothers with risk factors, these include small-for-dates, failure to thrive, microcephaly, splenomegaly, lymphadenopathy, chronic interstitial pneumonia (pneumocystis carinii in particular), recurrent otitis media, chronic sinopulmonary infection, oral candidiasis, chronic diarrhea and chronic parotid swelling. In case of transfusion-associated AIDS, these include interstitial pneumonia, Kaposi sarcoma, chronic

lymphadenopathy, recurrent pyrexia, splenomegaly, night sweats, weight loss, chronic diarrhea and evidence of other viral infections such as Epstein-Barr virus, hepatitis B or cytomegalovirus.

For diagnosis of pediatric AIDS, presence of a risk factor with demonstration of polyclonal hypergammaglobulinemia, T-cell immunodeficiency and evidence of infection with human immunodeficiency virus (HIV) are considered sufficient.

World Health Organization has suggested a clearcut criteria for clinical diagnosis of AIDS in developing countries (Table 35.2).

Leptospirosis (icteric type or Weil's disease) has dominant hepatic manifestations in the form of hepatomegaly, right upper quadrant abdominal pain, hyperbilirubinemia (both direct and indirect) and raised serum levels of liver enzymes. Renal manifestations include hematuria, proteinuria, casts, azotemia and oliguria oranuria. Hemorrhagic and cardiovascular phenomenon occur uncommonly. Initial symptoms include fever, shaking chills, myalgia, headache, nausea, vomiting, malaise, dehydration and prostration. Diagnosis is made by identification of Leptospira in infected tissue or body fluid, and by serologic testing.

Disseminated histoplasmosis, an acute illness particularly of immunosuppressant subjects, is characterized by hepatospleno-

Table 35.2: World Health Organization (WHO) criteria for diagnosing pediatric AIDS in developing countries

Major criteria

- Weight loss/abnormally slow weight gain for age
- Chronic diarrhea for over one month
- Prolonged/intermittent pyrexia for over one month

Minor criteria

- Generalized lymphadenopathy
- Oropharyngeal candidiasis
- Recurrent common bacterial infections
- Persistent cough for over one month
- Generalized dermatitis
- Confirmed HIV infection in the mother

Note: The presence of two major and two minor criteria provided that other known causes of immunodeficiency are not existing, is diagnostic of AIDS.

megaly, diffuse lymphadenopathy and pneumonia. Associated manifestations include nausea, vomiting, abdominal pain and diarrhea. The patient is critically ill with dyspnea. In untreated subjects, respiratory failure, bleeding from various sites as a result of disseminated intravascular coagulation or septicemia may prove fatal.

Hematogenous Diseases

Thalassemia major has hepatosplenomegaly (spleen far bigger than liver) as an important finding. Remaining features include progressive hemolytic anemia with icterus, and growth retardation. Lymphadenopathy, skin pigmentation, hypogonadism and recurrent respiratory infections are common. The so-called thalassemic facies are characterized by frontal bossing, depressed nasal bridge and prominent maxilla exposing maloccluded teeth.

Investigations reveal hemoglobin in the range of 4 to 9 g% with peripheral blood film showing microcytic-hypochromic erythropoiesis, anisocytosis, poikilocytosis, moderate basophilic stippling, nucleated and fragmented red cells (the so-called target cells), large number of normoblasts and reticulocytosis.

Bone marrow reveals erythroid hyperplasia which is responsible for widening of the medulla and thinning of the cortex of the bones.

Osmotic fragility test reveals a reduced fragility. In other words, there is resistance to hemolysis in highly diluted (hypotonic) solution.

Fetal hemoglobin is always over 40% and usually over 70% during the early years of life.

Radiologic picture is remarkable with such findings as thinning of the cortex, widening of the medulla and coarsening of trabeculations in the long bones, metacarpals and metatarsals. X-ray skull shows overgrowth of the maxilla with opacification of the sinuses. The diploic spaces are widened with prominent vertical trabeculae (striations) and atrophy of the outer table. The vertical striations are termed hair-on-end appearance.

Sickle-cell anemia, an inherited defect of hemoglobia S limited almost to black races (it is rare in most parts of India), may have

mild to moderate hepatomegaly in association with slight icterus, anemia, fever, headache, arthritis, osteopathy of metacarpals and phalanges in particular, skin ulceration, nocturnal enuresis, growth retardation and folic acid deficiency. Splenomegaly, though significant in early years, regresses in older children (autosplenectomy). The child is prone to repeated bacterial infections and anesthetic complications.

Three types of crises worsen patient's condition, namely hemolytic, vaso-occlusive and aplastic. Laboratory data show severe microcytic-hypochromic anemia with hemoglobin usually less than 8 g% (average 6 to 8 g%), irreversible sickled cells, poikilocytosis and target cells. Reticulocyte count varies between 5 to 15%. Nucleated red cells and Howell-Jolly bodies are usually present.

Bone marrow is markedly hyperplastic, Hectrophoresis reveals that 50 to 100% hemoglobin is of S type and that fetal hemoglobin level is elevated.

X-ray studies show expanded marrow spaces and osteoporosis.

Nutritional Problems

Soft, smooth, round-bordered, nontender enlargement of the liver which may, at times, reach as low down as the umbilicus, is a common observation in edematous type of protein-energy malnutrition, kwashiorkor. It is ascribed to fatty infiltration and is reversible. The essential features of kwashiorkor include:

(i) growth retardation as evidenced by low weight and low height,

(ii) marked muscle wasting with retention of some subcutaneous fat,

(iii) psychomotor change in the form of listless inertness, and

(iv) hypoalbuminemic edema at least over the pretibial region, provided that it is not due to congestive cardiac failure, liver disease, kidney disease or any non-nutritional cause. The variable features of kwashiorkor include hair changes, dermatosis, gastrointestinal upset, mineral and vitamin deficiencies, hepatomegaly and superadded infections and infestations.

Parenteral hyperalimentation may occasionally be accompanied by hepatomegaly which is reversible.

Vascular/Congestive Hepatomegaly

Congestive cardiac failure, even at a fairly early stage, causes enlargement of the liver, its magnitude depending upon the severity of the failure. Accompanying signs include dyspnea, raised jugular venous pressure, bilateral basal crepitations and slight generalized edema.

Constrictive pericarditis, occurring months or years after the primary disease (say tuberculous pericarditis, purulent pericarditis, viral pericarditis, trauma, neoplastic invasion of the pericardium), may cause hepatomegaly and ascites out of proportion to other manifestations. Remaining findings suggesting constriction include distention of neck veins, narrow pulses, quiet precordium, distant heart sounds, pericardial friction rub and pulsus paradoxicus.

Veno-occulsive disease of the liver, supposed to be caused by some hepatotoxins in the bush-tea, is a leading cause of hepatomegaly in West Indian peasant children. Three stages are recognized. The initial acute phase is characterized by acute onset of abdominal discomfort, smooth, firm, nontender hepatomegaly (often massive) and ascites. This is followed by subacute phase which is characterized by persistent hepatomegaly with or without splenomegaly. Often, the child is symptom-free. The chronic phase is characterized by cirrhosis with occurrence of repeated hematemesis, presence of an audible continuous venous hum, the Cruveilhier-Baumgarten sign, over the abdomen or lower thorax, hepatic failure and cholemia.

Storage Diseases

Reye's syndrome is always accompanied by an enlarged fatty liver. In a typical case, there is sudden onset of profound disturbances of sensorium (to the extent of coma), vomiting and convulsions. Hypoglycemia, hepatomegaly and hepatic dysfunction are the other prominent manifestations. Jaundice make a special note is, as a rule, conspicious by its absence. Dyselectrolytemia or bleeding diathesis may occur. Complications include pneumonia, respiratory failure, cerebral problems, cardiac arrhythmias and diabetes insipidus. Clinical spectrum varies from relatively mild to rapidly fatal disease. Mild cases may be missed without liver biopsy.

Investigations show that blood and CSF sugar are consistently low. While SCOT, SGPT and LDH are significantly raised, serum bilirubin and alkaline phosphatase are either normal or only marginally elevated. Prothrombin time is prolonged. Blood ammonia is elevated in most and urea nitrogen in few cases. Metabolic acidosis and respiratory alkalosis may coexist in the same subject.

Liver biopsy shows diffuse microvesicular steatosis with absence of glycogen and slightest inflammatory changes.

EEG changes consist of predominantly slow wave activity. Glycogen storage disease, type I (Von Gierke' disease), due to deficiency of the enzyme, glucose-6-phosphatase, is characterized by massive hepatomegaly together with doll-face, stunted growth ketonuria, hyperuricemia, bleeding tendency and hypoglycemic convulsions. Gout may complicate the clinical picture after puberty.

Diagnosis is confirmed by liver biopsy which shows increased fat and glycogen and absence of glucose-6-phosphatase enzyme.

Gaucher's disease, an autosomal recessive type of lipidosis caused by deficiency of the enzyme, beta-glucosidase, in brain liver, spleen, bone marrow and other organs, is characterized by rapidly progressive visceral enlargement, including hepatomegaly, and mental retardation (infantile type) or rapid development of hepatosplenomegaly without brain involvement, (juvenile type).

Diagnosis is made by demonstrating typical cells, the so-called Gaucher's cells, in the marrow or splenic puncture.

Niemann-Pick disease, an autosomal recessive type of lipidosis caused by absence of the enzyme, sphingomyelinase, is characterized by mental retardation, hepatosplenomegaly, lymphadenopathy, weight loss and abdominal distention. A cherry-red spot may be seen in every third child with this disease in the region of macula. Anemia, usually moderate, is invariably present. Death usually occurs in infancy.

Diagnosis is by demonstration of Niemann-Pick cell in blood, marrow or splenic puncture. X-ray may show miliary tuberculosis-like picture.

Galactosemia, causes hepatomegaly early enough along with feeding difficulty, vomiting, failure to thrive, jaundice and

hypoglycemic convulsions as a rule as soon as milk feed is given to the infant. With progression of the disease in later infancy, hepatomegaly shows further increase. Along with this, splenomegaly also appears. If treatment is delayed and the child survives, cataracts and gross mental retardation follow in due course of time. Damage to the kidneys may cause albuminuria and aminoaciduria.

Investigations demonstrate galactosemia, hypoglycemia, and galactosuria. Erythrocytes show increased level of galctose-1-phosphate.

Gargoylism, type 1 mucopolysaccharidosis or Hurler's syndrome, is characterized by hepatosplenomegaly together with grotesque facies, mental retardation, dwarfism, corneal cloudiness, umbilical hernia and kyphosis.

Diagnosis is usually clinical. Radiologically, elongated sella turcica, shortened vertebral bodies with concave anterior and superior surfaces and thickening of the tubular bones and metacarpals with tappering of ends lends support to the clinical impression.

Urine Shows Large Amounts of Chondroitin Sulfate

Hemosiderosis, meaning iron storage in excess in various organs, may be responsible for hepatomegaly eventually ending up as cirrhosis, together with slate or bronze pigmentation of the skin, diabetes mellitus and respiratory manifestations. Both primary (increased gastrointestinal absorption of iron) and secondary (repeated blood transfusions as in thalassemia major) forms occur.

Amyloidosis, meaning extracellular deposition of a proteinaceous material, may cause massive liver and splenic enlargement. Yet, there may be no symptoms other than abdominal discomfort. Liver function tests remain either absolutely normal or these are only minimally affected. Rectal biopsy assists in reaching the diagnosis.

Xanthomatosis, though rare in pediatric practice, may be responsible for hepatomegaly as also involvement of many other organs/systems.

Cystic fibrosis, a disorder of the exocrine glands, particularly the pancreas, may cause biliary cirrhosis in 2 to 3% of patients. Manifestations include hepatomegaly, jaundice, ascites, hematemesis from esophageal varices and evidence of hypersplenism. In the second decade of life, the child may develop biliary colic from cholelithiasis.

Cystinosis, characterized by accumutation of cystine in various tissues, especially reticuloendothelial system, may be responsible for hepatomegaly in addition to other manifestations like splenomegaly, lymphadenopathy, aminoaciduria, photophobia, etc.

Diabetes mellitus is known to cause enlargement of the liver in long-standing cases. The cause of hepatomegaly is fatty infiltration.

Wilson's disease, an autosomal recessive disorder of copper metabolism, is characterized by the triad of neurologic abnormalities, Kayser-Fleischer rings and cirrhosis. Hepatomegaly, due to excessive accumulation of copper, is the earliest manifestation. This is followed by splenomegaly, jaundice and anorexia. Edema, ascites or gastrointestinal bleeding occur sooner or later. The disease may resemble chronic active hepatitis or, infrequently, even viral hepatitis or cirrhosis.

The most reliable diagnostic criterion is liver tissue copper content exceeding 400 μg/g dry weight.

Malignant Diseases

Leukemias cause some degree of hepatomegaly in almost 80% of the patients, usually in association with splenomegaly, petechiae of mucous membrane, bleeding, progressive anemia, fever, bone pain/tenderness or arthralgia. Diagnosis in a suspected case is made by demonstrating leukemic blast cells in the blood and bone marrow smear.

Lymphomas, both Hodgkin and non-Hodgkin, may eventually involve the liver and other organs, causing organomegaly.

Neuroblastoma may, through hematogenous spread, involve the liver, resulting in hepatomegaly. Additional common findings include a firm, irregular and nontender upper abdominal swelling

which becomes big enough to cross the midline. Hemorrhage in the tumor mass causes significant anemia. Involvement of marrow may cause pancytopenia which leads to further pallor, petechiae and ecchymosis. Involvement of bones may cause bony tenderness and pain. The remaining features include skin nodules, raised intracranial pressure, fever, lethargy, anorexia and chronic diarrhea.

Wilms' tumor, if it metastasizes to liver, may cause enlarged nodular liver. Accompanying manifestations include a huge upper abdominal mass which usually does not cross the midline, abdominal pain, vomiting, fever and hypertension. Hepato-blastoma, occurring nearly always under the age of 3 years, causes massive hepatomegaly with abdominal enlargement (Fig. 35.4). A proportion to the cases (around 20%) have abdominal pain, anorexia and weight loss. Vomiting and jaundice occur less frequently. Occasionally, virilization may occur.

Liver function tests are usually within normal limits. Alphafetoprotein levels in blood and urinary excretion of cystathionine are, however, elevated in a majority of the subjects.

X-ray abdomen may show calcification in the enlarged liver in some 30% cases.

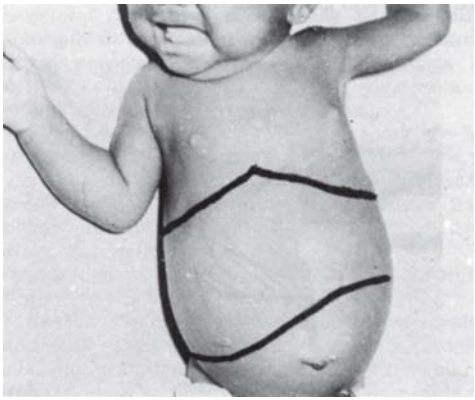

Fig. 35.4: *Hepatoblastoma* Note the massive hepatomegaly. Abdominal radiograph revealed calcification in the enlarged liver.

Miscellaneous Conditions

Indian childhood cirrhosis, irrespective whether it is of the dominant insidious onset type or the acute onset type, is characterized by the presence of progressive hepatomegaly.

The insidious onset type has three arbitrary stages. First stage is the stage of vague manifestations with liver that is palpable by 3 to 5 cm. The liver border is typically shape and leafy and its consistency firm (Fig. 35.5). Additional manifestations include abdominal distention, anorexia or voracious appetite, lassitude, irritability, slight fever, constipation or diarrhea with clay-colored sticky and formed stools, and growth failure.

Second stage is characterized by further increase in the liver size and its firmness, appearance of a clear-cut jaundice and dominance of the clinical picture by portal hypertension in the form of splenomegaly, ascites, hematemesis, anemia, prominent superficial abdominal veins and thrombocytopenia.

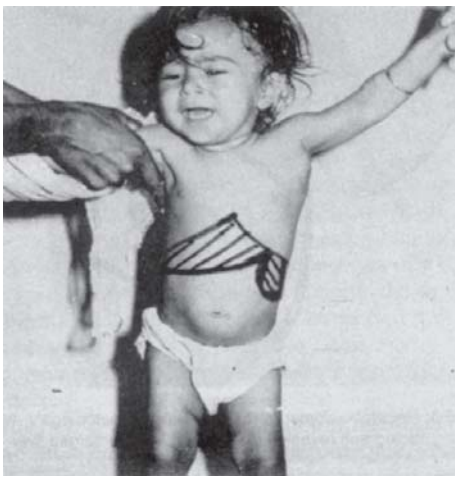

Fig. 35.5: *Indian childhood cirrhosis* This 10-month-old child presented with moderate icterus, hepatosplenomegaly (very firm liver with a sharp, leafy border and minima) ascites (stage II). In a matter of couple of days, he developed severe hepatocellular failure, thereby entering stage III.

Third or the terminal stage is characterized by massive hepatosplenomegaly, ascites, protuberant abdomen, prominent superficial abdominal veins, deep jaundice, apathy, emaciation and evidence of progressive hepatocellular failure.

In the acute onset disease, the infant has sudden onset of jaundice, fever, clay-colored stools and hepatomegaly. He finally dies in hepatic coma.

Congenital cysts may occasionally be the cause of hepatomegaly in association with portal hypertension and congenital polycystic kidney disease. Diagnosis is by strong suspicion and exclusion. Finally, exploratory laparotomy may have to be resorted to.

Hemangioma of the liver may be responsible for an enlarged liver. Additional symptoms include jaundice, vomiting, diarrhea, and abdominal protuberance. Occasionally, congestive cardiac failure (from arteriovenous fistula), hemolysis, thrombocytopenia, hypofibrogenemia and refractory anemia may occur.

X-ray abdomen shows enlarged liver and, at times, calcification in the hemangioma.

Systemic lupus erythematosus may be responsible for hepatomegaly together with splenomegaly. Additional common manifestations include prolonged irregular fever with remissions of variable duration, joint or muscle pains, malaise, weight loss, and a characteristic erythematous rash resembling the wings of a butterfly (butterfly rash) over the bridge of the nose and cheeks. Rash may also appear on fingers and palms, soles, palate and buccal mucosa. Alopecia may also occur.

Diagnosis is made by demonstrating the LE phenomenon and antinuclear antibodies (ANA).

Hepatotoxic drugs are known to produce toxic hepatitis but it is only occasionally that hepatomegaly occurs.

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Chapter 36

Hoarseness

Hoarseness, occurring at all ages including neonatal period, is a frequent problem encountered in pediatric practice. Fortunately, most often it is of benign etiology and resolves in a short span of time.

In the history, ask about the precise duration of hoarseness. How did it start? Was the onset gradual or sudden? Did it follow prolonged crying? Or, did it result after incessant shouting by an older child? Any history of trauma to the larynx as a part of birth injury, or, during the postnatal period, as a result of fall against a hard object or intubation? Any suggestion that the infant is suffering from floppiness which may point to the diagnosis of cretinism, myasthenia gravis or Werdnig-Hoffmann disease?

Is the child quite lethargic, having feeding problems, tendency to hypothermia and delayed milestones (cretinism)? Any pyrexia which may suggest infection of the larynx? Any history of foreign body?

Physical examination must include laryngoscopy.

Trauma to the Larynx

Birth trauma may cause dislocation of cricothyroid or cricoarytenoid articulations, leading to hoarseness along with, at times, wheeze and fluttering sounds. Another mechanism by which birth trauma may produce hoarseness is through recurrent laryngeal nerve paralysis during forceps delivery. Involvement of only one cord is accompanied by little stridor. However, when both the cords are involved, the child also becomes dyspneic on top of hoarseness and stridor.

Postnatal trauma may result from fall against a hard object, prolonged intubation and high tracheostomy. The resultant injury may be penetrating or nonpenetrating, the latter being deceptive.

Trauma from acute overuse of voice as in excessive crying, screaming or shouting, is a common cause of transient hoarseness. With elimination of the stress and, perhaps, following vocal rest, the voice reverts to normal. In case of chronic hoarseness in singers and screamers, vocal nodules may be detected.

Trauma from heavy cigarette smoking in a teenager may be responsible for hoarseness.

Foreign Body

Laryngeal foreign body hoarseness, croupy cough and aphonia are the major and most frequent manifestations of a foreign body in the larynx. A combination of obstruction and inflammation may cause dyspnea with wheeze and cyanosis, and hemoptysis.

Tracheal foreign body: A tracheal foreign body may also cause hoarseness, cough, dyspnea and cyanosis. The most characteristic signs are, however, audible slap and palpable thud because of momentary expiratory impaction at the subglottic level, and asthmatoid wheeze.

Bronchial foreign body: A bronchial foreign body may produce hoarseness and all other manifestations of a laryngeal or tracheal foreign body. Depending on the degree of obstruction, it may remain symptom-free, cause only some wheeze, or produce obstructive emphysema or atelectasis. If obstructive emphysema or atelectasis is allowed to persist, the outcome eventually may be chronic bronchopulmonary disease.

Congenital Laryngeal Anomalies

Laryngeal webs cause asphyxiation, respiratory distress, severe stridor, and weak and hoarse cry when the obstruction is complete or almost complete.

Congenital laryngeal stridor is characterized by noisy, crowing respiratory sounds, stridor, hoarseness or aphonia, dyspnea, feeding difficulty and poor weight gain. The stridor and other symptoms slowly disappear with growth and development of the airway.

Acute Laryngitis

Acute nondiphtheretic laryngitis (infectious croup), almost always viral in etiology, is characterized by a peculiar brassy or croupy cough, usually accompanied by inspiratory stridor, hoarseness and varying degree of respiratory distress. Four types are recognized:

1. *Acute epiglottitis:* A life-threatening, rapidly progressive infection of the epiglottis and the surrounding structures, it is characterized by sudden onset of high fever, hoarseness, drooling, moderate to severe respiratory distress and stridor during early hours of the night.
2. *Acute infectious laryngitis:* It is characterized by an upper respiratory infection with cough, sore throat and croup. Hoarseness, dyspnea and stridor appear in severe cases.
3. *Acute laryngotracheobronchitis*: This is the most common form of croup. An upper respiratory infection is followed in few days by brassy cough, inspiratory stridor and dyspnea. With progression of the infection lower down, expiratory phase also becomes labored, the child appearing restless and frightened. There may be high fever.
4. *Acute spasmodic laryngitis:* This resembles acute tracheo laryngobronchitis, except that signs of apparent infection are absent. A highly-strung child is predisposed to it.

Acute diphtheretic laryngitis is characterized by noisy breathing, progressive stridor, hoarseness and dry cough. The severity of dyspnea depends upon the extent of obstruction caused by the membrane.

Weakness of Laryngeal Muscles

Generalized muscular weakness as in cretinism, myasthenia gravis and Werdnig-Hoffmann disease may cause hoarseness.

Cretinism in the newborn may, in fact, be suspected from hoarse cry, in association with hypotonia, lethargy, sluggishness, feeding difficulty, persistent jaundice, oversleeping, persistent constipation, abdominal distention with umbilical hernia, cold, rough, dry and thickened skin, a large protruding tongue, an unusually large anterior fontanel and anemia showing poor response to hematinics. It takes another few weeks for the classical features, especially the

facies, and mental and growth retardation to manifest. With this the voice becomes typically hoarse.

In order to confirm the diagnosis, the investigations needed include radiologic studies for stunted bone age, and epiphyseal dysgenesis, serum cholesterol which is raised, serum alkaline phosphatase, FBI, and radioactive iodine (^{131}I) which are low, and plasma TSH which is raised. Most important parameters are T_3 and T_4 which are distinctly reduced.

Myasthenia gravis, resulting from an autoimmune reaction to acetylcholine receptors, may cause hoarseness. In the transient type, which the baby acquires from the mother, the manifestations, other than hoarse, feeble cry, include floppiness, feeding difficulty, feeble respiratory effort, profuse oral secretions and ptosis though the baby appears alert with normal tendon reflexes. Spontaneous recovery may occur in many within 2 to 4 weeks. Excellent response to edrbohonium or neostigmine is a rule. In the persistent type, which is likely to continue throughout life, eyelids and extraocular muscles are severely involved. Rest of the manifestations are those of the transient type. In this type, there is no evidence of the disease in the mother.

Werdnig-Hoffmann disease or infantile spinal muscular atrophy, an autosomal recessive disorder, may be responsible for a weak, hoarse cry in association with gross floppiness, are flexia, fasciculations or fibrillations in the tongue, neurologic involvement of intercostal and bulbar muscles and normal IQ. Respiratory failure, aspiration or a fulminant infection often proves fatal. The family history is often positive. The mother gives history of absence or reduction of fetal movements in utero.

Remaining Causes of Hoarseness

Laryngismus stridilus, chronic granulomatous disease vincristine.

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2. Green M Speech. In: *Pediatric Diagnosis*, 6th edn. Philadelphia: Saunders 1998:56-59.

Chapter 37 Involuntary Movements

The term, *involuntary movements*, applies to unintended movements which occur usually on attempt to carry out a skilled motor act to maintain a given posture, and are usually absent during complete relaxation (rest), more so during sleep. Principally, involuntary movements occur from involvement of basal ganglia, cerebellum or extrapyramidal system.

Tremors

Tremors are regular or irregular, repetitive, rapid movements occurring usually in distal extremities.

Physiologic tremors may occur in normal children and need cause no anxiety, provided that a meticulous CNS examination reveals no defect.

Mental subnormality may often be accompanied by tremors. Acute anxiety usually causes fine and rapid tremors. Infrequently, however, these may be coarse and irregular.

Thyrotoxicosis is characterized by fine tremors of the fingers if the arm is extended. Other manifestations of thyrotoxicosis (Graves disease) include emotional disturbances accompanied by motor hyperactivity, irritability, restlessness, voracious appetite with poor or no weight gain, enlarged thyroid, exophthalmos, excessive sweating, palpitations, dyspnea and cardiomegaly. T_3 and T_4 levels are usually increased.

Hepatolenticular degeneration or Wilson disease is accompanied by rather proximal tremors of the outstretched arms and wrists ("wing-beating" tremor) in association with dysarthria and dystonia at an advanced stage. Non-neurologic manifestations of the disease which occur rather early-include hepatomegaly,

splenomegaly, jaundice, anorexia, edema and ascites, gastrointestinal hemorrhage and hemolytic crisis. Kayser-Fleischer rings are seen in 75% of cases. Serum copper and ceruloplasmin levels are reduced. Liver tissue copper content exceeding 400 mcg/ g dry weight is the most reliable parameter for diagnosis of Wilson's disease.

Benign essential tremors are somewhat coarse and irregular. They occur in distal muscles and become worse in awkward postures such as the outstretched fingers held pointing at each other in front of the nose. They occur as a benign hereditary trait. Interestingly, they subside during movements.

Intention tremors, a sign of cerebellar lesion, are present only during movement and become more marked on approach to the target. In an infant, these can be elicited by inducing him to reach out for a bright object, say a toy.

Hysterical tremors are characterized by involuntary movements of a limb or the whole body which become worse as the examiner attempts to control them. The problem is encountered in older children and adolescents. History may be of considerable help since such a patient is described as having had a variety of bizarre symptoms and signs earlier too.

Maternal drug addiction may be responsible for tremors in the newborn and infants. The drugs blamed include alcohol, phenothiazine, diazepam, heroin and diphenlydramine. In the so-called "fetoalcohol syndrome", many other manifestation occur. These include intrauterine and postnatal growth retardation, microcephaly, mental retardation, ptosis, microphthalmia, and short palpebral fissures. Frequent accompaniments include maxillary hypoplasia, congenital heart disease, hemangioma, abnormal external genitalia, abnormal palmar creases and anomalies of bones and joints.

Drugs given to the child and possibly responsible for tremors include phenothiazines, aminophylline and terbutaline.

Poisoning with thallium may cause tremors. Solvent sniffing is also on record to cause tremors.

Infantile tremor syndrome, a disorders seen almost exclusively in Indian infants and young children and of obscure etiology, is

characterized by tremors, anemia and regression of milestones. Tremors are generalized though most pronounced in distal parts of limbs, especially upper limbs, head, face and tongue (Figs 37.1 and 37.2). Even trunk may be involved. Some infants produce tremulous cry like that of a lamb. They keep tossing their head from side to side with saliva drooling from mouth, and have dull, expressionless look. Mental and motor development is impaired in all. As a rule, tremors disappear during sleep in most cases. In others, their intensity remarkably diminishes. Remaining manifestations include hypotonia, hypochromotrichia with sparse hair, moderate anemia, mental apathy, reticular pigmentation and superimposed nutritional deficiencies.

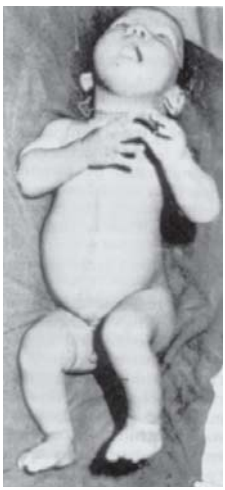

Fig. 37.1: *Infantile tremor syndrome:* Note the tremors, hair changes, chubby appearance despite malnutrition, vacant look and the reticular pigmentation. The infant was anemic with a hemoglobin of 7 g/dl, the peripheral smear and bone marrow being consistent with dimorphic anemia.

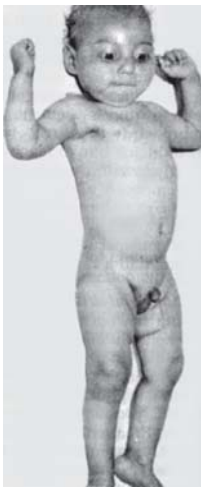

Fig. 37.2: *Infantile tremor syndrome:* Another infant with classical features, precipitated by onset of an episode of lower respiratory tract infection.

Spasmus natans is characterized by rhythmic jerking movements of the head in the form of intermittent head-nodding, usually in the lateral or horizontal direction, together with intermittent nystagmus. The manifestations are noted from the age of 4 to 12 months and disappear spontaneously by the age of 3 or 4 years. The movements disappear when the child concentrates on something and during sleep.

Jitteriness or jittery tremors are provoked by external stimuli and stopped by flexing the limb. These may be perfectly normal in a newborn. These have, however, to be differentiated from convulsive movements which are neither significantly provoked by external stimuli nor stopped by flexing the limb.

Choreiform Movements

Choreiform movements are irregular jerking and writhing movements which may vary from mild to violent intensity so as to render carrying such acts as walking virtually impossible. The causes of choreiform movements include rheumatic fever (Sydenham's chorea) and drugs like phenothiazines. Occasionally thyrotoxicosis and SLE may cause such involuntary movements. In adults, Huntington's chorea and senile chorea are well-known causes of such movements.

Rheumatic chorea, one of the 5 major manifestations of rheumatic fever, is characterized by repeated involuntary movements of the extremities, face and trunk, and emotional stability. Difficulty in walking and speech results from muscle weakness. The condition may be limited to one half of the body, the so-called "hemichorea". Most often, chorea occurs as a solitary manifestation, i.e. without any other evidence of rheumatic activity. Onset may be sudden or insidious. The usual patient is preadolescent or adolescent girl.

The parameters which may help in reaching the diagnosis of rheumatic chorea include: 1. Finger-nose test, 2. Buttoning the clothes test, 3. Dinner-fork position of the outstretched hands,
4. Pronation of forearm when hands are raised above the head
5. "Bag of worms" sign, i.e. tongue making peculiar movements when protruded out, 6. "Milkmaid" sign, 7. Audible "click" during

speech, 8. Clumsiness or inability in writing, 9. Counting the digits, 10. Ataxia. 11. Sustained, "hung-up" or double knee jerk, and 12. Brisk deep tendon reflexes.

Mild chorea may be confused with tics. A dependable distinguishing feature is that tics are stereotyped sudden movements that are seen in the same group of muscles against chorea in which one does not know which group of muscle is to show movement next. Also, tics can be voluntarily controlled for a while which is unlikely in case of choreiform movements.

Tics

Also termed habit spasm, tics are fast repetitive movements that are frequently stereotyped but alterable at will. They occur most often in school-going children and are usually a reflection of home conflict, emotional disturbance, maladjustment and other factors contributing to insecurity. Generally, they are an "outlet" for the pent up anger and worrisomeness following control of aggression from the parents or teacher. Various types of tics include twitching the face, blinking the eyes, shoulder shrugging, gaping (inappropriate mouth opening), tongue sniffing, etc.

A rare type of tic in which extensive and varied bodily movement, including head jerking, are accompanied by vocalization (say barking, hissing originating) is called Tourette syndrome (also, Gilles de la Tourette syndrome).

Drugs blamed for causing tics include amphetamine.

Athetosis

Athetotic movement, also called “choreoathetosis”, are slow writhing movements, generally more remarkable in distal muscles, consisting of alternating supination-pronation and flexin-extension of the extremity. The movements tend to disappear during sleep. Athetosis, when very severe, may have involvement of axial muscles and trunk so much and so that the subject is hardly in a position to stand. This situation, dystonia musculorum deformans, or torsion dystonia or spasm, occurs in 5 to 10-year-old. The overall picture is that of a young child with hypertonia of calf muscles resulting in inversion and adduction of the foot, followed by adduction and fixed flexion of hip together with

lordosis, torticollis and writhing movements as if the child is twisting something.

Athetosis, particularly when bilateral, occurs usually in degenerative diseases of the basal ganglia, especially Wilson's disease, Huntington chorea, etc.

Drugs blamed for athetosis, particularly dystonia, include phenothiazines, metoclopramide, haloperiodol, and amitriptyline.

Convulsions

See Chapter 12.

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Chapter 38

Irritability

Irritability

Irritability-to be exact, excessive irritability-means exaggerated reaction to a stimulus so that the child demonstrates excessive crying and fretfulness and fails to be calmed down by accepted means such as being held, fed, played with or changed the nappy.

While questioning the parents, find out if the mother had been taking such drugs as narcotics during pregnancy. Is he beginning to erupt teeth? Is he on any drug, say phenobarbital? Is he febrile? Is he vomiting? Did he sleep well? Any cough, ear discharge, drooling, diarrhea or constipation? Any suggestion of colic? Any history of food intolerance? Does he have pruritus, especially in the presence of pinworm infestation.

Physical examination should, in particular, exclude CNS infection, otitis media, urinary tract infection, pneumonia, and gastroenteritis. Make a special note of the "cry" (Table 38.1).

Narcotic Withdrawal Syndrome

Excessive irritability may occur in babies born to mothers addicted to narcotics a few days after birth. Such an infant is usually small-for-dates or preterm. He has excessive drooling, diarrhea or constipation. He coughs and sneezes frequently. He is very irritable and tremulous.

Serious Infections

Undue irritability in the neonatal period should be considered indicative of meningitis or septicemia, unless, of course, an obvious cause is found out. Other manifestations may include high-pitched and shrill cry, fever or hypothermia, feeding difficulty and lethargy

Table 38.1: "Cry" as a clue to diagnosis

Nature of cry	*Likely state*
Normal	Hunger
	Wind
	Soiling of nappies
	Loneliness
High-pitched shrill	Cerebral irritation
	Meningitis
	Hydrocephalus
	Kernicterus
Hoarse, croaky gruff	Hypothyroidism (cretinism)
Cat-like mewing	Cru-di-chat syndrome
Bleating, lamblike	Cornelia de Lange syndrome
	Infantile tremor syndrome
Crowing	Laryngeal conditions like laryngomalacia
Weak	Amyotonia congenita
	Gross malnutrition
Grunting, Whimper	Pneumonia
	Critically sick child

alternating with excessive crying. Seizures may occur though meningeal signs may be absent. A raised anterior fontanel helps, so does the finding of a septic focus such as umbilical sepsis (Fig. 38.1).

Other infections that may contribute to irritability include otitis media, urinary tract infection, pneumonia and gastroenteritis.

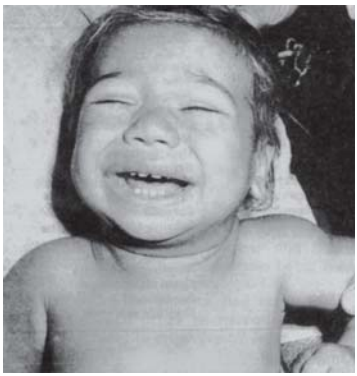

Fig. 38.1: Excessive crying and irritability in a child whose CSF turned out to be consistent with pyogenic meningitis. His cry was characteristically high-pitched and shrill.

Teething

Sharp edge of a tooth cutting through the gums may be responsible for undue irri-

tability. On inspection, gums appear red and swollen and there is excessive drooling.

Colic

Paroxysmal irritability may be related to colic. The condition occurs usually early in infancy and is characterized by recurrent acute abdominal pain. The infant gives shrill cry, sweats profusely and draws his legs to the chest.

Insecurity

A child, otherwise hale and hearty, may react to want of love, punishment or undue strictness and authoritarianism by throwing tantrums of incessant irritability.

Food Intolerance

Irritability is an important manifestation of gluten-induced enteropathy (gluten-sensitivity, or celiac disease). Other manifestations include chronic diarrhea with large pale, highly foul-smelling stools which stick to the pan, growth failure, nutritional deficiencies, abdominal distention and anorexia. The disease manifests a few months after the introduction of gluten-containing foods, say a wheat preparation, in the infant's diet. Investigations show steatorrhea, D-xylose malabsorption and varying degree of villus atrophy. Response to withdrawal of gluten from diet is gratifying. Gluten challenge leads to reappearance of the clinical, functional and histological abnormality.

Phenylketonuria (PKU), though very rare in our setting, is an important cause of excessive irritability. Other manifestations include vomiting, anorexia, excessive sweating, eczema, blond hair and blue eyes. Convulsions, mental retardation with hyperactive personality and erratic behavior become obvious as the child grows. The diagnosis in this here do familial autosomal recessive disorder due to deficiency of enzyme, phenylalanine hydroxylase, is confirmed by demonstrating serum phenylalanine level exceeding
1.5 mg% and by ferric chloride test or phenistix paper strips showing excess of phenylalanine and its metabolites.

Hypoglycemia

A school going child in the habit of reaching home in bad temper is very likely to show gratifying response to a hearty meal. The obvious cause is hypoglycemia.

Pink Disease (Acrodynia)

Excessive irritability is an important feature of pink disease resulting from mercury poisoning. Other manifestations include pinkness of hands and feet, constant crying, photophobia and undue sweating.

Drugs

Phenobarbital, primidone, ethionamide, cycloserine, hyoscine, cyclopentolate, fenfluramine, aminophylline, acetazolamide, thyroxine, imipramine, troxidone, ephedrine, amphetamine, clonezepam, antihistaminics, etc.

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Chapter 39 Jaundice

The term, *jaundice* or *icterus*, denotes yellowness of the scleral conjunctiva and skin due to hyperbilirubinemia. Yellow coloration of the skin caused by caroteinemia, due to ingestion by the child or the lactating mother of excess of carrots and other green vegetables, or associated with hypothyroidism, nephrotic syndrome and diabetes mellitus, should not be confused with true jaundice. Excess consumption of tomatoes, tomato juice and commercial infant foods treated with the coloring matter in them (lycopene) may also impart to the skin an orange or reddish-yellow color. This condition is called lycopenemia. Yellow staining may also occur from certain drugs such as mepacrine. Note that there is no rise in the serum bilirubin level in all these situations. In the postmaturity and placental dysfunction syndrome, baby's skin may have a yellow tinge because of the meconium staining.

Jaundice in the newborn is a common observation being encountered in about 75% of the babies. Undoubtedly in vast majority it is physiologic, resulting from insufficiency of the liver enzymes to deal with the bilirubin liberated following normal hemolysis. In our experience, based on a prospective study of over 300 hospitalized cases, the relative frequency of various etiologic factors is as follows: physiologic 47%, ABO incompatibility 16%, Rh incompatibility 12%, Septicemia/intrauterine infections 10%, neonatal hepatitis 2%, biliary atresia 2%, G6PD deficiency 2%, breast-milk 1%, cretinism 2%, galactosemia 1%, large cephal-hematoma 2%, undiagnosed/idiopathic hyperbilirubinemia 3%. Quite a few other conditions are stated as causing neonatal jaundice, but their incidence is certainly exceedingly low in Indian settings.

In recording history in case of neonatal jaundice, it is important to enquire about the time of onset of jaundice. For instance, jaundice appearing right at birth or during the very first day of birth is invariably due to blood group in compatibility, intrauterine infections or G-6-PD deficiency. Jaundice first noticed on second or third day is usually physiologic.

Enquire whether jaundice is decreasing or increasing in intensity. What is the infant's general condition whether healthy, having feeding difficulty, fever, rash, seizures or any other abnormal movements? Any history of excessive crying or drowsiness? Is there any pus discharge from the umbilicus? Is there any evidence of bleeding from any site? What is the type of feeding: breast or bottle?

Also, enquire about the maternal and family history with special reference to maternal infection (during pregnancy), drugs taken during pregnancy or labor, previous sibling(s) affected by jaundice or liver disease, and any family history of jaundice or anemia. What is the ethnic group of parents and ancestors?

Physical examination of the newborn presenting with jaundice must assess the severity of jaundice in daylight. Sclera is not easily available for examination in the newborn because of the photophobia. Clinically, one has got to, therefore, count on skin (Fig. 39.1). The touch of jaundice appears relatively early on face, nasolabial folds and tip of nose. At times, even marked jaundice may not be detected unless skin is blanched with a finger, preferring a flat area like forehead. This is observed in infants with red or pink skin. The dark-skinned infant may present difficulties. It is advisable to have a look at the hard palate of such babies. As a rough guide, you may refer to Table 39.1.

Table 39.1: Clinical examination as a clue to level of serum bilirubin in the jaundiced neonate as per Crammer's guidelines

Body surface jaundiced on blanching	*Approximate serum bilirubin*
Face	5 mg/dl
Chest and upper abdomen	10 mg/dl
Lower abdomen	12 mg/dl
Legs	15 mg/dl
Soles and palms	> 15 mg/dl

Also, assess the gestational age, activity and general condition of the baby. Is the umbilicus healthy or septic? Is there any evidence of hemorrhage, petechiae, etc? Any congenital malformation? Any neurologic finding? What is the size of liver and spleen? Is the baby significantly anemic? Any cephalhematoma? What is the color of urine and stools?

Fig. 39.1: *Neonatal jaundice*
Dermal zones are a good guide for magnitude of hyperbilirubinemia.

Jaundice in the later infancy and childhood has altogether different etiology. Viral hepatitis is the most commonly encountered entity in this age group.

History must seek information whether the onset has been insidious with vague symptoms or acute with fever, anorexia, vomiting, right upper quadrant abdominal pain and high-colored urine. Any history of abdominal distention and lump(s) in abdomen? Is the child becoming progressively anemic? (Any history of intake of hepatotoxic drugs? Any symptoms of urinary tract infection? Has the child lost considerable weight? Any delay/regression in milestones? Any restlessness, confusion or change in sensorium? Any flopping tremors?

Find out if there have been cases of jaundice in the family or neighborhood. Did the parents lose earlier a child or two as a result of liver problem? Did the patient get exposed to a case of acute jaundice some weeks ago? Did he have some kind of injection, drip or blood transfusion in the last 3 or 4 months?

A detailed dietary enquiry must explore history of early introduction of feeds contaminated with copper from copper and/ or brass utensils.

Physical check-up should ascertain the extent of jaundice. Does the child have hepatosplenomegaly? What is the liver consistency surface and border like? Is there any evidence of portal hypertension in the form of caput medusae, ascites, esophageal

varices, etc.? How is the state of consciousness? Is the child heading for hepatic coma?

JAUNDICE IN THE NEWBORN

Table 39.2: lists etiology of neonatal jaundice according to age of onset. Causes of unconjugated hyperbilirubinemia are given in Table 39.3.

Table 39.2: Important causes of neonatal jaundice based on age of onset

First day
Rh and ABO incompatibilities (hemolytic disease of the newborn)
Intrauterine infections like toxoplasmosis and cytomegalic inclusion disease
G-6-PD deficiency
Hereditary spherocytosis
Drug administration to mother (vitamin K, sulfisoxazole, salicylates)
Homozygous alpha-thalassemia
Second and Third Day
Physiologic
Hyperbilirubinemia of newborn
Birth asphyxia
Cephalhematoma
Acidosis
Hypothermia
Hypoglycemia
Drugs
Familial nonhemolytic icterus as in Crigler-Najjar disease, Gilbert disease, Dubin-Johnson syndrome
Fourth to Seventh Day
Septicemia
Syphilis
Toxoplasmosis
Cytomegalic inclusion disease
Extrahepatic atresia of bile duct
Breast-milk jaundice
After First Week
Septicemia
Extrahepatic atresia of bile duct
Hereditary spherocytosis
Neonatal hepatitis
Drug-induced hemolytic anemia
Galactosemia
Persistent Jaundice during First Month
Inspissated bile syndrome
Cretinism
Congenital hypertrophic pyloric stenosis

Table 39.3: Causes of unconjugated hyperbilirubinemia

Physiologic
Pathologic
Increased Production of Bilirubin
- Hemolytic disease of the newborn: Rh isoimmunization, ABO incompatibility, minor blood group incompatibility
- Hereditary spherocytosis
- Nonspherocytic hemolytic anemia: G-6-PD deficiency, pyruvate kinate deficiency, alpha-thalassemia
- Acquired hemolysis disorders: Vitamin K_3 -induced hemolysis, microangiopathies
- Septicemia
- Increased enterhepatic circulation: Intestinal obstruction, congenital hypertrophic pyloric stenosis, meconium ileus paralytic ileus, Hirschsprung disease

Decreased Clearance of Bilirubin
- Inborn errors of metabolism: Familial nonhemolytic jaundice (Crigler-Najjar syndrome) type I and II, Gilbert disease
- Medications:Vitamin K_3
- Hormones: Breast-milk jaundice, hypothyroidism, hypopituitarism

First Day

Blood group incompatibility ABO incompatibility or ABO hemolytic disease is by far the most common form of incompatibility and the most common cause of neonatal jaundice. The most common type involves group 'O' mother and group 'A' or 'B' infant though other in compatibilities also occur. Jaundice is usually mild and nonobstructive. In the presence of such adverse/predisposing factors as prematurity, hypoxia, infection, acidosis, hypoglycemia, hypothermia, and cephalhematoma, its intensity (as measured by bilirubin level in blood) may assume critical level.

Accompanying manifestations may include mild anemia and hepatosplenomegaly that is seldom gross.

Diagnosis is supported by demonstration of reticulocytosis, microspherocytosis and high fragility of red cells. In differentiating from spherocytosis, you may remember that in the latter condition one parent and, sometime, a sibling is affected. Moreover, mother's serum does not contain immune anti-A or anti-B bodies except

by coincidence. High titer of IgG hemolysis in maternal blood against infant's blood strongly favors the diagnosis of ABO incompatibility. Also, indirect Coombs' test is generally positive and direct Coombs' is negative. Acetylcholinestrase activity of cells is normal or only marginally low.

Rh incompatibility or hemolytic disease must always be excluded if severe jaundice appears on the first day of birth. The problem arises when a Rh negative mother carries Rh positive baby. The first baby is usually not affected unless, of course the mother had an earlier abortion or blood transfusion with Rh positive blood.

1. Hydrops fetalis is the severest form of the disease. The infant is born preterm with gross edema and effusion in serious cavities and massive hepatosplenomegaly. There is history of placenta having been large and edematous.
2. Icterus gravis is relatively less severe form of the disease and occurs when hemolysis in utero is not very intense. Deep jaundice appears during the first 12 to 24 hours. Progressive anemia and hepatosplenomegaly are invariably present. Some affected babies may have purpura. Incidence of kernicterus is high. Those who manage to survive are often left with crippling sequelae.
3. Congenital hemolytic anemia is the mildest and also the rarest form of Rh hemolytic disease. Jaundice, if present is slight. Anemia and hepatosplenomegaly are often detected towards the end of the first week or later.

Diagnosis, if not already made antenatally (mind you, in case of ABO incompatibility, antenatal diagnosis is not yet possible), has got to be made immediately after birth if serious consequences are to be prevented. The foremost investigation is to demonstrate that the mother is Rh negative whereas the infant is Rh positive. Occasionally, a Rh positive infant may type as Rh negative because of the "blocking antibodies". If possible, father's Rh group should also be determined. Secondly, direct Coombs test on infant's red cells is positive and anti-Rh titer of mother is high. Remaining investigation show high serum bilirubin (indirect or unconjugated), reticulocytosis, anemia, anti-Rh agglutinins and hypoglycemia.

Intrauterine infections: Toxoplasmosis, cytomegalic inclusion disease, and rubella are the leading intrauterine infections that may cause jaundice on the first day or any time during the neonatal period. The infection occurs antenatally by the passage of organisms across the placenta.

Jaundice in the newborn with congenital toxoplasmosis is accompanied by such manifestations as maculopapular rash, pyrexia, poorfeeding, hepatosplenomegaly, lymphadenopathy, microphthalmia, microcephaly/hydrocephalus, seizures, choreoretintis and cerebral calcification, singly or in some combination.

Congenital rubella may cause jaundice in a proportion to the newborns on the first day, the incidence being much less than in the case of toxoplasmosis. The remaining manifestations of the disease include congenital heart disease, hepatosplenomegaly, low birth weight, thrombocytopenia, interstitial pneumonia, cataracts, retinopathy, bone lesions, lethargy, irritability, bulging anterior fontanel and disturbances of tone.

Neonatal jaundice is seen in relatively higher frequency in cytomegalic inclusion disease, also called cytomegalovirus (CMV) infection than in the toxoplasmosis and rubella. The remaining manifestations include hepatosplenomegaly, petechial rash, microcephaly, chorioretinitis and cerebral calcification.

G-6-PD deficiency Jaundice from this X-linked recessive disorder that has emerged as a leading cause of neonatal jaundice, especially among the Mediterranean, African, Chinese and Indian stock, may occur right at birth or any time postnatally. It may be severe enough to warrant resort to exchange blood transfusion to guard against risk of brain damage. The enzymatic deficiency causes failure on the part of the red cells to utilize glucose. The cell membrane suffers and hemolysis follows. In order that significant hemolysis occurs some offending agent (usually a drug such as primaquine, vitamin K, sulfa, chloramphenicol, salicylate, etc. but not uncommonly such adverse factors as hypothermia, hypoglycemia, hypoxia, acidosis, infection, etc.) is needed to trigger off the process. Majority of the newborns are born preterm.

Second or Third Day

Physiologic jaundice: In full term infants, insufficiency of the liver enzymes to deal with the bilirubin liberated as a result of normal hemolysis may lead to appearance of jaundice on second (at the end) or third day of life. It is usually mild and disappears by 7-10th postnatal day due to the maturation of the liver function (Fig. 39.2). Occasionally, however, serum bilirubin may exceed 12 mg% and jaundice may take 10 to 14 days to disappear.

In preterm infants, jaundice is relatively deeper (sometime serum bilirubin may be as high as 15 mg%) and takes more days to disappear. Also termed jaundice of immaturity, it results from the same mechanism as in the full term infant. As a rule, it appears also on second or third day. It may not reach its peak until the sixth or seventh day.

What needs further emphasis (even at the cost of repetition) is that physiologic jaundice does not make the baby sick and inactive. The liver and spleen are not enlarged. Umbilicus is healthy. The urine and stools are normal in color. If the clinical picture is different from this description, the diagnosis needs revision. You may have to any certain investigations to arrive at the precise etiology. Important factors that have adverse effect on physiologic jaundice include prematurity (excessive and prolonged immaturity of the liver cells to produce the enzyme, glucornyl transferase), birth asphyxia, acidosis, hypoglycemia, hypothermia,

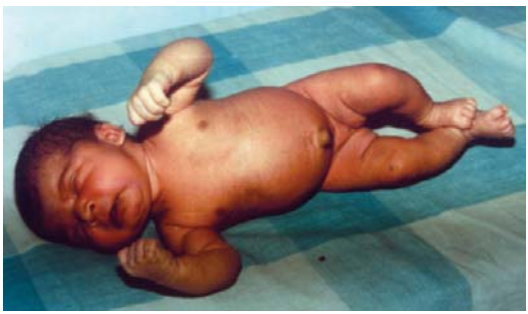

Fig. 39.2: *Neonatal jaundice* Note that the physiologic jaundice, first noticed on 3rd day, is in the process of regressing in this 8-day-old baby.

cephalhematoma, intrauterine or acquired infection, cretinism, possibly breast-milk, and drugs such as vitamin K, novobiocin, kanamycin, furazolidine, nitrofurantoin, sulfas, chloramphenicol, gentamicin, salicylates, steroids, contraceptive pill, etc.

Hyperbilirubinemia of the newborn: The term is applied to those preterm infants whose physiologic jaundice becomes considerably exaggerated so much and so that the infant is at a risk to develop kernicterus from neurotoxicity of unconjugated bilirubin. The primary problem appears to be a deficiency/inactivity of the enzyme, glucornyl transferase, and not the excess load of bilirubin for excretion.

Familial nonhemolytic jaundice: In rare disorders, Crigler-Najjar syndrome, Dubin-Johnson syndrome, Gilbert's disease and Rotor's syndrome, there is inability of the liver cells to excrete conjugated bilirubin, resulting in bile in the urine. Familial glucuronyl transferase inhibition/inactivity/deficiency operates as the fundamental cause in all of them.

Fourth to Seventh Day

Septicemia: Jaundice appearing after the third day and until the seventh day strongly suggests septicemia as the probable cause. Besides jaundice, the infant may have poorfeeding, vomiting, lethargy, irritability, fever or hypothermia, abdominal distention, hepatosplenomegaly and respiratory distress. Neonatal reflexes are sluggish often, umbilicusis unhealthy or there is evidence of septic focus elsewhere. Incidence of meningitis as a complication is high. Development of scleroma is a bad prognostic sign.

Blood culture is important to establish the diagnosis as also for guidance in therapy. In a large majority of the cases, E. coli and group B streptococcus are responsible for the disease. The remaining organisms include Staphylococcus aureus, Enterococcus, Klebsiella, Enterobacter sp., Pseudomonas, Proteus sp., Listeria monocytogenes and anaerobic organisms.

Recently, quite a few studies have registered rising incidence of Klebsiella aeurogenosa in the etiology of neonatal septicemia. During 1980-85, it emerged as the dominant causative agent at the Postgraduate Institute of Medical Education and Research,

Chandigarh. In subsequent years, similar reports have appeared from many other centers.

Breast-milk jaundice Infrequently (1 in 200 breastfeed term infants), significant unconjugated hyperbilirubinemia, (causing jaundice, that leads to no pathologic problem such as kernicterus) described to breast-feeding may occur between fourth to seventh postnatal day. Its cause is not clear. Of course, it could possibly result from presence of 5 beta-pregnane-3 alpha, 20 beta-diol and nonesterified long-chain fatty acids in the milk of some of these mothers, leading to competitively inhibited glucuronyl transferase activity. In other instances, alipase in milk may be responsible for jaundice. Another simple explanation is that relative dehydration which is common in the first few days may account for some of the cases.

The kind of jaundice shows its peak in the third week and then gradually disappears.

Though discontinuation of breastfeeding is known to rapidly lower the serum bilirubin level, there is no need to stop breastfeeding even temporarily unless the level reaches a critical point.

Large cephalhematoma: This otherwise benign, self-limited condition characterized by a nonpulsatile swelling, usually over the parietal or occipital region, that neither crosses the suture line nor increases in size on crying, may be large enough to cause massive overloading of the liver with bilirubin. If the liver fails to conjugate this excess bilirubin; jaundice may occur. At times, jaundice may be severe enough to warrant aspiration of the cephalhematoma.

Intrauterine infections: Between fourth to seventh day too, intrauterine infections, say syphilis, toxoplasmosis and cytomegalic inclusion disease, may cause jaundice.

Neonatal hepatitis: Jaundice due to neonatal hepatitis is usually first noted in the first week (in a large majority about the seventh day) but may appear at any time during the first month and even upto 3 months.

In almost 70% cases, no specific cause can be found. Hence, the term idiopathic neonatal hepatitis has been suggested for this

category of cases. The term, neonatal hepatitis syndrome implies that a group of disease entities, predominantly viruses, may cause a similar clinical picture. The causes include: (1) Viruses: hepatitis B, herpes simplex, rubella, cytomegalovinis, coxsackie B, adenovirus, (2) Bacteria: septicemia, urinary tract infection, syphilis, (3) Protozoa: toxoplasmosis, (4) Metabolic: galactosemia, alpha-l-antitrypsin deficiency, cystic fibrosis, Rotor's syndrome, Niemann-Pick disease, and (5) Chromosomal: Turner's syndrome, Trisomy 13-15,16-18 and 21.

Idiopathic neonatal hepatitis, also termed giant cell hepatitis, occurs twice as frequently in boys as in girls. It may occur in 2 or 3 infants of the same family. The incidence in premature babies is higher. Jaundice appearing in the first week or later may be the only complaint, or there may be accompanying manifestations like poor feeding, anemia, vomiting, high-colored urine, intermittent loss of pigment from stools, and hepatosplenomegaly. Liver is grossly enlarged and has firm consistency. Spleen is only moderately enlarged and that too in only half of the cases. Occasionally, thrombocytopenic purpura may occur.

Investigations show high serum hyperbilirubinemia (mostly conjugated), high SGPT, high alkaline phosphatase, and slightly prolonged prothrombin time. Rose-Bengal excretion in stools exceeds 15%. Australia antigen may be positive.

Liver biopsy shows multinucleated giant cells with complete loss of normal pattern of hepatic lobules and increased fibrous tissue around necrotic liver cells as also in portal tracts. Extrahepatic bile ducts are normal unless, of course, the disease has advanced considerably.

Contrary to the belief until recently, steroid therapy is of non-proven value. Complete recovery occurs in 75% of the subjects within a year without any specific treatment. The remaining 25% progress to chronic liver disease.

Extrahepatic biliary atresia: This obliterative disorder of the extrahepatic bile ducts is the most frequent cause of persistent jaundice that is first noticed about the seventh postnatal day. Quite often, jaundice appears to be a continuation of the physiologic jaundice of the newborn. It is mild to begin with but slowly and

progressively it becomes severe. Jaundice seemingly deepens and lightens alternately. Urine is heavily bile-stained. Despite absence of bile in stools, the latter may not become typically clay-colored and putty-like early enough. It is said that, in early neonatal life, jaundiced intestinal epithelium may be sloughed off and added to the bulk of the stool, thereby not letting the latter appear clay-colored. With progression of the disease, skin becomes bronze, olive-green in color. Hepatosplenomegaly and vitamin deficiencies (hemorrhages due to vitamin K deficiency) may occur.

Main differential diagnosis is from neonatal hepatitis (Table 39.4). An important diagnostic measure is the Rose-Bengal test which shows less than 10% fecal excretion of ^{131}I and ^{132}I as against over 15% in case of neonatal hepatitis.

Table 39.4: Neonatal hepatitis vs biliary atresia

Feature	*Neonatal hepatitis*	*Biliary atresia*
Sex	Predominantly in males	Predominantly in females
Jaundice	Peak moderate mild	Mild moderate severe
Activity	Normal or slow	Normal
Hepatosplenomegaly	Early	Late
Liver function tests	Grossly abnormal (except alkaline phosphatase) which is only marginally high)	Slightly abnormal (except alkaline phosphatase which is considerably high)
Rose-Bengal test	Over 15%	Under 10%
Liver biopsy	Giant cells	Dilatation and hyperplasia of bile canaliculi
Cholangiogram	Normal	Reveals block
Australia antigen	May be positive	Negative

Liver biopsy should be done in each and every case. Important findings include bile duct and ductular proliferation, hypertrophic changes in hepatic artery branches, bile plugs in dilated ducts, fibrosis, inflammatory changes and giant cell transformation.

In instances where no single test or battery of tests has conclusively differentiated the biliary atresia from neonatal hepatitis, you may resort to operative cholangiography before 8 weeks of age to demonstrate the patency or obliteration of bile ducts.

After First Week

Septicemia

Neonatal hepatitis

Extrahepatic biliary atresia

Break milk jaundice

Congenital or hereditary spherocytosis Also called congenital acholuric jaundice, this disease, occurring usually in people of north European origin, may occasionally present in neonatal period with jaundice and anemia. The spleen is enlarged in some cases. Rarely, hyperbilirubinemia may be severe enough to warrant exchange transfusion because of the serious risk of kernicterus. Investigations show reduced hemoglobin, reticulocytosis, erythoblastemia, increased fragility of red cells, microspherocytes, raised indirect serum bilirubin and urobilinogenuria.

Drug-induced hemolytic anemia This occurs in congenital deficiencies of the enzymes G-6-PD, glutathione, synthetase, reductase or peroxidase. The commonly-encountered drugs in causing hemolytic anemia thereby icterus include overdose of vitamin K, sulfas or camphor.

Persistent Jaundice During First Month

Intrauterine infections

Neonatal hepatitis

Extrahepatic biliary atresia

Familial nonhemolytic jaundice

Inspissated bile syndrome: In this rare condition, persistent jaundice in association with considerable rise in direct as well as indirect serum bilirubin occurs in infants with hemolytic disease,

Congenital hypothyroidism: Unusual prolongation of the physiologic jaundice may be the earliest sign of cretinism. The cause is delayed maturation of the enzyme, glucuronyl transferase. The infant is considerably heavier at birth than normal newborns and may also have feeding difficulties, sluggishness, respiratory problems, somnolence, obstinate constipation, refractory anemia, cold and mottled skin, umbilical hernia, widely open fontanels, and edema of genitalia and extremities.

Radiology shows retardation in bone age. For instance, the lower femoral center, normally present at birth, is usually absent.

T_3, T_4 and TSH assay is important to establish the diagnosis.

Galac-tosemia In this rare autosomal recessive disorder, due to absence of the enzyme, galactose-l-phosphate-uridyl transferase, which is responsible for converting galactose to glucose, galactose accumulates in blood and tissues.

No sooner does the infant take milk than he develops manifestations which include, besides jaundice, poorfeeding, vomiting and failure to thrive. Hypoglycemic convulsions may occur. Hepatomegaly is usually present though development of splenomegaly takes sometime. Pseudotumor cerebri may accompany the clinical picture.

Delay in absolute withdrawal of milk and its products may cause cataracts and mental retardation.

JAUNDICE IN LATER INFANCY AND CHILDHOOD

Viral Hepatitis

This is by and large the most common cause of jaundice in children beyond one year of age. For details see page 242.

Cirrhosis of Liver

A large number of diseases such as atresia of the bile duct, neonatal hepatitis that has failed to clear, cystic fibrosis, Wilson disease, galactosemia, glycogen-storage disease, syphilis and schistomiasis may cause cirrhosis. In India, over 90% cases of childhood cirrhosis are accounted by what has been designated as Indian childhood cirrhosis. Its counterpart in West Indies is known as Jamiacan cirrhosis or veno-occulsive disease of the liver.

Indian childhood cirrhosis; a familial disease of unknown etiology (though contamination of feeds with copper appears to be the most likely cause), occurs predominantly in male children, 1 to 5 years of age, from middle-class families, usually having vegetarian dietary background.

The common form, insidious onset disease, is arbitrarily divided into three stages:

First stage consists of sheer vague manifestations. Liver is enlarged by 3 to 5 cm and has a firm feel with sharp, leafy border. Abdominal distention, anorexia or voracious appetite, lassitude, irritability, slight fever, constipation/diarrhea with clay-colored, sticky, formed stools and growth failure may be present.

Second stage is characterized by further exaggeration of the manifestations of the second stage. Liver size is increased and liver feels firmer now. Definite jaundice is evident. In addition, manifestations of portal hypertension dominate the picture. These include splenomegaly, ascites, hematemesis, anemia, prominent superficial abdominal venous network and thrombocytopenia.

Third stage, the terminal phase, is characterized by apathy, emaciation, deep jaundice, protuberant abdomen with prominent superficial veins and ascites. Liver is, as a rule, grossly enlarged but may be shrunk in an occasional case. Spleen is usually considerably enlarged and hard. In addition, there usually exists manifestations of hepatocellular failure. Restlessness and confusion may eventually pass on to frank hepatic come in which case flopping tremors of the arms are observed. The child dies at this stage either from hepatocellular failure per se or intercurrent infections.

Total duration of illness varies between 6 months to 3 years. In the relatively less common form, acute onset disease, the condition suddenly manifests with jaundice, fever, clay-colored stools and hepatomegaly. All this may have rapid downhill course, the child finally dying in hepatic coma. Some cases become asymptomatic for a variable period and then again have reappearance of the manifestations which behave like ICC of insidious onset.

Toxic Hepatitis

Drugs and agents causing hepatitis and thus jaundice include ampicillin, cephalexin, chloramphenicol, cotrimoxazole, erythromycine stolate, ethambutol, kanamycin, nalidixic acid, neomycin, oleandomycin, sulfas, streptomycin, rifampicin, vincristine, acetazolamide, amitriptyline, vancomycin, tetra-cyclines, PAS, penicillin, phenacetin, paracetamol, anabolic steroids, amphetarnine, testosterone, chloroquine, quinine, thiouracil, troxidone, carbamazepine, clonidine, carbamazepine, clonidine, ethionamide, ethosuximide, phenothiazines, diphenyl-hydantoin, noviobiocin, ibuprofen, haloperiodol, griseofulvin, lin-comycin, methotrexate, nitrofurantoin, pyrazinamide, solvent sniff-ing.

Hemolysis

Jaundice resulting from hemolysis is characterized by normal col-ored stools (not clay-colored) and normal urine (not high-colored).

Thalassemia major also called Cooley's anemia or Mediter-ranean anemia, starts manifesting about 3 months of age with progressive pallor, growth failure, jaundice of varying degree and hepatosplenomegaly. Recurrent respiratory infections are common. Lymphadenopathy may be present. Physical retardation of growth may be accompanied by hypogonadism. Facial appearance is characteristic with frontal boss-ing, prominent maxilla (exposing the teeth), depressed bridge of nose and malocclusion of teeth. The appearance is termed thalassemic or hemolytic facies. Increased pigmentation of skin due to high level or melanin in epithelium and hemosiderin in dermis may be observed.

Blood picture shows a microcytic-hypochromic anemia (usually hemoglobin between 4 to 9 g% range), anisocytosis, poikilocytosis, moderate basophilic stippling, nucleated and fragmented erythrocytes, target cells, large number of normoblasts and reticulocytosis.

Bone marrow shows erythroid hyperplasia.

Osmotic fragility test reveals a reduced fragility.

Fetal hemoglobin measured by electrophoresis exceeds 40% of the total.

Radiologic picture is characteristic.

Sickle-cell anemia, relatively infrequent in most parts of India, is caused by the presence of all the body hemoglobin in the form of Hb-S. Slight jaundice invariably accompanies progressive anemia with fever, headache, arthritis, osteopathy of metacarpals and phalanges in particular, skin ulceration, nocturnal enuresis, growth retardation and folic acid deficiency. Splenomegaly occurs in early years but, as the disease progresses, spleen shrinks the so-called autosplenectomy. Incidence of superadded bacterial infections and anesthetic complications is high. Hemolytic, vaso-occlusive and aplastic crises may occur.

Besides usual evidence of hemolysis in the blood picture, an added characteristic findings is the "sickle-shaped" red cells.

Electrophoretic pattern shows 50 to 100% hemoglobin as Hb-S and increased level of Hb-F.

Congenital or hereditary spherocytosis, also, called congenital acholuric jaundice, is uncommon in India. When it manifests in postnatal period, jaundice is slight. Anemia is, however, variable from family to family. Spleen is invariably enlarged. Incidence of aplastic crises is high. Pigmentary gallstones occur usually in later childhood or adolescence.

Besides evidence of hemolysis, one must demonstrate basic defect of the red cells by osmotic fragility studies.

Autoimmune hemolytic anemia, idiopathic or secondary to drugs such as penicillin, cephalosporins, phenacetin, quinidine, alpha-methyldopa, etc. lymphoma, systemic lupus erythematosus (SLE) or immunodeficiency, occurs in two patterns.

1. Acute transient type, occurring usually in infants and young children, follows an infection with such manifestations as pallor, jaundice, prostration, fever and hemoglobinuria. Splenomegaly is present. Complete cure occurs following prolonged steroid therapy.
2. Chronic prolonged type is characterized by anemia and slight jaundice on top of a systemic disease. Hemolysis goes on and on for quite a few months or years. Response to steroids is not quite gratifying.

Investigations show considerable spherocytosis, polychromasia, remarkable reticulocytosis, leukocytosis and, occasionally thrombocytopenia. The association of autoimmune, hemolytic anemia with warm antibodies and immune thrombocytopenic purpura is termed Evans syndrome. Direct Coombs' test is strongly positive. Free antibodies, active at 37°C (warm antibodies) and belonging to IgG class may be detected in some cases.

Autoimmune hemolytic anemia with cold antibodies may occur as cold agglutinin disease in association with viral infections, infectious mononucleosis or mycoplasma pneumonia, or paroxysmal cold hemoglobinuria often in association with syphilis. Jaundice and anemia are found universally in these subjects.

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Chapter 40 Joint Pain

Joint pain is a common complaint in pediatric practice. I encounter it in approximately 10% of the children I see in the outpatients' wing. The incidence reached at in a study from south India is 6.5%, from Mumbai 11.2% and from Kolkata 9%.

The terms, *arthritis* and *arthralgia*, need clarification. Arthritis denotes inflammation of a joint manifested by pain, heat, redness and swelling. Arthralgia means simply pain in the joint, implying absence of inflammation. When we use the term arthralgia, the pointer is towards a definite pathological condition of the joint of some etiology. Whether it is a manifestation of local or systemic illness-obvious or yet to be determined-is altogether a different matter.

During symptomatic enquiry, ask if the pain is in a single joint or number of joints. If only one joint is involved, ask if there has been a history of trauma to the joint. Is the joint visibly swollen? Any limitation of movements? Any increase in pain on weight bearing or movements? Any fever and other signs of toxemia suggesting local sepsis? Any history of bleeding disorder, say hemophilia? Any complaint of bleeding, spongy, gums, excessive irritability and malnutrition (scurvy)?

In case of pain involving multiple joints, find out if the pain is simply arthralgia or arthritis. Is the joint involvement migratory (also termed fleeting or flitting)? Whether the large weight-bearing or small joints are involved? Any fever or other systemic manifestations? Any preceding history of sore throat? Any suggestions of septicemia or some such illness? Any history of drug misuse? Is the patient a known case of sickle-cell anemia, ulcerative colitis, Henoch-Schönlein purpura, etc.?

Physical examination must seek to clarify if the problem is arthritis or arthralgia, the specific joint(s) involved, status of the cardiovascular system (any carditis with or without congestive cardiac failure?), signs pertaining to skin and muscles, organomegaly, etc.

Trauma

As and when pain is confined to a single joint and there is deformity, swelling, discoloration, restricted mobility, hike in pain on movement or weight-bearing, effusion or hematoma, particularly without general symptoms, you must suspect trauma. The trauma may have caused hemarthrosis, effusion, strained ligaments, sprained muscles, dislocation or fracture.

Pulled elbow or traumatic subluxation of the radial head (nursemaid's elbow, Chassaignac paralysis), occurring quite commonly in children in 1 to 4-year-age group, results from sudden forceful jerk applied by a parent or a teacher while the child is held by the arm. This causes a tear of annular ligament at its attachment to radius. The ligament gets squeezed in between the radius and the capitellum. The result of this subluxation is that the arm is held in a position of slight flexion at the elbow and pronation at the forearm. The child refuses to move the arm, giving a superficial impression of paralysis. The condition is quite painful.

Septic Arthritis

Also called suppurative arthritis, the condition occurs most frequently in first year of life following skin or upper respiratory infection. The most common etiologic organism is staphylococcus, irrespective of the age group. The other bacteria include H. influenzae (type B), streptococcus, pneumococcus, meningococcus, Gram-negative enteric bacteria such as Salmonella, Yersinia, Brucella, etc. In sexually-active adolescents, gonococcal arthritis may occur. Large joints are usually involved.

Clinical picture is characterized by sudden onset of fever and other systemic manifestations together with painful, tender local swelling. The local temperature is raised and there is erythema. Mobility of the joint is considerably limited. More often the joint involved is a large one. Limp may be the first and often the only presenting feature initially in some instances.

The joint fluid obtained by arthrocentesis is, as a rule, purulent, showing remarkable rise in WBC, reduced glucose and positive Gram-stain.

Cultures of joint fluid as well as blood are strongly recommended for confirming the diagnosis.

Viral Arthritis

Arthritis accompanying viral infections (mumps, rubella, chickenpox, influenza, hepatitis B, infectious mononucleosis), occurring usually in 1 to 4 years age group, affects more or less large joints. Basically, it is a sort of monoarticular synovitis. Often there is a confusion in its differential diagnosis from arthritis of acute rheumatic fever. Remember that, typically, viral arthritis, runs a mild course of around a week, recurrence is a rarity in its case, and rheumatoid factors remain negative.

Tuberculous Arthritis

The joints that may be involved in tuberculosis include wrist joint, hip joint, knee joint, ankle joint and spine.

In tuberculosis of the wrist joint, the characteristic picture includes appearance of a doughy swelling over the dorsum, a puffy palmar surface, slightly flexed hands with restricted movements of the fingers, and, later, appearance of sinuses usually over the dorsal asoect.

Tuberculosis of the hip is by far the most common form of tuberculous arthritis. The frank joint involvement follows the initial lesion in the femoral epiphysis, greater trochanter or, infrequently, synovial membrane. The earliest symptom is an intermittent slight limp with pain which is usually referred to the knee or medial aspect of thigh. In due course of time, the thigh is flexed, adducted and medially rotated. Movements become restricted in all directions. An obvious swelling appears, showing gradual increase in size. An abscess may discharge anteriorly or in other directions.

Tuberculosis of the knee is rather infrequent and is more of a sort of synovitis than involvement of the bone. Besides general features of tuberculosis, including muscular wasting, there appears a white swelling (skin continues to be white and puffy) with local heat and tenderness. With progression of the disease process, the

joint is deformed in the so-called "triple displacement" position (flexion, posterior subluxation and lateral rotation of tibia) due to spasm of the hamstring muscles.

Tuberculosis of the ankle is predominantly involvement of the synovial membrane rather than the bone. It is characterized by a swelling around the malleoli, pain, wasting of calf muscles, impaired joint movements and the joint kept in a position of plantar-flexion to avoid weight-bearing. Later, abscess formation may manifest in the form of sinuses.

Tuberculosis of the spine, also called Pott spine, is characterized by local and referred pain according to the affected nerve root, rigidity resulting in all movements and deformity. The patient, usually a grown-up child or adolescent, may avoid bending to catch hold of something on the floor. He may walk unduly carefully on toes, keeping the body quite stiff. Often, the subject likes lying on his abdomen or in the mother's lap. In case of cervical involvement, the child has totricollis and he supports his head by his hand or holds stiffly. Thoracic involvement causes kyphosis with gibbus with or without scoliosis. Cervical and upper thoracic involvement is likely to cause paraplegia. A cold abscess may extend to cause retropharyngeal abscess, rupture into the pleura, penetrate to the scapula, gravitate to point above the Poupart ligament, or result in a psoas abscess.

Needless to say, in each and every case of suspected tuberculous arthritis, the diagnosis should be established by conducting such investigations as tuberculin (Mantoux)/BCG diagnostic test, gastric lavage/sputum for acid-fast bacilli (AFB) and X-ray chest as well as X-ray of the affected part(s).

Osteomyelitis Close to the Joint

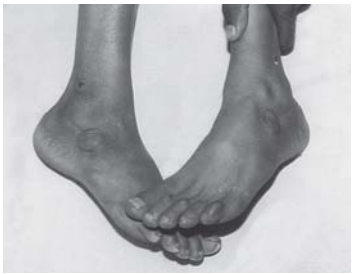
Osteomyelitis quite near a joint may give an impression of a swelling involving the joint per se. This may well be confused with septic arthritis. Unlike the case in osteomyelitis, it is virtually impossible to mobilize the joint in septic arthritis without causing considerable pain. Secondly, septic arthritis may be differentiated from osteomyelitis by aspiration of the joint.

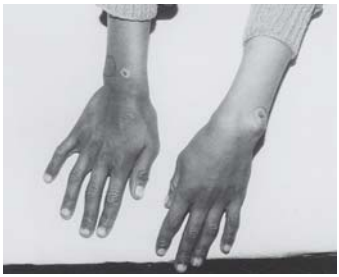
Rheumatic Fever

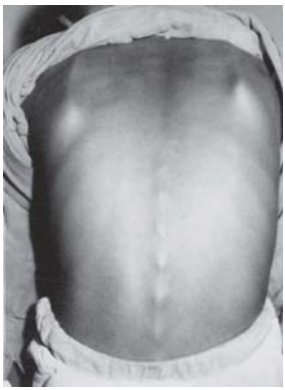
The joint pains of rheumatic fever may be in the form of polyarthritis or just arthralgia.

The polyarthritis, typically tends to be flitting and is manifested by pain and limitation of active movements or by tenderness, redness or swelling of two or more joints, usually the large and most distal and most proximal ones. The other major criteria (Jones-revised) are carditis, chorea, subcutaneous nodules (Figs 40.1 to 40.3) and erythema marginatum.

Arthralgia alone without objective evidence of joint involvement is not a major manifestation of rheumatic fever. It is a minor criteria, the other minor criteria being fever, previous rheumatic fever or rheumatic heart disease, raised ESR, leukocytosis or presence of C-reactive proteins (CRP), and prolonged P-R interval in the ECG.







Figs 40.1 to 40.3: *Rheumatic fever* Note the subcutaneous firm nodules, about 1 cm in diameter along the extensor surfaces of tendons close to bony prominences (Figs 40.1 and 40.2) and over spinous process of lumbar vertebrae (Fig. 40.3).

All this may be additionally reinforced by supporting evidence of preceding streptococcal infection: history of sore throat or scarlet fever, positive throat culture for group A streptococci, increased ASO titer or other streptococcal antibodies.

The presence of two major criteria or one major and two minor criteria is essential for labeling a case as rheumatic fever.

These criteria, in practice, serve well to minimize the chances of over diagnosis and under diagnosis. Nevertheless, an occasional case of rheumatic fever may not satisfy these diagnostic criteria. Likewise, at times, a child suffering from fever accompanied by pains in the extremities of some other etiology may satisfy the criteria. The point I wish to emphasize and re-emphasize is that the Jones criteria must only be regarded as a "guideline". These are, by no means, a substitute for the clinician's valued overall evaluation based on wisdom and judgement.

Juvenile Rheumatoid Arthritis (JRA)

In this collagen disorder, usually having its onset at 2 to 5 years and occurring more often in girls than in boys, the arthritis involves both small and large joints, including fingers and toes (proximal interphalangeal joints), wrist, temperomandibular joints, ankles, knees, hips and cervical spine. Joints are little swollen, tender and warm. Their mobility is reduced and they are kept in flexed position. A single joint may be involved (mono or pauciarticular form) in which case it is most likely ankle or knee, or several joints may be involved (polyarticular form) (Fig. 40.4). In due course (1 to 3 months), contractures may occur. A noteworthy development is the spindle-shaped fingers with smooth, shinny overlying skin. Early morning stiffness and wasting of muscles around the affected joint is classical.

The accompanying manifestations include prolonged fever (in some 10% cases it may precede by several weeks) with a morbilli form transitory rash (mainly over the trunk), muscle aches, weight loss, subcutaneous nodules, hepatosplenomegaly, lymphadeno-pathy, iridocyclitis, pericarditis, myocarditis, pneumonia and pleurisy.

ESR, if raised, is seldom over 40 mm (first hour) unlike in rheumatic fever. ASO titer is usually negative. CRP is, as a rule, absent.

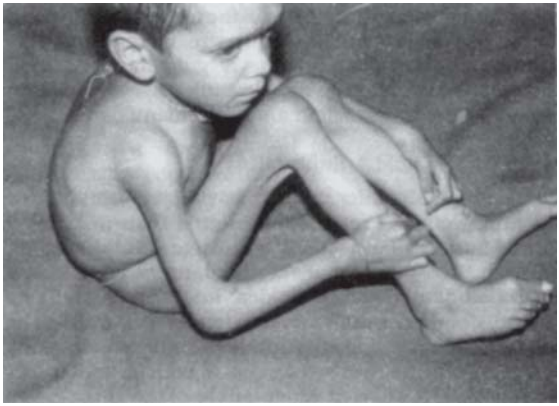


Fig 40.4: *Juvenile rheumatoid arthritis (polyarticular)* Note the involvement of several joints (both small and large) with contractures and spindle-shaped fingers and muscle wasting around the affected joints.

Systemic Lupus Erythematosus (SLE)

Joint pain (usually just arthralgia) is a common manifestation of this multisystem collagen disorder. The accompanying manifestations include prolonged irregular fever with remissions of variable duration, muscle pains, malaise, weight loss and a characteristic erythematous rash over malar area and bridge of the nose (butterfly rash) which appears to be photosensitive (Fig. 40.5). The rash, at times, appears on fingers and palms, soles, palate and buccal mucosa. Alopecia may also occur.

The disease does not spare any organ, renal involvement being particularly very common in childhood form. Hepatos-plenomegaly, generalized lymphadenopathy, thrombocytopenia, neurologic manifestations (including pseudotumor cerebri), pericarditis, pleural effusion, pulmonary infiltration, abdominal pain, vomiting and diarrhea may occur.

Diagnosis is confirmed by demonstrating typical lupus erythematosus (LE) cell and antinuclear antibodies (ANA), the latter being more sensitive.

Fig. 40.5: *Systemic lupus erythematosus (SLE)* Note the characteristic butterfly rash. The other presenting features were prolonged irregular pyrexia with remissions of variable duration, hepatosplenomegaly, generalized lymphadenopathy and abdominal pain. Both LE cell and ANA markers turned out to be positive.

Serum Sickness

Arthralgia and/or arthritis is an important manifestation of serum sickness, a systemic immunologic disorder characterized by allergic reaction following the administration of a foreign antigenic material a week or two earlier. The examples of etiologic antigenic material include penicillin, human gamma globulin for diphtheria and tetanus, antitoxins for treatment of rabies and antilymphocyte serum employed for immunosuppression in transplantation procedures.

The most frequent manifestation is generalized urticaria. The other manifestations include intense piuritus, edema (especially around face and neck), fever, lymphadenopathy, myalgia, and arthralgia and/or arthritis involving multiple joints.

The reaction is self-limited. The patient may suffer from such complications as Guillain-Barré syndrome, peripheral neuritis involving C, and C components of brachial plexus, carditis and nephritis.

Henoch-Schönlein Purpura

Arthritis is encountered in over 60% cases of this syndrome, also termed anaphylactoid purpura. The involved joints-usually large ones like knees and ankles-are swollen, tender and painful on passive movements. If effusion is present, which usually is the case, the joint fluid is serous with leukocytosis.

The remaining manifestations of this disease of unknown etiology (preceding URI, allergy or drug sensitivity is often blamed as playing a role) include a variety of skin lesions (usually urticaria, petechiae, purpura or ecchymosis) appearing in crops, colicky abdominal pain and azotemia, oliguria and hypertension.

Quite often, arthritis and purpura may be the only presenting features. This form of disease has excellent prognosis, recovery occurring in a few days. Recurrences are a feature of serious cases.

Investigations are essentially normal. Their importance lies in excluding hemorrhagic diathesis, etc.

Hemarthrosis

In hemophilia, an X-linked recessive disorder due to deficiency of factor 8 (antihemophilic factor) occurring exclusively in males, a minor trauma may cause bleeding into a joint such as knee, ankle or elbow. The affected joint becomes swollen and tender with pain on passive movements. In earlier stages the blood within the joint gets absorbed in due course. Repeated attacks may, however, cause inflammation and degenerative changes, the joint eventually becoming immobile, the so-called "fixed joint".

Radiology shows initially distention of the joint cavity and synovitis. Later, the changes include areas of synovial thickening, dimeneralization, erosion and contracture. Increased vasculari-zation of joint space results in accelerated bone growth, resulting in premature appearance of ossification centers. A complete destruction of articular surface and formation of juxta-articular cysts may also occur.

To confirm the diagnosis of hemophilia, a normal bleeding time and a prolonged clotting time together with deficiency of factor 8 in specific factor assay need to be demonstrated.

Sickle Cell Anemia

Joint pains resulting from vaso-occlusive crises are a common observation in this disease characterized by severe, chronic hemolytic anemia due to replacement of the normal hemoglobin with hemoglobin S. The initial manifestation in infancy is in the form of so-called hand-foot syndrome in which sickle-cell dactylitis leads to symmetrical, painful swelling of the hands and feet. In older subjects, large joints and surrounding parts become involved. The modus operandi for causing bone and joint changes is through infarction which may develop spontaneously or is precipitated by infection.

The remaining manifestations include progressive anemia with slight icterus, fever, headache, ulceration of the skin overlying the lower limbs, nocturnal enuresis, growth retardation and folic acid deficiency. Spleen is enlarged in the very young but under goes regression as also cessation of functioning following recurrent thrombosis in the subsequent years. This is termed "autosplenectomy".

Diagnosis is established by electrophoresis which shows that 50 to 100% of hemoglobin is S and that proportion of hemoglobin F is increased.

Acute Leukemia

Arthralgia may occasionally be the first complaint leading to the diagnosis of acute leukemia, particularly in the presence of anemia, reticulocytopenia/absence of reticulocytes, or thrombocytopenia.

I have seen a couple of cases presenting as rheumatic fever with joint pains migrating from one joint to another and high ASO titer turning out to be those of ALL on bone marrow examination.

Psoriasis

Arthritis is seen infrequently in this uncommon condition in childhood, occurring predominantly in girls. Arthritis may precede or follow the skin lesions which consist of erythematous papules. The papules tend to coalesce and form plaques with sharply demarcated but irregular margins. Finally silvery scales develop which leave pinpoint bleeding on removal. Nail involvement is frequent. The common sites for skin lesions are scalp, knees, elbows, umbilicus and genitalia.

Psoriatic arthritis may begin in one or more joints. The involvement is usually asymmetrical. Distal interphalangeal joints (unlike the proximal interphalangeal joints in rheumatoid arthritis) are involved in over 50% of the cases. In a few cases, sacroilitis and subsequently losing spondylitis may occur.

Gut Arthropathy

Arthritis may occur in a significant proportion of the children suffering from inflammatory bowel disease (say ulcerative colitis, Crohn's disease), affecting a few large peripheral joints in a pauciarticular way. In the usual variety, arthritis varies in intensity with activity of the underlying bowel disease. Joint destruction and permanent deformity do not occur. In the uncommon variety, ankylosing spondylitis may cause permanent deformity and disability, even though the underlying bowel disease is under control.

Arthritis may also occur in cystic fibrosis of pancreas.

Reiter Disease

Arthritis, sterile urethritis and ocular inflammation constitute the triad of symptom-complex of Reiter disease which is strongly associated with HLA B27 and may follow infections with Yersinia enterocolitica, Shigella or Clamydia, or a sexual exposure in adolescents.

The accompanying manifestations may include varied types of skin rash and gastroenteritis.

Reactive Arthritis

A sterile arthritis may follow such gut infection as with *Yersinia enterocolitica*, *Shigella* or *Salmonella*. Only a few peripheral joints in a pauciarticular fashion are involved. In a small proportion of the cases, the disorder is associated with HLA B27.

The prognosis is good. Most cases have only transient disease. In some, chronic spondyloarthropathy may result.

Ankylosing Spondylitis

This disease of young and middle-aged adults may begin in childhood, usually in boys over 8-years of age. Manifestations include stiffness and pain in the low back, hips and thighs with

or without arthritis of peripheral joints. Heel pain is a common observation. The joints are swollen, warm and tender.

Accompanying manifestations may include low-grade fever, easy-fatigability, loss of appetite and growth retardation. Iridocyclitis occurs in 25% cases at some stage.

Frequently, there is a positive family history for such arthritis or acute iridocyclitis.

Ankylosing spondylitis is often confused with pauciarticular juvenile rheumatoid arthritis. The points that favor the former include: (1) predilection for males, (2) positive family history, (3) characteristic involvement of hip and dorsolumbar joints, (4) high incidence of iridocyclitis, (5) rarity of rheumatoid factor, (6) extreme rarity of subcutaneous nodules, and (7) occurrence, though extremely rarely, of aortitis, resulting in aortic insufficiency.

Drugs

Phenobarbital, carbamazepine, isoniazid, rifampicin, ethambutol, chlordiazepoxide, cimetidine, penicillin, corticosteroid withdrawal after prolonged administration, animal sera, say tetanus or diphtheria antitoxin.

Remaining Causes of Joint Pain

Attention-seeking device, juvenile gout (both primary and secondary), foreign body ("rose-thorn arthritis"), dermatomyositis, sclerodema, periarteritis nodosa, sarcoidosis, brucellosis, syphilis, rubella, infectious mononucleosis, tumors.

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Chapter 41 Large Head

Large head is not an uncommon complaint put forward by the parents in our busy outpatients' wings. Often, parents, are unaware of it and somewhat surprised when the doctor questions them about it. On 3 very busy OPD days in a week, at least 8 of the 200 and odd patients I saw had unduly large head. The breakup of these 8 cases according to the clinical diagnosis was as follows: congenital hydrocephalus 2 (progressive 1, arrested 1), acquired hydrocephalus (meningitis) 1, vitamin D-deficiency rickets 2, space-occupying lesion (SOL) 1, achondroplasia 1, familial 1.

While eliciting history in a case of large head, find out if the size has been large right since birth or it occurred later. Is it still fast increasing? Or, is it arrested now? Did it follow a CNS illness, say meningitis? Any history of seizures, projectile vomiting, persistent headache, behavior problems etc.? Any congenital defect, such as talipes or meningocele, the parents are aware of? Any familial tendency to have a large head?

Physical examination should, in the first instance, confirm if the head size is indeed unusually large in relation to the body size, weight and age. At times, head enlargement may be more apparent than real as in IUGR infants. Serial measurements may be required in doubtful cases. Just because the size is rapidly increasing in no reason to label the observation as hydrocephalus. In infants, we do expect a rapid increase (Table 41.1). What is really important is that this increase is quite out of proportion to the corresponding increase in the body size.

Note the shape of the head. A large protruding occiput points to Dandy-Walker cyst. An asymmetrical head is typical of unilateral obstruction at the level of foramen of Monro.

Table 41.1. Differential diagnosis of large head due to hydrocephalus

A. Noncommunicating (Obstructive)
- o Aqueduct stenosis/atresia
  - Sporadic
  - Familial
- o Fourth ventricle obstruction
  - Dandy-Walker anomaly
  - Arachnoiditis
- o Obstruction from mass lesion
  - Neoplasm
  - Cyst
  - Hematoma,
  - Galans vein
  - Aneurysm

B. Communicating
- o AC malformation
- o Encephalitis
- o Meningeal adhesions
- o Choroid plexus papilloma

Transillumination shows the whole calvarium as "brilliant" if cerebral matter is absent or is extremely thinned down. Focal or generalized areas of abnormal transparency may be seen in porencephalic or other cysts and subdural effusion.

A complete neurologic examination is a must, particularly for signs of meningeal irritation. Is the anterior fontanel bulging? Are the sutures widely separated? Is there any meningocele, meningomyelocele or talipes equinovarus? What are the body measurements like? Any suggestion of rickets, achondroplasia, gigantism, etc.?

Hydrocephalus

Congenital hydrocephalus, a common cause of unusually large head right at birth or becoming apparent in the first few months of life, may be associated with Arnold-Chiari malformation in which case the infant also has spina bifida and meningomyelocele (Fig. 41.1), Dandy-Walker anomaly (Figs 41.2 and 41.3), malformation or stenotic lesions of aqueduct cerebri, or malformations of arachnoid villi.

Clinical picture is classical with a large head, wide and bulging anterior fontanel, open sutures, protruding forehead, and dilated prominent scalp veins (Fig. 41.4). The sunset sign, i.e. visible sclera above the iris, is characteristic. The crackpot sign, also called Macewen sign, elicited by percussing the skull, may be positive. Transillumination is positive. The mental faculty and other neurologic manifestations vary with the causative and associated factor(s).

Arrested hydrocephalus is the term applied when there is no further progression in head size (Fig. 41.5).

Acquired hydrocephalus, another common cause of unusually large head before the suture closure

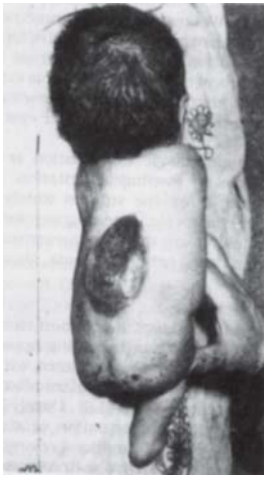
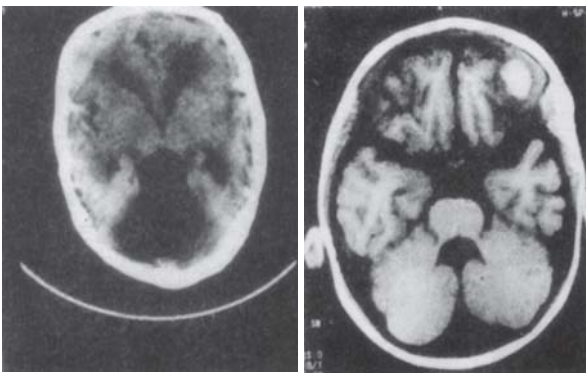


Fig. 41.1: *Meningomyelocele* in association with Arnold-Chiari malformation causing hydrocephalus.



Figs 41.2 and 41.3: CT scan showing Dandy-Walker cyst consisting of a cystic expansion of the 4th ventricle in the posterior fossa. The patient usually presents with rapidly increasing hydrocephalus with prominent occiput and evidence of long-tract signs, cerebellar ataxia and delayed developmental and motor as well as cognitive milestones.

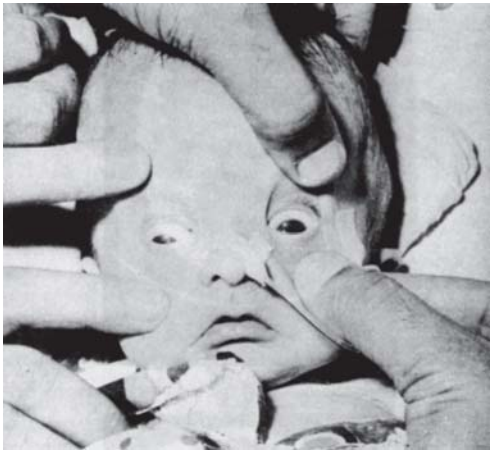


Fig. 41.4: *Congenital hydrocephalus* Also, note the presence of microphthalmia, more marked on right side, as also corneal opacities.

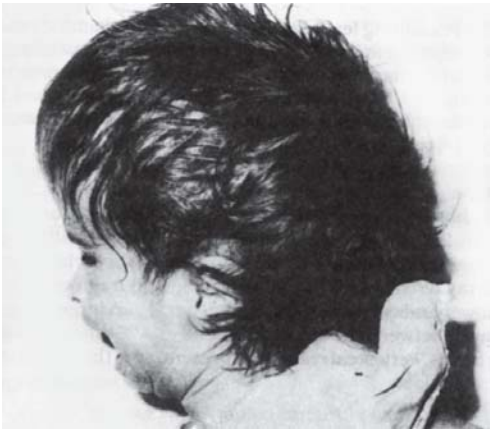


Fig. 41.5: *Arrested hydrocephalus* The child presented in second stage of tuberculous meningitis. Response to treatment was good.

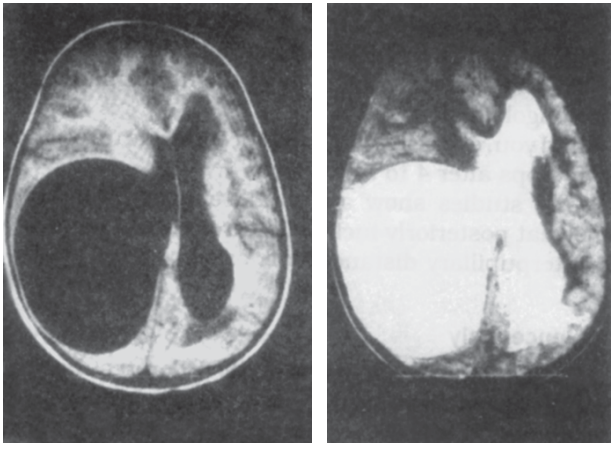
has occurred, may result from inflammatory disorders like meningitis and encephalitis, birth trauma, head injury, intracranial hemorrhage, and space occupying lesions like tuberculoma, subdural hematoma/abscess, hydatid cyst (Figs 41.6 and 41.7) or glioma.

Clinical features are those of the raised intracranial pressure described above plus those related to the etiologic condition.

Vitamin D Deficiency Rickets

Macrocephaly with flattening of vertex (box head) may well be associated with nutritional rickets. Accompanying signs in relation to head include frontal and parietal bossing, delayed closure of fontanels, craniotabes (a peculiar softening of occipital and posterior parietal bones which "give in" like a ping-pong (table tennis) ball under pressure from thumb).

The remaining features of rickets include rachitic rosary, pigeon-chest deformity, Harrison's sulcus (a groove along the insertion of diaphragm into the ribs), flaring of lower ribs, widening of



Figs 41.6 and 41.7: MRI, T1 and T2 weighted axial images, showing a large spherical cystic mass in the right parietotemporal region (hydatid cyst) causing hydrocephalus (acquired). Note the compression and midline shift of the right lateral ventricle and 3rd ventricle.

wrists, knock knee (genu valgum), bowel legs (genu varum), poor muscle tone, potbelly, visceroptosis, and delayed dentition and milestones.

Diagnostic investigations show raised alkaline phosphatase (exceptin malnourished children), low serum phosphorus and normal serum calcium. Reduction in serum 25-hydroxy-vitamin D level is a sensitive and reliable index of rickets even in malnourished children.

X-ray wrist shows cupping, fraying and fragmentation of the lower ends of radius and ulna. There is an increase in the distance between the epiphyseal centers and the shafts of the long bones. Periosteal reaction is present, so is the prominence of trabeculae.

Cerebral Gigantism (Sotos Syndrome)

Macrocrania is an important feature of this rare disorder characterized by rapid growth, not because of raised growth hormones level but as a result of pathologic cerebral defect.

Accompanying features include birth weight and length above 90th percentile, jumping to over 97th percentile by one-year of age, prominent forehead, acromegalic facies, large hands and feet, clumsiness, mental subnormality and antimongoloid slant of the eyes.

Mind you, excessive growth does not continue throughout life. It stops after 4 to 5 years of age.

X-ray studies show a large skull, a high orbital roof, somewhat posteriorly inclined sella turcica, and an increased interpupillary distance (hypertelorism).

Megalencephaly

Unusually large head in this rare disorder results from excessive growth of brain during infancy. There is delay in the developmental milestones. There is no evidence of raised intracranial pressure.

Excessive growth of brain occurs in achondroplasia, Hurler's syndrome, Tay-Sachs disease and metachromatic leukodystrophy.

Hydrancephaly

In this rare condition, there is congenital absence of cerebral hemispheres. Instead, there is a huge fluid-filled cavity. Brainstem and basal ganglia are well-formed.

At birth, the infant appears normal except for the increased head size and lack of visual following. He demonstrates no further voluntary motor and mental development. Convulsions may occur.

Diagnosis is made by transillumination of the skull in a darkened room.

Gangliosidoses

Tay-Sachs disease, also called infantile cerebromacular degeneration, is the most common of the 5 recognized illnesses under this heading. It is characterized by mental apathy, progressive loss of acquired motor functions, exaggerated startle response, spasticity with hyperreflexia, decerebrate rigidity, poor feeding', wasting and abnormally large head. Convulsions (grand mal, tonic or myoclonic) may occur. The most glaring finding is a cherry-red spot of macula bright red area in the region of fovea surrounded by a grayish-white rim.

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Chapter 42 Limping

The term, *limping*, means to walk lamely or unevenly as when one hip, leg or foot is stiff or hurt. Though, majority of the cases of limp in pediatric practice are minor and transient, the problem often causes considerable anxiety to the parents as long as it continues to trouble the child.

This common problem may be caused by a lesion (as minor as trauma from a protruding nail in the shoe, or as serious as paresis) anywhere in the weight-bearing structure-complex consisting chiefly of spine, hips, knees, ankles and feet. Often the lesion may be inapparent. Infrequently, the complaint may be projected as an attention-seeking device. Whereas a painful (antalgic) limping is usually secondary to injury, infection or pathologic fracture, Trendelenburg limping is predominantly due to congenital, developmental or neuromuscular/musculoskeletal disorder (polio, cerebral palsy, myopathy, DDH).

A thorough history and physical examination are central to early identification of the cause of limp.

While recording history, you must put considerable efforts to elicit the particular activity that may have caused limp. Was there a trauma: a fall, a pull, or a blow? Any preceding or accompanying fever? Any joint pain? Is the limp on way to recovery, going downhill or showing no change? Is the child aware of any problem with the shoes? Does the shoe pinch or it has a nail or strap buckle that troubles the child? Is the child suffering from some myopathy, tuberculosis, congenital defect, etc.?

Physical examination must include observation of the child, while he limps, by the physician. Attempt should be made to determine its cause in the spine, hip, knee, ankle, feet, bones or

soft tissues. Don't forget to look for asymmetry in the size of the legs. Is there any inguinal lymphadenitis? Is there any painful boil? You must also examine shoes for undue tightness, a protruding nail, or a bad buckle. Does the foot show any corn, wart, blisters, paronyechia, or ingrowing toenail?

A good musculoskeletal examination, including grading of muscle power, is important. Box 42.1 gives the popular system of grading the muscle power.

Box 42.1: Grading of muscle power

Grade 0	No contraction at all
Grade 1	Just trace contraction (flicker)
Grade 2	Active movements (gravity eliminated)
Grade 3	Active movements (against gravity)
Grade 4	Active movements (against gravity and some resistance)
Grade 5	Active movements (against full resistance)

JOINTS/BONES

Hips

Congenital dislocation of the hip (developmental dysplasia of the hip): A missed and untreated congenital dislocation of the hip may be responsible for a limp and delayed walking. A close examination of such a child shows asymmetry of the thigh, gluteal and knee creases, inability to abduct the hipfully, shortness of the affected leg, reduced spontaneous movements and a bulge of the femoral head.

A good screening test (Ortolani's sign) consists in abducting the hip passively. A clicking sound is heard from the hip at the end of the maneuver. It results from the jerking of the subluxated head as it reduces back into the acetabulum.

The Barlow's maneuver is better than Ortolani maneuver. Here, the pelvis is stabilized with one hand, followed by adduction of the opposite hip and application of a posterior force. A dislocatable hip is readily appreciated.

Diagnosis is confirmed by X-ray of the hip joint and/or ultrasonography. An anteroposterior X-ray view usually reveals superior and lateral displacement of the femoral head from the shallow acetabulum.

Congenital coxa vara: In this disorder of unknown etiology, usually encountered after 2 to 3 years of age, physical findings simulate a dislocated hip. The basic defect is that the femoral neck makes less than 135° angle with the shaft. Left unattended, varus deformity shows worsening.

Septic arthritis: Suppuration is the most important cause of painful hip and limp in infants and toddlers. Involvement of hip may be direct extension of osteomyelitis of the femoral neck or a blood-borne infection.

For confirmation of the diagnosis, X-ray hip, showing lateral displacement of the femoral head as also the fat close to the capsule due to fluid accumulation, is of considerable value. Aspiration of thick pus from the joint further establishes the diagnosis. If osteomyelitis coexists, increased bone uptake is demonstrated by a bone scan.

Toxic or transient synovitis: This disorder of toddlers and children may be responsible for painful hip and limp which responds to as simple a treatment as bed rest. The cause is not clear. Frequently, it is preceded by a viral upper respiratory infection a few days to 2 weeks earlier. All signs of inflammation of the joint are observed. The bacterial infection is, however, not responsible for the condition.

Tuberculosis of the hip: An intermittent slight limp with pain, occurring when the subject first gets out of bed and after exercise, is usually the first manifestation of tuberculosis of the hip. Pain is usually referred to the knee or medial aspect of the thigh. Limp and pain may show remission for days or weeks. With progressive destruction of the joint following absorption of the femoral head and neck, the thigh assumes a position of flexion, adduction and medial (earlier it is lateral) rotation.

Perthes disease: Also termed Legg-Calve-Perthes disease, this condition of a vascular necrosis of the head of the femur usually occurs in 5 to 9 years age group and is an important cause of pain and limp. It may be very difficult to differentiate it from tuberculosis of the hip and transient synovitis of the hip in early stages. It is of value to remember that, unlike in tuberculosis, in Perthes disease we have limitation of only abduction and internal rotation.

In the X-ray, head of the femur shows flatting, fragmentation and condensation and is dense and not lucent. The joint space is widened. Tie involvement does not extend beyond femoral capital epiphysis and metaphysis. In tuberculosis, acetabulum may also be involved, the joint space is narrow and the head of femur appears lucent.

Slipped capital femoral epiphysis: Also called adolescent coxa vara, this disorder occurs in fatty adolescent boys between 10 and 14 years of age, usually following trauma. The symptoms include limp with little pain and limited movements of abduction and internal rotation and free or exaggerated abduction and external rotation. The subject's gait is dipping on the affected side (waddling in case of bilateral involvement) and be tends to stand with the leg adducted and externally rotated.

X-ray (lateral film) shows displacement of the upper epiphysis of the femur downwards and backwards, neck-shaft angle reduced to a varying extent from the normal 150° in childhood and neck of the femur pushed up and externally rotated so much and so that the lesser trochanter becomes quite prominent.

Traumatic avulsion of muscles: Occasionally, an adolescent may overdo his physical exercise and have the origin or insertion of muscle-pulled, usually along with the apophysis. Thus, hamstring muscles may be pulled off the ischial tuberosity, iliopsoas off the lesser trochanter, sartorius off the anterior superior iliac supine, and rectus femoris off the anterior inferior supine. The symptoms include a limp and pain.

Knees

Knee problems are relatively less often responsible for limp in the infants and young children. In adolescents and preadolescents, knee is a common site for conditions that cause limp.

The knee disorders causing' limp include septic arthritis, tuberculosis, rheumatoid arthritis, osteochondritis, trauma, popliteal cyst, and Osgood-Schlatter disease.

Osteochondritis: In this disorder of unknown etiology, avascular necrosis occurs in a small chunk of the bone under the articular cartilage of the knee, usually over the lateral aspect of the medial

condyle of the femur. The fragment and the nearby articular cartilage may occasionally break off and float freely in the joint.

Popliteal cysts Also termed Baker's cysts, these are found usually posteriorly at the origin of the medial head of the gastrocnemius or semitendinosus muscle, and, rarely, in childhood, as posterior herniations of the knee joint.

Osgood-Schlatter disease In this disorder, anterior tibial tubercle becomes prominent and tender, resulting in pain and swelling with limp as and when there is excessive activity of the quadriceps.

Ankles

Limp as a result of involvement of ankle joint may occur in septi-carthritis, tuberculosis, rheumatoid arthritis, or trauma.

Feet

The major causes of limp due to problem with the foot include ill-fitting shoes, shoes with protruding nail or bad buckle, all painful conditions' such as thorn-prick, warts, corns, blister, paronychia, ingrowing toenail, injuries, and congenital defects like talipes, etc.

Spine

The lesions include tuberculosis, sciatica, lumbago and congenital defects.

NEUROMUSCULAR FRAME

Poliomyelitis: This condition should always be considered if limp follows a short febrile illness, especially if the latter is accompanied by muscle pain and tenderness. Limp may also be a feature of postpolio residual paresis (Fig. 42.1).

Acute hemiplegia: In acute infantile hemiplegia to be more exact acute hemiplegia of childhood-irrespective whether it is symptomatic or idiopathic, the onset is sudden with unilateral (occasionally bilateral) convulsions. In between episodes of convulsions, the affected side is flaccid. Unconsciousness, fever and vomiting may be present. Attention to hemiplegia is often drawn only on recovery of consciousness and cessation of convulsions. In some cases, hemiplegia may occur suddenly without any convulsions and little or no change in consciousness.

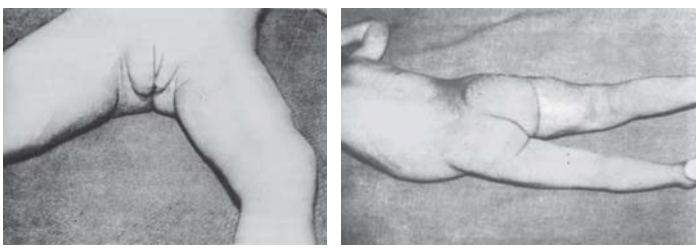
In carotid artery thrombosis, transient episodes of weakness may be observed.

In 50 to 75% of the patients, hemiparesis is left as a long-term sequelae. The patient invariably gains enough power to walk but he certainly limps. The arm shows relatively far less recovery, remaining almost useless. Accompanying seq-uelae include epilepsy and mental subnormality.

Fig. 42.1: Trendelenburg limping in a child with post-polio residual paresis (PPRP)

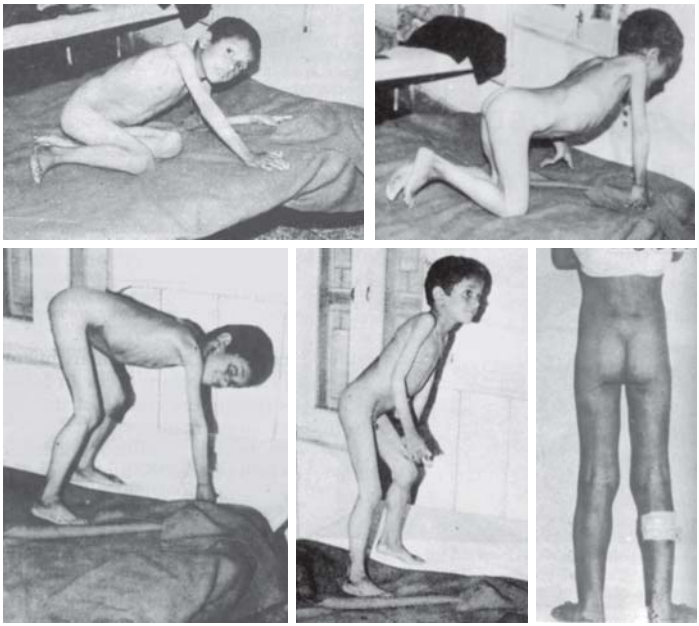
Hemihypertrophy: In this congenital disorder, one side of the body is larger than the other. The hypertrophy is usually of the whole one side, including face, tongue, teeth and genitalia (Figs 42.2 and 42.3). Associated with it may be malformations like hemangioma, nevi, polydactyly, cryptorchidism, hypospadias, tumors and calcification of adrenals. With gain in age, differences between the two sides becomes less conspicuous.

Pseudohypertrophy: Muscular dystrophy. Also termed Duchenne muscular dystrophy or simply Duchenne myopathy, the earliest manifestation of this condition may be a limp, difficulty in walking or standing, or other activities involving the muscles of the pelvis.



Figs 42.2 and 42.3: *Hemihypertrophy* Note that right side of the body is impressively larger than the left. Hypertrophy of even labia majora is striking. Also, note the presence of hairy nevus on the affected side.

Awaddlig gait may be noticed. As the disease assumes a classical picture, the subject shows a characteristic manner of rising from the bed to an upright position. He makes successive attempts as though to climb up his own thighs. This is called Gower's sign (Figs 42.4 to 42.9). Lordosis and forwardly-thrust tummy are outstanding when the child stands upright. Pseudohypertrophy, especially of the calf muscles, is striking. Tendon reflexes are sluggish or absent; ankle reflex is an exception. Cardiac enlargement, persistent tachycardia and cardiac failure occur in 50 to 80% of the cases sometimes during the course of the disease. About 33% have mental subnormality.



Figs 42.4 to 42.8: *Pseudohypertrophy muscular dystrophy (Duchenne muscular dystrophy)* Note the Gower's sign (using the hands to climb up the legs in order to assume an upright position) as also remarkable hypertrophy of the calf girth.

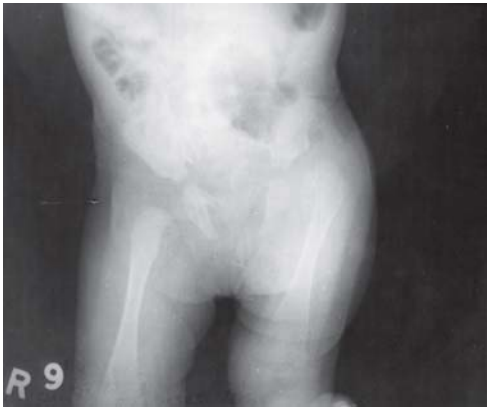


Fig. 42.9: Congenital dislocation (dysplasia) of hip (left).

This disorder having X-linked inheritance usually manifests before fifth year of life and generally proves fatal in the second decade of life.

Myotonic Muscular Dystrophy

This autosomal dominant disease may cause gait difficulty around preschool years. It is characterized by inverted V-shaped upper lip, thin checks, scalloped, concave temporalis muscles (Fig. 42.10),

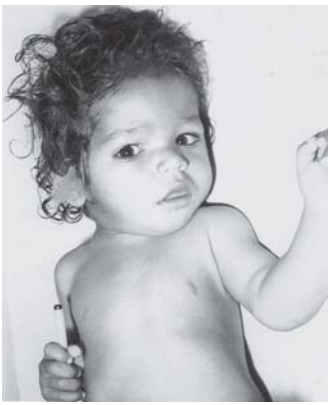


Fig. 42.10: *Myotonic muscular dystrophy* Note the inverted V-shaped upper lip, facial weakness, thin cheeks and poor muscle mass in temporal fossae in this infant with high-arched palate. As the child grew, gradually muscle weakness of distal distribution became more apparent. At 12 years, he needed bracing for stabilizing the ankles. He was going to school though his school performance was subnormal on account of low IQ (75) and cognitive impairment.

high-arched palate and wasting and weakness of distal muscles (in contrast to proximal distribution in other myopathies).

Besides cognitive dysfunction, speech, cardiac, endocrinal, and immunologic abnormalities may occur. Cataracts are frequent.

REMAINING CAUSES OF LIMP

Inguinal lymphadenitis, scurvy, cerebral palsy, psychologic, hysteria, polymyositis, leg length inequality, tumors, leukemia, etc.

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Chapter 43 Lethargy

The term, *lethargy*, denotes disinclination to get back to activity. According to the dictionary, it means drowsiness (Greek, lethargos means drowsiness). Just because the child exhausted himself on account of one or the other reason resulting in lethargy is not important from medical point of view. The role of the physician comes in only when it is a prolonged lethargy spread over considerable time and without preceding exertion.

Lethargy may manifest as fatigue, excessive sleepiness (somnolence), mental sluggishness or low activity.

History-taking should determine the normal activity and sleep patterns of the child. Ay suggestion of his being sick prior to onset of lethargy. Has he been febrile? Is he a patient of seizure disorder? Is he on some drugs, especially narcotics (therapeutic or self-medication)? Does he suffer from vague bodily pains? How has been his school performance —in studies, sports, and other activities? Has he failed in some test? Has he not been able to complete his homework regularly? Is he psychologically upset over some happening or his relationship with peers and teachers?

Physical examination must make a thorough search for signs of infection (including occult infection), such as urinary tract infection, pharyngitis, septic tooth or cellulites. Look for signs of CNS involvement.

It is indeed important to conduct psychological evaluation in the absence of positive physical sign.

Infections (including Low-grade Infection)

An infection, even without significant manifestations, is the most common cause of pathological lethargy.

Over and above lethargy, high fever is usually accompanied by such symptoms as prostration, diaphoresis, flushing and muscle pains.

In case of certain infections (say meningitis, sepsis), body temperature may not show significant rise. In fact, it may well be lower than normal (hypothermia). In case of meningitis, evidence of meingeal irritation in the form of neck stiffness and positive Kerning's and Brudzinski's signs, seizures, vomiting, etc. may be present. In sepsis, poor feeding, irritability or sluggishness, tachypnea, tachycardia and diarrhea may be encountered.

Infectious mononucleosis may cause lethargy, low-grade fever, generalized adenopathy, periorbital edema, pharyngitis and splenomegaly.

Anemia

Chronic anemia often leads to some sort of adaptation. But that is only up to a point. In addition to lethargy, the child may suffer from easy fatigability, drowsiness and low blood pressure (usually orthostatic).

Postictal Stage

Following an attack of seizures, the child is likely to sleep, become drowsy or lethargic.

Chronic Fatigue Syndrome (CFS)

This state, usually seen in adolescence and generally supposed to be caused by a virus (such as Ebstein-Barr), is characterized by lethargy, chronic fatigue and deterioration in work or school performance, daily activities, exercise tolerance and interpersonal relationship.

Physical examination usually shows nothing significant. Diagnosis is mainly be exclusion. A psychological evaluation is important.

Remaining Causes of Lethargy

Obesity, sleeplessness, puberty, hypoglycemia, drugs, Addison's disease, teenage pregnancy.

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Chapter

44 Lymphadenopathy

The term, *lymphadenopathy*, refers to enlargement of lymph nodes irrespective of its etiology. It is quite a common problem in day-to-day pediatric practice, often baffling the parents, nay the attending physician as well. Not infrequently, cumbersome investigations may be required to reach the precise diagnosis of lymphadenopathy which occurs in response to a wide range of infectious, inflammatory, neoplastic and immunologic conditions as also drugs (Figs 44.1 and 44.2).

Symptomatic enquiry in a given case must delineate whether the glandular enlargement is localized to a particular region only or is generalized, and whether the duration of such enlargement is short or prolonged. In the event of involvement of several groups of glands, find out which group was the first to be affected. Is

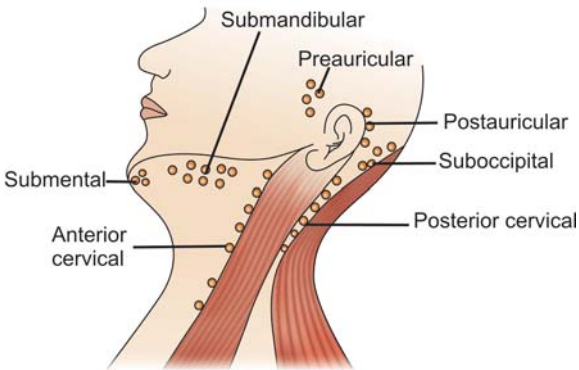

Fig. 44.1: Lymph glands (nodes) of the neck.

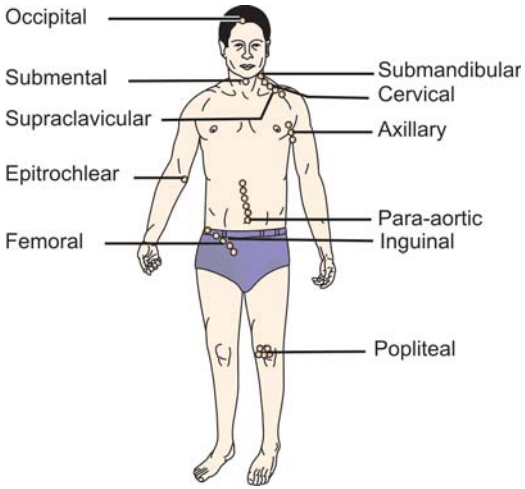

Fig. 44.2: Major groups of lymph glands.

the involved region painful? Does the patient suffer from fever? Does the patient have any sore throat, or did he suffer from it recently? Any suggestion of impetigo, particularly infected seborrhea of scalp? Any abrasion or inflammation in the drainage area? Any rash? Any symptoms of mediastinal compression due to concurrent involvement of mediastinal lymph nodes? Any suggestion of crampy abdominal pain?

Also, ask about BCG vaccine having been given in the recent past for prophylactic or diagnostic purposes in case of persistent axillary lymphadenitis.

Is there a history of progressive loss of weight over a prolonged period (tuberculosis) or in the recent past (neoplastic process)?

Never forget to enquire about past history of tuberculosis, including exposure to a tuberculous patient in the family or the neighborhood.

Physical examination should confirm the anatomical group(s) of lymph nodes involved. Note if the overlying skin shows signs of inflammation, abscess formation, ulceration, etc. Ascertain if the nodes are tender, soft, robbery, firm or shotty hard, and whether

these are discrete or matted. Are these fixed to the surrounding structures? Look for primary focus in the drainage area. Identify pressure effects like venous engorgement of bead and neck, dyspnea, cyanosis, etc. in case of suspected lymphoma. Do not miss examining spleen, liver, mesenteric nodes, lungs, etc. In suspected syphilis, it would be important to look for syphilitic stigmata.

INFECTIONS/INFLAMMATIONS

Acute

Acute lymphadenitis (localized) is characterized by swollen, tender and fixed nodes with hot, red and brawny overlying skin. The acute inflammatory process in the nodes follows passage of the bacteria, toxins and other by products of acute inflammation from the primary site, say cellulitis or some other infection.

Examples of this kind of lymphadenitis include acute cervical lymphadenitis secondary to acute tonsillitis or pharyngitis and inguinal lymphadenitis resulting from an infection of the lower limb. Mesenteric lymphadenitis may be secondary to some inapparent infection and may be responsible for crampy abdominal pain, at times mimicking acute appendicitis. Yet another example relates to mediastinal lymphadenitis secondary to pulmonary tuberculosis in which case the subject may complain of pressure/ obstructive symptoms and cough.

Usually, acute lymphadenitis subsides with regression of the primary condition. Occasionally however, it may suppurate. In this situation of abscess formation, fluctuation in the centre and pitting at the periphery on pressure can be easily elicited. Abscess is a strong indication for needle aspiration or surgical drainage.

Acute lymphadenitis (generalized) occurs in such acute infections as infectious mononucleosis, rubella, measles, enteric fever, and infected eczema.

In infectious mononucleosis (glandular fever), lymphadeno-pathy is quite a characteristic feature, particularly that of the posterior cervical and, epitrochlear group. The remaining features of the full blown disease, caused by Epstein-Barr (E-B) virus of the herpes group, include malaise, fever, sore throat, hepato-

splenomegaly, atypical lymphocytes in the peripheral blood, and a heterophil antibody response. Occurrence of petechiae at the junction of soft and hard palate is frequent. A maculopapular rash occurs in only a small proportion of the cases. However, 80% of the subjects treated with ampicillin develop it for some unknown reason. Edema of the eyelids may occur in a few cases.

Cytomegaloviral infection (acquired form which usually occurs in grown-up children and adolescents) may be responsible for cervical or other regional lymphadenopathy in additional to sore throat, anorexia, headache, myalgia, abdominal pain, excessive tiredness, excessive sleepiness, and fever with chills. Hepatosplenomegaly is usual. Just as in infectious mononucleosis, ampicillin administration causes a maculopapular rash.

Lymphadenopathy associated with rubella (German measles, 3 day measles) becomes evident at least 24 hours before the rash appears. In a proportion of the cases, it may manifest a week or more earlier. This is by far the only known condition that produces tender massive enlargement of retroauricular, posterior cervical and postoccipital nodes. The constitutional symptoms are mild. The rash resembles that of measles but is so slight that it is more often than not missed. Just before the onset of rash an exanthem in the form of discrete rose spots on the soft palate may appear.

Measles, so well-known for its classical rash and for causing considerable morbidity in our settings, characteristically causes enlargement of the lymph nodes at the angle of the jaw and in the posterior cervical region. In some instances, mesenteric lymphadenitis, causing crampy abdominal pain, may occur.

In enteric fever, generalized lymphadenitis, including mesenteric involvement, though not a prominent feature, may occur. Such manifestations as prolonged fever, malaise, lethargy, headache, myalgia, abdominal pain, diarrhea/constipation, anorexia, abdominal tenderness, cloudiness of consciousness and splenomegaly should help in suspecting enteric fever and confirming the diagnosis through Widal's test and blood culture.

Acute brucellosis, primarily a disease of animals but transmissible to man, may be responsible for axillary and cervical lymphadenoapathy together with hepatosplenomegaly. Symptoms

include a prodromal phase of weakness, myalgia, anorexia, bodily pains and constipation, followed by evening pyrexia, often with chills, diaphoresis, abdominal pain, cough, weight loss and epistaxis.

Infected generalized eczema is an important, though somewhat neglected cause of generalized tender lymphadenitis.

Tularemia, an uncommon disease of children exposed to the causative bacteria, Francisella tularemsis, may be responsible for development of lymphadenitis as such (glandular form), with ulcerated lesions of skin and/or oral mucosa (ulceroglandular form) or with severe conjunctivitis (oculoglandular form). Accompanying manifestations include myalgia, arthralgia, fever, chills, vomiting, headache, diaphoresis, a generalized maculo-papular rash, anemia and photophobia.

Acquired toxoplasmosis may be responsible for generalized lymphadenopathy, particularly that of posterior cervical region. The nodes are firm and tender. Shortly, they become nontender. There is no suppuration. Accompanying manifestations may include fever, malaise, myalgia, maculopapular rash, hepato-megaly, encephalitis, pneumonia, myocarditis, and, rarely, chorioretinitis.

Chronic

Chronic lymphadenitis is frequently associated with hyperplasia of the nodes.

Infections

Tuberculosis is by far the most common cause of regional lymphadenitis of prolonged duration. It affects most often the upper deep cervical nodes followed by mesenteric nodes. The lymphadenopathy is usually bilateral and occurs by hematogenous spread from the initial infection within 6 months. The nodes are initially firm, nontender and discrete (Fig. 44.3). In due course, they become somewhat matted together, adhere to the overlying skin and finally caseate, resulting in the formation of cold abscess. The cold abscess bursts through sinuses or ulceration of the skin which show no evidence of healing for a long-time. This what is termed scrofuloderma (Fig. 44.4).

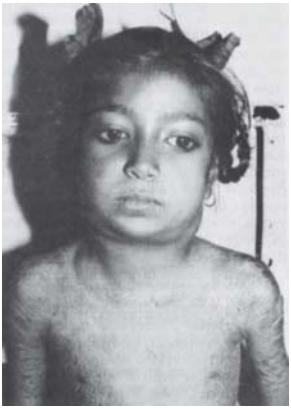

Fig. 44.3: *Tuberculous lymphadenitis* Note massive bilateral cervical lymphadenopathy which was firm, nontender and more or less discrete (tendency for some matting had set in). FNAC confirmed the diagnosis. Also, note the associated ichthyosis (secondary).

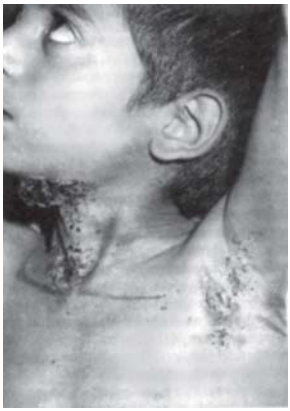

Fig. 44.4: *Scrofuloderma* Note the skin lesions (slougting, ulceration and sinuses) from underlying caseous lymph glands. At times, it may need to be differentiated from pyogenic lymphadenitis, actinomy-cosis or sporotrichosis.

Since quite a few nontuberculous conditions, say chronic septic lymphadenitis, fungal disease, brucellosis, or lymphoreticular malignancy, may resemble chronic lymphadenitis of tuberculous etiology, accurate diagnosis may need lymph node biopsy, fine needle aspiration cytology (FNAC) and culture of the material thus obtained.

Chronic septic lymphadenitis may closely mimic tuberculous lymphadenitis in its early stages. There is moderate enlargement of the nodes with tenderness and, in some instances, matting. Septic tooth, tonsillitis, pharyngitis, scalp infection, etc. are responsible for majority of such cases of cervical lymphadenopathy. In case of involvement of the inguinal region, unattended cuts, wounds, abrasions, boils, etc. in the lower limbs contribute to this condition.

Syphilis (acquired) is an important cause of chronic lymphadenitis. In primary syphilis, the so-called "chancre" is often

accompanied by lymphadenopathy which is characteristically painless, firm, shotty, discrete and nonsuppurative. In secondary syphilis which manifests 6 to 8 weeks after the primary chancre, generalized lymphadenopathy occurs. The remaining clinical manifestations include low-grade fever, sore throat, malaise, weight loss, arthralgia, and cutaneous lesions such as eruptions and condylomata.

Chronic brucellosis may present with lymphadenopathy together with manifestations resulting from localization of the organisms in various organs, e.g. hepatitis, endocarditis, osteomyelitis, epididymitis, cholecystitis, myelitis and encephalitis. A skin rash may occur. Symptoms include prolonged pyrexia, anorexia, myalgia, arthralgia, 'sweating, easy fatigability, nervousness, and depressive/psychotic episodes.

Filarial lymhadenitis involves the inguinal region. It is nearly always a problem of the males. The nodes are painful, tender, discrete and swollen. There is simultaneous swelling of the spermatic cord and/or scrotum. Diagnosis is by demonstration of massive eosinophilia and microfilariae in blood drawn at night when the number of parasites in circulation is expected to be highest.

Tropical eosinophilia, supposedly an allergic response to filarial infection, may be accompanied by adenopathy, wheezy bronchitis and very high eosinophil count.

Lymphogranuloma inguinale, occurring from an infected adult, is a sexually-transmitted disease. It is characterized by inguinal lymphadenitis (usually unilateral) developing 1 to 4 weeks following the appearance of the primary lesion-usually an erosion, pustule or papule over the glans, prepuce, shaft, scrotum, or coronal sulcus. The lymph nodes, initially firm and tender, become fixed to one another and the skin in due course. Eventually, they suppurate and rupture through a chronic sinus tract in the edematous skin. Resolution takes several months. Recurrences are frequent.

Diagnosis is established by isolation of the etiologic organism-related to the virus, Chlamydia trachomatis-from infected lymph nodes and an increase in complement fixing antibody and/or micro-immunofluorescent testing.

Benign lymphoreticulosis (cat scratch disease or fever, felinosis), probably caused by a Chlamydia-like microorganism, is characterized by self-limited suppurative lymphadenitis developing 2 weeks after the primary skin lesion at the site of cat scratch. Axillary and epitrochlear nodes are the most often involved followed by those of head and neck, and the lower limbs. The involved nodes, usually superficial, are tender and as big as 10 cm in diameter. Constitutional symptoms include low-grade fever, malaise, easy-fatiguability, anorexia, etc.

Diagnosis is confirmed by a positive Hanger-Rose test and characteristic histopathologic changes in the involved lymph nodes.

The tender lymphadenitis takes about 2 months to regress. Sarcoidosis is characterized by chronic generalized involvement of lymph nodes, particularly hilar and paratracheal lymph adenopathy, fever, weight loss, abdominal pain and anorexia. In this chronic granulomatous disease with multisystem involvement, lung is the organ most often involved.

Histopathologic examination of the biopsied lymph node or some other tissue is the most valuable diagnostic parameter. AIDS is discussed earlier.

Immunologic Disorders

Chronic granulomatous disease (CGD), a neutrophil defect, is characterized by generalized lymphadenopathy in association with granulomatous lesions in skin, liver, lungs, spleen and bones. Superimposed infections occur by bacteria which normally are of low virulence, and fungi. Cellular and antibody responses are essentially normal.

The real defect lies in the bactericidal activity of the neutrophils due to failure to the latter to generate microbial oxygen products. It can be detected in vitro by the nitroblue tetrazolium (NET) test. Normally almost 90% of leukocytes reduce the dye to a purple-black compound. In this disease, hardly 10% or even less are able to do so.

The disease is usually X-linked recessive. Males are affected whereas females are purely carriers.

Kawasaki's disease (mucocutaneous lymph node syndrome) is characterized by prolonged fever, stomatitis, conjunctivitis, erythema and desquamation over palms and soles, erythema multiforme and lymphadenopathy. Associated with these may be arthralgia/arthritis, myocarditis/pericarditis, aseptic meningitis, hepatitis, pyuria or proteinuria. Coronary vasculities has also been reported.

Juvenile rheumatoid arthritis of systemic-onset type is characterized by prominent extra-articular manifestations, including generalized lymphadenopathy, high fever, rheumatoid rash, hepatosplenomegaly, pleuritis, and pericarditis.

A high proportion of the patients with polyarticular type may also have lymphadenopathy together with low-grade fever, malaise, irritability, anorexia, anemia and hepatosplenomegaly.

Serum sickness, a systemic immunologic disorder that follows administration of a foreign antigenic material, may manifest lymphadenopathy as one of the signs. The most important and the most common finding is generalized urticaria.

Neoplastic/Malignant Diseases

Acute leukemias especially acute lymphocytic leukemia (ALL), may present with prominent generalized lymphadenopathy, usually in association with hepatosplenomegaly, petechiae or mucous membrane bleeding, significant anemia, fever, bone pain/ tenderness, or arthralgia.

Diagnosis is by demonstration of leukemic lymphoblasts in the blood smear, and bone marrow which invariably shows complete replacement by leukemic lymphoblasts.

Hodgkin's lymphoma is characterized by painless enlargement of lymph nodes (usually unilateral cervical to begin with) is the most frequent presenting feature. The involved nodes are usually matted, firm or robbery, nontender and mobile. With progression of the disease process, deeper glands may also be involved. They may cause symptoms by compressing the adjacent structures, e.g. chronic pertussis-like cough and respiratory distress.

The disease may involve any organ(s) in addition to lymph nodes, causing corresponding manifestations.

General symptoms of the disease include fever, anorexia, weight loss, night sweats and pruritus.

The most important investigation is histopathologic study of biopsy material from the involved lymph node.

Non-Hodgkin lymphoma mostly arises in the head and neck region as a painless cervical or supraclavicular lymphadenopathy. So rapid is the growth that within a matter of 1 to 3 weeks, the nodes may assume enormous size. Though the nodes are, to begin with, firm, nontender and discrete, they become confluent as the disease progresses.

Another common site of lymph node involvement is the mediastinum in which case the child presents with signs and symptoms of mediastinal compression.

Yet another frequent site of involvement of the nodes is the ileocecal region. The common mode of presentation in such a case is with abdominal lump, intestinal obstruction or intussusception.

Drugs

Diphenylhydantoin, troxidone, carbamazepine, BCG, iron-dextran complex, cephaloridine, meprobomate, PAS, primidone, phenylbutazone, sulfadimidine, etc.

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Chapter 45 Mass in Abdomen

Abdominal mass, lump or swelling is a commonly-encountered problem in pediatric practice. Inadequacy of clinical work-up often leads to unnecessary and cumbersome investigations in arriving at its precise diagnosis.

In a given case, ask when the lump was first noticed, provided that the attendants or the patient are indeed aware of it. Is it present since birth? Else, is it of short duration or has been there for quite sometime? Did it follow some trauma, or develop spontaneously? Is it growing rapidly or slowly, or regressing? Is it painful and whether pain is localized or referred? Did the pain precede the lump or follow it? What is the stated site of the lump-whether superficial or within the abdomen and roughly in which region? In case of a superficial swelling, any secondary changes such as ulceration, sinus formation, fungation, or softening?

Don't miss asking if the subject is febrile, losing weight, developing considerable pallor or having swellings elsewhere as well. Is the bleeding from anywhere? Any history of jaundice? Any history of ascariasis?

Physical examination must ascertain whether the swelling is in the abdominal wall (parietal) or intra-abdominal, what its exact anatomic position is, whether it is in connection with a particular organ (say liver, spleen, kidney, gut, or lymph nodes) and whether it is inflammatory or a growth.

To decide whether the lump is parietal or intra-abdominal, ask the patient to make his abdominal muscles taut by raising the shoulders with arms folded over the chest while he lies down on the bed. Abdominal muscles can also be made taut by raising the

extended legs from the bed, or by trying to blow out with the nose and the mouth covered with something or simply kept-closed. A parietal swelling becomes more prominent whereas an intra-abdominal one just disappears or becomes less apparent on any of these maneuvers. The observation that the swelling moves with respiration vertically also favors its intra-abdominal location.

Ascertain the position of the lump in relation to the standard anatomic regions of the abdomen (Fig. 45.1). To recapitulate the division, let us draw two imaginary horizontal and vertical lines. The upper horizontal line runs midway the umbilicus and xiphisternum, the lower at the level of the iliac tubercles. The vertical line pass on either side through the midpoint between anterior superior iliac spine and symphisis pubis. The three regions in the upper quadrant, thus formed, are right hypochondrium, epigastrium, and left hypochondrium. In the middle quadrant, the three regions are right lumbar, umbilical and left lumbar. The

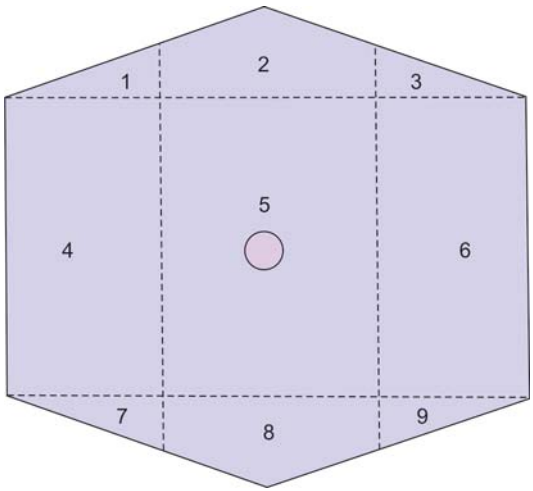

Fig. 45.1: *Anatomical topography of the abdomen* Region 1 represents right hypochondrium; 2-epigastrium; 3-left hypochondrium; 4-right lumbar; 5-umbilical; 6-left lumbar; 7-right iliac, 8-hypogastrium; 9-left iliac.

lower-most quadrant consists of right iliac, hypogastric and left iliac regions. Thus, in toto there are nine regions.

In case of intra-abdominal lump, you must try to sort out its relationship with liver, spleen, kidney, gallbladder, stomach, gut, mesentery, etc. Is there any ascites or other evidence of portal hypertension?

Never, never forget examining the hernial sites and for undescended testes.

PARIETAL LUMP

Right and Left Hypochondria

In addition to boils, carbuncles, abscesses, lipoma, angioma or neurofibroma, a parietal lump in any of the hypochondria may be an abscess secondary to cold abscess related to canes of the spine or ribs, or to liver or subphrenic abscess.

Epigastrium

Besides the conditions that are described in connection with the hypochondria, a well-built adolescent indulging in strenuous exercise or activity may develop a small rounded lump, about the midline between the umbilicus and the xiphisternum, which causes discomfort, particularly after food. This is called epigastric hernia.

Right and Left Lumbar Regions

The comments given in connection with the hypochondria can be faithfully applied in case of the lumbar regions as well, except that, on rare occasions, a lumbar hernia, may also be responsible for a lump in region.

Umbilical Region

Besides the conditions mentioned in case of hypochondria, umbilical hernia, and hematoma or abscess of the rectus sheath (the former from some trauma) may be responsible for swelling arising from the abdominal wall.

Umbilical hernia is a commonly encountered condition in newborns and infants, occurring as a result of weakness or faulty closure of the umbilical ring. Associated diastasis recti is frequent. The incidence in dark races is several times higher than in the whites. Low birth weight infants suffer more often.

The hernia manifests as a soft swelling of variable size, that protrudes or becomes more prominent on coughing, crying or straining (Fig. 45.2). It is covered by skin and is easily reducible. It may be found in otherwise normal infants but may well be a part of the manifestations of cretinism or gorgoylism.

Two types are recognized. First: "false" in which hernia occurs into the cord itself. It is a persistence of the physiologic state. Second: "true" is characterized by protrusion through the umbilical cicatrix. In both types, the hernial sac contains omentum or portions of the small intestine.

Spontaneous regression occurs in a large majority of the cases by the age of 18 months.

Umbilical polyp is a rare congenital bright red, firm and resistant swelling resulting from persistence of all or part of the omphalomesenteric duct or the urachus. It is formed by intestinal or urinary tract mucosa and may intermittently discharge urine or fecal matter in case of a communication with the bladder or the ileum.

Umbilical granuloma, often confused with polyp, is the result of persistence of exuberant granulation tissue at the base of the umbilicus (Fig. 45.3), The area appears pink or reddish with seropurulent secretions. Without cauterization with silver nitrate (often more than once), it usually does not heal.

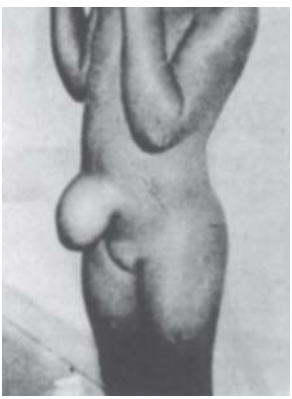

Fig. 45.2: *Large umbilical hernia*

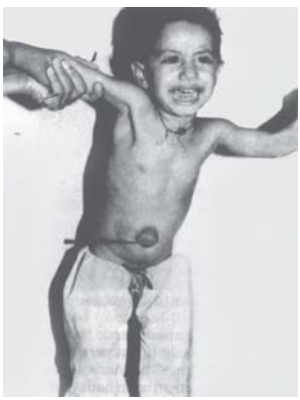

Fig. 45.3: *Umbilical granuloma*

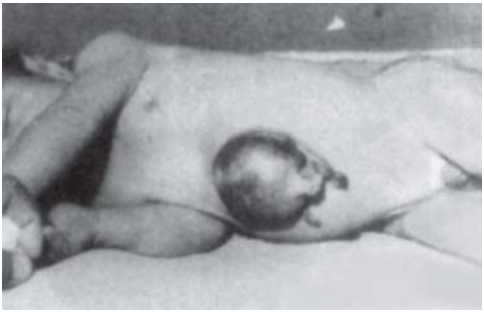

Fig 45.4: *Exomphalos minor* Note the protruding umbilical sac of small size without skin covering.

Congenital omphalocele (exomphalos) refers to herniation of the abdominal contents into the base of the cord, the size of the sac lying outside the abdominal wall depending upon the type of visceral protrusion. Remember, in contrast to the umbilical hernia, the sac of omphalocele is never covered by skin (Figs 45.4 and 45.5).

Gastroschisis refers to small protrusion of whole of the midgut loop through the defect in the anterior abdominal wall, placed usually to the right of the umbilicus and separated by a skin bridge. There is absence of sac. Cord is at normal position. Rarely, whole or part of the liver is also herniated (Fig 45.6).

Tumors of the umbilicus, through rare, may produce a mass. They include angioma, cysts of urachal or omphalomesenteric remnants, dermoid cyst, enteroter-atoma and myxosarcoma.

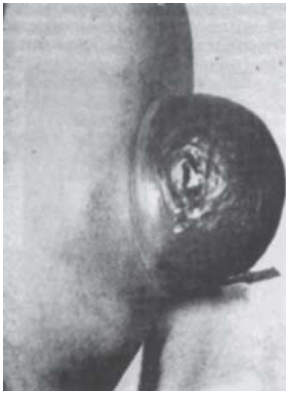

Fig. 45.5: *Exomphalos major* Note that the thin and translucent sac is not covered by skin unlike the umbilical hernia which is always covered by skin. Moreover, the defect is over 4 cm in diameter and is accompanied by other abnormalities.

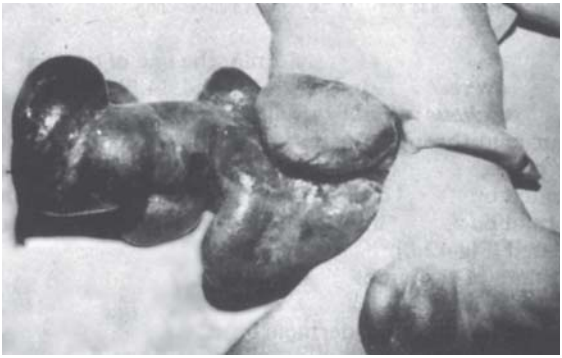

Fig. 45.6: *Gastroschisis* Note the protrusion of the whole of midgut loop and a part of liver through the defect in the anterior abdominal wall, placed to the right of the umbilicus and separated by a skin bridge.

Right Iliac Fossa

In addition to the swellings mentioned in connection with the hypochondria, a pyrogenic iliac abscess or an appendicular abscess may become parietal by burrowing through the anterior abdominal wall. More important, however, are the inguinal swellings.

Inguinal hernia is characterized by appearance of an intermittent inguinal or inguinoscrotal swelling (rarely involving the labium majus) on crying, coughing vigorously or straining at stools (Fig. 45.7). As a rule, it disappears when the child relaxes in mother's lap or lies down peacefully. Usually, there is no pain due to the swelling. On the other hand, crying thought to be the result of pain is the triggering factor for the swelling.

The observation of an inguinal or inguinoscrotal swelling that is usually right side and reduces spontaneously or on manipulation is virtually diagnostic of inguinal hernia. If the examiner fails to get a chance to observe the swelling even on raising the intra-abdominal pressure, he should roll the thickened spermatic cord on the affected side between his two fingers. He may feel a "crepitance". This is what is called "silk glove" sign.

Enlarged lymph nodes, secondary to an inflammatory or other lesion from umbilicus down to the toes, constitute the most

Fig. 45.7: *Inguinal hernia* The swelling in the groin appeared on crying and reduced spontaneously on relaxing. The "silk glove" sign (feel of a crepitance on rolling thickened spermatic cord between examiner's two fingers) was positive.

important and also the most common cause of swelling in the inguinal region. Most often the swelling is inflammatory, secondary to an acute infective focus in the drainage area. In this case, the nodes become enlarged, tender and fixed with the overlying skin showing classical signs of acute inflammation. In chronic septic lymphadenitis, the nodes become moderately enlarged with no or little tenderness. In the drainage area, you may find a primary focus, say a septic cut, ulcer, blister,etc. Inguinal lymphadenitis of tuberculous origin is rather infrequent. The enlarged nodes, unless the disease is in an early stage, become matted, i.e. adherent to each other followed by caseation and cold abscess formation. Finally, a more or less nonhealing ulcer or sinus follows.

Undescended testis may be responsible for producing an inguinal swelling (or else in the abdomen, perineum, femoral area, or at the base of the penis over the pubic bone when it is termed ectopic testis). You can ascertain that the swelling is due to testis by its shape, feel and that typical testicular sensation. The scrotum

is empty on the affected side. Moreover the affected testis is smaller than the normally-located testis. In an overwhelming majority of the cases, it is accompanied by inguinal hernia.

Retractile testis may occasionally cause an inguinal swelling. The cause is strong contraction of the cremaster muscle which periodically pulls the testis into the inguinal canal or the inguinal pouch. If this condition is suspected, repeated examinations may be needed.

Psoas abscess, resulting from caries spine or cold abscess, resulting from tuberculosis of hip or sacroiliac joints, may cause a large, swelling in the inguinal region. An impulse on coughing, crying or straining on stools occurs in the former. Evidence of a deformity of the spine, hip or sacroiliac joints often clinches the diagnosis.

Such causes of inguinal swelling as femoral hernia, saphena varix and psoas bursa are virtually seldom seen in childhood.

Left Iliac Fossa

The observations made in connection with the right iliac region are eminently applicable in this region too. However, as is understandable, appendicular abscess is unlikely to push through the abdominal wall on the left side.

Hypogastrium

All that I said in connection with the parital lumps in the umbilical region holds equally good here as well.

In addition, a urachal cyst or persistent urachus, due to failure of closure of the allantoic duct, extending from bladder to the umbilical, may be responsible for a cystic swelling at the umbilical. A clear, light yellow urine-like discharge at the umbilicus continues.

INTRA-ABDOMINAL LUMP

Right Hypochondrium

Liver

Hepatomegaly is a common finding in infancy and childhood. Not always is it of pathologic significance. Quite frequently, liver is palpable in normal, healthy children up to the age of 4 or 5 years-

say up to around 2.5 cm in the first 2 years and up to 1 cm from 2 to 4 or 5 years. Of course, such a normal liver is soft, smooth, round edged and nontender.

A large number of conditions may be responsible for organic hepatomegaly, right from infections (such as viral hepatitis) through nutritional disorders (such as kwashiorkor) or essentially malignant states (such as cirrhosis, leukemia or tumors) as outlined below :

Infections/inflammations Viral hepatitis, amebic hepatitis/ abscess, pyogenic hepatitis/abscess, ascariasis, cholangitis, hydatid disease, tuberculosis, malaria, kala-azar, enteric fever, brucellosis, septicemia, neonatal/intrauterine infections like toxoplasmosis, rubella, cytomegalic inclusion disease, syphilis, infectious mononucleosis, leptospirosis, histoplasmosis.

Hematogenous diseases Congenital hemolytic anemias like thalassemia and sickle-cell anemia, erythroblastosis fetalis.

Nutritional problems Kwashiorkor, total parenteral alimentation (caloric overload).

Vascular/congestive Congestive cardiac failure, hepatic vein thrombosis, constrictive pericarditis, veno-occlusive disease of liver.

Storage diseases Acute-Reye syndrome. Chronic-Glycogen-storage disease, Gaucher's disease, Niemann-Pick disease, galactosemia, gargoylism, hemosiderosis, amyloidosis, xanthomatosis, cystic fibrosis, cystinosis, diabetes mellitus, Wilson's disease, gangliosidosis, cholesterol storage disease, Wolman's disease.

Malignant diseases Leukemias, lymphomas, neuroblastoma, Wilms' tumor, gonodal tumors, hepatoblastoma.

Miscellaneous Cirrhosis (esp. Indian childhood cirrhosis), congenital biliary atresia, cysts, alpha-1-antitrypsin deficiency, hemangioma, macroglobulinemia, SLE, drug toxicity.

For details on hepatomegaly, see Chapter 35.

Gallbladder

A palpable tender mass in the right hypochondrium with or without radiation to the right shoulder (just below the scapula) should cause a strong suspicion of cholecystitis, particularly if the

patient is an older teenaged girl. Remaining manifestations include fever (with shaking chills in case of cholangitis), jaundice, and, occasionally indigestion, flatulence or food intolerance.

Two type of disease are known to occur: noncalculus and cholelithiasis. The former is associated with acute systemic infections (say septicemia), enteric fever, giardiasis, ascariasis, leptospirosis, erysipelas, anaerobic diphtheroid infections, Kawasaki disease, gross dehydration, gross protein-energy malnutrition and neonates with associated amnionitis.

Subphrenic Abscess

Liver, though not actually enlarged, may become palpable due to its depression in subphrenic abscess (on the right side) resulting from an appendiceal or other intra-abdominal suppuration as also from an empyema on rare occasions. A history pointing to some such predisposing condition can usually be elicited. On local examination, a tender diffuse swelling is found in continuity with the liver. Rarely, you may be able to demonstrate alternate areas of dullness and resonance along the midaxillary line on percussion. Remaining manifestations include hectic rise of temperature with chills and rigors and toxemia.

In order to establish the diagnosis, you must demonstrate elevated diaphragm on right side with gas under it in the X-ray. Screening, in addition, shows that the diaphragm is fixed rather than demonstrating normal up and down movements with respiration.

Aspiration of the pus finally confirms the diagnosis.

Gut

Intussusception The lump as a result of intussusception is sausage-shaped, somewhat tender and usually located in the right upper quadrant of the abdomen with its long axis directed cephalocaudally. If it increases in size as also firmness under the examining finger during a paroxysm of abdominal pain, the clinical impression is further corroborated. In addition to the lump, rectal examination reveals presence of blood on the examining finger as it is withdrawn. Remaining manifestations include sudden onset of a severe paroxysmal pain, shock-like state, fever, vomiting, and passage of blood and mucus (current jelly) in stools.

Intestinal tuberculosis Rarely, a lump formed by ileocecal tuberculosis may get drawn to the right hypochondrium by fibrosis. Barium follow-through shows the "filling defect" along with elevation of the cecum and spasm of the terminal ileum. Diagnosis needs corroboration by Mantoux/BCG test, ESR, X-ray chest and family screening.

Kidney

A kidney swelling is better felt in the loin than anteriorly. Its causes include movable kidney, hydro- or pyonephrosis, tuberculosis, polycystic kidney, renal calculus, Wilms' tumor, neuroblastoma and perinephric abscess.

Movable kidney is characteristically only slightly enlarged, if at all. Accompanying manifestations may include colicky or dragging pain, and neuroasthenia in grown-up children and adolescents who become overconscious that they have such a kidney. In order to establish the diagnosis, an IVP is needed.

Hydronephrosis produces a lump having general characteristics of a renal swelling, often varying in size with the large passage of urine. It is cystic, fluctuant and shows positive fluid thrill if large enough in size. Usually, a similar lump is palpable on the left side as well. Until the lump has assumed considerable size, it may remain virtually symptomless. Later, it becomes painful. Hematuria may occur. Fever with chills indicates superimposed infection.

Pyonephrosis produces a clinical picture that closely mimics the one produced by hydronephrosis. In addition, there is hectic rise of temperature, rigors, sweating, toxemia and leukocytosis.

Renal tuberculosis, a rare cause of lump in the hypochondrium in infancy and childhood, may be accompanied by such manifestations as increased frequency of micturition, pain in the loin and hematuria. Persistent sterile pyuria is a strong indication for excluding renal tuberculosis. Radiologic findings include calcified tuberculous lesions, calyceal cavities, and dilatation followed by stenosis of the urinary tract. Bladder becomes contracted and small. Typically, there are multiple sites of involvement.

Polycystic kidney may be of two types: infantile form and adult form. In the infantile form, an autosomal recessive disease, the kidney (in fact both kidneys) is enlarged, the whole parenchyma being filled with fusiform or cylindrical cysts. Cysts are found in liver, pancreas, bile duct, and lung as well. Radiology shows radially-aligned renal parenchyma opacifications in the shape of streaks, widened calyces and visible contrast medium in the cortex.

In the adult form (a misnomer because it manifests in childhood as well), an autosomal dominant disease, the subject presents with a renal swelling (rather on the other side also) accompanied by, at times, dragging pain in the loin, hematuria or uremia, and pale urine (of low specific gravity) showing albumin and casts. All through the parenchyma, the kidney shows cysts. Accompanying features may include an intracranial aneurysm. Radiology shows calyces which are elongated and bizarrely distorted with terminal clubbing, making sponge-like appearance.

Renal calculus may occasionally be responsible for an enlarged kidney. Remaining manifestations include colicky abdominal pain, hematuria, recurrent urinary infections, passing of the calculus and urethral obstruction. X-ray establishes the diagnosis.

Perinephric abscess manifests with diffuse renal swelling, erythema, edema and tenderness of the flank. The individual is toxic, having pyrexia of unknown origin. The lumbar spine shows scoliosis with the concavity towards the involved side. Movements of the spine to the opposite side is usually painful. There may be limp and fixed flexion of the hip. Radiology shows displacement of the affected kidney and ureter with obliteration of the psoas shadow.

Wilms' tumor, also called nephroblastoma, may be responsible for a huge painless renal lump in the right upper quadrant. Hematuria is rare. If metastases has occurred, associated symptoms will be seen depending upon the organ(s) involved. Radiology shows a soft tissue opacity displacing the gut in the area normally occupied by the kidney, and distortion of calyces (spiderleg deformity).

Adrenals

Neuroblastoma, a malignant tumor arising from adrenal medulla or sympathetic ganglia (so, not a renal growth in actuality), may produce a lump that not only fills the right hypochondrium but also goes down and to the left, crossing the midline. The kidney is in reality pushed upward by this mass which is hard and fixed. Remaining manifestations depend upon the extent of the growth. Fever, bone pain anemia and weight loss are common. Subcutaneous nodules, adrenal masses with involvement of the bone marrow, hepatomegaly from massive infiltration of the liver, paraplegia, paroxysmal hypertension and proptosis secondary to retroperitoneal deposits may occur.

Radiology shows displacement of one of the kidneys by a suprarenal mass. Gross skeletal metastases may also be detected.

Urine examination reveals an excessive excretion of catecholamine and/or their metabolites, vanilmandelic acid (VMA) and cystythionine.

Bone marrow may show secondary deposits, i.e. neuroblasts, which may simulate leukemia.

Epigastrium

Liver and Subphrenic Space

Refer details given in connection with the right hypochondrium.

Stomach, Duodenum and Gut

Congenital hypertrophic pyloric stenosis, occurring in infants about 3 to 5 weeks old, may be responsible for epigastric fullness, gastric waves moving from left to right and a palpable olive-shaped lump about the size of the thumb. The classical story is that the infant, usually a first born male, begins to vomit. Within 30 minutes, vomiting becomes forceful and projectile. He is constantly hungry and fails to thrive. Occasionally, greenish stools (starvation diarrhea), gastric hemorrhage or jaundice may be present. Dehydration, electrolyte imbalance (especially alkalosis, hypokalemia and hyponatremia) and tetanic spasms may complicate the picture. Barium meal study shows gross narrowing and elongation of pylorus. The stomach is markedly distended, with abnormal retention of barium, and there is increased intensity of peristaltic waves.

Intussusception (though usually its lump is palpable in the right hypochondrium) may cause a lump in the epigastric region in some cases. In the latter situation, its long axis is directed transversely rather than cephalocaudally.

Trichobezoar Some infants and children, especially if having behavioral problems, may get into the practice of pulling out the head hair and swallow the material. In due course, this chronic practice may lead to collection of a lot of hair in the stomach which becomes palpable as a big lump, the so-called trichobezoar or hairball, particularly after meals. The lump gives a soft crackling feeling when palpated. Symptoms include indigestion, dyspepsia and epigastric discomfort, more so after meals. Areas of alopecia, secondary to trichotilomania, over head in an emotionally disturbed or mentally retarded child may suggest the diagnosis.

Barium meal study shows a lump outlined by barium. *Intestinal tuberculosis* In hyperplastic tuberculosis, contracted transverse mesocolon may pull the transverse colon to the lower part of the epigastrium, leading to a palpable mass and fullness in the epigastric region.

In tuberculosis, the omentum may get rolled up to form a transverse ridge in the epigastric region. A mass of lymph nodes with adherent intestinal coils may be felt in the epigastrium.

Pancreas

Pseudopancreatic cyst may form a smooth rounded fluctuating lump in the epigastrium. It is a collection of fluid in the lesser sac of the peritoneal cavity. A trauma or inflammation figure among the causes.

Barium meal shows that the lump is situated behind the stomach.

Kidney and Suprarenal

See discussion in connection with the right hypochondrium.

Aorta

A lump in the epigastrium with characteristic expansile pulsation may well be aneurysm of upper part of the abdominal aorta.

Lymph Nodes

Enlarged lymph nodes, of whatsoever etiology, may cause palpable lump in the epigastric region.

Left Hypochondrium

Except for the splenic lump, intra-abdominal mass in this region merits about the same components as given in connection with the right hypochondrium.

A detailed discussion on differential diagnosis of splenomegaly will be found in Chapter 55. A comprehensive list of its causes is as under.

Infections Malaria, kala-azar, enteric fever, tuberculosis, brucellosis, intrauterine infections, septicemia, infective endocarditis, infectious mononucleosis, histoplasmosis, coma viral fevers.

Hematogenous diseases Hemolytic anemias, erythroblastosis fetalis, nutritional anemia, hypersplenism, thrombocytopenic purpura.

Congestive splenomegaly Congestive cardiac failure, cirrhosis, hepatic, portal or splenic vein thrombosis, constrictive pericarditis.

Inborn errors of metabolism Glycogen storage disease, Gaucher's disease, Niemann-Pick disease, gargoylism, amyloidosis, hemosiderosis, xanthomatosis, cystinosis, cystic fibrosis.

Malignant diseases Leukemia, lymphosarcoma, Hodgkin's lymphoma, myeloproliferative disorders.

Miscellaneous Cysts, hemangioma, abscess, systemic lupus erythematosus, rheumatoid arthritis (Still's disease), osteopetrosis, nutritional recovery syndrome.

Right and Left Lumbar Regions

There is no special comment about the lump in lumbar region, except that it may be either in connection with the kidney or colon, or an extension of a lump in connection with the neighboring structures, say liver, gallbladder and appendix on the right and spleen on the left.

Umbilical Region

Lump in this region may develop in connection with stomach, gut omentum, pancreas, lymph nodes, kidney, liver and spleen. In

kwashiorkor, hepatomegaly may be huge enough, reaching as low as the umbilicus and even below. Likewise, splenic swelling in tropical splenomegaly syndrome, thalassemia or chronic myeloid leukemia may extend to this region or even lower down.

Right Iliac Fossa

Appendix

Appendicular lump is by and large the most frequent cause of intra-abdominal swelling in the right iliac region. It is tender, firm, irregular and fixed or little mobile. Inflammatory signs evident over the overlying abdominal wall indicate that the lump is not just a mass of inflamed and swollen appendix wrapped up by omentum, coils of intestine and lymph but has an element of abscess formation as well.

Leukocytosis is present, particularly in an infant in whom the count may be 20,000/cmm or more.

Gut

Intussusception, as already stated, produces a lump usually in the right hypochondrium and less frequently in the epigastric region. The right iliac fossa is, as a rule, empty. Rarely, however, at an early stage of the disease, a lump may be palpable in the ileocecal region *per se*.

Roundworm impaction, in children heavily infected with *Ascaris lumbricoides* in the lower most portion of the ileum, may be responsible for a palpable lump which could easily be confused with an intussusceptum. This possibility should, therefore, be carefully borne in mind in endemic areas.

Amebic colitis may infrequently be responsible for a palpable lump in the right iliac fossa. History of amebic dysentery/diarrhea with demonstration of *Entamoeba histolytica* trophozoites or cysts establishes the diagnosis.

Crohn's disease, also termed regional ileitis or granulomatous enterocolitis, is a nonspecific inflammatory bowel disease (the other being ulcerative colitis) which may produce a palpable abdominal mass in the iliac fossa in a proportion of the subjects who usually are preadolescents or adolescents. Accompanying manifestations include crampy abdom-

somewhat subsides after defecation, chronic diarrhea, malnutrition, perianal lesions, aphthous stomatitis, polyarthritis, clubbing and erythema nodosum

Diagnosis is established by sigmoidoscopy, rectal biopsy (showing typical granulomas even in the absence of significant segmental involvement on sigmoidoscopy), endoscopy (which defines the limits of colonic lesions) and barium follow-through (which shows irregular mucosa or a "cobbler-stone" pattern, thickened bowel wall, enteric fistulas and segmental distribution of the lesions).

Lymph Nodes

Lympadenopathy secondary to such conditions as tuberculosis, filariasis or lymphoma may be responsible for a lump in the right iliac region. Also, see Chapter 44.

Ileopsoas Sheath

lleopsoas cold abscess, secondary to caries spine, may cause a lump in the right iliac fossa-just above the inguinal ligament and below the inguinal ligament by trickling down from its original site (Fig.
45.8). If the cold abscess fills virtually the whole of right iliac fossa, the primary bony lesion is in all probability tuberculosis of the hip or sacroiliac joint.

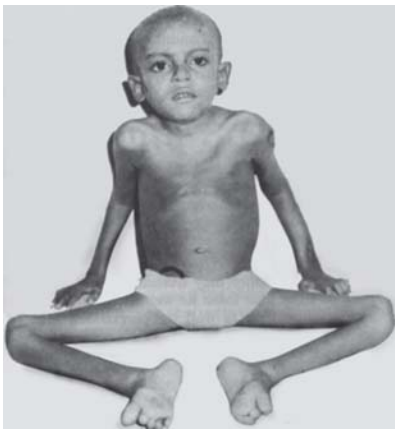

Fig. 45.8: *Ileopsoas abscess*
Note the part of the outline of the mass in the right iliac fossa. Radiologic evidence of caries spine (sacroiliac) was present.

Kidney

Movable kidney may be responsible for a palpable lump in the right iliac fossa.

Unascended kidney, may be responsible for a lump in the right iliac fossa (or pelvis), the area where the first rudiment of renal tissue is supposed to appear. IVP must be done in suspected cases.

Gallbladder

Hydrops gallbladder or any condition leading to a massive swelling of the gallbladder may descend down to right iliac fossa where it becomes distinctly palpable, particularly when hepatomegaly accompanies the condition. This is a rare entity.

Testis

Retained testis may rarely become palpable in the right iliac fossa, particularly when it develops a pathology such as malignancy at or after puberty. The lump is fixed, firm and irregular.

Urinary Bladder

A full distended bladder may assume an enormous size, extending to right iliac fossa as well. It is felt as a tender globular swelling that is dull on percussion and often reaches the umbilicus. When slightly pressed, the child feels a desire to micturate. On micturition, the bladder lump disappears.

Hypogastrium

Except for the swelling produced by a full bladder, it is rather uncommon to have a lump in this region. It may, of course, occur in connection with other structures as well, say small intestine, sigmoid colon, pelvis, etc.

Left Iliac Fossa

The description given for the right iliac fossa is more or less applicable to this region too. Here, rather than gallbladder, a splenic lump may be palpable. Secondly, in place of appendix, here descending colon becomes relevant. Diverticulae, congenital anomalies due to persistence of intestinal abnormal tissue in close relation to a part of the alimentary tract, though very rare in childhood (Meckel's diverticulum is an exception), must be

mentioned in relation to this region. They may cause mechanical obstruction, and become inflamed (diverticulitis), ulcerated or perforated.

FURTHER READING

1. Golden CB, Feusner JH. Malignant abdominal masses in children: Quick guide to evaluation and diagnosis. *Pediatr Clin North Am* 2002;49:1369-92.

Chapter 46 Mouth-Breathing

Mouth-breathing is a common observation in pediatric practice. It is responsible for several secondary adverse effects, including dryness of the mouth and lips and their proneness to fissuring and infection.

In a given case, find out if the child mouth-breathes just out of habit or he has an obstructive nasal problem. Does he have persistent or recurrent upper respiratory infection? Does he sneeze a lot? Any headache, hyposmia, or postnasal discharge?

Physical examination should, in particular, exclude adenoids, polyp, foreign body, deviated septum and allergy.

Adenoids

Adenoidal hypertrophy may interfere with the passage of air through the nose, resulting in mouth-breathing, especially during sleep when the child lies supine. When gross adenoidal hypertrophy is present, the child develops a tendency to keep the mouth open during day also. Accompanying manifestations may include dryness of the mucous membrane of the mouth and lips, persistent rhinitis, pharyngitis, snoring, nasal voice, offensive breath, impaired taste, bad smell, harassing cough, impaired hearing and chronic otitis media. Eventually, the child may develop dull expression with open mouth and maloccluded teeth-the so-called adenoid facies. His school performance too suffers.

In a suspected case, digital palpation, indirect visualization with a pharyngeal mirror or fiberoptic bronchoscope, or lateral pharyngeal X-ray may help in clinching the diagnosis.

Choanal Atresia

In bilateral choanal atresia, if the infant is able to mouth-breathe, he experiences difficulty when sucking and swallowing. The infant may even become cyanotic on being nursed.

Diagnosis is made by passing firm catheter through each nostril deep into the nasopharynx.

Maternal Medication

A hypertensive mother on reserpine may pass on the drug to the baby and cause nasal obstruction and mouth-breathing.

Nasal Allergy

Mouth-breathing may accompany nasal allergy which occurs as a result of changed reactivity of nasal mucosa to a variety of substances. Two types are known: seasonal and perennial. In seasonal allergy, also termed hay fever or pollinosis, the antigen (allergen) is an inhalant such as pollens of flowers, weeds, trees or grass. In perennial allergy, the allergen may be an inhalant or ingestant like egg white, fish, milk, etc. as also a drug, bacteria or perfume.

Symptoms in either type include, in addition to mouth-breathing secondary to nasal obstruction, intense irritation in nose and eyes, sneezing, excessive nasal discharge and watering of eyes. Local examination reveals that the nasal mucosa is pale/bluish and swollen. Nasal airway is diminished and there is watery nasal discharge. Conjunctiva is congested. There may also be bronchospasm.

Nasal Polyp

Nasal polyposis, meaning a pedunculated, hypertrophied edematous nasal mucosa supposedly due to allergy, infection or both, is an important cause of nasal obstruction and mouth breathing. Accompanying symptoms include persistent cold, sneezing, headache, hyposmia and postnasal drip.

Foreign Body

A foreign body in the nose (say peas, beans, crayon, beads, buttons, pieces of pencil or plastic, maggots, etc.) produces inflammatory reaction. Nasal obstruction may lead to mouth-breathing.

Remaining symptoms include a unilateral blood-stained foulsmelling discharge.

Deviated Nasal Septum

Deviated nasal septum (DNS), when gross, may cause unilateral or bilateral nasal obstruction and mouth-breathing together with dryness of mouth and pharynx, recurrent attacks of cold, headache and facial pain, epistaxis, cosmetic deformity, anosmia and local tenderness due to pressure on anterior ethmoidal nerve, the so-called Studer's syndrome.

Mouth-Breathing as a Habit

Not infrequently, children (so do adults) get into the habit of mouth-breathing without any evidence of nasal obstruction or any reasonable cause.

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Chapter 47 Nystagmus

By the term, *nystagmus,* is meant involuntary rapid movements (horizontal, vertical, rotatory, or mixed) of the eyeball, usually causing no or little disturbance to the subject. The most common form of nystagmus seen in pediatric practice is related to visual defects. As many as 22 out of the 40 infants and children with nystagmus seen by me during the recent months turned out to have one or the other defect of vision as the cause.

History should ascertain whether nystagmus has been there since early infancy or it occurred later. Is it spontaneous, or follows certain stimulus, say when the subject tries to fix at an object placed in an extreme lateral position (end-position nystagmus) or, when the eye attempts at fixing a stationary object while the subject is in a moving vehicle (optokinetic nystagmus)? Does the individual suffer from a visual problem? Is he on antiepileptic drugs, or such agents as aspirin or diphenoxylate hydrochloride? Does the patient have nodding spasm? Any history of associated nausea, vomiting, dizziness, ataxia or tremors?

Physical examination should, in particular, focus on vision and CNS besides routine examination. Is there any evidence of albinism?

PHYSIOLOGIC NYSTAGMUS

Physiologic types of nystagmus require a stimulus before these occur. In a neonate (after the first week) and an infant, it is an expected finding, provided that the ocular muscles are functioning normally.

Train, railroad or optokinetic nystagmus is characterized by

individual, travelling in a moving vehicle, attempts at fixating a non-moving object.

End-position nystagmus is a nystagmus in the direction of fixating an objects that has been placed in an extreme lateral position.

ORGANIC NYSTAGMUS

Visual defects constitute the most common cause of nystagmus. The defects include optic atrophy and astigmatism.

Optic atrophy, characterized by marked pallor of the disc and loss of nerve head substance, at times with enlargement of the disc cup, may be traumatic, inflammatory, degenerative, vascular or neoplastic. The chief causes in pediatric practice are hydrocephalus and space-occupying lesions (intracranial tumors).

Astigmatism, meaning a difference in the refractive power of the corneal meridians mostly due to irregularity in the curvature of the cornea and infrequently due to changes in the lens, manifests with eye strain, headache, fatigue, school failure/indifference, restlessness and conjunctival hyperemia in addition to nystagmus.

Labyrinthine nystagmus is as, rule, unidirectional, showing horizontal or jerking movements with the eyes at rest. Accompanying symptoms include nausea, vomiting and dizziness. The most common cause of this vestibular nystagmus is labyrinthitis which may occur secondary to acute or chronic otitis media.

Congenital nystagmus may occur as congenital pendular nystagmus or congenital jerky nystagmus.

In congenital jerky nystagmus, in some instances familial, the subject shows horizontal jerky oscillations on lateral gaze with eyes at rest. The nystagmus is bilaterally symmetrical. In a particular eye, of course, nystagmus is coarser in one direction of gaze than in the other. Visual acuity and fixation are considerably affected. There always is a point at which nystagmus is least and the vision the best. Hence, the patient has a strong tendency to adopt a compensatory posturing, turning the head to bring the eyes into the position of minimal nystagmus.

In congenital pendular nystagmus, associations with visual and/ or ocular defects (albinism, congenital cataracts, congenital

optic atrophy, total color blindness, retrolental fibroplasia, aniridia, achromatopsia, congenital macular defects, high refractory errors) is very common. Only in a small proportion, it occurs as a dominant or X-linked familial disorder without any evident ocular lesion. This form of nystagmus is characterized by rhythmical to-and-fro movements of the eyeball while the individual is looking forward or attempting to fixate an object.

Spasmus nutans is characterized by nystagmus that is very fine, rapid, horizontal and pendular. It is nearly always bilateral. When unilateral, one eye is more involved than the other. Remaining components of the disorder, which is benign, self-limiting and start within the first 1 to 2 years of life, are head nodding and torticollis. The components of the disorder, however, may manifest at different times.

Albinism, a defect in the formation of melanin, is usually accompanied by nystagmus, the remaining manifestations depending upon whether it is generalized oculocutaneous type or partial type involving the eyes. Note that inpartial type, involving localized areas of skin and hair, nystagmus is absent. The last-named is autosomal dominant.

Oculocutaneous albinism, also called autosomal recessive albinism, has as many as 6 variants. In addition to nystagmus, an albino has extremely fair skin, fine silky hair, gray or blue iris, refractory errors with poor visual acuity, strabismus and photophobia. Fundoscopy reveals that retina is devoid of pigment. Red reflex may be present.

Partial albinism (ocular variety), also called X-linked albinism, the patient has poor visual acuity, depigmentation of iris and/ or retina, photophobia and nystagmus.

Nystagmus secondary to neurologic disease may occur in cerebellar ataxia, cerebellar tumor or abscess, hydrocephalus, Friedreich's ataxia or infratentorial tumors.

An interesting condition, characterized by rapid jerking of the eyeballs towards each other or into the orbit together with vertical gaze palsy usually secondary to hydrocephalus or pinealoma, is termed convergent nystagmus or nystagmus retractorius.

Drugs may cause nystagmus through idiosyncracy, overdose or as side effect. Drug-induced nystagmus is characterized by rhythmic jerking of the eyeball which is more remarkable on the lateral gaze and by the slow component being towards the midline. The offending agents in this category include diphenylhydantoin sodium and other anticonvulsants, aspirin, diphenoxylate hydrochloride and colistin sulfate.

NYSTAGMUS-SIMULATING EYE MOVEMENTS

Opsoclonus, occurring secondary to encephalitis or neuroblastoma, is characterized by chaotic movements of the eyeballs in various directions. The movements are nonrhythmic, spontaneous and multidirectional.

Ocular motor dysmetria, occurring secondary to cerebellar disorder, is characterized by lack of precision in performing movements of refixation. When the individual attempts to look from one point to another, the eyes overshoot or undershoot with several corrective to-and-fro movements.

Flutter, occurring in cerebellar disease, is characterized by intermittent to-and-fro horizontal movements of the eyeballs which may occur spontaneously or on changing fixation.

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Chapter 48 Obesity

The term, *obesity*, denotes overweight, as a result of excessive accumulation of fat in the subcutaneous and other tissues. Thus, overweight in which body size is increased from increased lean body mass rather than accumulation of fat is, in reality not obesity. Understandably, stocky children with large skeletal body frames and higher than the average muscular tissue, are bound to have weight, height and overall body size that exceeds those of the average child of their age. They need not (in fact, they must not) be considered "obese".

When confronting an obese child, always ask parents if the child has an excessive appetite, and whether he indulges in overeating? It is useful to ask them to prepare a detailed daily intake chart of their child spread over a week's period, and then scan it to get as impression about his dietary intake on an average. Find out about his activities, including participation in sports. Does he watch too-much of TV? Any drug intake (clonazepam, valproate there steroids).

Is any history of headache, vomiting, visual disturbances or poor school performance? Has the problem followed a serious illness like meningitis or encephalitis?

The best parameter for evaluating obesity is the Body Mass Index (BMI). It correlates well with both subcutaneous and total body fat while, at the sametime, allowing a variation in lean body mass.

BMI =

$$\frac{\text{Weight (kg)}}{\text{Height (met)}^2} = \text{kg/met}^2$$

BMI >95th percentile or >30 kg/met^2 for age establishes existence of obesity.

Look for distribution of the fat (whether truncal or generalized) and for, any other malformations like polydactyly, syndactyly, hypogonadism, excessive hypotonia, hepatosplenomegaly (glycogenosis I-VG), short extremities and bradymetacarpia, especially of 3rd, 4th and 5th digits (pseudohypoparathyroidism), hypoplasia of dental enamel, tetany, respiratory distress, cyanosis had polycythemia.

In case of associated short stature, evaluate the anthropometry in details.

EXOGENOUS OBESITY

Obesity usually becomes evident in the first year of life, at 5-6-year of age and during adolescence. In a large majority of the cases; it is exogenous in etiology i.e., energy intake exceeds expenditure leading to increased body fat stores. Such a child is overweight
i.e., weight over 20% of expected for height and relatively taller usually with advanced bone age. Facial features are fine with deposition of fat in the mammary regions of boys, giving an appearance of breast enlargement, which often puts the child in an embarrasing situation. Abdomen is pendulous with white or purple striae, even normal-sized external genitalia may remain imbedded in pubic fat and thus appear disproportionately small. Menarche may be somewhat advanced. Puberty occurs rather early, so that eventual height of the obese adolescent turns out to be less than the normal persons. Obesity is more evident in upper arms and thighs. Most of them have genu valgum. Social and psychological disturbances are common.

ENDOGENOUS OBESITY

Cushing's Syndrome

In infancy, manifestations include moon facies (rounded face with prominent cheeks and flushing), double chin, buffalow hump and generalized obesity, signs of masculinization (hypertrichosis over face and trunk, pubic hair, acne, deepening of voice, enlargement of clitoris), growth retardation, fragility despite a robust

appearance, hypertension, CCF, vulnerability to infections and congenital defects like hemihypertrophy.

In older children, manifestations include obesity, short stature, delayed puberty, purplish striae over abdomen, hips and thighs, amenorrhea in girls past puberty, headache, weekness, emotional, lability, poor school performance, hypertension and renal stones.

Hypothyroidism

Obesity may occur in some children with congenital or acquired hypothyroidism. The diagnosis becomes obvious from the characteristic clinical profile.

Pseudohypoparathyroidism (Albright's Syndrome or (Albright's Hereditary Osteodystrophy)

In addition to obesity, the patient has mental retardation, short stature, tetany, lenticular cataracts, brachydactyly with dimpling of the dorsum of the hands, brachymetacarpia, especially of 3rd, 4th and 5th digits with inedx finger being occasionally longer than the others, and hypoplasia of the enamel of the teeth. Serum calcium is low, whereas phosphorus and alkaline phosphatases are high.

Hypothalamic Dysfunction

In pituitary-diencephalic syndrome, resulting from involvement of the hypothalamus following a CNS infection, i.e. encephalitis, meningitis, child may have obesity in addition to diabetes insipidus, disturbed temperature regulation, sleep abnormalities, etc.

In Frohlich's syndrome, resulting from damage to hypothalamic center, obesity if characteristically truncal. Additional manifestations are short stature Hypogonadism, Diabetes insipidus, visual disturbances, headache, seizures and increased carbohydrate tolerance. The condition is extremely rare.

Polycystic Ovaries (Stein-Leventhal Syndrome)

Obesity is accompanied by hirsutism, secondary amenorrhea, and infertility. A combined rectal and abdominal examination shows palpable ovaries which are considerably enlarged.

Prader-Willi Syndrome

In this condition, obesity develops in association with hypotonia, hypogenitalism, mental retardation and hyperphagia. Extreme obesity may cause respiratory embarrassment in some of the cases. Such cases may develop cyanosis, somnolence and, at times, CCF. The so-called "obesity-hypoventilation" state, i.e. Pickwickian syndrome results because chest and diaphragmatic movements becomes restricted, causing rapid, shallow breathing and alveolar ventilation reduction with ensuing hypoxemia.

GENETIC SYNDROMES

Laurence-Moon-Biedl Syndrome

The boys with this syndrome have obesity, short stature, mental retardation, polydactyly (some hexadactyly or syndactyly) and retinitis pigmentosa.

Turner's Syndrome

In this disorder (usual chromosomal pattern 45 XO), obesity may add up to the characteristic features of the condition, say short stature, peripheral edema, lymphedema, extra skin fold, webbing of neck, gonodal dysplasia, renal and CVS anomalies, etc.

Other Causes of Obesity

Drugs such as steroids and anticonvulsants like clonazepam and valproate may also cause obesity.

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Chapter 49 Precocious Puberty

The term, *precocious puberty* or *sexual precocity*, denotes development of secondary sex characters before the anticipated age. In subtropical and tropical settings, the age landmark for boys is 10-years and for girls 8-years. The guideline, is, however, purely arbitrary. Appearance, before the age of 8 to 10 years, of the following characters should arouse suspicion of this diagnosis: breast enlargement, menarche, excessive enlargement of penis or clitoris, dark and coarse axillary and pubic hair, change in voice, and acne.

Precocious puberty may be true or pseudo. True precocious puberty is always isosexual, implying early appearance of the features of the same sex. Here, both secondary sex characters and maturation of gonads (spermatogenesis or ovulation) occur early enough. Precocious pseudopuberty is characterized by premature appearance of secondary sex characters and rapid somatic growth. The gonads, however, do not mature. Sex characters may be isosexual or hetrosexual, the latter implying the appearance of secondary sex characters of the opposite sex.

History-taking should pay special attention to the age at which sexual precocity was noticed by the parents. If it occurred right in infancy, chances are that the child has a significant organic problem. Occurrence of precocity in late childhood may mean just the normal variation, say early isosexual development or constitutional precocity.

It is also of value to determine the sibling's development as also parents' height and the age at which they had experienced puberty.

Ascertain if there has been history of head injury,' or CNS infection in the past. Does the infant develop dehydration easily?

TRUE PRECOCIOUS PUBERTY

Constitutional Precocity

This condition is responsible for 80 to 90% of the girls and 50% of the boys with precocious puberty. There are no pathologic findings. It is surmized that the hypothalmic mechanism concerned with initiation of puberty gets activated precociously. Whereas the female cases are sporadic, in males the condition may be familial.

Besides precocious development of sex characters, these children, irrespective of the sex, height, weight and osseous maturation, are advanced though eventually, because of early closer of the ossification centers, the stature turns out to be much less than it would have been normally.

McCune-Albright Syndrome

Also called polyostotic fibrous dysplasia, this condition is characterized by fibrous dysplasia of the bones, patchy skin pigmentation and endocrinal disturbances in the form of precocious puberty as such or with Cushing's syndrome or hyperthyroidism. The endocrine disturbances are now believed to originate not in the hypothalamus but as a result of autonomous hyperfunction of peripheral target glands.

In addition to the manifestations of precocity, such as menarche, the child may develop gigantism and/or acromegaly.

Organic Brain Lesions

Next to constitutional precocity in frequency come the organic brain tumors which are responsible for the condition in 10% of the girls and 40% of the boys. Pinealomas, gliomas, suprasellar teratomas, neurofibromas, astrocytomas, ependymomas and hypothalamic hamartomas are examples of such tumors.

Any child presenting with true precocious puberty (particularly a boy) in association with hypothalmic manifestations such as diabetes insipidus, hypematremia, hyperthermia, obesity, wasting, and unnatural crying or laughing must arouse suspicion of an intracranial tumor. Such manifestations as deterioration in mental

faculty, seizures, and neurologic signs should also point to this diagnosis.

Hypothyroidism

It is now being increasingly recognized that half of the untreated cases of hypothyroidism may have varying degrees of isosexual development early enough for their osseous development.

Sex maturation usually encountered is breast development in girls and testicular enlargement in boys. Pubic and axillary hair growth is only sparase. Menstrual bleeding is common. Galactorrhea and excessive pigmentation occur in only a small proportion of the cases.

Rare Causes of True Precocious Puberty

Hepatoblastoma, hepatoma, intracranial chorioepithelioma, choriocarcinoma, polyembryoma of the posterior mediastinum, post-CNS infection, hydrocephalus, medicaments.

PRECOCIOUS PSEUDOPUBERTY

Adrenogenital Syndrome

Congenital adrenal hyperplasia, caused by an inborn defect in the biosynthesis of adrenal corticoids, may be responsible for precocious pseudopuberty.

Salt-sparing type is characterized by premature isosexual development, appearing by the age of 6 months or at 4 to 5 years or later in the male. In case of the female, it results in female pseudohermaphroditism. Right at birth, you may find evidence of masculinization in the form of enlargement of the clitoris and labial fusion. The clitoris may be large enough to look like a penis.

It causes virilization of the external genitalia in females and no genital change in males. Such accompanying manifestations as failure to regain birth weight, progressive weight loss, vomiting, poorfeeding, dehydration, dyspnea and cyanosis in a female with virilization of the external genitalia, therefore, virtually establish the clinical diagnosis.

Virilizing Adrenocortical Tumors

Precocious pseudopuberty in association with hypertension and features of Cushing's syndrome suggest the diagnosis of tumors of the adrenal cortex. The fact that these symptoms occur in later life helps to differentiate this entity from the congenital adrenal hyperplasia which begins to manifest right at birth or soon after.

Feminizing Adrenal Tumors

These tumors may cause hetrosexual precocious pseudopuberty in boys through excess of estrogen production.

Tumors of the Testes

Functional tumors of the testes are a rare cause of the precocious pseudopuberty in the form of gynecomastia and other signs of puberty. Clinical detection of a testicular tumor in a suspected case helps to diagnose this condition.

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Chapter 50 Purpura

The term, *purpura*, is employed to refer to a group of diseases in which small hemorrhages occur in the superficial layers of the skin, leading to areas of purple discoloration.

When purpura takes the shape of minute pinpoint hemorrhages (less than 1 mm diameter) about the small blood vessels, the latter are termed petechiae. When hemorrhages are extensive (over 5 mm diameter) the condition is called ecchymoses. For those between 2 and 5 mm, the term purpuric spots is used.

It is customary to designate purpura as thrombocytopenic or nonthrombocytopenic. In thrombocytopenic purpura, hemorrhages are secondary to remarkably reduced platelet count (less than 40,000/cmm). In nonthrombocytopenic purpura, platelet count is within normal limits and the cause of bleeding is either in the small blood vessels or secondary to the qualitative defect in platelet function.

History should include information whether purpura has occurred spontaneously in an otherwise healthy child or in an already ill-child. Is there a preceding history of trauma, infection or drug intake? Is there bleeding from other sites, say epistaxis? Any history of previous episodes of purpura? Is there any accompanying joint or abdominal pain?

Physical examination should ascertain the exact location, size and distribution of the petechiae, purpuric spots, ecchymoses or hematomas (Fig. 50.1).

Changing Color of Bruise is a Good Guide to its Age

Look for any bleeding from the mucosal sites such as mouth and rectum. Is there any abnormal bleeding from the venepuncture sites? Any arthritis, evidence of intestinal obstruction (say,

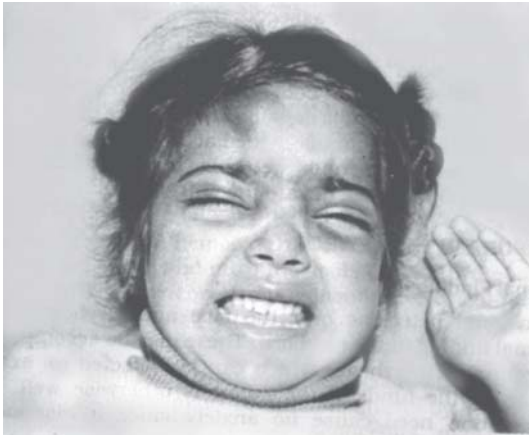

Fig. 50.1: Bruising and hematoma

intussusception), or urticaria? Any signs of liver disease in the form of hepatosplenomegaly, icterus, liver palms, spider angiomata, or abnormal venous pattern? Any accompanying bony pain or tenderness, lymphadenopathy, or frank bleeding? (Table 50.1)

Table 50.1: Aging of bruises

Color	*Age (days)*
Red blue	1
Dark blue to blue-brown	1-3
Green yellow	7-10
Yellow brown	Over 8
Fading to pink	14-28

Find out if there is any abnormal skin elasticity and hyperextensibility of joints, pointing to inherited connective tissue disease.

It is useful to do Hess or tourniquet test. Mark an area 2.5 sq. cm on the flexor aspect of the forearm. Notice if any purpuric spots are present. Now apply the blood pressure cuff and record the systolic and diastolic pressures. Maintain the pressure between

the two readings for 5 minutes. After the cuff is deflated, appearance of more than 8 fresh spots in the circumscribed area indicates a positive test. In case numerous petechiae appear before the deadline of 5 minutes, deflate the cuff immediately.

PURPURA IN THE NEWBORN

Normal Finding

Occasional petechiae over the face and forehead are a normal finding in the newborn. These may be accompanied by retinal hemorrhages which can be detected on examination of the fundi. If the infant is otherwise well, this observation need cause no anxiety since it disappears without any intervention. The cause appears to be the normal birth trauma.

Maternal Medication During Pregnancy

Such drugs as chloroquine, quinine, anticoagulants, anticonvulsants, salicylates and thiazide diuretics taken by the mother during pregnancy may be responsible for purpura in the newborn.

Intrauterine Infections

Rubella Almost one-half of the newborns with congenital rubella suffer from thrombocytopenic purpura. It is usually slight to moderate in intensity and resolved *per se* during the first month only.

Cytomegalovirus infection Just like congenital rubella, cytomegalovirus infection too may cause thrombocytopenic purpura. In 50% of the severely affected newborn, the purpuric rash is generalized and tends to disappear in 48 to 72 hours. It is believed that the cytomegalovirus has a direct adverse effect on the bone marrow.

Toxoplasmosis Infrequently, congenital toxoplasmosis may cause slight purpuric rash, usually in the form of small petechiae. More often, the rash is of maculopapular type. Remaining manifestations of the disease include fever, poor-feeding, hepatosplenomegaly, lymphadenopathy, jaundice, hydrocephalus, microcephaly, microphthalmia, convulsions, cerebral calcification and chorioretinitis singly or in combination.

Hemolytic Disease of the Newborn

Severe cases of Rh hemolytic disease, hydrops fetalis, may develop petechiae and purpuric spots due to thrombocytopenia and possibly concurrent consumptive coagulopathy.

Septicemia

Advanced fulminant septicemia (especially gram-negative) in the newborn may be accompanied by petechiae. Remaining manifestations of septicemia may include hyperthermia or hypothermia, icterus, feeding difficulty, poor activity, respiratory distress, abdominal distention, vomiting, hepatomegaly and convulsions. A high index of suspicion in a newborn at risk assists in arriving at the diagnosis.

Immune Neonatal Thrombocytopenia

In 1 in 3 newborns of mothers suffering from active idiopathic thrombocytopenic purpura, widespread petechiae may appear within few minutes of birth. There may be evidence of hemorrhage from such sites as brain, kidney and gastrointestinal tract. The disease is self-limited, taking 2 to 3 months to disappear.

Thrombocytopenia-Absent Radius (TAR) Syndrome

In this familial disorder (resembling Fanconi's pancytopenia, an altogether different entity), severe bleeding manifestations appear on the very first day of life. Associated findings include aplasia of the radii and thumbs and cardiac and renal anomalies. There is absence of megakaryocytes from the bone marrow.

Disseminated Intravascular Coagulation (Consumptive Coagulopathy)

The newborn infant may manifest with petechiae or purpuric spots in a number of pathologic processes including septicemia (especially gram-negative), giant hemangioma, etc. There usually is evidence of bleeding from many sites, leading rapidly to severe anemia. Infarction of large areas of skin and subcutaneous tissue occurs. Investigations show prolongation of prothrombin, partial thromboplastin and thrombin times, remarkable reduction in platelet count and fragmented burr and helmet-shaped red cells (schizocytes) and fibrin-split products (FSP).

Remaining Causes of Purpura in the Newborn

Congenital, leukemia, renal vein thrombosis, generalized herpes, syphilis, galactosemia.

PURPURA IN LATER INFANCY AND CHILDHOOD

Thrombocytopenic Purpura

Immune (Idiopathic) Thrombocytopenic Purpura (ITP)

This is by far the most common of the thrombocytopenic purpuras seen in childhood. In the predominant form, acute type, an upper respiratory infection is followed in 1 to 4 weeks span by sudden onset of bruising, petechiae and bleedding from the mucosal surfaces such as those of the nose, gums, gut and urinary tract. There is no evidence of injury. Spleen may become just palpable in only 25% of the cases. After a few days, there is reduction in bleeding due to an improvement in capillary integrity though thrombocytopenia continues to be present. Most subjects completely recover in 6 months. Only a small proportion of cases pass on to the chronic stage.

Chronic type accounts for 10 to 15% of the cases of childhood ITP. There usually is a prolonged history of bleeding or a bruising tendency. The course is marked by relapses and remissions. Bleeding is, as a rule, less severe because of less severe involvement of the capillaries. Chronic ITP may persist for years at a stretch.

Diagnostic investigations should include tournquet (Hess) test which is positive, bleeding time which is prolonged, clotting time which is normal, clot retraction which is poor, platelet count which is below 40,000/cmm, and bone marrow which shows normal or increased megakaryocytes. Some megakaryocytes are immatured with deep basophilic cytoplasm. Platelet budding may be scanty.

Drug-induced Thrombocytopenic Purpura

Drugs that may cause immune thrombocytopenic purpura include quindine, quinine, apronalide, carbenicillin, cephalexin, penicillin, PAS, rifampicin, sulfadimidine, salicylates, indomethacin, phenyl-butazone, trimethoprim, tolbutamide, acetazolamide, anticonvul-sants, atropine, mebrobomate, penicillamine, nonvobiocin, iodides, methimazole, actinomycin D, chlordizepoxide, antihistamics,

corticosteroids, and digoxin. In each and every instance of thrombocytopenic purpura, a careful search for a drug exposure should be made.

Hemolytic-Uremic Syndrome

This condition is characterized by an acute onset of renal failure, microangiopathic hemolytic anemia and thrombocytopenic purpura. These features occur several days to weeks after an attack of gastroenteritis, an acute flu-like illness or an upper respiratory infection. The syndrome recurs over periods of several years.

Investigations reveal a gross hemolytic anemia. Reticulocyte count is high. Red cells show fragmented, helmet-shaped and burr cells. Platelet count falls below 100,000/cmm within the first week of onset. Azotemia and electrolyte imbalance may be present. Serum uric acid and LDH activity are high. Hematuria and proteinuria with RBC or granular casts are usually present. Some cases may show paradoxical hypokalemia.

Wiskott-Aldrich Syndrome

This syndrome is characterized by a triad of recurrent infection, eczema and thrombocytopenic purpura due to an X-linked recessive immunologic defect. Bloody diarrhea, and hemorrhage during the first month of life are the first symptoms. Hepatosplenomegaly develops in due course of time. There is an increased incidence of lymphoreticular malignancy.

Thrombopoietin Deficiency

In this rare disorder, chronic thrombocytopenic purpura results from a deficiency of a megakaryocyte maturation factor that is an integral component of normal plasma.

Kasabach-Merritt Syndrome

A large cavernous hemangioma of the trunk, limbs or abdominal viscera may trap and destroy platelets within its extensive vascular bed, causing severe thrombocytopenia and other evidence of consumptive coagulopathy. Bone marrow shows adequate number of megakaryocytes. Spontaneous recovery may occur.

Nonthrombocytopenic Purpura

Henoch-Schönlein Purpura

Also called Anaphylactoid purpura, the condition is perhaps the most common type of purpura seen in pediatric practice. In all probability, it is a collagen disorder characterized by widespread purpuric lesions (particularly urticaria-like skin eruptions) due to angitis with involvement of abdominal viscera and/or joints. Henoch purpura is dominated by signs of acute abdomen. At times, the picture almost mimics that of interstinal obstruction, volvulus intussusception or appendicitis. Schönlein purpura is dominated by signs of arthritis, especially of the knees and ankles. At times, it could be mistaken for rheumatic or rheumatoid arthritis.

Hematologic Investigations Reveal Normal Results

Thrombocytopathic Purpura

Also called thromboasthenia, this condition is characterized by appearance of petechiae and excessive bleeding due to platelets which are normal quantitatively but have defective function.

Purpura Fulminans

This serious condition occurs as a complication of a bacterial or viral infection, usually chickenpox or scarlet fever, during the convalescent phase. Manifestations include acute onset of shock, toxicity, fever, and diffuse symmetrical hemorrhages with overwhelming inflammatory vasculitis and necrosis of skin and subcutaneous tissues, especially over the buttocks and lower limbs. In those who manage to survive, sloughing of large areas of skin and muscle results. Platelet count is usually adequate.

Hereditary Hemorrhagic Telangiectasia

Also termed Osler-Weber-Rendu disease, this autosomal dominant disease usually causes purpura at puberty. The mucocutaneous lesions are 1 to 4 mm macules, papules, or spider-like projections made of tortuous telangiectatic vessels. Recurrent epistaxis may occur before skin and mucous membrane lesions become apparent. Bleeding from the lesions may occur spontaneously or following slight trauma. Massive hemorrhage may cause severe anemia.

von Willebrand's Disease

This autosomal disorder, also called pseudohemophilia, is characterized by purpura and disproportionately excessive bleeding following minor trauma. Bleeding time is prolonged, whereas clotting time is normal.

The cause appears to be operation by an unidentified plasma factor that leads to reduced synthesis of clotting factor VII and abnormal platelet adhesiveness. A capillary defect is also described.

Ehlers-Danlos Syndrome

This syndrome is characterized by hyperextensibility of joints, hyperelasticity of skin, remarkable friability of skin and blood vessels and subcutaneous nodules, easy bruising and purpura. Eight distinct forms of the syndrome, which is supposed to be a collagen defect, are recognized.

Meningococcemia

A child presenting with petechiae, purpuric spots or ecchymotic lesions in the presence of meningeal irritation should be regarded as suffering from meningococcemia unless proved otherwise. You should lance the skin lesions and smear the material for gram-negative diplococci. In order to establish the diagnosis, organisms need to be cultured from blood, CSF, skin lesions or other locations of infection.

Dengue Hemorrhagic Fever (DHF)

Purpura is a feature of second stage of dengue hemorrhagic fever (DHF). Classically, hemorrhagic manifestations are usually cutaneous but bleeding may occur from other locations. In the epidemic seen by us in Jammu in the fall and autumn of 1993, gastrointestinal hemorrhage dominated the scene. Table 50.2 presents the clinical picture of DHF and DSS in relation to various grades.

Table 50.2: Standard grading of DHF/DSS as recommended by World Health Organization (WHO)

Grade 1	Fever, nonspecific constitutional manifestations, tourniquet (Hess) test positive
Grade 2	Grade 1 + spontaneous bleeding (cutaneous or other locations)
Grade 3	Grades 1 and 2+ circulatory failure (shock) manifestated by rapid weak pulse, low blood pressure, low pulse pressure, cold and clammy skin, restlessness.
Grade 4	Profound shock (unrecordable blood pressure and pulse) dominates the scene.

DHF/DSS is believed to be a hypersensitivity response to a repeat attack with a dengue fever virus. According to Halstrea's antibody dependent immune enhancement theory, prior sensitization with dengue fever virus causes collection of subneutralizing concentrations of antibodies to the virus. Presence of these sensitized antibodies lead to an enhance replication of the dengue virus. Once T cells recognize infected monocytes, cytokines are released. These cytokines activate the complement and clotting cascade. What follows is the release of vasoactive mediators, resulting in enhanced capillary permeability. Capillary leakage causes bleeding, shock and hypoproteinemia.

Diagnosis is by and large clinical. An high index of suspicion, especially during an epidemic, is the cornerstone of diagnosis. Thrombocytopenia, though never severe enough, hemoconcen-tration and a right sided pleural effusion are quite characteristic.

For specific confirmation of the diagnosis, virus isolation is ideal. However, since it is quite time-consuming, in practice, demonstration of a 4-fold rise in IgM-antibody titer is considered good enough.

FURTHER READING

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Chapter 51 Pyrexia of Unknown Origin (PUO)

The term, *pyrexia of unknown origin* (PUO), is currently employed to denote documented fever of over 1 week duration defying diagnosis after 3 weeks of evaluation as an outpatient or 1 week of intensive investigations in hospital. The problem is one of the common reasons for pediatric consultations and may often prove quite perplexing even with the support of reasonable laboratory facilities. Nevertheless, it needs to be clearly understood that most cases of PUO result from common diseases that may be atypical rather than classic in their presentation. In our as well as others' experience, over 50% of the pediatric subjects with PUO are due to infections.

In the very first instance, as you would appreciate, it is important to establish that the child indeed has pyrexia. How have the parents been recording the temperature? Mouth or rectal temperature is decidedly more reliable than the groin or axilla temperature. The latter site gives a record of the skin temperature which is considerably influenced by the environmental temperature and whether the child is overclothed or underclothed. Also, it is worth remembering that, even in healthy children, temperature recording just following some vigorous activity may give an erroneously high reading of up to 37.7°C (100°F).

Find out the exact length of time the child has been suffering from fever. Is the fever continuous, remittent or intermittent? In continuous fever, the temperature never touches the normal though there may be fluctuation not exceeding 1°C (1.5°F) during the 24 hours. In remittent fever, the daily temperature fluctuation is more than 2°C (3°F). When fever is present only for several hours during the day, the temperature remaining normal rest of the time, it is

called intermittent fever. Intermittent fever may be "quotidian" when temperature touches normal daily, "tertian" when it happens so on alternate day, or "quartan" if it happens every two days.*

Always enquire about history of medication for fever or preceding it. Antipyretics with or without chemotherapy may alter the true pattern of fever. Drug fever is usually an isolated symptom, the temperature remaining high at a particular level. Usually within 72 hours of its withdrawal, the temperature returns to normal, except in the case of such agents as iodides where fever may take upto a month to resolve. Don't miss asking about the intake of over-the-counter (OTC) agents and topical preparations including eyedrops, e.g. atropine-induced fever.

It is important to enquire about the chronologic development of symptoms accompanying fever, preceding acute diarrheal disease, boil or such other infectious illnesses, contact with an individual suffering from tuberculosis, etc. Are there any localizing manifestations that may provide a clue to the organ system which is involved?

Physical examination should be thorough with special search for lymphadenopathy, hepatosplenomegaly and deep in-apparent abscess such as subphrenic or liver abscess. You must make a careful search for skin rashes and petechial hemorrhages in skin, fundi, nailbeds and conjunctiva.

Fever blisters may be a manifestation of pneumococcal, streptococcal, meningococcal, malarial or rickettsial infection. Rarely, they may occur in salmonella or staphylococcal infection.

Repetitive chills and rigors are common in malaria, or septicemia accompanying urinary tract infection, infective

* Undoubtedly, a core or central temperature reading (mouth or rectal) is the best. In most situations a peripheral reading, i.e. axillary is good enough. An inexperienced parent or attendant may cause injury to the child from broken glass. Note that axillary temperature is, as a rule. 0.5°C less than that recorded centrally. Also, note that for recording the mouth temperature, a thermometer must be left *in situ* for at least 2 minutes (preferably 3 minutes), in order to obtain correct reading. The so-called "strip thermometers" (disposable) for use over the forehead are available, but these are usually less accurate.

endocarditis, or localized collection of large amount of pus. Remember, young children may fail to convey their parents, their perception of extraordinary cold chills. Nonetheless, the rigors can be always observed as vigorous shaking movements of the body.

Oral thrush may point to an immunologic disorder. Congestion of the pharynx suggests salmonellosis, infectious mononucleosis, toxoplasmosis or cytomegalic inclusion disease.

Generalized muscle tenderness may mean abroviral or mycoplasmal infection, dermatomyositis polyarteritis or trichinosis. Localized tenderness over the trapezius muscle may point to a subdiaphragmatic abscess. Point tenderness over a bone may suggest osteomyelitis or a neoplasm invading the marrow.

Absence of sweating in the presence of fever may mean diabetes insipidus, anhidrotic ectodermal dysplasia, exposure to atropine or familial dysautonomia.

Persistent red eye may be a sign of a collagen disorder such as polyarteritis nodosa.

Thyrotoxicosis may be suggested by hyperactive deep tendon reflexes.

Rectal examination may point to iliac adenopathy, pelvic abscess or osteomyelitis.

The presence of occult blood in stools may mean ulcerative colitis as the cause of PUO.

INFECTIONS

Bacterial Infections

Localized

These include walled or closed-off abscesses, urinary tract infection, osteomyelitis sinusitis, chronic mastosiditis, chronic appendicitis and periappendicitis.

Closed-off abscesses subphrenic abscess and liver abscess may be responsible for pyrexia of unknown origin without any other apparent symptoms and signs. A persistent fever following attack of abdominal pain may mean subphrenic abscess following perforation of appendix. A careful palpation during inspiration and expiration may reveal that liver is palpable and tender though

absence of these findings does not necessarily rule out the possibility of subphrenic or liver abscess. An X-ray must be obtained for presence of gas under the diaphragm which too may be raised.

Perinephric abscess as a cause of unexplained fever may cause considerable difficulties in arriving at its diagnosis. It may follow rupture of a renal carbuncle or pyonephrosis into the tissue around the kidney, or a staphylococcal skin infection. The availability of history of trauma preceding it may, therefore, be an important clue. Clinical findings include diffuse swelling, edema and erythema in the lumbar region, percussion tenderness of the costovertebral angle and renal tenderness on bimanual examination. Rigors, toxemia and limp or fixed flexion of the hip on the affected side are likely to be present. Intermittent pyuria is usual. X-ray shows a bulging psoas shadow. IVP shows obliteration of the psoas shadow with displacement of the affected kidney and ureter.

Lung abscess should be suspected if there is history of aspiration of a foreign body or severe coughing episodes of short duration, particularly when accompanied by hemoptysis and production of copious amount of foul-smelling or purulent sputum. Areas of bronchial breathing with amphoric breathing are found on auscultation. X-ray chest shows a cavity (with or without a fluid level) surrounded by alveolar infiltration. A mixture of anaerobic bacteria may be detected in the sputum.

Brain abscess should be suspected in cases of unexplained fever in association with headache, particularly when accompanied by neck stiffness. You must explore history of a focus of infection in the neighbourhood (discharging ear, scalp infection, sinusitis), bronchiectasis or congenital heart disease. TLC shows polymorphonuclear luckocytosis. ESR is raised. CSF shows high protein and high white blood cell count with predominance of lymphocytes. You must remember to avoid doing lumbar puncture when intracranial pressure is elevated. EEG, CAT scan and radionuclide scan are useful diagnostic tools in reaching the diagnosis.

Pelvic abscess should be aspected in the presence of abdominal distention, bladder irritability and rectal tenesmus with or without

the passage of small fecal matter containing mucus. A tender mass may be felt on rectal examination.

Appendiceal abscess is suggested by a tenderness in the right lower quadrant, usually in association with a palpable lump.

Dental abscess may be suggested by a localized swelling and redness with chronically draining fistula.

Urinary tract infection: This is by far the most common cause of pediatric PUO without abnormal findings. The diagnosis is by high index of suspicion. One or two negative urine examinations certainly do not exclude it. Of course, repeated negative tests reduce its possibility. Suprapubic aspiration of urine may be warranted to avoid contamination of the sample.

Osteomyelitis: A low-grade osteomyelitis/ostitis may persist over several weeks before the classical signs become apparent. You must, therefore, make it a habit to palpate all the bones for local tenderness in every child with PUO. Also, look for minor limitation of movements. If tenderness or pain is suspected, an X-ray should be taken.

Mastoiditis: Inflammation of the mastoid air cell system as a complication of otitis media (both acute and chronic) is a frequent cause of obscure pyrexia in children. The patient has earache but he may be able to give expression to it only in the form of incessant crying or pulling at the ear. X-ray reveals a cloudy mastoid.

Sinusitis: At times, protracted sinusitis may remain undetected as a cause of obscure pyrexia over considerable period. A meticulous clinical examination usually brings out the diagnosis which can be confirmed by radiologic examination.

Chronic appendicitis and periappendicitis: Occasionally, these conditions, representing the sequelae of a conservatively managed acute appendicitis, may be responsible for unexplained prolonged pyrexia. Nausea, anorexia or localized pain usually accompany the clinical picture. Guarding and pain during bimanual rectal and abdominal palpation often suggest the diagnosis. High ESR and leukocytosis with left shift of the white cells-both signs of chronic inflammation are invariably present.

Generalized

Tuberculosis: In India and other developing countries, tuberculosis is a leading cause of prolonged pyrexia of obscure origin. Tuberculin (Mantoux) or BCG diagnostic test together with X-ray chest often help to clinch the diagnosis, particularly if there is history of tuberculosis in the family or close neighborhood. Diagnosis of CNS tuberculosis needs lumbar puncture as also fundoscopic examination for presence of choroid tubercles.

Enteric fever: Salmonellosis, especially typhoid and paratyphoid fever, is characterized by a soft palpable spleen in association with prolonged pyrexia. Rose spots, so prominently highlighted by the Western books, are seldom seen in patients in the tropics and subtropics.

Septicemia: Low grade septicemia may cause unexplained prolonged fever without any abnormal physical signs. This sort of situation is encountered usually in gram-negative septicemia in children with impaired immunity. Repeated blood cultures are strongly recommended in such instances.

Infective endocarditis: Obscure pyrexia in a child with congenital or acquired heart disease, particularly with chills, may well be indicative of infective endocarditis. You must look for petechiae, more so under the nails, splenomegaly and hematuria to clinch the diagnosis.

Brucellosis: Chronic brucellosis is an important, though infrequent, cause of PUO. Such complaints as fatigue, sweating, myalgia, arthralgia, anorexia nervousness, depression and a rash in the presence of hepatosplenomegaly and lymphadenopathy should arouse suspicion of this diagnosis. Diagnosis is confirmed by brucella agglutination test which shows titers more than 1 : 160 and isolation of brucella organism by cultures of blood or infected material such as abscess or tissue.

Tularemia: In this uncommon infection, fever is usually accompanied by chills, myalgia, arthralgia, vomiting, headache, anemia, photophobia, maculopapular rash and diaphoresis. There is also lymphadenitis, ulcerated skin and/or mucosal lesions or conjunctivitis. A history of contact with rabbit, ingestion of rabbit

or squirrel meat, or bite by fly, tick or some other vector should suggest the diagnosis. Diagnostic tests include smear and gram stains of sputum or some other infected material, serum agglutination test, skin testing and direct culture of the organisms.

Yersinial infection: Occasionally, Yersinia enterocolitica or pseudotuberculosis may account for unexplained fever. Yersinia enterocolitica causes usually appendicitis-like disease with mesenteric adenitis and terminal ileitis manifesting as severe abdominal pain. Diagnosis is by identification of the organisms in stools, blood culture and passive hemagglutination tests.

Viral Infections

Viral hepatitis: Anicteric hepatitis may well be responsible for unexplained fever. Anorexia, nausea/vomiting, enlarged and tender liver. High-colored urine, and light-colored stools point to this diagnosis, warranting investigations. Chronic active hepatitis may at the onset manifest with only unexplained fever. Other symptoms, though present, are so minimal that they go unnoticed. You must ascertain if the patient has fluctuating jaundice, fatigue, anorexia, hepatosplenomegaly, gastrointestinal bleeding, arthra-lgia, edema, colitis, etc.

SGOT and SGPT are remarkably raised. Hyperbilirubinemia is mild to severe. Prothrombin time is usually prolonged.

Cytomegalic inclusion disease: Acquired cytomegalovirus infection may occasionally become responsible for obscure pyrexia in premature newborns and infants (1 to 2 months old) who are residents for a prolonged period in intensive care unit and those having been given blood transfusions from seropositive donors. The infant manifests a septic look, gray pallor, fast deterioration in respiratory status, hepatosplenomegaly and atypical lymphocytosis. In immunosuppressed subjects, chorioretinitis may be detected.

Acquired disease in older children presents with sore throat, malaise, myalgia, anorexia, headache, abdominal pain, cervical or other regional lymphadenopathy, hepatosplenomegaly and excessive sleep. Fever with chills may persist for 2 or more weeks. Liver dysfunction and atypical lymphocytosis are prominent.

Infectious mononucleosis This disease caused by Epstein-Barr (E-B) virus of the herpes group, is characterized by malaise, fever, sore throat, lymphadenopathy, hepatosplenomegaly, atypical lymphocytosis and a hetrophilic antibody response. Clinically, it is very difficult to distinguish it from acquired cytomegalovirus disease. The latter is hetrophil-negative rather than positive.

AIDS: Prolonged or intermittent pyrexia is an important feature of pediatric AIDS, especially when the HIV infection follows a transfusion. Accompanying lymph-adenopathy, failure to thrive and chronic/recurrent infections like candida in a vulnerable situations, must arouse suspicion of pediatric AIDS.

Parasitic Infections

Malaria: It may present in pediatric practice with obscure fever which is irregular rather than with classical febrile episodes, more so in children less than 5-years of age. Accompanying manifestations may include bodily pains, headache, nausea abdominal pain and splenomegaly. In falciparum malaria in particular, fever is less classical and may even be continuous. Severe manifestation pertaining to cerebral, respiratory, urinary or gastrointestinal system are usually a feature of falciparum infection. In algid malaria, shock is followed by coma. Repeated attacks of malaria in malnourished children in endemic areas may lead to a very large and firm splenomegaly as an abnormal immune response to the parasite. This condition, a sort of chronic malaria, has been termed tropical splenomegaly, idiopathic splenomegaly or big spleen disease.

Diagnosis of malaria is confirmed by identifying the parasite in properly-stained thick and thin blood smear.

Toxoplasmosis: Acquired toxoplasmosis may present with unexplained fever with or without malaise, myalgia, generalized lymphadenopathy, hepatomegaly, pneumonia, myocarditis, encephalitis and maculopapular rash. Dye test is the most sensitive and dependable tool for detecting the antibodies of causative organism, Toxoplasma gondii, in human sera.

Visceral larva migrans: This parasitic infection, caused by larvae of toxocara species (hence the other name toxocariasis) occurring in preschool children suffering from pica and coming in close

contact with dogs and cats, may cause an obscure pyrexia. Remaining manifestations may include wheezy bronchitis, convulsions, hepatomegaly, papular or urticarial skin lesions, lymphadenopathy and abdominal pain. Eosinophilia is more or less a rule. X-ray chest shows scattered patchy infiltrates. Enzyme-linked immunosorbent assay (ELISA) is the only dependable diagnostic tool available at present.

Trichinosis: Occasionally, trichinosis may be responsible for unexplained fever. In the presence of periorbital edema, myalgia (most marked in masseters, intercostals and diaphragm) and eosinophilia, especially if there is history of eating uncooked meat, this possibility must be seriously considered. The diagnosis is established by serologic studies and muscle biopsy.

Rickettsial Infection

Rickettsial diseases, Q fever and rocky mountain spotted fever, may cause unexplained pyrexia in endemic areas. These are virtually nonexistent in the Indian subcontinent.

Chlamydial Infection

Psittacosis: Also called omithosis, this disease is usually characterized by an abrupt onset with fever, sore throat, headache, malaise, myalgia, cough, nausea, vomiting and mental confusion. Hepatosplenomegaly, carditis and pneumonia may occur. Fever may persist for 3 weeks or more.

Lymphogranulama venereum: This disease, caused by an agent related to chlamydia trachomatis, is sexually transmitted and occurs in children from an infected adult. It is a systemic disease and may cause obscure febrile illness together with malaise, anorexia, headache, a pustule or a papule, inguinal lymphadenitis and terminally, elephantiasis. The diagnosis is confirmed by isolation of the organism from infected lymph nodes.

Fungal Infection

Histoplasmosis: Disseminated histoplasmosis is an important though infrequent cause of PUO. Remaining manifestations include acute lower respiratory infection, nausea, vomiting, abdominal pain and diarrhea. Diffuse lymphadenopathy and hepatosplenomegaly are invariably present. X-ray chest shows a diffuse interstitial pneumonia.

Blastomycosis: A child with PUO presenting with any combination of lung, skin, bone or genitourinary disease should arouse suspicion of blastomycosis. Identification of the yeast forms of *B. dermatitidis* in sputum, abscess or biopsy material and isolation of the organism confirm the diagnosis.

COLLAGEN DISORDERS

Juvenile rheumatoid arthritis (JRA): This is an important cause of unexplained pyrexia. Onset of the disease may be with a precipitous (sleepy) fever with chills or episodes of remittent fever lasting for quite a few weeks. Accompanying manifestations may include weight loss, anorexia, excessive sweating, anexanthem, lymphadenopathy, splenomegaly, morning stiffness of affected joints, cyanosis of the adjoining skin, conjunctivitis, and photophobia. Diagnosis is based mainly on clinical evaluation as well as on exclusion of other conditions. Rheumatoid factor is positive in as low as just 5% of the affected children.

Systemic lupus erythematosus: This diagnosis must be entertained in cases of obscure pyrexia. Once the typical butterfly rash appears on the face, the diagnosis becomes evident. Remaining manifestations of the disease include hepatosplenomegaly, polyserositis, arthritis, lymphadenopathy, hypertension, albuminuria, thrombocytopenia, abdominal pain and puncta on palms and fingers.

Diagnosis is established by demonstrating antinuclear antibodies (ANA) which is a more sensitive test than LE preparation.

Dermatomyositis: In this rare disorder, clinical manifestations include fever, muscle tenderness and pain, weight loss, malaise, pseudoparalysis, arthralgia and an erythematous rash which first develops over the bridge of the nose and around eyes and then anywhere over trunk and limbs. An edematous swelling of the malar area and visible capillaries in the nailbed and gum margin are highly suggestive. Eventually, the affected muscles become firm, atrophic and contracted. Calcinosis may occur. The face may develop an expressionless appearance, the child hardly being able to open the mouth in hill.

Polyarteritis nodosa: This rare disorder too can present with obscure fever. Remaining manifestations include weight loss, generalized body pains, abdominal pain, skin eruptions, subcutaneous nodules, hypertension, hematuria, convulsions, paralysis, congestive cardiac failure and ischemic gangrene of a limb.

MALIGNANCIES

Hodgkin lymphoma: This entity should be suspected in a child with unexplained fever and persistent lymphadenopathy, particularly if an infective/inflammatory process is no longer on the card. Usually, fever is irregular but occasionally it may be characterized by periods of hyperpyrexia followed by afebrile intervals. This is what is called Pel-Ebstein fever. Accompanying symptoms include anorexia, fatigue, weight loss, night sweats, nonproductive cough or symptoms of mediastinal compression, pruritus, hepatosplenomegaly, anemia, thrombocytopenia and nephrotic syndrome.

Investigations reveal neutrophilic leukocytosis, lymphopenia and, in some instances, eosinophilia and monocytosis. ESR is usually elevated. Sternberg-Reed cells may be seen in the marrow. Lymph node biopsy is diagnostic.

Non-Hodgkin lymphoma: Unexplained fever may be one of the systemic manifestations of non-Hodgkin lymphoma. Rapidly growing painless noninflammatory swelling of lymph nodes, usually in the region of head and neck, or anterior mediastinum is characteristic of the disease. Lymphoma of the abdomen and bone is less frequent. Anemia, thrombocytopenia, neutropenia, weakness, fatigue, weight loss, increased intracranial pressure and cranial nerve involvement (7th in particular) are some of its other manifestations. Definitive diagnosis is by biopsy from the available tumor mass.

Leukemia: Occasionally patients with leukemia manifest only prolonged pyrexia spread over quite a few weeks before other manifestations of the disease become apparent. In suspected cases, it is important to do bone marrow.

Histiocytosis: Also called reticuloendotheliosis and comprising 3 diseases (i.e. Hand-Schuller-Christian disease, Letterer-Siwi

disease and eosinophilic granuloma), this group of disorders may have its onset in the form of recurrent febrile episodes without any definite pattern. Hepatomegaly, splenomegaly, painless adenopathy, petechiae, ecchymosis, papules or flat infiltration on trunk in particular take time to occur. Diagnosis is by demonstration of histiocytes in peripheral blood and bone marrow aspirate which appears scanty.

Brain tumor: If despite a reasonable clinical and investigative workup, the cause of PUO is not becoming clear, the possibility of a slowly-growing space-occupying lesion of the CNS needs to be entertained. Look for, in particular, signs of raised intracranial pressure and involvement of the cranial nerves.

Wilms' tumor: Also termed nephroblastoma, this tumor may be responsible for obscure pyrexia in some 1 in 5 instances of the growth. In a child aged around 3 years, it would be reasonable to suspect this diagnosis when there is large intra-abdominal smooth and firm mass, that does not cross the midline. Additional features include abdominal pain, vomiting, hypertension and microscopic hematuria. IVP is the most important diagnostic tools for this tumor.

Neuroblastoma: Obscure fever may be a feature of neuroblastoma, both localized and disseminated. There usually is an abdominal mass (nontender, firm and irregular) which sooner or later crosses the midline, invariably in the upper abdomen. Anemia, body tenderness, petechiae, ecchymoses, skin nodules raised intracranial pressure, chronic diarrhea and hepatomegaly are some of the remaining manifestations. Raised catecholamine level in urine is diagnostic of the disease.

DRUG FEVER

All drugs, particularly those listed below, could cause obscure fever by pharmacologic action, effect on thermoregulation, immunologic action, local complication, parenteral administration or overdosage:

Aspirin, sulfonamides, rifampicin, acetazolimide, cephalos-porins, colistin, erythromycin, nitrofurantoin, isonex, PAS ethambutol, amphetamine, azathioprine, carbamazepine, mebrobomate, penicillamine, diphenylhydantoin, potassium iodide, streptokinase, thiouracil, atropine and allied agents, haloperidol, indomethacin, monomineoxidase inhibitors.

MALINGERING (FACTITIOUS FEVER)

Malingering, though infrequent in pediatric practice as a cause of unexplained pyrexia, may at times cause considerable difficulty in tackling the problem. The subject is usually an older child who wishes to bunk school. He manages to cause the thermometer to register incorrectly high reading by rubbing the bulb of the thermometer vigorously against the bedcloth, giving it a dip in a hot drink, placing it in contact with a hot water bottle, or vigorously shaking it while it is inverted. Factitious fever is characterized by high swinging fever usually only when temperature is recorded.

When the caretaker of the child, usually the mother with some medical background, fabricates, falsifies or actually induces symptom or apparent symptom of a disease in the child as a part of child abuse, the phenomenon is termed Munchausen's syndrome by proxy or Meadow's syndrome. The symptoms may vary from pyrexia through host of gastrointestinal manifestations, rashes, bleeding from various sites and renal stones to induced apnea that, at times, proves fatal.

When malingering as a cause of unexplained fever is suspected, you must conduct measurements of temperature under close personal observation. Alternatively, you may record temperature of the voided urine immediately to get correct estimate of the body core temperature. Remember, urine temperature, as a role, is about the same as rectal temperature.

DEHYDRATION FEVER

Anhidrotic ectodermal dysplasia In this condition, the child may experience episodes of high fever when in a warm environment since he is not able to sweat. The remaining features of this X-linked recessive disorder, include frontal bossing, malar hypoplasia, flat nose, thick everted lips, prominent lowset ears, thin, dry and hypopigmented skin, absent or sparse eyelashes, and widely spaced pegshaped teeth.

Diabetes insipidus: Both nephrogenic and non-nephrogenic diabetes insipidus may cause dehydration and resultant hyperthermia. The former fails to respond to exogenous vasopressin (pitressin) whereas the latter, being a congenital

vasopressin dependent disease, is characterized by an excellent response.

NORMAL HIGH TEMPERATURE

Infrequently, a child, otherwise quite fine, cheerful and energetic, has a little persistent rise of body temperature or a daily rise upto 38°C (101°F). No abnormality on clinical and investigative checkup is found. A follow-up too reveals that all is well. Such a child should be declared as "normal" and the parents told to stop recording the temperature.

Some parents develop an obsession for recording the rectal temperature every now and then. They don't appreciate that the rectal temperature is a degree higher than that of the mouth and two degrees higher than the axillary temperature. They, therefore, start worrying that the child has pyrexia which he indeed does not have. Often, they lead the doctor also to the garden path. Needless to say, many avoidable investigations are conducted for nothing.

MISCELLANEOUS CAUSES OF PUO

Sarcoidosis, mucocutaneous lymph node disease, ulcerative colitis, Crohn's disease, pancreatitis, familial dysautonomia, Caffey's disease, periodic fever, serum sickness, thyrotoxicosis agammaglobulinemia, liver disease (e.g. ICC), subdural effusion, sickle-cell anemia, dengue fever, etc.

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Chapter 52 Rash

The term, *rash* (French: rasche) refers to an eruption of the skin, usually as a result of communicable (contagious) diseases. Also termed, exanthema, it is a shade of red with variation from disease to disease.

While confronting a child presenting with a skin rash, ask parents, if it followed a few days' fever and cold, irritability, malaise, etc. Is it accompanied by intense itching? Is there any history of known allergy to a drug(s)? Has the child been exposed to an index case of a contagious disease such as measles, rubella or chickenpox in the preceding 2 to 3 weeks period? Is he on any particular drug currently? Don't miss out on asking about the accompanying problems, which may give clues about the primary disease causing the rash or about its possible complications that may need immediate attention.

During physical examination, make it a point to carefully observe the location and characteristics of the rash, say its exact color, size (diameter as well as height), pattern, secondary changes in the form of crusting, and whether discrete or colasced (Table 52.1). An indirect evidence of pruritus is presence of signs of scratching.

General physical examination must also make a note about child's overall condition, sensorium, signs of shock, temperature, state of conjunctiva, appearance of mucous membrane, cervical lymphadenitis, liver and spleen, etc. in particular.

RASH IN THE NEWBORN

Neonatal Urticaria (Erythema Toxicum)

The lesions are characterized by a mixture of erythematous macules and white or yellow papules that appear in first few days, usually

first 3 days and may persist until tailend of first fortnight. If a needle is employed to lift the head from a macule and a gram stain is performed, predominantly eosinophis are seen.

Staphylococcal Skin Infection of the Newborn

The lesions are predominantly vesicles and pustules, though macules may also be seen. At times, differentiation from erythema toxicum becomes rather difficult. In such a situation, a needle needs to be employed to lift the head from a vesicle or a papule. After gram staining, a lot many polymorphs and gram-positive cocci are seen as against eosinophils in erythema toxicum.

Neonatal Varicella/Herpes Simplex

Neonates exposed to maternal vericella may develop varicella (chickenpox), provided that maternal chickenpox has occurred 5 days on either side of delivery. Neonatal varicella is a very serious condition and is a strong indication for administering varicella-zoster immune globulin (VZIG) by intramuscular injection, together with oral acyclovir, 20 mg/kg every 6 hour.

In case of neonatal herpes simplex, herpetic lesions of maternal genetic tract are traceable. The vesicles are fairly large and are not quite opaque, unlike in staphylococcal lesions.

Neonatal Miliaria

Classically, the lesions are very small pustular rashes over nasal bridge, cheeks or chin. The cause is retention of sebum.

Impetigo Neonatorum

The lesions characteristically are small pustules with surrounding red area. More often, the cause is Staphylococcus aureus rather than Streptococcal infection.

Other Causes of Neonatal Rash

Congenital rubella (petechiael, purpuric), congenital CMV (petechial, purpuric), birth asphyxia, phototherapy, immune thrombocytopenia, etc.

RASH IN INFANCY AND CHILDHOOD

Maculopapular Rash

Measles (Rubeola)

The disease is characterized by a 3-5 day prodromal phase of catarrhal symptoms, followed by a classical measly rash with the following features: • Pink or red blotchy irregular erythema (macular) which fades

in pressure and quickly darkens and blends into large red patches of varying size and shape. The rash has a tendency to become confluent over upper part of the body; in lower part, it remains rather discrete.

- Face and areas behind the ears are the locations where the rash appears first (Fig. 52.1). It travels lower down to trunk and limbs subsequently.
- The rash tends to fade after 3-4 days. Mild itching may accompany it. Its disappear is in the same order as it appears.
- Finally, there results a fine sheding, i.e. desquamation of the superficial skin of the face followed by that of the trunk and limbs with the exception of hands and feet, leaving behind a light-brown pigmentation.

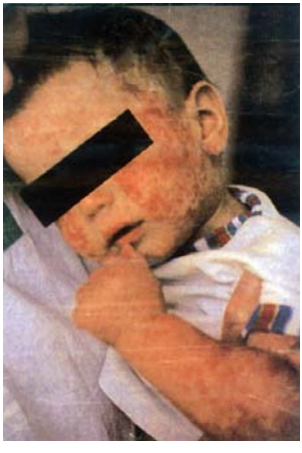

Fig. 52.1: *Measles* Note the classical red maculopapular rash, displaying tendency for confluence, on the 3rd day.

Roseola Infantum

Its pink macular rash, usually appears on trunk, neck and proximal areas of the limbs only. As the rash appears, the fever which is present in the preceding 4 days subsides. Typically, the rash is discrete and lasts for just 24 hours or so as against measles in which it lasts 4-7 days. The cause is human herpes virus II.

Rubella (German Measles, Three-Day Measles)

The pink rash is discrete and mild, appearing and disappearing more rapidly than in measles without any desquamation. There is a significant posterior cervical lymphadenopathy. Predromal phase too, is slight and brief.

Infectious Mononucleosis (Glandular Fever)

The maculo-papular rash often becomes manifest following administration of ampicillin. Accompanying features are fever, generalized lymphadenopathy and hepatosplenomegaly. The disease, caused by Epstein-Barr virus (EBV) is benign.

Scarlet Fever

The dark-red and punctiform rash is most remarkable over neck and major skinfolds. Since the rash spares the area around the mouth, a circumoral pallor is prominent. Desquamation occurs but, unlike in measles, hands and feet are involved. White and red strawberry tongue due to inflammation is characteristic of true scarlet fever.

Typhus

Pinkish red macules are by and large centripetal. Other manifestations include change in sensorium, hypotension, oliguria and azotemia.

Erythema Infectiosum (Fifth Disease)

It is the disease, caused by a paravirus. To begin with, cheeks appear red and flushed with circumoral pallor ("slapped cheek" appearance). Then, there is appearance of a maculopapular rash, mainly over arms and legs.

Kawasaki Disease

The characteristic rash is in the form of discrete red maculopapules on feet, around knees and in the axillary and inguinal skin creases. Desquamation of hands and feet is frequent.

Miliaria Rubra (Prickly Heat, Sudamina, Heat Rash)

The characteristic eruption is a pinhead-sized erythematous papule over the areas where sweat glands are in abundance.

Vesicular Rash

Chickenpox (Varicella)

The characteristic eruption appears rapidly following a short and mild prodromal phase and is in crops of various stages of development (macules, papules, vesicles, pustules). The crops are profusely spread over the trunk and proximal limbs. Even buccal mucosa may exibit some vesicles.

Herpes Zoster

The lesions closely resemble, those seen in chickenpox but are restricted to specific dermatomes or cranial nerves.

Herpes Simplex-Type I

Typically, the vesicles appear in crops following high fever and irritability over the eczematous skin. Nonetheless, the most frequent presentation in herpes simplex in childhood, is in the form of gingivostomatitis.

Impetigo

Both streptococcal and staphylococcal impetigo are present as red macules, which eventually become vesicles. The small vesicles later burst, leaving behing a honey-colored crust. On removal, the crusts leave a moist raw surface.

Dermatitis Herpetiformis

This conditon, often associated with celiac disease, i.e. gluten-induced enteropathy, is characterized by appearance of recurrent crops of pruritic papulovescicles over extensor surfaces, including elbows, knees and buttocks.

Molluscum Contagiosum

Flesh-colored papules with a central dimple initially firm, softer and more waxy later), 2-5 mm in size are seen over the face, trunk and limbs, and more often in school-going children.

Table 52.1: Different forms of skin rash

Macule	Flat and impalpable.
Papule	Raised and circumscribed; palpable
Vesicle	Raised, circumscribed, filled with fluid, under 0.5 cm in diameter
Pustules	Raised lesions filled with purulent exudate (pus)
Petechiae	Flat or raised hemorrhagic, 1-5 mm in diameter, which cannot be blenched by compression
Purpura	Flat or raised hemorrhagic spots over 5 mm in diameter
Ecchymosis	Large, irregular discolored areas (irregular), blue black (originally), greenish brown or yellow later; result from extravasation of blood into skin (even mucous membrane at times)

Petechial and Purpuric Rash

Meningococcemia

Petechial or purpuric rash anywhere on the body may well be the first sign of meningococcemia as such or preceded or accompanied by a maculopapular rash. Other signs of septicemia such as meningitis and toxemia are present. Lancing may assist in isolation of the bacteria from the skin lesions.

Occasionally, septicemia resulting from other bacteria, especially H. influenzae may cause similar petechial rash.

Henoch-Schönlein Purpura

In anaphylactoid purpura, as upper respiratory catarrh may be followed by appearance of a maculopapular hemorrhagic rash on buttocks and extensor surfaces of limbs (especially knees and ankles). The lesions, which appear in crops, fade over the next few days, leaving a brownish pigmentation. The cause of purpura in this autoimmune disorder is a type of vasculitis.

Immune (Idiopathic) Thrombocytopenic Purpura (ITP)

In this disorder, characterized by severe thrombocytopenia, purpuric rash is often accompanied by frank bleeding from other sites, say epistaxis.

Leukemia

Hemorrhagic rash with evidence of bleeding from other sites, considerable anemia, lymphadenopathy and hepatosplenomegaly should strongly point to the diagnosis of a blood dyscrasia such as leukemia.

FURTHER READING

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Chapter 53 Short Stature

Short stature means length/height below third percentile for age (according to international standard), below fifth percentile (according to Indian Council of Medical Research standard), or below 3 standard deviations (SD) of mean for age. It is a common pediatric problem. According to a pilot study, the etiologic breakup of the 300 consecutive children of short stature seen by this author at Government Children Hospital, Jammu, was as follows: chronic protein-energy malnutrition (PEM) 35%, IUGR (primordial dwarf) 10%, chronic diarrheal disease (malabsorption, intestinal parastitosis, etc.) 20%, endocrinopathies (hypothyroidism, pituitary dwarf, diabetes mellitus, adrenal hyperplasia) 10%, constitutional 10%, familial 10%, and chromosomal/genetic (Turner's syndrome, achondroplasia, Laurence-Moon-Biedl syndrome, etc.) 5%.

Short stature may be primary or secondary. Primary short stature is usually due to an intrinsic defect in the skeletal system as a result of some genetic or prenatal damage (say IUGR). Here, the potential for normal bone growth is impaired though skeletal age is unaffected. Main effect is on diaphyseal growth. Secondary short stature is characterized by impairment of bone age and height to the same extent. Here, the potential for reaching the adult height is subject to availability of suitable treatment.

While obtaining history, confirm child's exact age. Find out specifically if the child was of low birth weight and or preterm. Has he been suffering from chronic diarrhea, chronic nutritional deprivation, chronic worm infestation or any other chronic/ recurrent ailment that may have adversely affected his growth? What about the nature of the parents, siblings and the

grandparents? Is his intellectual development also affected? Get an idea if the secondary sex characters were delayed in one or both parents.

Physical examination with special emphasis on the following measurements, recorded accurately, is of paramount importance:

Height/length—At 2 years and after, height is measured with a stadiometer. This instrument consists of a sliding rigid board mounted at right angles onto a vertical scale. The child stands erect barefoot, making himself as tall as possible without elevating his feet. His head needs to be in the Frankfurt plane, meaning the line passing through outer canthi and external auditory meatuses should be parallel to the ground. The knees need to be straight. All these requirements are met if it is ensured that, while he stands, his occiput, shoulders, buttocks and heels are in touch with the vertical surface.

For children under 2 years, supine (recumbent) length rather than standing height (the latter may be less by 2 cm the exact measurement), using an infantometer, is recommended. While making this measurement, it must be ensured that the child's legs are extended fully at hips and knees and the feet are at right angles to the legs. Assistance from a parent or attendant is usually needed for this purpose (Fig 53.1).

Fig. 53.1: *Achondroplasia* This 18-year-old girl, standing by the side of a normal adult, had large head with depressed bridge of nose due to midfacial dysplasia and prominent forehead, short height (125 cm) and limb shortening with the hands falling short of reaching the normal level when allowed to hang down by the body sides. The closest differential diagnosis is spondyloepiphyseal dysplasia. Skiagrams are required for differentiation between these two conditions.

The term, height age, means age at which the child is expected to have the said height.

Height velocity, calculated from at least two accurate readings at least 6 months (but preferably one year) apart, is more useful than a single recording of height. A velocity of less than 4 cm per year between 5 years of age and adolescence points to a pathologic state. For younger children, the figure is variable with age, i.e. 15 cm for 0 to 6 months, 7 cm for 6 to 12 months, 10 cm for 1 to 2 years and 5 cm for 2 to 5 years.

Body proportions are considered to be the most accurate measure of height, helping in deciding whether short stature is proportionate or disproportionate. Upper segment/lower segment ratio (1:7:1.0 at birth, 1:3:1.0 at 3 years 1:1 by 7-8 years) is increased in hypothyroidism and short-limbed dwarfism (achondroplasia). Span (measurement from midfinger tip to midfinger tip in case of fully outstretched arms and hands is increased (more than height) in spondyloepiphyseal dysplasia (Morquio's disease).

It is useful to measure height of parents and siblings. Midparental height, a genetic component, gives the subject's target height. It is denoted by the mean of the heights of father and mother plus 13 in boys. In girls, it is obtained as a mean of the heights of the mother and father minus 13.

Weight—If weight is less proportionally less than height, nutritional deprivation must be seriously considered. On the other hand, if weight is nearly normal but height is significantly less, hypothyroidism, growth hormone deficiency and hypercorticism need to be considered in the differential diagnosis.

The term weight age means the age at which the said weight is expected to be attained.

Pubertal staging is done by Tanner's classification, based on pubic hair, penis and testes in boys and pubic hair and breast in girls as shown in Tables 53.1 and 53.2

Children with delayed puberty and short stature should arouse suspicion of sex chromosomal anomalies such as Turner's syndrome. Here, stature, despite timely onset of puberty, is likely to end up with short stature. In "late matures", both short stature and delayed onset of puberty coexist. It is noteworthy that these

late-maturers eventually attain better heights compared to early-maturers.

Bone age, assessed through radiologic examination of certain bones and then comparing the appearance and fusion of epiphyseal centers with standard normal radiographs for different ages, is of vital importance. In infancy, knee, wrist and hand are most useful sites. In later years, elbow, wrist and hand are suitable (Table 53.3).

Based on the assessment mentioned so far, the following guidelines must be borne in mind:

Table 53.1: Pubertal (sex maturity) stages in boys

SMR stage	*Pubic hair*	*Penis*	*Testes*
1.	None	Preadolescent	Preadolesoent
2.	Scanty, long, slightly pigmented	Slight enlargement	Enlarged scrotum, pink, texture altered
3.	Darker, stats to curl, small amount	Longer	Larger
4.	Resembles adult type but less in quantity; coarse, curly	Larger, glans and breadth increase in size	Larger, scrotum dark
5.	Adult distribution, spread to medial surface of thigh	Adult size	Adult size

Table 53.2: Pubertal (sex maturity) stages in girls

SMR stage	*Pubic hair*	*Breasts*
1.	Preadolescent	Preadolescent
2.	Sparse, lightly pigmented, straight, medial border of labia	Breast and papilla elevated as small mound; areolar diameter increased
3.	Darker, beginning to curl, increased amount	Breast and areola enlarged; no contour separation
4.	Coarse, curly, abundant but amount less than in adults	Areola and papilla form secondary mound
5.	Adult feminine triangle, spread to medial surface of thighs	Mature ; nipple projects, areola part of general breast contour.

Table 53.3: Bone age through radiology

Bones	*Average age, at appearance of ossification center*	
	Males	*Females*
Carpal bones		
Capitate	2 mo	2 mo
Hamate	3 mo	2 mo
Triangular (triquetral)	30 mo	21 mo
Lunate	42 mo	34 mo
Trapezium	67 mo	47 mo
Trapezoid	69 mo	49 mo
Scaphoid	66 mo	51 mo
Pisiform	13 years	10 years
Metacarpal bones		
Second	18 mo	12 mo
Third	20 mo	13 mo
Fourth	23 mo	15 mo
Fifth	26 mo	16 mo
First	32 mo	18 mo
Fingers		
Proximal, 3rd finger	16 mo	10 mo
Proximal, 2nd finger	16 mo	11 mo
Proximal, 4th finger	17 mo	11 mo
Distal, 1st finger	19 mo	12 mo
Proximal, 5th finger	21 mo	14 mo
Middle, 3rd finger	24 mo	15 mo
Middle, 4th finger	24 mo	15 mo
Middle, 2nd finger	26 mo	16 mo
Distal, 3rd finger	28 mo	18 mo
Distal, 4th finger	28 mo	18 mo
Proximal, 1st finger	32 mo	20 mo
Distal, 5th finger	37 mo	23 mo
Distal, 2nd finger	37 mo	23 mo
Middle, 5th finger	39 mo	22 mo
Sesamoid (adductor policis)	152 mo	121 mo
Shoulder		
Acromian	14 years	12 years
Caracoid	6 years	13 years
Clavicle (medial end)	17 years	17 years
Humerus (head)	3 weeks	3 weeks
Greater tuberosity	3.5 years	3 years

Contd.

Contd.

Bones	Average age, at appearance of ossification center	
	Males	Females
Elbow		
Radius	6 years	3.5 years
Medial condyle	7.5 years	5.5 years
Lateral condyle	6 years	7.5 years
Trochlea	8 years	7.5 years
Capitulum	2 weeks	2 weeks
Ulna	10 months	9 months
Wrists	1.7 years	3.5 years
Radius	1.7 years	3.5 years
Ulna	7.4 years	6.5 years
Hip and Knee		
Femur (distal end)	At birth	At birth
Tibia (proximal end)	At birth	At birth
Femur (head)	4 months	4 months
Greater trochanter	24 months	—
Lesser trochanter	12 years	—
Patella	16 years	29 months
Iliac crest	16 years	16 years

1. If height age falls within 2 years of the chronologic age, child need not be considered of short stature.
2. If height age is less than the chronologic age and the bone age equal to height age, slow growth, meaning constitutional delay, is the likely cause of short stature. Chances are that, such a child will attain his normal height subsequently.
3. If the height age is less than the chronologic age and the bone age equal to chronologic age, genetic short stature is the diagnosis. Such a child has the short parents and is likely to remain short.
4. Bone age less than chronologic age should suggest constitutional growth retardation, hypothyroidism, malnutrition, growth, hormone deficiency or chronic systemic diseases as the probable cause of short stature.

Indications for intensive workup are:

1. Height, > 2 SD, below mean for chronologic age.
2. Growth velocity, < 4 cm/year.
3. Clinical evidence of a syndromal state.

Specific Investigations Include

1. Buccal smear.
2. Thyroid function tests.
3. Somatomedin (measurement).
4. Hormonal (cortisal, LH, FSH, PRL, testosterone, estrogen) levels.
5. Urinary iodine levels,
6. Karyotyping.
7. Malabsorption studies.
8. Renal—acidification tests.
9. Urinary aminoacidogram.
10. Imaging (US, CT scan).

Genetic (Familial) Short Stature

This is a leading cause of short stature universally. It runs as a familial trait with one or both parents and sibling(s) being short. A noteworthy feature is that bone age is consistent with chronological age. Growth occurs at the genetic potential. Eventually, the child attains a height that is consistent with the midparental height.

Constitutional Short Stature (Fig. 53.2)

This is a sheer variant of normal growth and is, therefore, more appropriately termed constitutional growth delay. Here, bone age is consistent with height age rather than the chronological age—a point in sharp contrast with the observation in genetic short stature. Onset of puberty is delayed. Eventually, however, adult height and sexual maturation are normal.

Persistence of the relatively hypo-gonadotrophic state of childhood is believed to be responsible for this kind of short stature. Frequently, one or both parents or other close family members

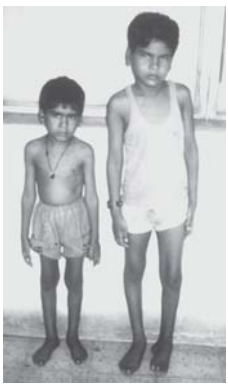

Fig. 53.2: *Short stature* Note that the height of the 8-year-old child (left) is just 108 cm against 123 cm of the child of the same age.

have a history of short stature in childhood, delayed puberty and, finally, normal stature.

Classically, a constitutional short child is born with normal weight and length. Growth remains normal for the first 4 to 12 months. Then, it slows down until 2 to 3 years age when it becomes normal but at a relatively lower level of normal (5 cm or little more per year). Puberty too is delayed. Nevertheless, final outcome is satisfactory as normal adult height as well as sexual development are attained.

Primordial Dwarfism

In this condition, intrauterine growth retardation (IUGR) is responsible for short stature. It is claimed that arrest of the fetal growth early in pregnancy results in reduction in number of cells. As a consequence, growth potential in the postnatal period is diminished. Bone age is normal, corresponding to the chronological age. Usually, prognosis for adult height is poor, particularly in the subjects who are small for gestational age.

Silver-Russet syndrome is characterized by short stature, small triangular facies, frontal bossing, scanty subcutaneous fat, and short and incurved fifth finger with or without hemihypertrophy in a child who had low birth weight for gestational age.

Nutritional Dwarfing

Chronic malnutrition of long-standing, particularly when it is not gross enough to cause overt kwashiorkor or marasmus, leads to stunting in height as an adaptation reaction. Bone age is, as a rule, less than the chronological age.

Catch-up growth, though incomplete, is expected in these children once nutritional rehabilitation is satisfactorily achieved.

Emotional Deprivation

Also termed psychosocial dwarfism, deprivation dwarfism or reversible hyposomatotropism, this condition, perhaps, causes short stature through functional hypopituitarism. These children have perverted appetite, enuresis, encopresis, insomnia, crying spasms and sudden tantrums. They may be passive or aggressive. History of upset mother—child or family relations provides clue

to the diagnosis. Bone age is little delayed or just normal. Body proportions are normal.

Following availability of emotional warmth and security, these children show catch-up growth.

Chronic Visceral Diseases

Most chronic visceral diseases (malabsorption syndrome, congenital heart disease, renal tubular acidosis, chronic renal failure, diabetes mellitus, thalassemia, bronchial asthma) also chronic infections (tuberculosis, chronic intestinal parasitosis, malaria, kala-azar, syphilis, pyelonephritis) cause retardation in stature, in fact in total growth as such. Recently, it is being increasingly recognized that short stature may be the solitary manifestation in certain cases of celiac disease. The implication of this observation, particularly in areas where this disease occurs, is significant.

Endocrinopathies

Remarkable delay in bone age is characteristic of short stature accompanying endocrinal disorders.

Growth hormone deficiency should be suspected if the subject's appearance is infantile, bone age is remarkable retarded and the growth velocity is less than 4 cm per year. Diagnosis is confirmed by testing growth hormone levels after provocative stimulation (say: exercise, insulin, pro-pra-nolol, arginine, L-dopa).

Remember that growth hormone deficiency is an uncommon cause of short stature. It may occur in isolation or in association with other pituitary hormones when the condition is termed panhypopituitarism.

Hypothyroidism: The clinical profile of a full-blown case is classical so that the condition is easily recognized. What needs to be borne in mind is that hypothyroidism can present with short stature and growth retardation alone. Body proportions remain infantile. Bone age is retarded remarkably. Diagnosis must be confirmed by demonstrating low T_4 and high TSH levels.

Cushing syndrome: may result from exogenous steroid therapy or secondary to a pituitary or adrenal tumor. Despite being overweight, the child has growth retardation, short stature and delayed

epiphyseal maturation. Remaining features of the syndrome such as moon facies, abdominal striae, plethora, hypertension and reduced glucose tolerance may be present.

Diabetes mellitus is usually accompanied by growth retardation, particularly when it is poorly controlled. There may be history of polyuria, nocturnal enuresis, polydipsia and polyphagia. Urine and blood sugar clinch the diagnosis.

Skeletal Disorders

In case of disproportionate short stature, chondrodystrophies such as achondroplasia, pseudoachondroplasia, osteogenesis imperfecta, rickets, spondyloepiphyseal dysplasia, caries spine or hemivertebrae must be suspected.

Chromosomal Disorders

Turner's syndrome (XO) must always be considered in the differential diagnosis of short stature in girls. Remaining features of the condition include webbing of neck, edema of lower limbs, widely-placed nipples, cubitus valgus, coarctation of aorta and a short fourth metacarpal as also absence of secondary sex characters.

Noonan's syndrome is just the proto type of Turner's syndrome in boys with the exception that chromosomal count is normal and, in place of coarctation of aorta, pulmonary stenosis with or without ASD is more common.

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Chapter 54 Small Head

Small head often accounts for pediatric cases presenting to the doctor for elucidation as regards the precise diagnosis. Recently, in a pilot study we found that, out of a total of 200 and odd OPD cases, 6 had small head whereas the head size was considered significantly large in 8. The breakup of these 6 cases of small head according to clinical diagnosis was: microcephaly 3, cranio-synostosis 1, familial 1, small baby 1.

History should seek information whether the developmental and mental milestones have been delayed or within normal limitis. Any history of seizures? Are the parents consanguinously related? Do other children in the family and the parents have small heads? Any history of alcoholism in the mother?

Physical examination should first establish if the head size is indeed significantly small in relation to the body size, weight and age. In doubtful cases, it is important to record serial measurements. Is the shape of the head also abnormal? Are there any characteristic facies and congenital anomalies? In infants and small toddlers, find out if the anterior fontanel is prematurely closed? Is a ridge palpable in the region of the sutures? Any papilledema?

A complete neurologic examination must be undertaken. What is the child's developmental age? What is his intelligence quotient? Look for signs of raised intracranial pressure.

Skull roentgenogram is important for diagnosing intrauterine infection or craniosynostosis.

Microcephaly

Strictly speaking, the term should be reserved for small size of head (3 SD below the average) as a result of developmental

abnormalities and/or destructive processes of the brain, usually during the intrauterine life or early infancy.

The following conditions need to be considered in the differential diagnosis of true microcephaly:

Defects in brain development: Hereditary (recessive) microcephaly, trisomy esp. Down's syndrome, phenylketonuria, Cornelia de Lange's syndrome, Rubinstein-Taybi's syndrome, Smith-Lemli-Opitz syndrome, fetal alcohol syndrome, Seckel's dwarfism, fetal ionizing radiation exposure.

Intrauterine infections: Rubella, cytomegalovirus infection, toxoplasmosis, syphilis.

Natal and postnatal disorders: Anoxia, gross malnutrition, neonatal herpes virus infection.

Craniosynostosis (Craniostenosis)

Small head secondary to premature closure of the skull sutures which interfere with proper brain growth is often accompanied by asymmetry of the head as well. One or more sutures may be involved. Since the stiff skull vault does not allow the brain to grow, a kind of situation resembling raised intracranial pressure results.

Oxycephaly means fusion of coronal and, in some cases, all sutures. The head may be anteroposteriorly flattened and elongated transversely and upwardly. This is called acrocephaly. When all the sutures are fused, head is symmetrically small (Fig. 54.1).

Scaphocephaly results from fusion of the sagittal suture. Skull grows anteroposteriorly and assumes an elongated appearance resembling a boat (Fig. 54.2). This is the most common type of craniosynostosis, accounting for around 50% of the cases (Fig. 54.3).

Plagiocephaly is characterized by asymmetrical skull resulting from asymmetrical fusion of the suture(s).

The symptomatic subjects have manifestations secondary to high intracranial pressure. These include headache, vomiting, proptosis, squint, convulsions, hyperreflexia, hypertonia and mental retardation.

Physical examination shows typical appearance. The concerned sutures are united and fontanels prematurely closed, or in the process of doing so. There may be signs of neurologic deficit.

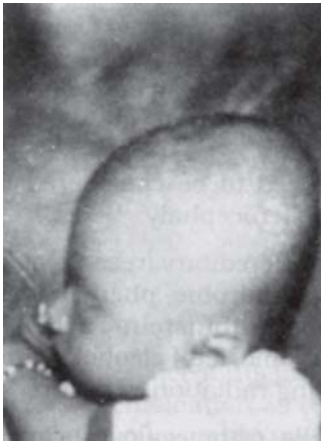

Fig. 54.1: *Microcephaly secondary to craniosynostosis* Clinically, the ridges over suture lines were palpable and anterior fontanel was prematurely closed.

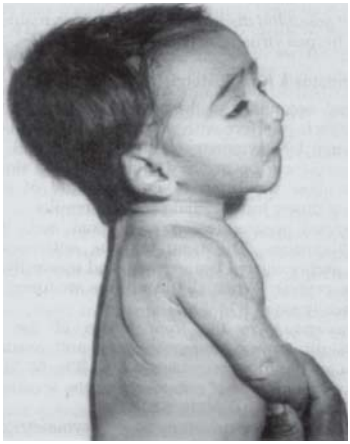

Fig. 54.2: *Scaphocephaly* Microcephaly secondary to craniosynostosis of the sagittal suture, leading to boat-shaped skull (scaphocephaly). Half of the cases of craniosynostosis belong to this category.

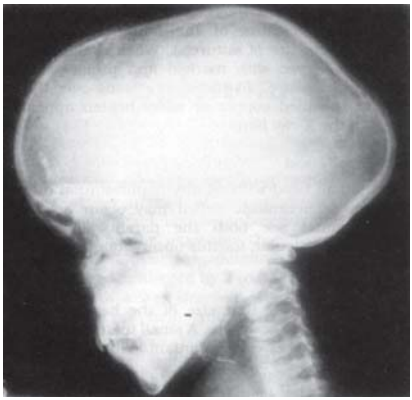

Fig. 54.3: X-ray of a scaphocephalic skull. Note the premature synostosis of sagittal suture.

Apert's syndrome refers to occurrence of craniosynostosis in association with syndactyly. When oxycephaly is accompanied by beaked nose, proptosis, and hypertelorism, the combination is termed craniofacial dysostosis or Crouzon's disease. In Carpenter syndrome, there is acrocephaly, syndactyly in the hands, polydactyly and syndactyly in the feet, and tendency to mental retardation.

Diagnosis is based on characteristic clinical appearance, palpability of a ridge along the involved suture(s) and premature closure of the fontanels. X-ray skull confirms the closure of suture(s). When craniosynostosis is of severe degree with marked and prolonged rise of intracranial pressure, distinct impressions over the skull vault, the so-called copper or silver-beaten appearance, are seen in the X-ray film.

Familial Small Head

At times, small head without any manifestation of mental retardation or neurologic deficit may occur as a family trait. You must see both the parents in suspected instances, in particular, for this observation.

Small Infant

An oftignored fact is that size of the head normally is proportionate to the body size. A small infant is expected to have small head whereas a big infant is likely to have a big head.

Normal Variation

Not infrequently, a diagnosis of microcephaly is wrongly made when in fact the head size, though apparently small, falls within the normal range. Some years ago, a family approached me, complaining that their 1-year-old son's head size was much smaller than that of his cousin aged exactly the same. On examination, I found that the child in question had a head circumference of 44 cm against the 45 cm of his cousin. Both children were perfectly normal. Both children had average growth and development.

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Chapter 55 Splenomegaly

Splenic enlargement ranks only next to hepatomegaly in frequency of occurrence of intra-abdominal lumps in infancy and childhood. Like hepatomegaly, this too is more often detected by the examiner than by the patient or attendant himself. Just palpability of this organ means that it has already enlarged by 2 to 3 times its normal size. For detection of lesser degrees of enlargement, clinical palpation does not help. You would have to resort to radiography.

In order to palpate the spleen, you should preferably stand on the patient's right side. Then, you should place the flat of your left hand over the left lateral and posterior part of the chest and the right hand just below the left costal margin. During the inspiratory phase, right hand is insinuated underneath the costal margin to feel the organ. While this is being done, the left hand engages in pressing the chest wall. Spleen is usually felt as a firm mass with smooth rounded borders and a notch. If you fail to feel it this way, the subject may be turned halfway to the right and the maneuver repeated. Make sure that careful and gentle palpation of the relaxed abdomen is conducted if you wish to obtain reliable information about the size of the spleen.

In infants, spleen enlarges vertically downward against its diagonally downward enlargement in children and adults (Fig. 55.1).

A significantly enlarged spleen must be differentiated from other masses in the left hypochondrium, notably the kidney. The points that may help you in establishing that it indeed is spleen are:

1. Upper margin of the spleen is concealed by the rib cage and,

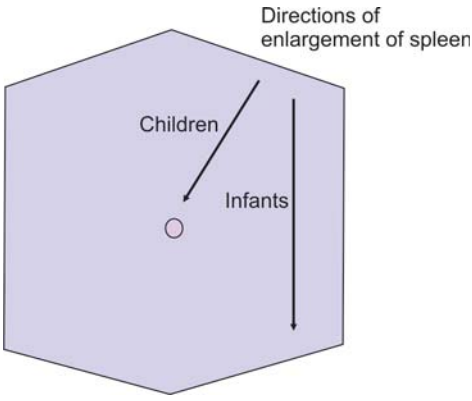

Fig. 55.1: In infants, spleen enlarges vertically downward against its diagonally downward enlargement in children and adults.

2. Medial border of the spleen has a characteristic notch.
3. In splenic swelling, the overlying bowel is absent.
4. Splenic swelling tends to extend towards the umbilicus which means downwards, forwards and inwards. Kidney swelling, on the other hand, enlarges forwards and vertically downwards towards the iliac fossa.
5. Splenic swelling moves freely with respiration. Renal swelling does not move with respiration.
6. Splenic swelling is palpated from the anterior aspect whereas kidney enlargement is palpable from the posterior aspect or bimanually.
7. Splenic swelling is not ballotable unlike the kidney swelling. Slight palpability of spleen is encountered in some 5 to 10% of normal children, especially the neonates.

Infections

Malaria: This is, perhaps, the most common cause of a large, firm splenic lump in children in areas endemic for malaria (Fig. 55.2). Manifestations other than splenomegaly include classical febrile episodes of irregular fever, bodily pains, headache, nausea, abdominal pain and hepatomegaly. Severe manifestations related

to CNS, respiratory system and gastrointestinal tract point to the diagnosis of faciparum malaria. Shock followed by coma is a feature of algid malaria.

In chronic malaria, spleen is quite big and firm. In addition the child is malnourished, anemic and stunted. In these cases, febrile episodes are either absent or simply nonspecific as in sepsis. The terms, tropical splenome-galy, idiopathic splenomegaly or big spleen disease refer to this very condition.

Diagnosis is made by demonstrating the malarial parasite in the thick and thin blood film.

Enteric fever Spleen usually becomes palpable in the second week in enteric fever (Fig. 55.3). Remaining manifestations include fever, malaise, anorexia, vomiting, abdominal distention, abdominal pain, headache,

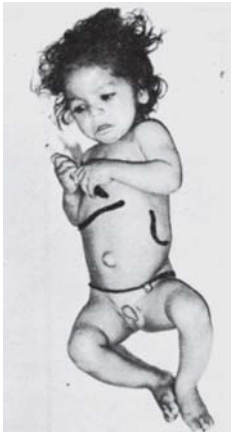

Fig. 55.2: *Malaria* Note the significant enlargement of spleen which was quite firm as also just palpable liver. Presenting complaint was just episodes of hyperpyrexia of short duration (3 days). Response to chloroquine was dramatic.

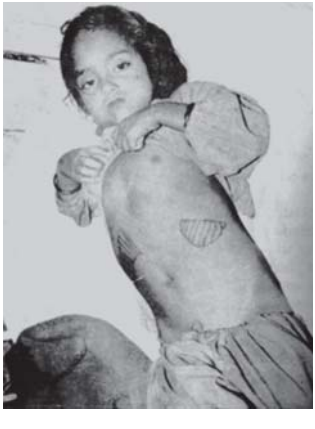

Fig. 55.3: *Enteric fever* Note the soft modest splenomegaly and slight hepatomegaly. This child presented with 9 days history of pyrexia. Widal test showed a titer of 1 in 320.

diarrhea, sometimes constipation, cloudiness of consciousness, doughy abdomen and hepatomegaly.

Investigations may reveal eosinopenia, leukopenia with relative lymphocytosis in a proportion of the cases, Widal test with "O" antibody titer of 1 in 250 or more, and S. typhi in blood and bone marrow culture.

Tuberculosis: In generalized tuberculosis, splenomegaly may accompany hepatomegaly and other signs of tuberculosis (Fig. 55.4). Attempts must be made to identify the primary lesion in the lungs or elsewhere.

Septicemia: Any child with acute splenomegaly and multisystem involvement, especially when osteomyelitis, an abscess, pneumonia, endocarditis or some septic focus is apparent, must have septicema (severe bacteremia making the patient critically ill) excluded. A blood culture is mandatory before initiating intensive antibacterial therapy.

Infective endocarditis: In this condition caused by Streptococcus viridans, E coli, Staphylococcus albus or other infective agents in subjects with congenital or acquired valvular heart disease, a sort of septicemic stage develops. Clinical features include; besides splenomegaly, low grade fever, general weakness, malaise, anorexia and splinter hemorrhages. Splenomegaly, anemia and clubbing are usually present. Osier nodes may be found in some patients. Microscopic hematuria is invariably present. Leukocytosis is usual. ESR is high.

Diagnosis is confirmed by positive blood culture, taken

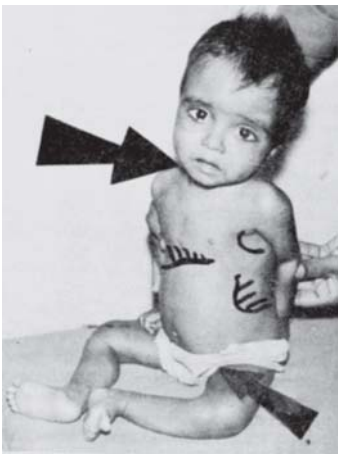

Fig. 55.4: *Generalized tuberculosis* Note the splenohepatomegaly and generalized lymphadenopathy-cervical (indicated by the arrow), axillary and inguinal (also indicated by the arrow).

every 6 hours for 36 hours, while the patient is yet to be started on appropriate intensive chemotherapy.

Brucellosis: Splenomegaly in brucellosis is accompanied by hepatomegaly, cervical and axillary lymphadenopathy, high fever with chills and diaphoresis, epistaxis, cough, abdominal pain and weight loss. These manifestations are preceded by prodromal symptoms such as tiredness, weakness, headache, myalgia, constipation and anorexia.

Diagnosis can be confirmed by brucella agglutination test showing titers over 1 in 60 in acute illness.

Kala-azar: Spleen enlarges quite rapidly in kala-azar. This contrast with the slow enlargement of the liver in this condition. Remaining manifestations include mild to moderate persistent pyrexia, skin pigmentation, weight loss despite good dietary intake since the appetite remains good, and scalp hair which become sparse and brittle, leaving areas of alopecia (Fig. 55.5).

Investigations show positive aldehyde (formal gel) test, Chopra's antimony test, complement fixation test and LD bodies in blood and bone marrow smears.

Intrauterine infections: Toxoplasmosis, rubella, cytomegalovirus, syphilis and herpes are nearly always accompanied by splenomegaly.

Extended rubella syndrome is characterized by, besides splenomegaly, growth, retardation, congenital heart disease (patent ductus arteriosus), hepatitis with hepato-megaly, thrombocytopenic purpura, deafness, otitis media, pancreatitis, pneumonitis, cerebral diplegia, cleft palate and foot, syndactyly, spina bifida and talipes equinovarus, dental malformations, microphthalmia, buphthalmos and retinal lesions.

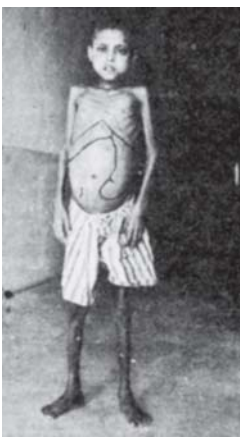

Fig. 55.5: *Kala-azar* Note the massive splenomegaly (quite out of proportion to hepatomegaly), remarkable wasting, pigmentation and sparse brittle hair.

Congenital toxoplasmosis is characterized by, besides splenomegaly; poorfeeding, maculopapular rash, pyrexia, hepatomegaly, lymphadenopathy, jaundice, hydrocephalus/ microcephaly, microphthalmia, seizures, cerebral calcification radiologically and chorioretinitis.

Cytomegaloviral infection, both congenital and postnatally acquired, is accompanied by splenomegaly. Remaining manifestations of the congenital infection include: jaundice, purpura, hepatomegaly, microcephaly, cerebral calcification and chorioretinitis. Appearance of a petechial rash in association with splenomegaly on the very first day of birth strongly suggests this condition as the probable diagnosis. Isolate congenital anomalies such as high-arched palate, clubfoot, microcephaly and deafness may also occur in this disease.

Acquired infection too is accompanied by splenomegaly. Other features include: pyrexia, septic shock, gray pallor, fast deterioration in respiratory status, hepatomegaly and atypical lymphocytosis in premature newborns and infants 1 to 2 months of age.

Acquired infection in older children also causes hepato-splenomegaly in addition to sore throat, malaise, myalgia, anorexia, headache, abdominal pain, cervical or other regional lympha-denopathy, pyrexia, excessive sleep, atypical lymphocytosis and liver dysfunction.

Congenital syphilis (early) may manifest in first 6-week of life with snuffles, rhagdes, lesions over skin, soles and palms, mucous patches, ulceration and fissuring in mouth and anus, anemia, hepatosplenomegaly, jaundice, fever, failure to thrive, lympha-denopathy, and chorioretinitis. Painful osteochondritis and/or priostitis may cause pseudoparalysis, the so-called parrot paralysis. Renal, meningovascular, respiratory and hepatic complications may occur.

Neonatal herpes simplex, usually acquired during passage through the birth canal, may be responsible for splenomegaly in association with hepatomegaly, pyrexia, poorfeeding, lethargy, imlability, vomiting, jaundice, seizures, apneic spells, cyanosis, respiratory distress, bulging anterior fontanel, paralysis opistho-tonos, decerbrate rigidity and coma.

Infectious mononucleosis: This condition, caused by Epstein Barr (EB) virus with positive hetrophilic antibody response, is an important cause of marked splenomegaly. Remaining manifestations include malaise, pyrexia, sore throat, headache, nausea or vomiting, hepatomegaly, lymphadenopathy, petechiae at the junction of hard and soft palate and atypical lymphocytosis.

Neonatal hepatitis: In almost half of the infants with neonatal hepatitis, moderate splenic enlargement occurs. Remaining features of this condition include jaundice, poorfeeding, vomiting, anemia, high-colored urine and intermittent loss of pigment in the stools. Liver is grossly enlarged with firm consistency. The differential diagnosis from extrahepatic biliary atresia often poses problem.

For details see Chapter 39.

Common viral infections: Common nonspecific viral infections responsible for producing unexplained pyrexia, bodily pains, malaise, etc. are often accompanied by splenomegly. This diagnosis, therefore, should be seriously considered before subjecting the patient to cumbersome investigations.

AIDS see Chapter 35.

Histoplasmosis: Occurrence of splenomegaly in combination with hepatomegaly, pyrexia, generalized lymphadenopathy, anemia and leucopenia should arouse suspicion of disseminated histoplasmosis. Histoplasmin skin test is indicated in such a situation.

Hydatid disease: Rarely, echinococcal infection may produce one or more cysts in the spleen resulting in marked splenomegaly. Similar cysts may be found in lungs, liver and other organs. Skin test and/or indirect hemagglutination reaction may help in confirming the clinical diagnosis.

Hematogenous Diseases

Anemias: Splenomegaly is an important feature of hemolytic anemias as a result of extramedullary hemopoiesis and hyperplasia of the reticuloendothelial system. It occurs in both congenital (thalassemia major, sickle-cell disease) as well as acquired hemolytic state (Figs 55.6 and 55.7).

Splenomegaly occurs also in nutritional anemias due to iron, folate, vitamin B_{12}, or combined deficiency.

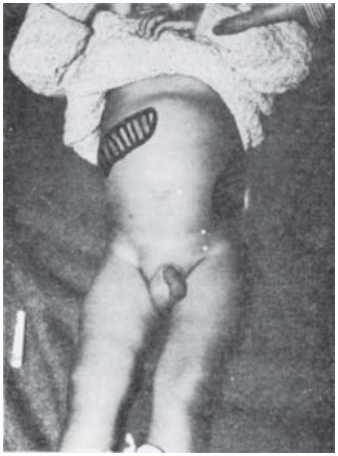

Fig. 55.6: *Thalassemia major* Note the splenohepatomegaly in the child whose chronic anemia failed to respond to iron therapy. His fetal hemoglobin turned out to be 65%.

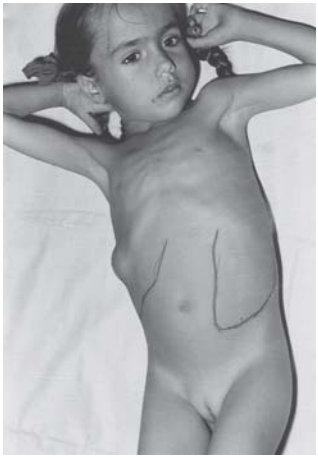

Fig. 55.7: *Splenohepatomegaly* in a 3-year-old with sickle cell anemia. Spleen tends to shrink as also cease to function (autosplenectomy) in the subsequent years as a result of repeated thrombosis.

For details on anemias, you may refer to Section 3. *Hypersplenism:* This state is characterized by an enlarged spleen usually secondary to a large number of causes, depression of one or more cellular elements of blood (anemia, leukopenia, thrombocytopenia), active formation of these elements in the bone marrow and correction of the said hematologic abnormalities resulting from splenectomy.

Thrombocytopenic purpura: In some 25% children with acute idiopathic thrombocytopenic purpura, slight splenomegaly may be encountered. Moderate splenomegaly occurs in recurrent or chronic ITP cases.

Congestive Splenomegaly

This state may occur secondary to portal or splenic vein obstruction, to intrahepatic disease (cirrhosis, Wilson's disease, galactosemia, biliary atresia, cystic fibrosis, alpha-l-antitrypsin deficiency) or to chronic congestive cardiac failure.

Manifestations include splenomegaly, thrombocytopenic hemorrhages, anemia, prominent superficial abdominal veins (collaterals), hemorrhoids/esophageal varices and ascites.

Investigations show abnormal liver function, pancytopenia, active hemopoiesis with abundant megakaryocytes in the marrow and raised portal venous pressure with visualization of the obstructive lesion of splenic and portal veins, on splenoportogram.

Inborn Errors of Metabolism

Splenomegaly is a feature of several inborn errors of metabolism and storage diseases, including glycogen-storage disease, Gaucher's disease, Niemann-Pick disease gargoylism, amyloidosis, hemosiderosis, xanthomatosis, cystinosis and cystic fibrosis. A reasonable discussion on these conditions is available elsewhere in this volume, particularly in Chapter 35 which deals with hepatomegaly.

Malignant Diseases

Splenomegaly occurs in such malignant diseases as leukemias (its size is enormous in chronic myeloid leukemias), Hodgkin's lymphoma, non-Hodgkin lymphoma, etc.

Miscellaneous

Splenic cysts An asymptomatic smooth lump in the left upper quadrant of abdomen displacing the stomach medially, should arouse suspicion of splenic cysts. These cysts may be: (i) epidermoid cysts, or (ii) pseudocysts which follow trauma or infection.

Hemangioma: Rarely, a large hemangioma may be responsible for splenic enlargement. X-ray abdomen shows an enlarged spleen and, occasionally, calcification in the hemangiomatous growth.

Abscess: Splenic abscess may result as a part of multiple pyemic abscesses or septicemia.

Systemic lupus erythematosus: Splenomegaly together with hepatomegaly constitutes an important finding in SLE. The diagnosis needs to be seriously considered in the presence of additional features such as unexplained pyrexia of prolonged duration, butterfly rash over cheeks and bridge of the nose, joint or muscle pains and weight loss.

Demonstration of LE cell phenomenon or, more importantly, antinuclear antibodies (ANA) establishes the diagnosis.

Still's disease: In this form of juvenile rheumatoid arthritis (JRA), splenomegaly occurs in association with arthritis/arthralgia and lymphadenopathy. The illness has an acute febrile or systemic onset.

Nutritional recovery syndrome: Splenomegaly may occur in a proportion of cases with nutritional recovery syndrome. This syndrome is encountered in grossly malnourished children who are being treated with very high quantity of proteins. Manifestations include increasing hepatomegaly, abdominal distention, ascites, prominent thoracoabdominal venous network, hypertrichosis, parotid swelling, gynecomastia and eosinophilia. It occurs both in kwashiorkor and marasmus and is supposed to be related to endocrinal disturbances.

Extrahepatic biliary atresia: In advanced stage of this condition, marked hepatomegaly is accompanied by splenomegaly. Jaundice keeps deepening and lightening. Vitamin K deficiency may cause hemorrhages. Often, it becomes difficult to differentiate it from neonatal hepatitis.

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2. Camitta BM. Splenomegaly. In: Kliegman RM, Behrman RE, Jenson HB, Stantom BF (Eds): *Nelson Textbook of Pediatrics*, 18th edn. Philadelphia: Saunders 2008: 2091.

Chapter 56 Stiff Neck

Stiff neck is an alarming complaint, calling upon the clinician to use his skill, knowledge and experience in arriving at its precise diagnosis with judicious use of investigations. The cause may be as simple as a self-limited phenothiazine toxicity, cervical lymphadenitis or viral myalgia involving the sternomastoid muscle, or as serious as meningitis.

In a given case, you must ask about the onsent of the complaint. Has it been there for quite sometime or it occurred only now or recently? Any history of trauma, fever, muscle pains, sore throat, dysphagia, drugging especially to check vomiting associated with gastroenteritis, convulsions, change in sensorium, odd behavior etc.? Did it follow lumbar puncture which may have been done elsewhere before the child reports to you ? In neck stiffness of slow, chronic onset in a young child, find out if the parents had all along been aware of a small hard swelling in connection with the sternomastoid muscle ever since the neonatal period or little later.

Clinical examination should, besides other things, be particularly aimed at evaluation of the CNS status. Cervical lymphadenopathy, tonsillitis, pharyngitis, local findings in connection with the sternomastoid muscles, evidence of trauma, and vertebral anomalies.

Phenothiazine Toxicity

Neck stiffness is a common manifestation of phenothiazine toxicity/idiosyncracy. Clinical picture is dominated by acute onset of signs and symptoms pertaining to the extrapyramidal system. The characteristic features include, besides torticollis, choroform movements, muscle rigidity, opisthotonos, marked deviation of

the eyes and oculogyric crisis. Trismus, swallowing difficulties, drooling, tremors, ataxia and coma occur much less frequently.

Drugs responsible for this self-limited condition include trifluopromezine (Siquil), prochlorperazine (Stemetil), and chlorpromezine (Largactil). Concomitant administration of chloroquine, amodiaquine (Comaquin), metoclopramide, haloperidol, phenytoin, diazoxide, lithium, reserpine, chlorprothixene as also presence of dehydration boosts the risk of phenothiazine toxicity, both in frequency and severity. Now it is being increasingly appreciated that some of these drugs-metoclopramide, for instance-may *per se* cause extrapyramidal manifestations. I have seen several cases as a result of metoclopramide, and occasionally, cases related to chloroquine, haloperidol and phenytoin.

Meningitis and Other CNS Infections

Meningitis must always be excluded as a cause of stiff neck. Neck stiffness in this condition (as also in meningism secondary to a host of viral, bacterial and parasitic infections such as pneumonia, mumps, malaria, etc.) is observed on flexion only and not on lateral movements.

Pyogenic meningitis is characterized by sudden onset of high fever, vomiting, restlessness, irritability, headache, and often convulsions with or without neck stiffness as a leading complaint. The younger the age of the child less the specific manifestations. In a newborn, for instance, pyogenic meningitis may have insidious onset with meagre symptoms like refusal to take feed, fever and irritability. Some may have convulsions. These, especially in the presence of bulging anterior fontanel, must arouse suspicion.

Physical examination may reveal, in addition to neck stiffness, positive Kernig and Brudzinski signs. Cranial nerve palsies and papilledema are present in some cases. Hemiplegia may be noticed in a few cases who report late.

Lumbar Puncture, Clinches the Diagnosis

Tuberculous meningitis manifests with neck stiffness and other features of raised intracranial pressure and meningeal irritation in its second stage. Child becomes progressively drowsy and even

unconscious. Headache, vomiting and feverishness become aggravated. Kernig's sign is positive. Plantars are extensor. Ankle and patellar clonus may be elicitable, abdominal reflexes are absent. Hypotonia is usual. In small infants, anterior fontanel may be bulging. Cranial nerves, involved are 3rd, 4th and 7th. Ocular paralysis, strabismus, nystagmus and contracted pupils are common. Also, there may be papilledema. Choroid tubercles along the blood vessels of choroid plexus may be seen in a small proportion of the cases. This stage is followed in about a week or so by the third stage which is characterized by widespread paralysis and coma. Neck stiffness disappears in this terminal stage.

Lumbar Puncture is a must to Clinch the Diagnosis

Encephalitis may also manifest with meningeal irritation as a result of inflammatory reaction of meninges. Accompanying manifestations include change in sensorium, varying from lethargy to coma, fever, vomiting and convulsions. Some children demonstrate peculiar behavior, hyperactivity, altered speech, and ataxia. Headache is common in older children whereas an infant may start with sheer gross irritability and feeding difficulty. What is remarkable about this condition is that the clinical picture shows rapid variation-from hour to hour.

Diagnosis is essentially clinical. Lumbar puncture should always be done, not because encephalitis has any typical CSF picture but to rule out meningitis.

Cerebral malaria and brain abscess may manifest with meningeal signs in addition to other features characteristic of these conditions. A high index of suspicion helps in identifying them.

Retropharyngeal Abscess

Stiff neck may accompany retropharyngeal abscess complicating bacterial pharyngitis or resulting as an extension of a wound infection in the neighborhood or vertebral osteomyelitis.

Manifestations, occurring in a child who just has or is still having pharyngitis or nasopharyngitis, include abrupt onset of high fever, dysphagia, throat pain and distress, refusal of feed, noisy breathing, drooling, and hypertension of the neck.

Examination shows a distinct bulg in the posterior pharyngeal wall. Else, in a suspected case, a lateral film of the neck should be done to detect it as a retropharyngeal mass.

Retropharyngeal abscess may occur in caries spine as well (Fig. 56.1).

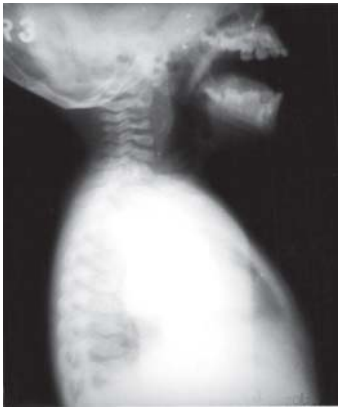

Fig. 56.1: *Retropharyngeal abscess* Note the increase in the retropharyngeal space and erosion of body of C3 vertebra in the lateral view of cervical spine.

Cervical Lymphadenitis

Not infrequently, massive cervical lymphadenitis may produce a tender bulge in the posterior pharyngeal wall and cause manifestations skin to retropharyngeal abscess.

Viral Torticollis

Also called rheumatic stiff neck, this condition is characterized by tender stiff neck, mainly on lateral or rotatory movements rather than on flexion, due to acute spasm of sternomastoid muscle, presumably as a result of a viral infection. It has nothing to do with rheumatic fever or rheumatoid arthritis.

Trauma

Stiff neck may result from trauma to the neck say a hard blow, leading to contusion and strain of the ligaments and muscles.

Congenital Anomalies

Congenital anomalies of the cervical vertebrae may be responsible for torticollis in some cases.

Congenital torticollis refers to a condition in which there is developmental shortening of the sternomastoid muscle of one side. Inability to turn the newborn's head 90° in both directions after 1 week of age should arouse suspicion of this diagnosis. You may feel a firm lump in the midportion of the affected muscle during

the first 2 to 3 months. Left untreated, the muscle becomes fibrotic and shortened, resulting in permanent limitation of neck movements. The head and face also become asymmetrical.

This entity may well be the same as sternomastoid tumor.

Remaining Causes of Stiff Neck

Lumbar puncture, poliomyelitis, tetanus, intracranial hemorrhage or tumor, rheumatoid arthritis, meningeal leukemia, spastic cerebral palsy, myositis ossificans progressiva, etc.

Chapter 57 Stridor

Stridor is defined as an audibly harsh, noisy inspiratory sound as a result of incomplete obstruction of the laryngeal area or trachea. Often it is accompanied by croupy cough, hoarseness, dyspnea, restlessness and feeding difficulties.

In stridor manifesting at birth, always consider the possibility of trauma if intubation had been done, and obstruction caused by mucus, meconium or blood. This kind of stridor usually disappears within 24 hours.

Find out if the stridor is worsening? If the answer is in affirmative, there is strong possibility of an anatomical obstruction or vocal cord paralysis.

Is the stridor accompanied by significant respiratory distress? Laryngeal atresia and tracheal atresia, both serious conditions, need to be considered in this situation.

Hoarseness accompanying stridor in a newborn suggests a laryngeal problem with the sole exception of laryngomalacia.

Stridor with brassy or barking cough in a newborn points to a tracheal problem.

Does the newborn tend to keep the neck in an hyperextended position? Does he have dysphagic symptoms? If yes, chances are of your dealing with a case of vascular rings.

Physical examination should, in particular, ascertain if the newborn has severe dyspnea with cyanosis and chest retraction. Any glossoptosis, micrognathia, or choanal atresia?

In stridor manifesting during postneonatal period and later, find out if the child had been hale and hearty prior to the onset of this problem. Does he have fever, cough, hoarseness, sore throat

or dyspnea? Is he in the habit of putting foreign body into his mouth?

While conducting clinical check-up, you must focus on certain vital points. Is the stridor purely inspiratory, expiratory or both? Is it intermittent, or persistent? Is there respiratory distress. Is there any extrinsic neck mass? Any evidence of injury? Is the throat congested?

STRIDOR MANIFESTING IN THE NEONATAL PERIOD

Laryngomalacia

Also called congenital laryngeal stridor, this condition is responsible for nearly 90% of cases of stridor in the neonatal period. The cause is abnormal collapse of the supraglottic tissues (elongated or curved epiglottis, redundant aryteno-epiglottic folds) during inspiratory phase.

Manifestations occur usually after the first week or two of birth. Stridor is characteristically intermittent. It is mainly inspiratory though, at times, it may be partly expiratory. During sleep and rest, it disappears whereas crying or excitement aggravates it. It is much less in prone position but is increased in supine position. The voice, cry, feeding and general health of the baby remain unaffected. Dyspnea with indrawing of the lower part of the chest during inspiration occur in a large majority of the cases.

After the age of 6 months, the manifestations begin to regress.The condition disappears by the age of 18 to 24 months.

Atretic Obstructive Lesions in the Upper Airway

Congenital atretic lesions of the upper airway usually cause death soon after birth. In supraglottic web, the infant has inspiratory stridor in association with hoarseness, subdued cry and chest indrawing. Laryngeal webs and cyst cause hoarse cry, dyspnea and inspiratory stridor. Stridor as a result of subglottic pathology (congenital subglottic stenosis, hemangioma, angioma, papilloma, lymphangioma, polypi) is both inspiratory and expiratory. Hoarseness may be present. Cry is normal. Brassy or croupy cough may sometimes accompany the clinical picture.

Tracheomalacia, tracheal cyst or tracheal stenosis leads to expiratory stridor.

Laryngeal Edema/Obstruction

Laryngeal obstruction from presence of mucus, meconium or blood together with edema from trauma of intubation is an important cause of inspiratory stridor. It resolves well within 24 hours, particularly if aspiration of the obstructive stuff can be carried out under direct vision without loss of time.

Vocal cord paralysis Paralysis of the recurrent laryngeal nerve (usually right) may occur in hydrocephalus associated Arnold-Chiari malformation or in brainstem injury. Bilateral paralysis may occur.

Manifestations, more marked in bilateral involvement, include inspiratory stridor, hoarseness, weak cry and choking during feeding.

Laryngoscopy shows lack of mobility of the vocal cords.

Vascular Rings

Stridor in vascular rings (double aorta or an abnormally placed subclavian artery) is, as a rule, intermittent and both inspiratory and expiratory though it may be purely inspiratory or expiratory. Accompanying features include intractable cough which may be brassy or bitonal, and opisthotonos. An attempt at flexing the neck worsens the stridor.

Diagnosis is by exclusion of other causes and by lateral X-ray of the airway.

Tumors

Outside compression from mediastinal or neck tumors (say lymphangioma, goiter) may produce stridor. There usually is some more evidence of compression, making the diagnosis easy.

STRIDOR MANIFESTING IN LATER INFANCY AND CHILDHOOD

Acute Laryngotracheobronchitis

This condition, caused usually by *H. influenzae* or parainfluenzae virus and also termed croup, is the most common cause of acute

inspiratory stridor. It occurs in children, usually under 3 years of age.

Following one or two days history of "cold", the child develops inspiratory stridor, usually at night. He begins to hyperventilate and is quite upset. As the stridor persists, cyanosis and lower chest retraction develops. With further progression of the disease, impairment of the consciousness occurs. Trachea and bronchi may become partially obstructed by thick secretions resulting in expiratory stridor and coarse rhonchi in the lung fields.

Acute Epiglottitis

This state of acute septicemia usually caused by *H. influenzae* type B, *Staphylococcus* or *Pneumococcus*, is characterized by rapid development of inspiratory stridor, dyspnea, muffling of the voice, dysphagia and drooling. The child is febrile and flushed. With increasing respiratory effort, inspiratory stridor diminishes. Throat examination shows an intensely red and swollen epiglottis.

Foreign Body

Sudden development of inspiratory stridor in a child who was otherwise fine, particularly if he is left to eat unattended and is fond of taking small objects into the mouth, must arouse suspicion of a foreign body having got impacted in the larynx.

Diphtheria

Laryngeal diphtheria may be responsible for inspiratory stridor. Additional manifestations include hoarseness, aphonia, brassy or barking cough, dyspnea and cyanosis, restlessness, anxiety and prostration. Neck shows lymphadenitis and brawny edema (bull-neck).

Diagnosis is by observing the characteristic membrane in the throat. In a vast majority of the cases, laryngeal involvement is secondary to faucial diphtheria. You may, however, readily see the membrane in the larynx by laryngoscopy.

In order to establish the diagnosis, you must take a throat/ laryngeal swab and examine the smear for the organisms which are seen as rods with bipolar bar.

Trauma

Any trauma to the larynx, resulting from instrumentation, corrosive agents or inhalation of smoke, may be responsible for laryngeal edema and acute stridor.

Laryngospasm

Laryngospasm, associated with tetany of whatsoever etiology, may manifest with inspiratory stridor, apneic episodes and cyanosis. The attacks last over a few minutes and keep recurring.

Retropharyngeal Abscess

A retropharyngeal abscess manifests with inspiratory stridor only when pressure is put on the larynx. Clinical features include an abrupt onset of high fever, dysphagia, refusal of feeding, throat pain, hyperextension of the neck and noisy respiration. A careful examination reveals a bulge in the posterior pharyngeal wall. This spectrum of manifestations is preceded by an acute nasopharyngitis or pharyngitis.

Retropharyngeal Lymphadenitis

A nonfluctuating lymphadenitis may produce a tender bulge in the retropharyngeal space and a clinical picture closely resembling retropharyngeal abscess.

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Chapter 58 Sudden Infant Death Syndrome (SIDS)

The term, *sudden infant death syndrome (SIDS)*, is applied to the sudden, unexpected death of an apparently healthy infant (typically 2 to 3-month-old) who was put to sleep without any suspicion of such an anticipation. A conventional autopsy fails to reveal the cause of death. When an apparently healthy infant suffers from an episode in which he stops breathing, develops cyanosis or pallor and becomes unresponsive but is successfully resuscitated, the term; apparent life-threatening event (ALTE) should be employed. This state has also be termed near-miss or aborted SIDS. Such an infant runs significant risk of SIDS. In case of an infant with SIDS in a family, risk of the next or subsequent infant suffering from SIDS is 5-times the usual risk.

The crux of the pathologic findings points to occurrence of hypoxia preceding the tragic event. Paradoxically, autopsy shows no hyperplasia of the carotid bodies. This observation weighs against the presence of chronic hypoxia.

Etiology remains unclear. Allergy to cow's milk, enlargement of thymus, suffocation, deficiency of parathyroids or adrenals, hypernatremia and fulminant respiratory infection causing laryngeal obstruction and/or spasm figure among the conditions that have been incriminated in its etiology. On top of all this, such states as prolonged sleep apnea associated with CNS disorders, vascular rings, familial prolongation of QT interval (Ramano Ward and Jervell and Lango-Nielsen syndromes), accidental suffocation and child abuse and neglect (CAN) could camouflage as SIDS. A common etiology involving an abnormality of cardiorespiratory control, in which state of consciousness or CNS activity plays a modulating role, appears to be shared by all cases of true SIDS.

In case of infants at risk (low birth weight, near-miss, or ALTE, sibs of SIDS case), history should be obtained in relation to physiological handicaps before birth, e.g. low Apgar score, abnormality in control of respiration, heart rate and temperature, and postnatal growth retardation. It is appropriate to question the parents about infant's feeding, medication, etc.

Physical examination should obtain information on the infant's nutritional status, hydration, evidence of infection, CAN and neurological handicap. Respiratory system must particularly be evaluated. He must also be observed while being given a feed.

With this clinical evaluation, it should be possible to rule out a known medical cause for the catastrophe. In suspected cases, investigations should include blood analysis for serum glucose, sodium, potassium, calcium, phosphorus, magnesium, BUN, pH and blood gas analysis, urinalysis, microbiological tests as dictated by the merits of the case, ECG monitoring, EEG, barium swallow, esophageal pH studies, chest X-ray and skeletal survey and 4 to 8 hour sleep studies.

Apnea (Respiratory Pause)

Apnea of 20 seconds or more is significant. It may be of three types:

1. Central as a result of absent neurological output from the respiratory center,
2. Obstructive as a result of closure of the upper airway (even lower airway may be involved) so that the infant fails to experience airflow despite considerable respiratory effort;
3. Mixed as result of combination of an obstructive episode and central apnea. Though, apnea has been incriminated in the etiology of SIDS, the cause and effect relationship remains unclear.

Upper Airway Dysfunction

Anatomical and developmental anomalies of the upper airway may cause obstruction and, perhaps, SIDS or ALTE, e.g. posterior displacement of the tongue as in Pierre Robin syndrome, reduced airway diameter following neck flexion, cleft palate, laryngomalacia, tracheomalacia, bronchomalacia, laryngeal cleft or other anomalies, tracheoesophageal fistula of H-type,

bronchomalacia, vascular rings, immature or abnormal neuromuscular control of oropharyngeal muscles, etc. In the presence of a viral respiratory infection, proneness to airway obstruction may be enhanced.

Hyper-reactive Airway

Introduction of some fluids into the larynx may stimulate reflex apnea and reflux with aspiration, and cause SIDS.

Cardiac Anomalies (Arrhythmias)

The role of cardiac arrhythmias (R on T phenomenon, sick sinus syndrome) in the causation of SIDS remains debatable. No significant difference in cardiac rhythm is found between infants dying of SIDS and the normal controls. In ALTE, a proportion of the infants exhibit increased vagal tone. The resultant bradycardia is, perhaps,triggered by events such as a reflux.

Gastroesophageal Reflux

Reflux, a common finding in first 6 months of life, has been shown to produce apnea in some studies. How far it contributes to occurrence of SIDS remains unclear.

Abnormal Autonomic Nervous System and Chemical Mediators

Abnormality in autonomic nervous system in infants with ALTE is evidenced by increased heart rate, and decreased heart-rate viability, shorter QT index and higher ventilatory response to CO_2.

In SIDS, increased levels of dopamine in carotid bodies are found. In infants with abnormal autonomic nervous system, a relationship between SIDS and short-chain opioid peptides, e.g. B-casomor-phine, has been postulated.

The role of such chemical mediators as catecholamines, endorphins, and serotonin in causation of SIDS has also been speculated.

Brainstem and Carotid Body Defects

Evidence suggests that brainstem and carotid body defects may be responsible for some cases of SIDS. The former circuit controls respiratory or cardiac stability. The integrity of the latter is important for oxygen responsiveness as also sheer survival.

Hyperthermia

Overwrapping leading to overheating of the preterm infants, who are susceptible to apnea when exposed to high environmental temperature, has been suggested as a factor in the etiology of SIDS. The concept, however, remains unproven.

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Chapter 59

Tall Stature

By definition, *tall stature* is said to exist when an individual has an height that is above the 97th percentile for age. It is infrequent for the parents to seek advice for a child with tall stature. During the past over 3 decades, I had only 18 adolescents and 3 toddlers brought to my OPDs at Postgraduate Institute of Medical Education and Research, Chandigarh, Medical College, Shimla, Govt. Medical College, Jammu, and Narayana Medical College, Nellore, for this complaint. The incidence is, perhaps, not as low. It appears that tall stature is evidently socially more acceptable than short stature. Hence, parents do not care to seek advice for too tall children. Interestingly, the treatment given to this condition in the pediatric texts too varies from negligible to far too scant. Table 59.1 outlines the important causes of tall stature and Box 59.1 clinical situations ending up with tallness.

History should endeavor to obtain information about the abnormally tall parent(s) or close relative(s), as also about his intellectual performance. Is there any suggestion of precocious puberty or delayed puberty. Was the child very long right from the beginning and showed rapid linear growth in the subsequent few years ? Did the height show sudden acceleration only recently?

Physical examination, in the first instance, must record the accurate height and body proportions. Are there signs of raised intracranial pressure? Are there any other neurologic signs? Are there any abnormal features like arachnodactyly, antimongoloid slant of eyes,obesity, etc?

Table 59.1: Etiology of tall stature

System	*Condition(s)*
Genetic/chromosomal	Familial
	Marfan's syndrome
	Klinefelter's syndrome
	Primordial gigantism
	Beckwith-Wiedemann syndrome
Endocrinal	Congenital adrenal hyperplasia (in the early stage)
	Androgen-secreting adrenal tumors (in the early stage)
	Thyrotoxicosis.
	True precocious puberty (in the early stage)
Pituitary gigantism CNS	Hydrocephalus
Metabolic	Homocystinuria

Box 59.1: Clinical situation ending up with tall stature

Fetal overgrowth
Maternal diabetes
Cerebral gigantism
Beckwith-Wiedemann syndrome
Other IGF-II excess syndromes
Postnatal overgrowth
Leading to tall stature in childhood
Familial
Cerebral gigantism
Beckwith-Wiedemann syndrome
Obesity of exogenous origin
Pituitary gigantism (excess growth hormone secretion)
McCune-Albright syndrome
Precocious puberty
Marfan's syndrome
Klinefelter's syndrome (XXY)
SHOX excess syndrome
Fragle excess syndrome
Homocystinuria

contd...

contd...

XYY
Hyperthyroidism
Leading to tall stature in adulthood
Familial (constitutional)
Androgen/estrogen deficiency
Estrogen resistance (in males)
Testicular feminization
ACTH/cortisol deficiency
ACTH/cortisol resistance
Aromatase deficiency
Pituitary gigantism
Marfan's syndrome
Klinefelter's syndrome (XXY)
XYY

Familial Tall Stature

This kind of tallness can be recognized from the family history indicating that the child is taking after one or other parent or a close relative. The child is born with an above-average length. During all stages of growth, he shows a proportionate but above-average growth.

Marfan's Syndrome

This autosomal dominant disease is characterized by tall stature with strikingly low upper segment-lower segment ratio, arm span > height and long slender bones of forearm and long metacarpals together with multiple skeletal, cardiovascular and ocular malformations (Figs 59.1 and 59.2). Tallness and slimness are frequently seen right at birth and persist postnatally. Now two types of the condition are recognized: infantile (congenital) and adult (Table 59.2).

Homocystinuria

This condition is characterized by clinical features that are similar to those seen in Marfan's syndrome. The distinction, can be established by urinary amino acid analysis.

Fig. 59.1: *Marfan's syndrome* Note the striking arachnodactyly, tall statures (165 cm) with very low upper/lower segment ratio (0.8:1.0) and slimness in this 13-year-old girl. She had accompanying mitral valve prolapse.

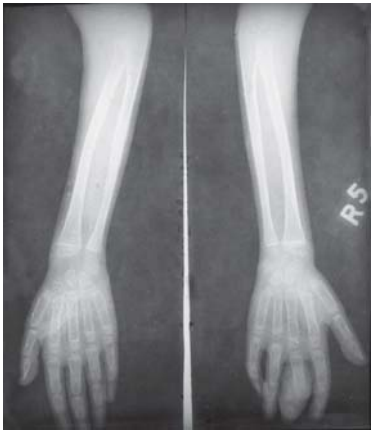

Fig. 59.2: *Marfan's syndrome* note long slender bones of forearm and long metacarpals.

Table 59.2: Marfan's syndrome vis-à-vis homocystinuria

Feature	*Marfan's syndrome*	*Homocystinuria*
Inheritance	Autosomal dominant	Autosomal recessive
Defect	Connective tissue disorder	Inborn error of metabolism
Cardiovacular component	Usually mitral incompetence, aortic root dilation	Rarely, risk of arterial thrombosis in dehydration
Diagnosis	Clinical	Urine examination
Treatment	Nothing specific	Responds favorably to Dietary restriction of Methionine plus pyridoxine
Risk to offsprings .	1 in 2	Low
Prenatal diagnosis	Not yet available	Amniocentesis

Klinefelter's Syndrome

This 47, XXY syndrome is characterized by, besides tallness, frank mental retardation or simply psychosocial, learning or school adjustment problems, slimness, long legs, poor weight, underdeveloped testes and phalus and delayed pubertal development. All tall boys, more so with mental retardation, must have karyop-typing to exclude Klinefelter's syndrome.

Cerebral Gigantism

Also termed Sotos syndrome or primordial gigantism, in this condition rapid linear growth occurs during the first 4 years so that the child reaches 97th percentile from the birth length of over 90th percentile. Additional features include large hands and feet, a large head, anti-mongoloid slant (down-slanting eyes), a high-arched palate and mental retardation. A non-progressive hypothalamic lesion is blamed for this disorder.

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Chapter 60 Vertigo

The term, *vertigo* (Latin, meaning "turning round"), denotes the sensation of moving around in space or having objects move about the person. The former is termed subjective vertigo and the latter objective vertigo.

It is often, though wrongly, employed for dizziness, light-headedness or giddiness.

History should include time of onset of vertigo, presence or absence of preceding aura, relationship with meals, etc. Any preceding illness, especially in relation to the ears, trauma or drug intake. Any accompanying symptoms such as headache, hearing loss, tinnitus, nausea vomiting, nystagmus or visual complaint? Any psychosocial problem(s)? Any suggestion of hyperventilation?

Physical examination, over and above GPE, should focus on ENT, CNS and psychosocial evaluation. It is important to look for anemia in particular and record blood pressure.

Vasovagal Response (Syncope)

Severe shock or fright may set a neurogenic mechanism (vasovagal stimulation), causing syncope and vertigo.

Drugs

Analgesics: Aspirin, indomethacin,
Antihistaminics,
Antimicrobials: Trimethoprim, gentamicin, nalidixic acid, kanamicin, isoniazid, sulfas, griseofulvin, minocycline
Tranquillizers: Phenothiazines, diazepam
Anticonvulsants: Carbamazepine, phenytoin, clonazepam *Diuretics*: Acetazolamide, thiazides

Anemia

Anemia leads to fall in cerebral perfusion and orthostatic hypotension. Upon arising from the supine position, the child may experience vertigo and even syncope.

Hypoglycemia

Symptoms, in addition to vertigo, include tachypnea, tachycardia, diaphoresis, generalized weakness, fainting and seizures.

Epidemic Vertigo

The condition follows an upper respiratory infection (viral). It occurs in recurrences and subsides in a matter of a week or two.

Benign Paroxysmal Vertigo

Occuring at 1-3 years of age, a suddent attack of severe vertigo may be accompanied by vomiting and nystagmus. The terrified child becomes pale, sweats profusel, cries and clings to mother. The attack lasts a some seconds or minutes but recurrences may be seen over months and sometimes years. In contrast to epilepsy, sensorium is preserved. The condition may well be a migraine equivalent.

Remaining Causes of Vertigo

Hyperventiltion
Seizure disorder
Migraine
Vestibular neuronitis
Otitis media
RICP
Head injury
Mumps
Cerebellar tumor/abscess
Allergy
Heat stroke
Ramsay-Hunt syndrome

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Chapter 61 Vomiting

Vomiting, a common symptom during infancy and childhood, is defined as forcible expulsion of contents of the stomach from the mouth. The strong contraction of the muscles of the abdominal wall and violent descent of diaphragm is the triggering factor that operates in its causation, irrespective of the actual cause.

The vomiting center lies in the cerebral medulla. Since it is under influence of chemoreceptors, disease affecting nearly any system-of course, brain is the most important-may cause vomiting. An obstructive lesion at pylorus or beyond, for instance, may cause vomiting by visceral afferents reaching the vomiting center.

History-taking should pay special attention to the age of the child who vomits. Vomiting in the newborn infant may have altogether different implications than vomiting in later infancy and childhood. For instance, it is normal for a neonate to bring up small amounts of feed without being adversely affected as far as his health and well-being are concerned. Such vomiting, howsoever minor, in a young child should arouse suspicion of some organic problem.

It is of value to determine precisely its frequency and whether the problem is acute or it had been there in a recurrent form over quite a few months. What is the amount, color and character of vomitus? Any relationship with feeding? Any abdominal discomfort or pain? Any accompanying drooling? Any suggestion of food poisoning? Does the child have associated diarrhea and dehydration? Any weight loss? Any convulsions, drowsiness or unconsciousness? Is there any history of trauma, especially to the head?

Physical examination should ascertain the hydration and nutritional status of the child. Any evidence of infection? Any neurologic abnormality?

VOMITING IN THE NEWBORN

Benign

Swallowed amniotic fluid or blood may be responsible for vomiting in a few days after birth. Though the symptom causes much anxiety, it settles down in due course without any treatment.

Swallowed air due to erratic feeding, say far-too-rapid feeding or feeding a very large amount in a short time, is a common cause of vomiting or regurgitation in the newborn and early infancy. The vomitus is unchanged, contains no curd and is not maladrous. Vomiting in such cases occurs either soon after the feed or sometime within an hour's time. These babies with erratic feeding also suffer frequently from abdominal distention and colic. Accompanying these manifestations may be failure to thrive.

Organic

The common causes of organic vomiting in the newborn are septicemia and other infections such as meningitis, intrauterine infections causing encephalitis, otitis, gastroenteritis, and congenital obstructive defects of the gastrointestinal tract. The remaining causes include birth trauma, birth defects of CNS, hypoglycemia and galactosemia.

The organic cause of vomiting should be considered in the presence of the following features:

1. Persistent vomiting despite correction of feeding technique 2. Accompanying abdominal distention 3. Green vomitus which should be regarded as due to intestinal obstruction until and unless proved otherwise 4. Poorfeeding 5. Dehydration, fever, septic umbilicus, bulging anterior fontanel, drowsiness, convulsions
6. Failure to pass meconium in the first 24 hours
7. Apparent peristalsis from right to left
8. A palpable intra-abdominal mass
9. Maternal hydramnios.

Septicemia: Vomiting may be the earliest symptom of this serious neonatal problem. Remaining manifestations include lethargy, refusal of feed, irritability, restlessness, loose motions, abdominal distention, fever or hypothermia, failure to gain weight, jaundice, respiratory distress and skin eruptions. Umbilicus is often septic. Hepatosplenomegaly and pallor may accompany the clinical picture. Occurrence of seizures should arouse suspicion of meningitis.

Meningitis: Vomiting may well be the only manifestation of meningitis during neonatal period. Drowsiness, poor feeding and convulsions may occur later. Bulging anterior fontanel may or may not occur. Neck stiffness is seldom present. In view of great emergency involved in the diagnosis and treatment of this condition, it is important that lumbar puncture is done immediately.

Hirschsprung disease: Vomiting together with abdominal distention and failure to pass stools during the first week of life may suggest the diagnosis of this condition. Following rectal examination, the baby may have relief from these symptoms. Explosive discharge of feces and gas is characteristic. Episodes of constipation alternating with diarrhea, failure to gain weight and even weight loss, dehydration, hypoproteinemia and edema are some of the other manifestations of this disorder.

A barium enema may show the classical features of the disease:

1. Abrupt change in caliber between the ganglionic and aganglionic segments
2. Irregular contractions of the aganglionic segment, the so-called sawtooth contractions
3. Parallel transverse folds in the dilated proximal portion of the colon
4. Thickened, nodular and edematous proximal colon which is reminiscent of protein losing enteropathy, and
5. Failure to pass out the barium.

However, the only conclusive evidence of congenital megacolon is absence of ganglion cells in the submucosa and intermuscular

nerve plexus with or without increased number of nerve fibers in the rectal biopsy.

Esophageal atresia: In the most common type, esophageal atresia with distal tracheoesophageal fistula, the baby regurgitates and vomits all feeds and his mouth overflows with mucus and saliva. There is history of his having choked and vomited on his very first feed. Profuse chocking, coughing, cyanosis, excessive drooling and abdominal distention are frequent.

Diagnosis is established by demonstrating air in the stomach and intestines in the plain X-ray abdomen.

Alternatively, you may introduce a catheter down the infant's esophagus and take a X-ray film. In case of atresia, the catheter gets coiled in the blind upper pouch as seen in the plain X-ray film. You may introduce a small amount of diluted barium to confirm the diagnosis.

Since incidence of maternal hydramnios in such babies is high, it is a good practice to rule out the presence of esophageal atresia before giving feed to the baby, born to a mother with hydramnios.

Congenital hypertrophic pyloric stenosis: Vomiting, starting in the second half of the first month and progressively becoming forceful and projectile within 30 minutes of feeding, constant hunger and failure to thrive are classical manifestations of this condition. Occasionally, greenish stools (starvation diarrhea), gastric hemorrhage or jaundice may be present. Dehydration, electrolyte imbalance-especially alkalosis, hypokalemia, hyponatremia and tetany may complicate the picture.

Barium meal study showing gross narrowing and elongation of pylorus, markedly distended stomach with retention of barium and increased intensity of peristaltic waves confirm the diagnosis.

Chalasia of esophagus: Also called gastroesophageal reflux this condition results from incompetence of the lower esophageal sphincter. Manifestations (as a consequence of excessive reflux of the stomach contents into the esophagus) include vomiting, rumination and failure to thrive. Vomiting characteristically occurs when the baby is returned to the cot (Fig. 61.1).

Diagnosis may be confirmed by barium meal study, demonstrating reflux of contrast material from the stomach into

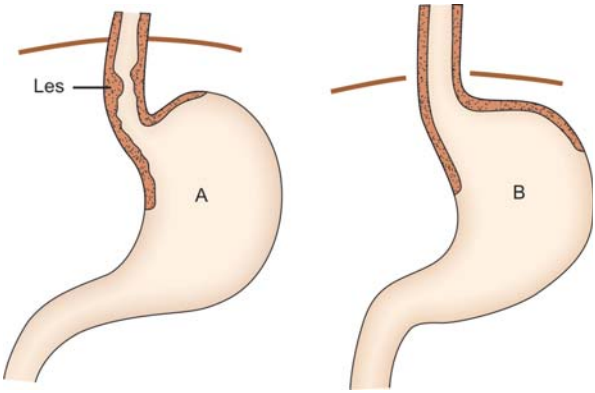

Fig. 61.1: (A) Showing diagrammatic representation of the anatomy of the normal gastroesophageal junction, i.e. presence of intra-abdominal esophagus, well developed LES and acute angle of Hiss, the factors that prevent GER in normal infants. (B) Showing GE junction in GER, i.e. reduced length of intra-abdominal esophagus, poorly defined LES and obtuse angle of Hiss, all favoring GER.

the esophagus during respiration or by applying pressure over the abdomen, and esophageal pH.

Hiatal hernia: In the most common form of hiatal hernia, cardiac end of stomach slides high up above the diaphragm and then back into the abdomen. It is frequently associated with reflux. Manifestations include requrgitation or vomiting (often projectile), failure to thrive and anemia. Aspiration may cause pneumonia. Manifestations do not occur as long as the child is held upright. As soon as he is back to the cot, vomiting occurs.

Achalasia: This rare cause of vomiting in the neonate results from hypertonicity of the lower esophagus as a consequence of reduced ganglia in the mesenteric plexus.

Diagnosis is by radiologic demonstration of the obstruction at the cardiac end of the esophagus without organic stenosis.

Obstruction of the small intestine: Vomiting from obstruction of the small intestine is frequent, persistent, bile-stained, copious and non-projectile. Accompanying features include abdominal

distention, visible deep peristaltic waves, and diminished or, perhaps, absent bowel movements.

Upright X-rays of abdomen show the distribution of air in the intestine, thereby assisting in locating the site of obstruction.

VOMITING IN LATER INFANCY

Benign

Faulty feeding: This is by far the most common cause of benign vomiting in infancy. This causes vomiting by introducing excessive "wind" into the stomach during the act of feeding.

The common type of faulty feeding in case of a breastfed baby is sucking an empty breast for quite a prolonged duration, resulting in air swallowing. Another type of defective feeding is "too rapid gulping" of milk because milk flows out of the distended breast very fast as is the case with the first morning feed.

In case of bottlefed infant, the most common cause of faultyfeeding and wind is the presence of an unduly small hole in the nipple. Also, anything that creates vacuum in the bottle (say the propped-up bottle) or obstructs the hole in the nipple (say, addition of cereals to the milkfeed) is likely to cause swallowing of excess of air.

Overfeeding: Some mothers of low birth weight or preterm infants may develop an obsession to rather overfeed the infant whose capacity does not permit this overindulgence. Understandably, he begins to vomit. One wintry morning, a 2-month-old infant was referred to me for vomiting quite a proportion of virtually every bottle feed. On detailed enquiry, I learnt that the mother, in her overenthusiasm to make up for his low birth weight, was trying to push almost double the feed for the infant's needs down his throat. The infant showed dramatic response to the reduction in feed.

Too-much-crying: Not infrequently, the mother attempts to feed an excessively crying baby. As you would appreciate, such a baby (unless of course, he immediately stops crying as the nipple goes into his mouth) is likely to swallow considerable amount of air which may cause vomiting.

Erratic handling: If the infant is improperly handled after a feed, he may bring out some or the whole of it. In preterm infants, this is a common problem. The reason is that in such small babies, cardioesophageal sphincter is lax. A frequent mishandling, I have observed, is that the ignorant mother, in the process of changing the nappy, raises the lower part of the body after the feed. This facilitates bringing up of the feed.

Loneliness: Some infants react to loneliness and other indifferent attitudes of the mother by vomiting.

Too late or too early introduction of solids: If an infant is not offered solids by 6 to 7 months, the age at which he can chew well, he is likely to refuse them and to vomit them.

Foods dislike: The mother may push down the infant's throat a food that he dislikes or that he does not like in an amount that the mother wishes to feed to him. The result is that the baby vomits it.

Rumination: In this serious type of chronic regurgitation and vomiting, the infant, usually suffering from maternal/emotional deprivation, gags himself with the tongue or fingers, then pushes his abdomen in and out, arches his back and eventually succeeds in bringing the milk up. Thereafter, he virtually gargles with it, the milk alternately appearing and disappearing in the throat. On being observed, he may stop this activity. Else, he may vomit it and lie continuously in a small pool of regurgitated milk.

Organic causes of rumination, say hiatal hernia gastroeso-phageal reflux, esophageal stricture, achalasia or duodenal ulcer need to be excluded.

Travel sickness: Infrequently though, as young an infant as 5 or 6 months of age may begin experiencing motion sickness in an automobile, resulting in obscure vomiting.

Migraine: Occasionally, migraine may herald its onset in as young an infant as a 6-month-old with recurrent episodes of vomiting. Such symptoms as headache, abdominal pain and fever manifest by 4 to 10 years.

Cow's milk allergy: Vomiting may be a symptom of allergy to cow's milk-usually to lactaglobulin, at times even to casein, lactaglobulin, bovine serum globulin and bovine serum albumin.

Additional manifestations include diarrhea (usually watery), colic, skin rash (infantile eczema, urticaria, angioneurotic edema) anaphylaxis, unexplained crying, chronic cough with wheezing, otitis media, anemia and failure to thrive.

Investigations may show eosinophilia, glucosuria, sucrosuria, lactosuria, aminoaciduria, renal tubular damage, acidosis and pulmonary acidosis. Smear from rectal mucosa shows eosinophils.

Response to withdrawal of cow's milk is dramatic and challenge with this milk results in reappearance of the symptoms within 48 hours.

Organic

Infection: Occurrence of an infection should be suspected if a previously hale and hearty child suddenly begins to vomit, especially if he has accompanying fever and a sick look. Gastritis or gastroenteritis, upper respiratory infection, otitis media, urinary tract infection, whooping cough, viral hepatitis, meningitis and encephalitis need to be considered in the differential diagnosis.

Obstructive GIT defects: Congenital obstructive lesions of the gastrointestinal tract responsible for vomiting in infancy include hypertrophic pyloric stenosis, chalasia, hiatal hernia, and tracheoesophageal fistula. The persistence of vomiting without any obvious cause, particularly if there had been imperforate anus or some other congenital anomaly of the GIT and/or congenital heart disease, should give a lead for this diagnosis. Positive history of hydramnios in the mother further supports this probability. X-ray abdomen shows gas in the stomach. You may pass a Ryle's tube down the esophagus with the proximal end of the tube dipped in water. As you gradually withdraw it up the esophagus, occurrence of "bubbles" at the proximal end in water establishes the diagnosis of fistula.

Pylorospasm: It is a very, very rare disorder leading to recurrent vomiting in infancy.

Remaining organic causes of vomiting in later infancy: These include space-occupying lesions, peptic ulceration, gluten induced enteropathy, appendicitis, Reye's syndrome, diabetes mellitus, uremia, ketotic hypoglycemia, galactosemia and drugs and

poisons, including salicylates, morphia, pethedine, anthelmintics, antibiotics, antihistaminics, antiepileptics, antidepressants and anticancer agents.

VOMITING AFTER INFANCY

Benign

Nonorganic causes of vomiting in childhood include (1) forcing the feed, (2) excitement of attending a party or the like, (3) anxiety or fear of going to school, (4) attention-seeking device in disturbed parent-child relationship, (5) imitation of another child having vomiting, (6) suggestion by overanxious parents, (7) finger insertion into the mouth, (8) migraine, and (9) travel or motion sickness.

Organic

Infection: Infections are a leading cause of organic vomiting in children beyond infancy as in infants. These include gastritis/otitis media, whooping cough, gastroenteritis, tonsillitis, UTI, viral hepatitis, Reye's syndrome, meningitis, encephalitis, appendicitis, pancreatitis, and mesenteric lymphadenitis.

Obstructive: GIT lesion intestinal obstruction of whatsoever etiology is an important cause of persistent vomiting in childhood.

Remaining cause of organic vomiting after infancy: Space-occupying lesions, torsion of undescended testis, uremia, diabetes mellitus, cholemia, hypercalcemia, and drugs.

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Chapter 62

Wheezing

The term, *wheezing*, is applied to the high-pitched rhonchi produced as a result of obstructive lower respiratory tract disease. The site of obstruction may be anywhere from the lower trachea to the small bronchi or large bronchioles.

Narrowing of the airway is not always due to bronchospasm. Such factors as mucosal edema and collection of large amounts of secretions too play a significant role in its causation. In infancy, wheeze occurs virtually exclusively due to mucosal edema and seretions. At this age, smooth muscles are yet to develop. Therefore, bronchospasm occurs not in infancy but later when the smooth muscles have developed.

Infants and children under 3 years are particularly prone to wheezing since their narrow airways are quite susceptible to the development of obstructive effect of bronchospasm, mucosal edema and secretions.

Wheezing must be differentiated from "stridor". The latter is usually a medium or low-pitched inspiratory sound resulting from narrowing of the upper airway, usually in the laryngeal area. It is frequently accompanied by hoarseness of voice and croupy cough.

Wheezing needs to be differentiated from "ruttling" as well. The latter is secondary to air bubbling through fluid in the trachea or bronchi. It is heard without the aid of a stethoscope. Auscultatory finding is in the form of coarse crepitations (rales).

History must obtain information whether this is the first attack or the child had previous episodes of wheezing. Isolated attack of acute wheezing may accompany bronchiolitis or

bronchopneumonia. Acute onset of severe wheezing in a healthy child who had been active and playing with crayons, peas, nuts, etc. a while ago should raise the suspicion of a foreign body aspirated into the lower respiratory tract. If recurrent or persistent wheezing dates back to birth, you must entertain the possibility of congenital structural defects of the lower respiratory tract.

Ascetain if the child appeared sick prior to the onset of wheezing. Does he suffer from any allergies? Any history of skin rash, eczema, etc? Is he taking any medicines? Is the attack acute or insidious? Is it accompanied by fever, cough or respiratory distress?

In case of recurrent wheezing, find out if the child has a problem of recurrent/chronic diarrhea as well. In cystic fibrosis of pancreas, protracted diarrhea with stools highly steatorrheic and recurrent respiratory infection with wheezing are common manifestations. Is there any history of ascariasis or other worm infestations? Any history of recurrent abdominal pain, increase or decrease in appetite, pica or failure to thrive? In developing countries such as India, recurrent wheezing is often associated with tropical eosinophilia and hypereosinophilia accompanying ascariasis. Is there a family history of asthma?

Physical examination must ascertain the magnitude of respiratory distress, if present. What is the state of hydration ? Any respiratory acidosis? Is he febrile? Is he in CCF ? Any evidence of emphysema, bronchopneumonia or bronchiolitis? Presence of finger clubbing suggests a chronic lung infection. In uncomplicated bronchial asthma it is seen only rarely. Allergic rhinitis, eczema, urticaria, etc. point to the possibility of bronchial asthma or asthmatic bronchitis. Presence of nasal polyps suggests allergic conditions or cystic fibrosis. Mediastinal shift may mean a foreign body. You should make sure that congestive cardiac failure is not responsible for wheezing.

Asthmatic Bronchitis

This, supposedly a mild form of bronchial asthma, occurs in first 5 or 6 years of life. The child develops typical "cold" which in another 1 to 3 days is followed by wheezing and dyspnea, often

indistinguishable from bronchial asthma. This response to "cold" by wheezing and dyspnea is likely to stop once the child has crossed the age of 5 or 6 years. Remember that most remarkable feature of asthmatic bronchitis is that the child never wheezes in the absence of cold and in-between the attacks.

Bronchial Asthma

In this condition characterized by bouts of dyspnea, predominantly expiratory, as a result of temporary narrowing of the bronchi by bronchospasm, mucosal edema and thick secretions, the child also wheezes when he is not having "cold". Though the onset of the disease in most instances is in the very first 2 years, the peak incidence is seen in 5 to 10 years age group. Boys suffer twice as much as girls. A strong family history of asthma is frequently available. There may be acute eczema and history suggestive of allergies to inhalants like pollen, dust and powder; foods like egg, meat, wheat and chocolate, and drugs like aspirin and morphine.

The onset of an asthmatic paroxysm is usually sudden and often occurs at night. Occasionally, it is preceded by the so-called asthmatic paroxysm in the form of tightness in the chest, restlessness, polyuria or itching.

A typical attack consists of marked dyspnea, bouts of cough and chiefly expiratory wheezing. Cyanosis, pallor, sweating and restlessness are often present. Pulse is invariably rapid. The fulminant attack may subside in an hour or two, sometimes with vomiting or coughing up of viscid secretions. Some expiratory wheezing may, however, continue over several days though the child is otherwise comfortable.

In the event of a severe asthmatic paroxysm failing to respond to adequate doses of adrenaline and thereby persisting over hours or days, the condition is called status asthmaticus.

Generally, recurrent asthmatic attacks last over 2 to 7 or 10 days. Then, there is an interval of freedom which may vary from a few days to a few months.

Children with severe bronchial asthma over a prolonged period may develop a barrel-shaped chest deformity.

Diagnosis of bronchial asthma is usually clinical. All attempts should be made to detect the responsible allergen. X-ray chest

shows generalized emphysema (Fig. 62.1) and patchy atelectasis. Demonstration of eosinophilia in sputum or nasal secretions lends further support to the clinical impression.

Acute Bronchiolitis

This serious respiratory viral infection, occurring predominatly around the age of 6 months, is characterized by inflammation of the bronchioles, resulting in severe dyspnea.

Following a mild uppper respiratory catarrh, the condition makes its appearance felt with dyspnea (rapid shallow breathing) and prostration. Cough is either absent or just slight. Mild to moderate fever is usually present. If dyspnea is marked (which usually is the case) air hunger, flaring of alae nasi and cyanosis may occur. Also, dehydration and respiratory acidosis may develop.

Chest signs include intercostal, subcostal and suprasternal retractions. Hyperresonant percussion note which is due to emphysema that may also push the liver and spleen downward, diminished breath sounds, widespread crepitations, and expiratory wheeze.

Diagnosis of bronchiolitis is generally obvious from the clinical picture. X-ray chest shows emphysema, prominent broncho-vascular markings and small areas of collapse. Screening reveals lowlying diaphragm with limited movements. Lungs are characteristically overinflated and intercostal spaces are wide.

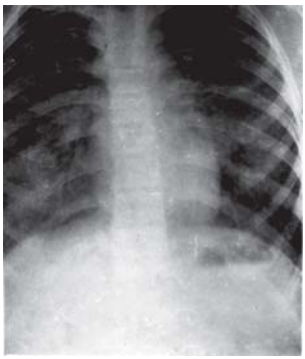

Fig. 62.1: *Chronic obstructive pulmonay disease* Note the emphysematous changes with extensive parenchymal infiltration.

Tropical Eosinophilia

This entity, a sort of allergic response to filarial infection, is an important cause of wheezy chest or bronchitis. Excepting infants under 1 year, it occurs at all ages.

Chief manifestations have their onset insidiously. These include persistent cough (often simulating bronchial asthma). Some exertional dypsnea with wheezing, low-grade fever, anorexia, growth failure and malaise. At times, vague abdominal manifestations may be present. Also, there may be enlargement of liver and lymph nodes. These manifestations tend to persist for months at a stretch without any significant systemic disturbance.

Investigations show that TLC is increased, sometimes to as high as 100,000/cmm. Absolute eosinophil count varies from 4,000 to 50,000/cmm, forming about 30 to 80% of all the cells.* ESR is usually high.

X-ray chest is abnormal with increased reticular markings, coarse mottling (especially at the bases) and hilar prominence (eosinophilic lung, pulmonary eosinophilia) (Fig. 62.1) Peripheral lung fields are, as a rule, clear.

Foreign Body

Wheezing occurs when a foreign body lodges itself in the lower airway.

There is history of choking followed by respiratory distress.

On physical examination, you may notice varying degree of dyspnea, asymmetrical chest expansion, decreased breath sounds, and unilateral wheezing.

X-ray chest may show infiltration or consolidation confined to a specific segment or lobe of the lung.

Bronchoscopy has diagnostic as also therapeutic value.

Pneumonia

Unlike in adults, wheezing is a common accompaniment of the clinical picture of pneumonia in infancy and childhood, no matter whether the cause is viral, bacterial or fungal. Remaining

** Other causes of gross eosinophilia include parasitic infections (visceral larva migraines, ascariasis, ancylostomiasis, trichninosis), allergy (asthma, hay fever), malignancy (Hodgkin's lymphoma, leukemia) sarcoidosis, mycosis, drugs and immune deficiency.*

manifestations include a mild upper respiratory infection followed by abrupt onset of fever, restlessness, apprehension, respiratory distress, air hunger, cyanosis and cough.

Physical findings may show classical signs of consolidation or bronchopneumonia with exaggerated rhonchi.

X-ray chest may or may not confirm the clinical impression since X-ray changes follow the actual lung changes by 2 to 4 days.

Tuberculosis

Wheezing as a result of enlarged mediastinal lymph nodes compressing the bronchi (as in tuberculosis) must seriously be investigated in areas where tuberculosis is rampant. High ESR, positive tuberculin (Mantoux) test/BCG diagnostic test, X-ray chest revealing hilar prominence, and gastric lavage/sputum positive for acid-fast bacilli, especially in the presence of a positive family history of tuberculosis, all assist in confirming the diagnosis.

Cystic Fibrosis

Though relatively uncommon in India and other tropical and subtropical regions, cystic fibrosis is decidedly an important cause of wheezing.

This genetic disorder, involving not just the exocrine pancreas but also the sweat glands as also glands in the liver and exocrine glands elsewhere, starts manifesting early in infancy. Manifestations include chronic/recurrent diarrhea and recurrent respiratory infections, failure to thrive despite exceptionally good appetite, and multiple nutritional deficiencies. Stools are characteristically steatorrheic but may be loose. An obstinate catarrh or "frog in the throat" may be present ever since the first week of life. Abdominal distention, a palpable liver, clubbing and higher incidence of rectal prolapse and nasal polyposis are some of the other manifestations. Complications include bronchiectasis, systemic amyloidosis, cor pulmonale and cirrhosis. A typical X-ray chest picture is given in Fig. 62.2.

When clinical picture arouses suspicion, fat balance studies to establish steatorrhea and D-xylose test to establish that steatorrhea is not exogenous in origin are indicated. Poor tryptic activity lends support to the clinical diagnosis. A high sweat chloride (60 mEq/ L or more) is a "must" to confirm the diagnosis.

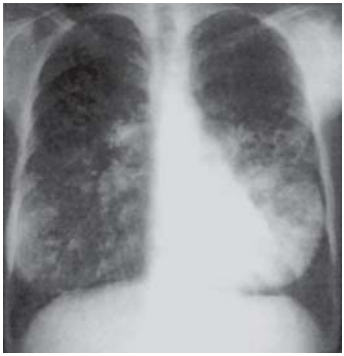

Fig. 62.2: X-ray chest showing typical picture of cystic fibrosis in a child with wheezy chest and chronic diarrhea with failure to thrive since early infancy.

Drugs/Poisons

Aspirin, beta-blockers, penicillin, cephalosporin, erythromycin, ethionamide, neomycin, streptomycin, rifampicin, tetracyclines, lipiodol, vitamin K, indomethacin, ibuprofen, organophosphates, insecticide, tartrazine.

Remaining Causes of Wheezing

Löffler's syndrome, pulmonary hemosiderosis, congestive cardiac failure, congenital heart disease, vascular anomalies like pulmonary vascular rings, aspiration syndromes (prematurity, hiatal hernia, tracheoesophageal fistula, chalasia of esophagus, epilepsy, kerosene, paraffin, baby powder), bronchiectasis, postpertussis, Kartagener's syndrome, anaphylaxis, bronchopulmonary dysplasia, immunodeficiency states, etc.

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Part

3

Differential Diagnosis of Selected Clinical Signs

Chapter 63 Differential Diagnosis of Selected Clinical Signs

Stridor in First Few Days of Life

- Laryngomalacia
- Vocal cord paralysis
- Laryngeal webs
- Vascular ring
- Congenital subglottic stenosis
- Hypocalcemia

Macrocephaly

- Familial
- Hydrocephalus (Fig. 63.1)
- Subdural effusion
- Lipidosis
- Tuberous sclerosis

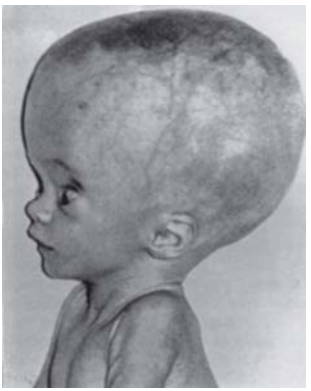


Fig. 63.1: *Large head secondary to congenital hydrocephalus* Note the dilated scalp veins and "setting sun" sign as a result of downward deviation of eyes because of impingement of the dilated supraspinal recess on the tectum.

- Cerebral gigantism (Sotos syndrome)
- Megalencephaly
- Hydrancephaly
- Gangliosidosis

Microcephaly

- Familial
- Defects in brain development
- Down syndrome
- Seckel's dwarfism
- Intrauterine infections
- TORCH/STORCH
- Natal/Postnatal disorders
- Anoxia
- Gross PEM
- Neonatal herpes virus infection
- Craniosynostosis (craniostenosis)

Sparse and Light-Colored Scalp Hair

- Kwashiorkor
- Infantile tremor syndrome (ITS)
- Acrodynia
- Zinc deficiency
- Copper deficiency
- Acrodermatitis enteropathica.

Frontal/Parietal/Occipital Bossing

- Vitamin D deficiency rickets
- Thalassemia major
- Achondroplasia
- Cogenital syphilis
- Ectodermal dysplasia
- Cleidocranial dysostosis
- Ehlers-Danlos syndrome
- Lowe's syndrome
- Hallermann-Streiff syndrome
- Mucopolysaccharidosis.

Large Anterior Fontanel

- Vitamin D deficiency rickets
- Protein-energy malnutrition
- Congenital hypothyroidism
- Hydrocephalus
- Prematurity
- IUGR
- Cogenital syphilis/rubella
- Achondroplasia
- Osteogenesis *imperfecta tarda*
- Trisomy 13-, 18-, 21
- Cleinocranial dysostosis
- Apert's syndrome
- Hallermann-Streiff syndrome
- Hydrocephaly
- Hypophosphatasia
- Pyknodysostosis
- Russel-Silver syndrome
- Thalassemia major
- Progeria.

Craniotabes

- Normal variant in first 3 months of life, especially in premature and LBW infants
- Vitamin D deficiency rickets
- Hydrocephalus
- Congenital syphilis
- Osteogenesis imperfecta tarda
- Treacher Collins syndrome
- Hypervitaminosis A
- Lacunar skull.

Rickets with Mental Retardation (MR)

- Galactosenia
- Wilson's disease
- Lowe's syndrome
- Cystinosis
- Tyrosenemia

- Fructose intolerance

Bulging Anterior Fontanel

- During excessive crying •
  Raised intracranial pressure
  - Hydrocephalus •
    Meningitis •
    Encephalitis •
    Intracranial hemorrhage •
    ICSOL
- Pseudotumor cerebri (Otitic hydrocephalus)
  • Middle ear infection • Hypo- or hypervitaminosis A • Tetracycline toxicity • Nitrofurantoin toxicity • Nalidix acid toxicity • Steroid therapy/sudden withdrawal • Lead poisoning • Iron-deficiency (chlorosis)
  - DPT (triple) vaccine •
    SLE •
    Hypothyroidism •
    Hyperparathyroidism •
    Hypocalcemia •
    Congenital hypophosphatasia •
    Galactosemia •
    Addison's disease •
    Obesity in prepubertal girls •
    Overenthusiastic nutritional rehabilitation of grossly malnourished infants
  - Mucopolysaccharidosis.

Lowset Ears

- Down syndrome
- Turner's syndrome
- Trisomy 16-, 13
- Apert's syndrome

- Carpenter's syndrome
- *Cri-du-chat* (catcry) syndrome
- Treacher Collins syndrome
- Idiopathic hypercalcemia
- Hurler's syndrome.

Short Neck

- Down syndrome •
  Congenital hypothyrodism •
  Turner's syndrome •
  Noonan's syndrome •
  Mucopolysaccharidosis
  (Hurler's syndrome, Morquio's disease)
- Klippel-Feil deformity
- Sprengel's deformity.

Depressed Bridge of Nose

- Racial
- Congenital hypothyroidism (cretinism)
- Down syndrome
- Thalassemia major
- Congenital syphilis
- Mucopolysaccharidosis (Hurler's syndrome).

Hypertelorism

- Racial*
- Down syndrome*
- Congenital hypothyroidism (cretinism)*
- Trisomy 8
- 4 p-
- 5 p-
- Triploidy syndrome
- Penta X, XXXX, XXXXX
- Aarskog's syndrome
- William's syndrome
- Noonan's syndrome
- Fetal amniopetrin's syndrome
- Fetal warfarin's syndrome

- Apert's syndrome
- Pfeiffer's syndrome
- Saethre-Chotzen syndrome
- Robert's syndrome
- Rubinstein-Tayabi syndrome
- G syndrome
- Robinow's syndrome
- Weaver's syndrome
- Hypertelorism—hypospadias syndrome
- Sotos' syndrome
- Larsen's syndrome
- LEOPARD's syndrome
- Sjögren-Larsen syndrome
- DiGeorge's sequences
- Thalassemia major
- Ehlers-Danlos syndrome
- Waarenburg's syndrome
- Chondrodystrophies
- Turner's syndrome.

Note Condition with asterix are accompanied by only pseudohypertelorism, i.e. they give an impression of hypertelorism (increased distance between two eyes because of presence of flat nose). In true hypertelorism, the distance between two pupils (midpupillary distances) is actually increased and the eyes are set apart, because of congenital overdevelopment of the lesser wings and underdevelopment of the greater wings of the sphenoid.

Hypotelorism

- Trisomy 13
- Holoprosencephaly
- Trigonocephaly
- Oculodental digital syndrome

Periorbital Edema

- Excessive crying
- Acute conjunctivitis/blepheritis
- Kwashiorkor

- Acute nephritis/nephrotic syndrome
- Anemia
- Angioneurotic edema
- CCF
- Hypothyroidism
- Cavernous sinus thrombosis
- Dermatomyositis

Mongoloid (Upward and Lateral) Slant of Eyes

- Racial
- Down syndrome
- Prader-Willi syndrome
- Ectodermal dysplasia
- Laurence-Moon-Biedl syndrome.

Epicanthal Folds (Fig. 63.2)

(Skun-folds covering medial canthi)

- Normal trait in young children
- Down syndrome
- Other trisomies
- Single gene disorders

Antimongoloid (Downward and Lateral) Slant oF Eyes (Fig. 63.3)

- Apert's syndrome

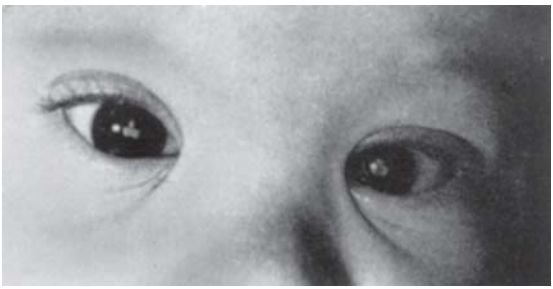


Fig. 63.2: *Epicanthal fold* Note that the vertical (somewhat oblique) fold of skin, starting from upper lid, covers significant inner canthal area of left eye. As a result, the infant appears to have squint (pseudoesotropia).

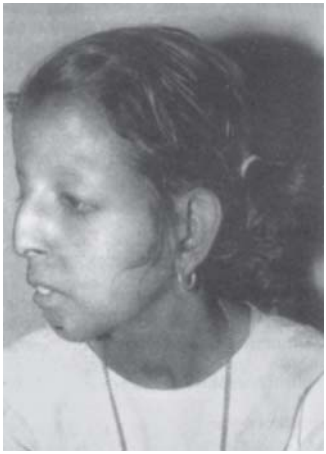


Fig. 63.3: *Antimongoloid slant* Note the outward and downward inclination of the eyes (against upward and outward in case of mongoloid slant). Differential diagnosis includes Treacher Collins syndrome, Apert syndrome and cerebral gigantism.

- Treacher Collins syndrome
- Cerebral gigantism
- de Lange syndrome
- Whistling face syndrome
- *Cru-di-chat* (catcry) syndrome
- Trisomy 16.

"Sunset" Sign

- Physiologic (2-4 mo age)
- Hydrocephalus
- Kernicterus
- Asphyxia
- Pineal tumor.

Ptosis

• Congenital • As an isolated anomaly (Fig. 63.4)
  • Marcus-Gunn phenomenon (Marcus-Gunn jaw winking syndrome)
  • Congenital fibrosis syndrome •

Acquired
  • Myasthenia gravis

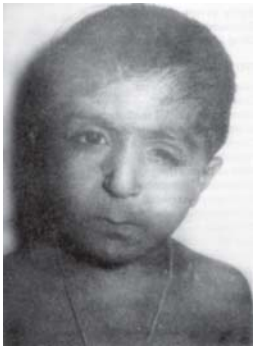


Fig. 63.4: *Unilateral congenital ptosis* It usually occurs as an isolated finding and is the result of a localized dystrophy of the levator muscle with replacement of the striated fibers by fibrous tissue.

- Horner's syndrome
- Sturge-Weber syndrome
- Von Recklinghausen's syndrome
- Fetal alcohol syndrome
- Whistling face syndrome
- Noonan's syndrome
- Mobius' syndrome
- Aarskog's syndrome
- Myotonic dystrophy
- Botulism
- Injury to upper lid or 3rd nerve
- Excessively sticky eyes
- Drug-induced: mydriasis, vincristine.

Proptosis (Exophthalmos)

- Shallowness of the orbit
  - Craniosynostosis (craniostenosis)
  - Other craniofacial malformations
- Relatively increased tissue mass • Cavernous sinus thrombosis • Periorbital cellulitis • Orbital hemorrhage • Neoplasm (neuroblastoma, anterior meningocele, rhabdomyosarcoma)
  - Arteriovenous aneurysm
  - Chloroma

- Neurofibromatosis •

Endocrinopathy

- Thyrotoxicosis.

Blue Sclera

- Phenylketonuria (PKU)
- Osteogenesis imperfecta tarda.

Subconjunctival Hemorrhage

- Whooping cough (pertussis)
- Severe cough
- Severe sneezing
- Leukemia
- ITP
- Trauma (birth, mechanical injury)
- Inflammation (conjunctivitis).

White Reflex (Cat's Eye)

- Cataract
- Retinoblastoma
- Retrolental fibroplasia
- Pupillary membrane (persistent central hyaloid artery)
- Vitreous opacity
- Visceral larva migrans
- Retinal detachment

Cataract

- Developmental variant (Mittendrof dot)
- Maternal infections: TORCH, STORCH •
  Metabolic disorders
  - Galactosemia •
    Diabetes mellitus (juvenile-onset)
  - Wilson's disease (hepatolenticular degeneration) •
    Mucopolysaccharidosis
- Chromosomal disorders • Trisomy 13-,
  18-, 21 • Turner's syndrome • Deletion
  and duplication syndromes
- Drugs

  - Steroids • Vitamin D (both hypo- and hyper-)
  - Tetracyclines • Chlorpromazine • Radiation
- Trauma • CAN • Contusion • Penetrating injury
- Multisystem disorders
  - Kartegner's syndrome
  - Marfan's syndrome
  - Myopathies
  - Lowe's syndrome
  - Progeria
  - Alport's syndrome.

Discoloration of Teeth

- Poor orodental hygiene
- Caries
- Fluorosis
- Iron therapy
- Tetracycline therapy
- Neonatal hyperbilirubenemia
- Porphyria erythropetica
- Amelogenesis imperfecta.

Macroglossia

- Congenital hypothyroidism (cretinism)
- Glycogen storage disease
- Hurler's syndrome
- Amyloidosis (primary)
- Pseudohypertrophy muscular dystrophy
- Beckwith syndrome (hypoglycemia with macroglossia).

Gingival Hyperplasia

- Hydantoin sodium side effect
- Scurvy

- Bad orodental hygiene
- Epulis
- Hurler's syndrome
- Xanthomatosis
- Diffuse fibromatosis
- Histiocytosis X.

Blindness

- Congenital
  - Cataract: developmental, rubella, galactosemia.
  - Malformation
- Acquired
  - Vitamin A deficiency
  - Retinoblastoma
  - Optic atrophy
  - Retinal detachment
  - Retrolental fibroplasia
  - Trauma
  - Ophthalmia neonatorum
  - Acute exanthema

Pinpoint Pupil

- Structural lesions in pons •
  Some metabolic disorders •
  Mushroom or nutmeg poisoning •
  Organophosphate poisoning •
  Drugs: Morphine, heroin, barbiturates, clonidine, meprobomate, carbamate insecticide, pilocarpine eyedrops

Iris Coloboma

- Chromosomal syndromes: Trisomy 13 4p-, 13q-, triploidy
- CHARGE association
- Goltz syndrome
- Rieger syndrome

ACUTE UVEITIS

- Inflammatory bowel disease (IBD)
- Kawasaki disease

- Enteropathic arthritis
- Pauciarticular JRA (type II)
- Ankylosing spondylitis

Deafness (Hearing Loss)

• Congenital • Genetic: (i) isolated, (ii) complex: Pendred's hypothyrodism,
deafness syndrome, just arch syndrome.
• Embryopathy: (i) infections TORCH/STORCH (ii) Drugs: Thalidomide, streptomycin
• Idiopathic: (i) nerve deafness, (ii) absent middle ear •
Acquired
- Infection: AOM, CSOM, meningitis, mumps • Perinatal: birth injury, asphyxia hyperbilirubinemia, prematurity, drugs like kanamycin and gentamicin
- Head injury
- Early otosclerosis.

Parotid Swelling (Fig. 63.5)

- Viral parotitis
  - Mumps
  - Parainfluenza 1 and 3
  - Coxsackie
  - Influenza A
  - CMV

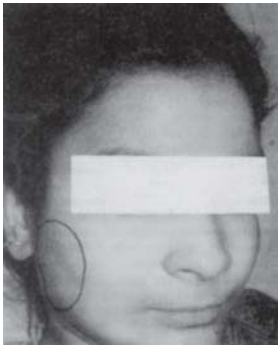


Fig. 63.5: *Recurrent parotid swelling* it defined all diagnoses and therapies. Finally, it turned out to be HIV-related.

- EBV •
  Enteroviruses •
  Lymphocytic Choriomeningitis virus •
  HIV
- Pyogenic/purulent parotitis (usually *staph aureus*)
- Sarcoid (often accompanied by uveitis)
- Sjögren syndrome •
  SLE •
  Recurrent parotitis (autoimmune, allergy, infection, block of the Stensen's duct from calculus, injury or inspissated mucus)
- Mikulicz disease (bilateral painless parotid and lachrymal gland enlargement, dryness of mouth and eyes)
- Preauricular lymphadenopathy.

Preauricular tags/pits

- Goldenhar syndrome
- Treacher Collins syndrome
- Frontonasal dysplasia
- Wolf syndrome
- Cri du chat (catcry) syndrome

Retarded (Delayed) Speech

- Deafness •
  Dumbness (elective mutism)
- Cerebral palsy •
  Mental retardation •
  Deprivation (emotional)
- Developmental delay •
  Autism •
  Sequel to serious CNS infection in infancy (meningitis, encephalitis, cerebral, malaria)
- Degenerative disorders

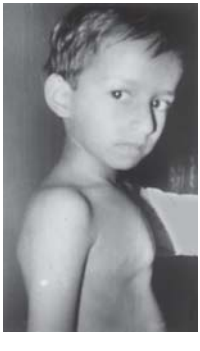


Fig. 63.6: *Pectus carinatum (pigeon chest)* in a child with nutritional rickets.

Pectus Carinatum (Pigeon Chest)

- Familial (63.6))
- Rickets •
  Associations: Scoliosis, mitral valve disease, coarctation of aorta

Pectus Excavatum (Funnel Chest)

- Congenital deformity (63.7)
- Marfan's syndrome •
  Ehler-Danlos syndrome •
  Acquired
  - Chronic lung disease
  - Neuromuscular disease
  - Injury

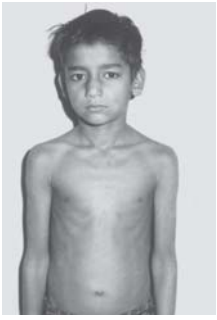


Fig. 63.7: *Pectus excavatum (funnel chest)* as a congenital deformity.

Harrison Sulcus

- Vitamin D deficiency rickets
- Asthma.

Costochondral Beading

- Vitamin D deficiency rickets (Fig. 63.8)
- Scurvy
- Achondroplasia

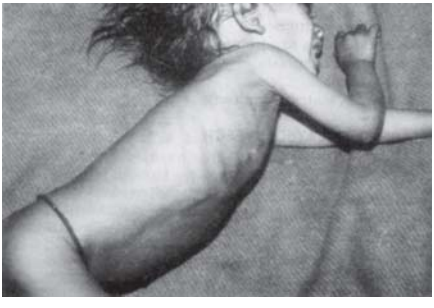


Fig. 63.8: *Costochondral prominence (beading)* In nutritional rickets (rachitic rosary). It is smooth, rounded and nontender. In scurvy (scorbutic rosary), it is sharp, angular and tender.

Senile Appearance

- Progeria
- Cockayne syndrome
- Rothmund-Thomson syndrome
- Werner syndrome

Congenital Limb Hypertrophy

- Neurofibromatosis
- Wilms' tumor
- CHILD* syndome
- Russel-Silver syndrome
- Beckwith-Wiedemann syndrome

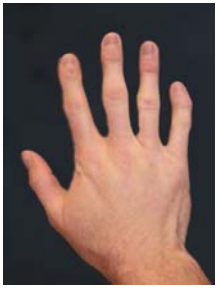


Fig. 63.9: *Clinodactyly*
Note the incurving of the little finger.

Clinodactyly

(Incurving, i.e. lateral curvature, of little finger)

- Isolated anomaly (Fig. 63.9)
- Down syndrome
- Russell-Silver syndrome
- Carpenter syndrome

Polydactyly

- Isolated anomaly • Laurence-Moon-Biedl syndrome.
- Majewski's polydactyly syndrome (short rib syndrome, polydactyly with chondrodystrophy)
- Trisomy 13

Knock-Knee Deformity (Genu Valgum)

(Intermalleolar distance > 2 cm)

- Physiologic (up to 4 years)
- Metabolic Bone/skeletal disease – Rickets (vitamin D deficiency, nutritional, vitamin D resistant)
  - Renal osteodystrophy
  - Hypophosphatasia
- Bone/skeetal dysplasia
  - Metaphyseal dysplasia

---

* Congenital hemidysplasia, icthyosiform-erythroderma and limb defects.

– Achondroplasia • Asymmetrical growth arrest
– Trauma
– Infection
– Tumors

Bowleg Deformity (Genu Varus)

- Physiologic (up to 2 years)
- Metabolic Bone/skeletal disease – Rickets (vitamin D deficiency, nutritional, vitamin D resistant)
  – Renal osteodystrophy
  – Hypophosphatasia
- Bone/skeletal dysplasia – Metaphyseal dysplasia – Achondroplasia
- Asymmetrical growth arrest
  – Trauma
  – Infection
  – Tumors
  – Blount disease (tibia vara)
- Congenital disorders
- Neuromuscular disorders

Painful Swelling of Thigh

- Traumatic
- Subperiostal hemorrhage of scurvy (Fig. 63.10)
- Hemophilia (usually in association with hemarthrosis of knee)

Dry, Scaly, Hyperkeratotic Skin

- Vitamin A deficiency (Fig. 63.11)
- Linoleic acid deficiency
- Vitamin C deficiency
- Ichthyosis (Figs 63.11 and 63.12)

Skin Tuberculosis

- Syphilitic Chancre

Fig. 63.10: Phrynoderma

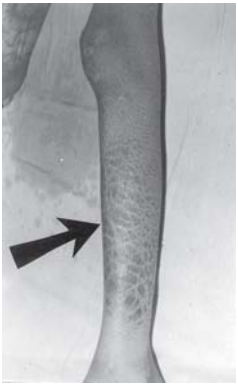


Fig. 63.11: *Ichthyosis vulgaris* Note dry, hyperkeratotic scaly skin lesions primarily on the extensor surface of the legs. In this autosomal dominant disorder, lesions tend to worsen in winter and show some regression in summer.

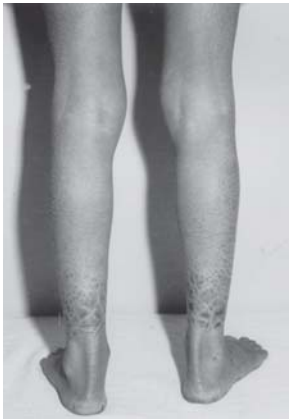


Fig. 63.12: *Ichthyosis vulgaris* Note only scanty lesions over back of legs.

- Leprosy
- Atypical mycobacterial infection
- Fungal infection
- Tularemia
- Cat-scratch disease
- Spirotrichosis
- Nocardiosis
- Leishmaniasis
- Foreign body reaction (e.g. nylon sutures)
- Papular acne rosacea

Scrofuloderma

(Skin involvement in tuberculous lymphaderitis)

- Syphilitic gumma
- Deep fungal infection
- Actinomycosis

- Hidradenitis suppurativa

Sinus Bradycardia

- Physiologic variant
- Prematurity
- Hypoxemia
- Raised intracranial pressure (RICP)
- Hypothyrodism
- Drugs: Digoxim.

Sinus Tachycardia

- Fever
- Anemia
- CCF
- Hyporolemia
- Hyperthyroidism
- Drugs.

Paroxysmal Supraventricular Tachycardia

- Idiopathic •
  Congenital heart disease (Ebstein's anomaly, TGA, single ventricle, atrial surgery)
- Endocardial fibroelastosis •
  Sick sinus syndrome (SSS)
- Wolff-Parkinson-White syndrome (WPW syndrome).
- Hyperthyroidism •
  Drugs: Theophylline, beta-agonists, decongestants (anticold agents)

Innocent Cardiac Murmur

- Classic vibratory systolic murmur (Still's murmur)
- Pulmonary ejection systolic murmur
- Pulmonary flow murmur of the newborn
- Venous hum (continuous)
- Carotid bruit (systolic)

Cardiomegaly without Murmur

- Congenital heart disease
  - Coarctation of aorta (in infants)

- Ebstein anomaly •

Myocardial disease
- Endocardial fibroelastosis
- Viral or idiopathic myocarditis
- Glycogen storage disease (Pompe's disease)

• Coronary artery disease • Kawasaki disease • Collagenosis (Periarteritis nodosa)
- Anomalous origin of the left coronary artery from pulmonary artery
- Calcification of coronary artery •
  Medial necrosis of coronary artery

• Miscellaneous
- Pericardial effusion
- Severe anemia
- Beriberi
- PEM
- Respiratory disease leading to CCF
- PAT with CCF
- Drug toxicity: Adriamycin, radiation

Atrial Flutter/Fibrillation

- CHD: Ebstein anomaly
- Cardiomyopathy
- WPW syndrome
- Sick sinus syndrome
- Myocarditis
- Introatrial surgery
- Atrioventricular valve regurgitation

Umbilical Hernia

- Normal Variant
- Prematurity
- Congenital hypothyrodism
- Down's syndrome
- Mucopolysacaridosis.

Scoliosis

- Primary which may manifest in infancy or later • Secondary
  - Rickets
  - Hemivertebrae
  - Marfan's syndrome
  - Muscular dystrophy
  - Postpolio
  - Cerebral palsy
  - Spina bifida
  - Neurofibromatosis
  - Friedreich's ataxia.

Flat Foot

- Normal variation
- Congenital
  - Marfan's syndrome • Ehlers-Danlos syndrome • Tarsal bone fusion
- Neurologic
  - Cerebral palsy
  - Spina bifida
  - Muscular dystrophy.
- Nutritional
  - Rickets

Talipes Equinovarus (Club Foot)

- Familial • Intrauterine posture • Spina bifida • Postpolio • Arthrogryposis multiplex Congenita (Fig. 63.13)
- Cerebral palsy
- Vertical talus.

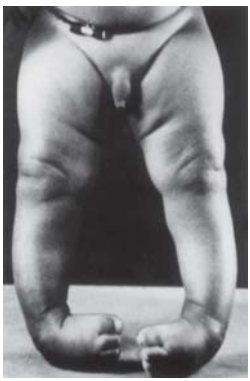


Fig. 63.13: *Talipes equinovarus (club feet)* in association with arthrogryposis multiplex congenita.

Congenital Goiter

- Iodine deficiency/excess
- Maternal goitrogen consumption
- Congenital hyperthyroidism
- Dyshomogenic defects

Gynecomastia

- Normal pubertal development •
  Drugs: Estrogens, phenothiazines, digoxin, meprobamate, reserpine, spiranolactone, marijuana •
  Deficient androgen production: Klinefelter syndrome, testicular failure, isolated LH deficiency (fertile eunuch)
- Overproduction of estrogens: Feminizing adrenal tumors •
  Local problems: Carcinoma, lipoma, abscess, hemangioma, bruise, neurofibromatosis
- Miscellaneous: Pituitary/thyroid tumor, thyroid disease

Simian Crease

- Normal (4% neonates)
- Down syndrome (50% cases)
- Other trisomies

Cafe-au-lait Spots

- Normal variant
- Neurofibromatosis (von Recklinghausen's disease)
- Tuberous sclerosis
- Fanconi's anemia
- Gaucher's disease
- Ataxia telangiectasia
- Roussel's Silver syndrome
- Pheochromocytoma
- Chronic myeloid leukemia
- McCune-Albright syndrome
- Multiple lentigenes
- Ataxia telangiectasia
- Bloom's syndrome
- Epidermal nevus syndrome
- Chédiak-Higashi syndrome.

Drug-induced Lupus

- Hydralazine
- INH
- Procainamide
- Beta-blockers
- Anticonvulsants (Probable)
- Quinidine
- Captopril
- D-penicillamine

Butterfly Rash

- SLE
- Dermatomyositis
- Contact dermatitis
- Pemphigus erythematosus
- Mitral stenosis
- Hypothyroidism

Recurrence of Fever in Meningitis (on Treatment)

- Phlebitis (IV puncture site)
- Drug fever
- Superadded infection: viral, malaria, UTI
- Drug resistance.

Recurring Meningitis

- Congenital defects: Meningomyelocele, neurenteric cysts, midline or spinal dermal sinuses
- Acquired defects: Basal skull fracture
- Immunodeficiency
- Chronic relapsing encephalomyelitis
- Inherently recurrent infections: Mollaret's meningitis

Opisthotonos

- Tetanus
- Meningitis
- Kernicterus
- Dystonia/phenothiazine toxicity
- Strychnine poisoning
- Infantile Gaucher's disease

Neck Rigidity (Stiffness)

- Cervical lymphadenitis
- Retropharyngeal abscess
- Dystonia
- Meningitis
- Intracranial space occupying lesion (ICSOL)
- Subar achnoid hemorrhage
- Tetanus

Acute Ataxia

- Postinfection
- Chickenpox
- ECHO
- Coxsckie
- Drug-unduced
- Antihistaminics
- Anticonvulsants
- Alcohol
- ICSOL
- Intracranial infections
- Hydrocephalus
- Miller-Fisher's syndrome (ataxia, areflexia, ophthalmoplegia)

Chronic Ataxia (Static)

- Postencephalitic
- Agenesis of cerebellar vermix
- Hydrocephalus

Chronic Ataxia (Progressive)

- Friedreich's ataxia

Calf Hypertrophy

- Physiologic
- Duchenne's muscular dystrophy (DMD)
- Hypothyroidism
- Becker's muscular dystrophy
- Polymyositis
- Myotonia congenital
- Kugelberg-Wilander syndrome

Painful/tender Hepatic Enlargement

- Acute hepatitis
- Liver abscess
- CCF
- Hepatoma

Dull Percussion Note (Chest)

- Pleural effusion
- Consalidation
- Collapse
- Fibrosis
- Thickened pleura
- Bronchopneumonia
- Abscess

Pigeon Chest Deformity

- Congenital
- Rickets
- Emphysema
- Skeletal dysplasia
- MPS (type 4)
- Marfan's syndrome
- Noonan's syndrome

Hemihypertrophy

- Idiopathic
- Beckwith-Wiedemann's syndrome
- Wilms' tumor
- Neurofebromatosis
- Russel-Silver syndrome
- Adrenocartical carcinoma
- Cutis marmorata congenital

Micro-orchidism

- Hypopituitarism
- Hypothyroidism
- Rudimentary tests syndrome
- Klinefelter's syndrome
- Laurence-Moon-Biedl syndrome

Macro-orchidism

- Sexual precocity
- Hypothyroidism
- Fragile-X syndrome
- Testicular tumor

Micropenis (< 2 cm; normal 4-5 cm)

- Hypopituitarism
- Down syndrome
- Klinefelter's syndrome
- Laurence-Moon-Biedl syndrome
- CHARGE association
- Hypogonadotrophic hypogonadism
- Prader-Willi syndrome
- Kallman's syndrome
- Cornelia de lange syndrome
- X-linked hypogamma globinemia
- Noonan's syndrome
- Fanconi's anemia
- William's syndrome
- Rainbow syndrome
- Hallerman-Streiff syndrome
- Carpenter's syndrome

Vaginal Bleeding

- Newborn: Withdrawal bleeding in girls •
  Infancy and childhood: Before menarche—Precocious puberty, exogenous estrogen vaginitis, foreign body, urethral prolapse. After menarche: DUB, bleeding diathesis, gonorrhea, IUD, birth control pill, ectopic pregnancy, abortion.

Syndrome of Inappropriate Secretion of ADH (SIADH)

- CNS tumors
- Lung tumors
- Lymphoma
- Gastrointestinal carcinoma
- Drugs: Vincristine, cyclophosphamide

Ascites

- Hypoproteinemia: Kwashiorkor, nephrotic syndrome protein-losing enteropathy
- Cirrhosis of liver
- Portal hypertension
- Cardiac: CCF
- Infectious: Tuberculosis, peritonitis
- Neoplasm
- Iatrogenic: Postdialysis, postventriculoperitoneal shunt
- Chylous

Gastroenteritis with Arthritis

- Infectious
  - Salmonella
  - Shigellosis
  - Yersinia
  - Adenovirus
  - Tuberculosis
- Noninfectious • Inflammatory bowel disease (ulcerative colitis, Crohn's disease)
  - Anaphylactoid purpura

Gastrointestinal Bleeding

- Upper
  - Bleeding from a oral or pharyngeal source
  - Esophageal: Varices, esophagitis
  - Gastric: Gastritis, ulcer, foreign body, vascular lesion, tear
- Lower • Dysentery (bacillary)
  - Colitis; Amebic, inflammatory bowel disease, pseudo-membranous, radiation-induced, allergic, ischemic
  - Vascular: Hemangioma hemorhoids, angiodysplasia
  - Mass lesion: Malignancy, polyposis, duplication
  - Obstructive: Intussusception, midgut volvulus
  - Congenital: Meckel's diveritculum (becoming "symptomatic" in a toddler).

Ulcerative Colitis-like Manifestations

- Infections Colitis
  - Amebiasis
    - Giardiases
  - Cl difficile
  - Cytomegalovirus
- Allergic Colitis
- Crohn's disease
- Colitis of hemolytic uremic syndrome

Soft Neurologic Signs

(Occurring during normal development but not helpful in an individual child from clinical point of view; related to learning problems).

- Choreiform movements (upper limbs)
- Hyperactivity •
  Short attention span •
  Involuntary mirror movements of fingers on opposite hand (synkinesis)
- Poor motor incoordination
- Poorly performed alternating movements
- Inability to hop or tandem walk
- Failure to appreciate simultaneous touch to face and hands
- Mixed or confused laterality
- Inability to appreciate numbers drawn on the hand

Premature Greying of Hair (Premature Canities)

- Isolated dominant condition
- Autoimmune disorders
- Pernicious anemia
- Hyperthyroidism
- Hypothyroidism
- Progeria
- Werner's Syndrome

Part

4

Differential Diagnosis of Selected Laboratory Findings

Chapter 64 Differential Diagnosis of Selected Laboratory Findings

Normocytic Anemia

- Decreased production
- Hemolytic anemias
- Acute bleeding

Increased MCV (Macrocytic Anemia)

- Normal in the neonate
- Vitamin B_{12}/folic acid deficiency
- Hemolysis/hemorrhage (- reticulocytes)
- PEM
- Down syndrome
- Leukemia
- Congenital RBC aplasia

Hypochronic Anemia

- Iron deficiency
- Thalassemia
- Chronic infection/inflammation

Decreased MCV (Microcytic Anemia)

- Iron deficiency (RBC count decreased)
- Lead poisoning (RBC count decreased)
- PEM (RBC count decreased)
- Thalassemia major (RBC count remains normal)
- Chronic inflammation
- Sideroblastic anemia
- Copper deficiency

Increased MCHC

- ABO incompatibility
- Hereditary spherocytosis
- Autoimmune hemolytic anemia
- Hemolytic uremic syndrome (HIJS)

Target Cells

(RBC with an area of increased staining in the central pallor)

- Thalassemia
- Sickle cell anemia
- Iron deficiency anemia (IDA)
- Lead poisoning
- Chronic liver disease
- Postsplenectomy

Basophilic Stippling

(Small basophilic inclusions throughout RBC cytoplasm)

- Thalassemia
- Megaloblastic anemia
- Lead poisoning
- Dyserythropoiesis
- Liver disease
- Unstable hemoglobinopathies
- Pyrimidine 5'-nucleotidase deficiency

Howell-Jolly Bodies

(Small round cytoplasmic red cell inclusion with staining characteristics of nucleus)

- Hemolytic anemia
- Megaloblastic anemia
- Postsplenectomy

Tear Drop Cells

(RBC resembling a tear drop)

- Iron deficiency anemia (IDA)
- Megaloblastic anemia
- Bone marrow fibrosis

Elliptocytosis

(Elliptical or oval RBCs)

- Hereditary elliptocytosis
- Iron deficiency anemia (IDA)
- Thalassemia
- Myelofibrosis

Acanthocytosis

(RBCs with spicules of unequal length and uneven distribution over the surface)

- Postsplenectomy
- Liver disease
- Starvation
- Anorexia nervosa

Rouleax Formation

(RBCs resembling stacks of coins)

- Hyperfibrogenemia
- Hyperglobulinemia

Stomatocytes

(RBCs having mouth-like form because of a central linear slit)

- Hereditary stomatocytosis
- Hereditary spherocytosis
- Alcohol

High Neutrophil (Neutrophil Leukocytosis)

- Infection (usually bacterial)
- Tissue destruction: Trauma, burns, infarctions, gangrene neoplasm
- Blood loss: Hemorrhage, hemolysis
- Drug therapy: Steroids, poisons
- Myeloproliferative disease

Low Neutrophil (Neutrophil Leukopenia)

- Infection: Viral, overwhelming bacterial like typhoid brucellosis and malaria
- Factor deficiency anemia: Vitamin B_{12} and folic acid, infrequently iron

- Bone marrow depression
- Hypersplenism
- SLE
- Leukemia

Eosinophilia

- Allergy
- Asthma
- Hay fever
- Serum sickness
- Urticaria
- Food sensitivity
- Drugs: Penicillins, nitrofurantoin
- Parasitic infestation: Ascariasis
- Tropical eosinophilia
- Infections: Convalescent phase
- Myeloproliferative disorders
- Reticulosis
- Leukemia
- Sarcoidosis

Eosinopenia

- Cushing's disease
- Steroid therapy
- Pertussis
- Acute illnesses

Lymphocytosis

- Infections: Infectious mononucleosis, exanthemata, influenza, hepatitis, pertussis, tuberculosis, syphilis, typhoid, brucellosis
- Convalescent phase of any infection
- Lymphocytic leukemia
- Reticulosis

Lymphopenia

- Steroid therapy
- Cushing's disease
- PEM

Monocytosis

Bacterial infections
- Tuberculosis
- Typhoid
- Endocarditis
- Brucellosis
- Convalescence

Protozoal infections
- Malaria
- Trypnosomiasis

Chronic diseases
- Ulcerative colitis
- Crohn's disease
- Connective tissue disease

Malignancy
- Myeloma
- Monocytic leukemia
- Lymphadenoma

Leukemoid Reaction

(Markedly high TLC with circulating immature cells but normal hemoglobin, platelets and bone marrow)
- Severe infections
- Tuberculosis
- Acute hemolysis

Thrombocytopenia

(Platelet count < 150×10^9/L)

Poor megakaryocytosis
- Bone marrow hypoplasia
- Bone marrow infiltration

Poor thrombocytopoiesis
- Megaloblastic anemia
- Leukemia

Poor platelet survival
- ITP
- Drugs
- Acute infections, septicemia, malaria

• Thrombotic thrombocytopenia
• Hemolytic-uremic syndrome
• DIC

Sequestration of platelets

• Hypersplenism

Thrombocytosis

(Platelet count > 400 × 10^9/L)

Primary (Essential)

• Myeloproliferative disorders

Secondary (Reactive)

• Acute infections or inflammations •
Chronic infections/inflammatory disorders (tuberculosis, rheumatologic conditions)
• Splenic hypofunction or asplenemia
• Acute hemorrhage
• Iron deficiency anemia
• Trauma
• Leukemia (CML, CLL)

Hypocellular Bone Marrow (Figs 64.1 to 64.3)

• Drug-induced: Carbamazepine, chloramphenicol
• Chemical-induced: Benzene
• Virus-induced
• Ionizing-radiation
• Inherited bone marrow failure syndrome
• Aplastic anemia

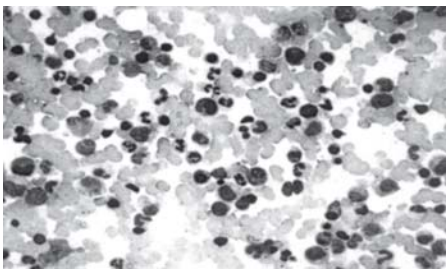


Fig. 64.1: Bone marrow showing heterogenous population of cells composed of erythroid cells, cells of myeloid series lymphoid cells, plasma cells etc.

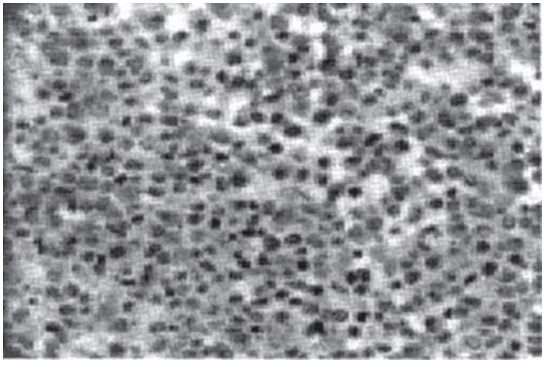


Fig. 64.2: Normocellular bone marrow

Fig. 64.3: Hypocellular bone marrow

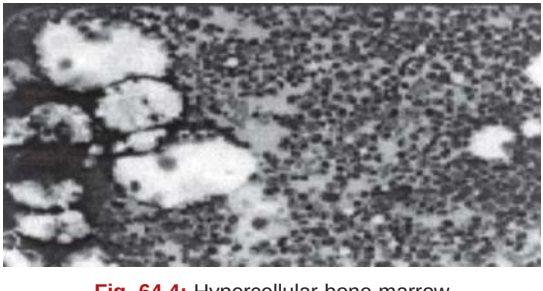


Fig. 64.4: Hypercellular bone marrow

Hypercellular Marrow (Figs 64.1, 64.2 and 64.4)

- Leukemias • Myeloproliferative disorders
- Myelodysplasia
- Lymphomas
- Megaloblastic anemia
- Sideroblastic anemia
- Compensatory hyperplasia (following cell destruction)

Megakaryocytic Hyperplasia

- ITP
- Reactive: Chronic inflammatory disorders
- Essential thrombocythemia
- Myeloproliferative disorders

Megakaryocytic Hypoplasia (Depression)

- Aplastic anemia
- Viral infections
- Drug-induced

Erythroid Hyperplasia

(Myeloid: erythroid ration < 1:1; normal = 2:1 to 4:1)

- Hemolytic anemias • Massive hemorrhage • Polycythemia • Hemoglobin synthesis abnormalities: Thalassemias, congenital sideroblastic anemia • DNA synthesis defects: Folate/vitamin B_{12} deficiency, methotrexate

Erythroid Hypoplasia

(M:E ratio > 4:1 as a result of absence or suppression of RBC precursors)

- Pure red cell aplasia
- Diamond-Blackfan syndrome
- Thymoma
- Parvovirus B19 infection

Low Serum Proteins (Total)

- Artefactual: Blood drawn from an arm with IV drip running • Reduced synthesis: Severe dietary deficiency, malabsorption, liver dysfunction •
  Increased loss: Nephrotic syndrome, burns and exudates, protein-losing enteropathy

High Serum Proteins (Total)

- Artefactual: Venepuncture stasis •
  Fluid depletion •
  Hyperglobulinemia: A paraprotein or polyclonal rise in gamma-globulin

Low Serum Albumin

See "Low Serum Proteins (Total)"

High Serum Albumin

- Artefactual: Blood drawn from an arm with IV drip running
- Fluid depletion

Low Alpha$_1$-Globulin

- Nephrotic syndrome
- Alpha-1-antitrypsin deficiency

High Alpha$_1$-Globulin

- Tissue damage
- Inflammation

Low Alpha$_2$-Globulin

- Reduced albumin synthesis
  - Protein-energy malnutrition
  - Malabsorption syndrome
  - Liver disease

High Alpha$_2$-Globulin

- Acute stress
- Nephrotic syndrome
- Diabetes mellitus
- Hyperthyroidism
- Adrenal insufficiency

High Beta-Globulin

- Biliary obstruction
- Nephrotic syndrome

Low Gamma-Globulin

- Protein loss: Proteinuria as in nephrotic syndrome, burns, exudates, and protein-losing enteropathy
- Malabsorption syndrome
- Malnutrition

High Gamma-Globulin

- Polyclonal
  - Chronic infections
  - Rheumatoid arthritis
  - SLE
  - Liver disease
  - Sarcoidosis
- Monoclonal

High IgG

- Infections
- SLE
- Hashimoto's disease
- Liver disease

Low IgG

- Nephrotic syndrome
- Congenital deficiency
- Malignancy

Low IgA

- Congenital deficiency
- Protein-losing enteropathy
- Drug therapy: Gold, penicillamine, phenytoin

High IgA

- Cirrhosis (portal)
- IgA Nephropathy
- Autoimmune disorders

Low IgM

- Protein loss

High IgM

- Chronic infections
- Biliary cirrhosis
- Connective tissue disorders (rheumatoid arthritis)

High IgE

- Asthma •
  Allergic rhinitis •
  Parasitic infestations •
  Atopic dermatitis •
  Miscellaneous: Cirrhosis, celiac disease, glomerulonephritis, paraproteinemia

Low Complement (C3, C4)

- Post-streptococcal acute glomerulonephritis
- SLE nephritis
- Membrano-proliferative glomerulonephritis
- Serum sickness
- Liver disease

High C-Reactive Protein (CRP)

- Rheumatic fever
- Rheumatoid arthritis
- Systemic vasculitis
- Septicemia (neonatal)

High Alpha-1-Fetoprotein

- Primary hepatoma
- Secondary hepatic carcinoma
- Tumors of alimentary tract
- Tumors of the gonads
- Cirrhosis
- Hepatitis
- Fetal death or neural tube defects in pregnancy

High Creatine Phosphokinase (CPK)

- Muscle diseases: Duchenne's myopathy in which values are over 10 times the normal and precede the clinical picture, viral myositis, toxoplasmosis, trichinosis, acute myoglobinuria, myotonias, neurogenic disease, severe exertion, seizures, intramuscular injection, etc.
- Hypothyroidism
- Hypoparathyroidism
- Rickets
- Chronic renal failure
- Shock
- Myocardial infarction
- Drug therapy: Alcohol, hypnotics, clofibrate

High SGOT/AST

- Liver disease •
  Severe hemolysis •
  Muscle damage •
  Myocardial damage •
  Drugs: Alcohol •
  Miscellaneous: Trauma, shock, surgery, occult CCF, hypokalemia, severe exertion

High SGPT/ALT

- Hepatic cirrhosis
- Hepatic metastasis

High Alkaline Phosphatase

- Rickets
- Paget's disease
- Bony metastasis
- Ankylosing spondylitis
- Liver disease

Low Alkaline Phosphatase

- Hypophosphatasia •
  Reduced bone growth: Cretinism, vitamin C deficiency, achondroplasia
- PEM

High Serum Amylase

- Acute pancreatitis
- Perforated peptic ulcer
- Mesenteric infarction
- Cholecystitis
- Ruptured aneurysm
- Drug therapy: Opiates, steroids, phenylbutazone, thiazides
- Following cholecystegraphy
- Renal failure
- Salivary gland disease
- Macroamylasemia
- Metastatic tumors

High Serum Lactate Dehydrogenase (LDH)

- Megaloblastic anemia
- Hemolysis
- Leukemia
- Acute liver congestion
- Acute intoxication
- Malignant disease, especially when accompanied by metastasis

High Serum Calcium

- High intake of vitamin D, especially in renal failure, hypoparathyroidism, concomitant use of thiazide diuretics
- Primary hyperparathyroidism •
  Neoplasm: Metastatic bone disease, pseudohyperparathyroidism
- Addison's disease
- Severe thyrotoxicosis
- Acromegaly
- Immobilization
- Paget's disease
- Dehydration
- Sarcoidosis
- Familial benign hypercalcemia

Low Serum Calcium

- Vitamin D deficiency •
  Hypoparathyroidism •
  Renal failure •
  Maternal diabetes, osteomalacia or hypoparathyroidism •
  Drug therapy: Anticonvulsants, oral phosphates and calcitonin, anabolic, steroids esteogens

High Serum Phosphate

- Vitamin D excess
- Hypoparathyroidism
- Diabetic ketosis
- Renal failure
- Healing fractures
- Hemolysis
- Acromegaly
- Neoplasm

Low Serum Phosphate

- Vitamin D deficiency •
  Hyperparathyroidism •
  Nutritional deficiency as during prolonged intravenous infusion or nasogastric suction, persistent vomiting, alcoholism
- Renal tubular disease
- Acute infections: Gram negative septicemia

High Serum Magnesium

- High doses of magnesium as an antacid or cathartic
- Renal failure with hyperkalemia
- Hypercalcemia

Low Serum Magnesium

- Severe diarrhea
- Malabsorption
- Nasogastric aspiration
- Protein-energy malnutrition, especially in kwashiorkor
- Hypokalemia
- Hypocalcemia

• Drug therapy: Diuretics, gentamicin, cisplatin

High Serum Urea (Azotemia)

Reduced excretion
• Reduced filtration
• Increased reabsorption
Catabolism of absorbed protein
• High protein diet
• Gastrointestinal bleed

Low Serum Urea

• Anabolic states
• Low protein diet
• Liver failure
• IV infusion

High Serum Urea-Creatinine Ratio

• Protein catabolism
• Sodium and water depletion, e.g. diuretic therapy
• CCF

Low Serum Urea-Creatinine Ratio

• Reduced urea concentration •
High creatinine concentration
  • Dialysis
  • Drugs
  • Rhabdomyolysis

Aminoaciduria

Nonspecific (Fanconi's syndrome)
• *Congenital*: Cystinosis, Lowe's syndrome, medullary cystic disease, idiopathic Fanconi's syndrome, Wilson's disease, galactosemia, glycogen, storage disease
• *Acquired*: Myelomatosis, amyloidosis, massive proteinuria, Sjögren's syndrome, heavy metal (lead mercury, cadmium) poisoning, phenols, outdated tetracyclines
• *Specific tubular defects* (*cystinuria*)
• *Overflow aminoaciduria*

- *PKU*

Phosphaturia

- Renal tubular defects
  - Fanconi's syndrome
  - Hereditary hypophosphatemic rickets
  - Renal tubular acidosis
- Primary hyperparathyroidism
- Secondary hyperparathyroidism

Smell and Taste as Clues to Diagnosis

- Acetone on breath Diabetic ketoacidosis
- Mousy smell from urine Phenylketonuria (PKU)
- Smell of fresh maple sap from urine
- Maple syrup urine disease
- Fishy urine *Proteus* infection
- Excessively salty kiss (cystic fibrosis)

Simple Observation on Urine as a Clue to Diagnosis

- Color and concentration
- Orange: Jaundice, rifampicin
- Red, dark tea or coke-colored: Acute glomerulonephritis
- Dilute watery: Diabetes insipidus, polydipsia states

Frothy: Albuminuria

- Acute nephritis
- Alkaptonuria
- Melanotic sarcoma
- Casts
- Granular or red-cell: Acute glomerulonephritis

Hyaline: Normal

- Cloudiness
- Dissolved urates: Normal
- Leukocytes: UTI

Pathognomic Jejunal Biopsy Findings

- Abetalipoproteinemia
- Lymphoma
- Amyloidosis

- Lymphangiectasia
  - L. Giardia

High Sweat Chloride

- Cystic fibrosis (> 60 mEq/L)
- Insufficient sweat
  - Congenital hypothyroidism • Ectodermal dysplasia • Riley-Day syndrome
- Metabolic • G-6-PD deficiency • Diabetes insipidus (nephrogenic)
  - Mucopolysaccharidosis •

PEM.

- Miscellaneous
  - Adrenal insufficiency (untreated)
  - Fucosidosis
  - Celiac disease
  - Familial cholestasis

False Negative Sweat Chloride

- Peripheral edema
- Cloxacillin
- Hypoparathyroidism
- Klinefelter's syndrome (XXY)
- Hypogammaglobulinemia
- Hypohidrosis
- Atopic dermatitis
- Glycogen storage disease (I)

False Negative Tuberculin (Mantoux) Test

- Immunosuppression • Severe PEM • Immunosuppressant therapy (steroids) • Diseases: • HIV malignancy • TBM, military tuberculosis
- Exanthemata
  - Measles

- Mumps •
  Chickenpox
- Young infants
- Stress of surgery, burns, etc.
- During incubation period

Xanthochromic CSF

- Froin's syndrome
- Guillain-Barré syndrome (GBS)
- Deep icterus
- Old subarachnoid hemorrhage

Albumino-cytological Dissociation

- Guillain-Barré syndrome (GBS)
  (CSF: cells nearly normal, proteins quite high)
- Froin's loculation syndrome/spinal subarachnoid block (CSF: cells within normal range, proteins high (more than twice upper limit of normal) xanthochromia, clot on standing)

Part

5

Differential Diagnosis of Selected Radiologic Signs

Chapter 65 Differential Diagnosis of Selected Radiologic Signs

Hilar Enlargement

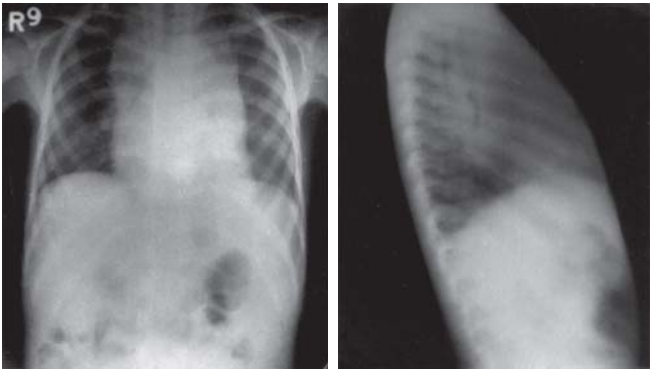
- Nonspecific bronchopneumonia (secondary to viral infections like measles, chickenpox, influenza, to mycoplasma, or to rickettsia). Usually, hilar enlargement is bilateral. The hilar borders are indistinct, the perihilar markings are exaggerated with streaky densities extending outward, and there are peribronchial and interstitial infiltrates.
- *Tuberculosis:* The hilar enlargement is usually unilateral •
  Lymphoma: The hilar enlargement may be unilateral initially but soon it becomes bilateral with widening of the mediastinum and has remarkably sharp borders.
- *Sarcoidosis:* The hilar enlargement is bilateral, lobulated and well defined with calcification at times.
- *Lymphoblastic leukemia:* The hilar enlargement is bilateral and resembles sarcoidosis.

Enlargement of the Anterior Mediastinum

- Thymic enlargement (Figs 65.1 to 65.3)
- Thymoma
- Dermoid cyst
- Teratoma
- Substernal goiter

Enlargement of the Middle Mediastinum

- Atypical location of the thymus
- Persistence of left superior vena cava
- Widening of right superior vena cava
- Bronchogenic cyst



Figs 65.1 and 65.2: Widened anterior mediastinum (thymus).

- Pericardial cyst
- Lymphoma
- Neuroblastoma
- Testicular tumor
- Pericardial cyst
- Cardiac myxoma
- Angiomatous lymphoid hamartoma

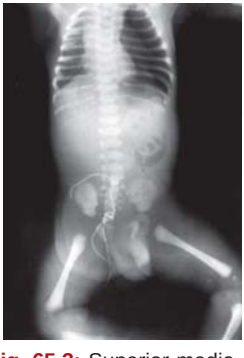


Fig. 65.3: Superior mediastinal widening (thymus shadow).

Enlargement of the Posterior Mediastinum

- Atypical location of the thymus
- Neurogenic tumors like neurofibroma, neurofibro-sarcoma and neuroblastoma
- Hemangioma
- Meningocele

Multiple Finely Granular Shadows (Miliary Mottling) in the Lungs

• *Miliary tuberculosis (Fig. 65.4):* Miliary lesions are very small but equal in size. The number of the lesions decreases in craniocaudal direction. There is invariably an enlargement of the hilar or paratracheal lymph nodes.

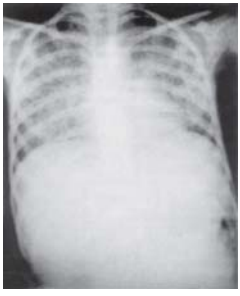


Fig. 65.4: *Miliary mottling* in disseminated pulmonary tuberculosis. It needs to be differentiated from such conditions as tropical eosinophilia, miliary bronchopneumonia seen in measles or pertussis, pulmonary hemosiderosis, pulmonary edema, etc.

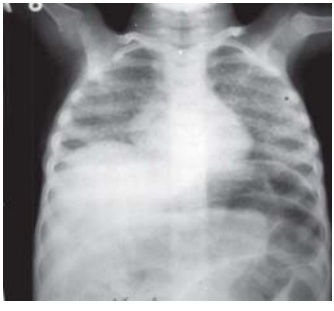


Fig. 65.5: Miliary bronchopneumonia (expiratory/film).

- *Miliary bronchopneumonia (Fig. 65.5)*: The lesions are of varying size and not well defined. They decrease from hilum to periphery. The involvement of the hilum with streaky densities is usual. This kind of bronchopneumonia is frequent in measles and pertussis.
- Staphylococcal pneumonia (Fig. 65.6)

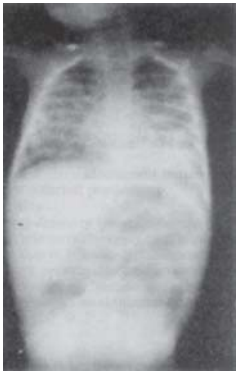


Fig. 65.6: *Staphylococcal pneumonia* Note the pneumatoceles of different sizes. In contrast to the diffuse bronchopneumonia of pneumococcal etiology. Here the lung involvement is patchy. A fast progression from bronchopneumonia to effusion or pneumothorax is strongly suggestive of staphylococcal pneumonia.

- Tropical eosinophilia (Fig. 65.7)
- Fungal infections
- Aspiration pneumonia
- Pneumocystis carinii pneumonia
- Sarcoidosis
- Lymphoma
- Leukemia
- Methotrexate lung
- Thyroid malignancy
- Idiopathic pulmonary hemosiderosis
- Pulmonary alveolar proteinosis
- Pulmonary alveolar microlithiasis
- Pulmonary edema
- Uremic lung

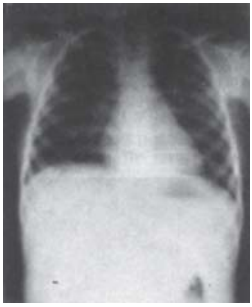


Fig. 65.7:
Tropical eosinophilia

Solitary Lung Densities

- Congenital cysts
- Acquired cysts
- Pneumonic infiltrates
- Localized effusions
- Eosinophilic infiltrate
- Tuberculoma
- Echinococcosis
- Abscesses
- Aspergillosis

Multiple Lung Densities

- Bronchopneumonia (Fig. 65.8)
- Bronchogenic dissemination in tuberculosis
- Septic pulmonary infarction
- Multiple hydatid cysts (Fig. 65.9)

Large Lung Density

- Lobar pneumonia/consolidation (Fig. 65.10)
- Atelectasis
- Abscess

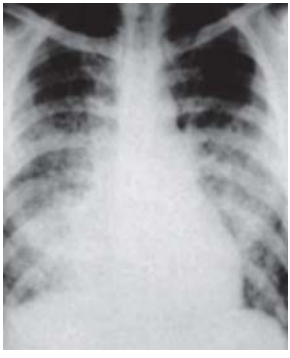


Fig. 65.8:
Viral pneumonia in chickenpox.

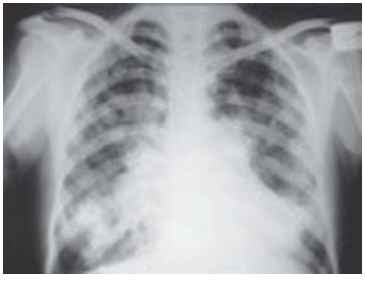


Fig. 65.9:
Multiple hydatid cysts

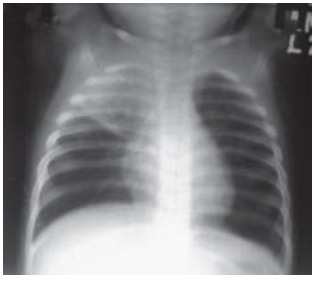


Fig. 65.10:
Consolidation (right upper lobe)

- Tuberculosis
- Pulmonary sequestration
- Pulmonary agenesis
- Pleural effusion/empyema (Figs 65.11 and 65.12)
- Hydropneumothorax (Fig. 65.13)

Overwhelming Interstitial Changes in Lung Field

- Pertussis •
  Cystic fibrosis •
  Pneumocystis carinii pneumonia •
  Sinobronchitis •
  Congenital pulmonary lymphangiectasia •
  Congenital lesions of the heart with pulmonary edema or congestion due to enhanced pulmonary blood flow
- Wilson-Mikity syndrome

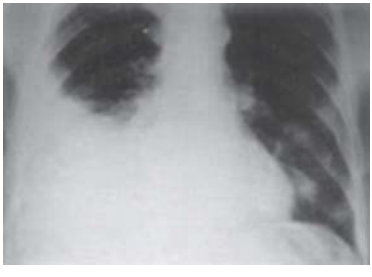


Fig. 65.11: *Pleural effusion (right)*
Note the curved line

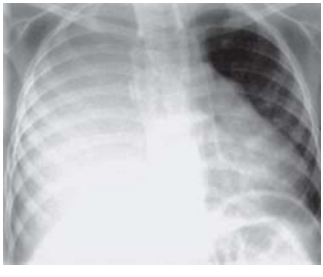


Fig. 65.12: Empyema

- Interstitial pulmonary fibrosis (Hamman-Rich syndrome)
- Collagenosis
- Scleroderma
- Histiocytosis

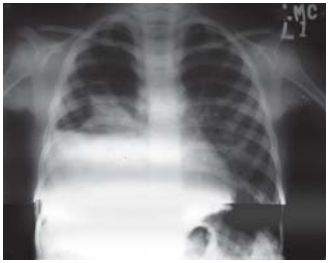


Fig. 65.13: Hydropneumothorax

Unilateral Increase in Lung Radiolucency

• Rotation into the oblique position of the subject • Congenital lobar emphysema (infantile lobar emphysema)

- Emphysema secondary to a foreign body in the main stem bronchus
- Macleod's syndrome (unilateral or partial bronchial obstruction)

Pulmonary Edema (Unilateral)

- Pulmonary edema if the child's position is decubitus
- Rapid removal of fluid or air from pleural space on one side only
- Pulmonary lymphangiectasia

Pulmonary Metastases

- Wilms' tumor
- Ewing sarcoma
- Rhabdomyosarcoma
- Fibrosarcoma
- Synovial sarcoma
- Hodgkin lymphoma

Middle Lobe Consolidation (Fig. 65.14)

- Asthma •
  Tuberculosis •
  Acute infection
  - *P. pseudomonas*
  - *Klebsiella*

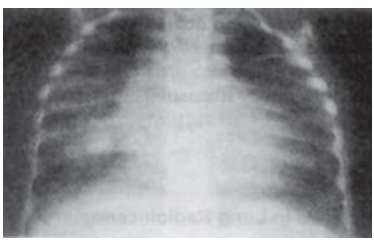


Fig. 65.14: Right middle-lobe consolidation. Differential diagnosis includes pseudomonal or klebsiellal infection, asthma and tuberculosis.

Enlarged Cardiac Shadow

- CCF
- Pericardial effusion (Fig. 65.15)
- Myocarditis (Fig. 65.16)
- VSD
- Cardiomyopathy (Fig. 65.17)

Air Bronchogram

- Hyaline membrane disease (HMD)
- Pulmonary edema • Pneumatic consolidation • Adult respiratory distress syndrome (ARDS)
- Sarcoidosis

Opaque Hemithorax

- Massive pleural effusion • Atelectasis/collapse/fibrosis, consolidation • Thickened pleura (tuber culous)
- Pulmonary agenesis

Kerley Lines in X-ray Chest

A sign of interstitial pulmonary edema

- LVF
- Mitral stenosis
- Sarcoidosis
- Pneumoconiosis
- Lymphangiectasia

Nodular Opacities in X-ray Chest

- Tuberculomas
- Pyogenic abscesses • Fungal messes • Secondaries ("Cannon-ball metastases")

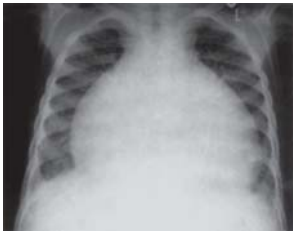


Fig. 65.15: *Pericardial efffusion* Note the symmetrically enlarged ("flask-shaped") heart with sharp, well-defined, Stenciled borders and wide base with acute angle between rigt border and right hemi-diaphragm. Cardiothoracic (CT) ratio is 0.8 against the normal 0.5.

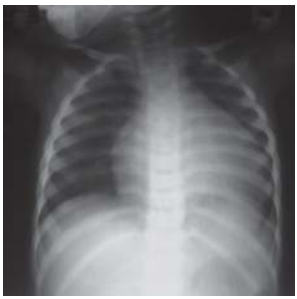


Fig. 65.16: Myocarditis

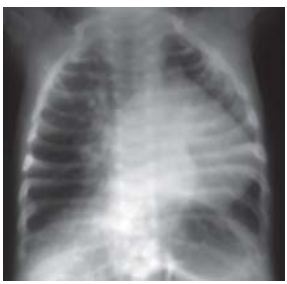


Fig. 65.17: Cardiomyopathy

- Hyd C
- Hamarfomes

Calcification in X-ray Chest

- Tuberculosis
- Hemosiderosis
- Fungal infection

Reticular Granular Pattern in X-ray Chest

- Hyaline membrane disease (HMD)
- Meconium aspiration syndrome (MAS)
- Congenital pneumonia
- Pulmonary edema
- Pulmonary hemorrhage

Soap-bubble Appearance in Abdomen Film of Neonates

- Meconium ileus
- Meconium plug
- Necrotizing enterocolitis
- Atresia/severe stenosis
- Hirschsprung's disease
- Fecolith

Right Ventricular Enlargement

- Pulmonary stenosis
- Pulmonary hypertension
- As a part of cardiomyopathy with global enlargement

Left Ventricular Enlargement

- VSD
- Aortic regurgitation
- Mitral valve disease
- Cardiomyopathy

Left Atrial enlargement

- VSD
- PDA
- Mitral valve disease
- Cardiomyopathy

Right-sided Heart

- Dextrocardia (Fig. 65.18)
- Large pleural effusion/empyema (left lung)
- Space-occupying lesion, say large hydatid cyst, tumor, etc. (left lung)
- Collapse (right lung)

Abnormal Intra-abdominal Air Collection

- Abnormally located bowel segment
  - Inguinal hernia
- Pneumoperitoneum • Retropneumoperitoneum
  - Perforation • Gas in bowel wall
  - Gastric pneumatosis • Rupture of a lung bulla
- Gas within abscess
  - Subphrenic • Hepatic • Renal/perirenal
- Gas in biliary system
  - Stone
  - Cholecystitis
  - Tumor with hepatobiliary fistula
  - Surgery

Bowel Showing Opaque Material (Calcification/ Opacities) in Abdominal Film

- Iron
- Salicylates
- Phenothiazine
- Chloral hydrate

Intra-abdominal Cyst

- Omental cyst
- Mesenteric cyst

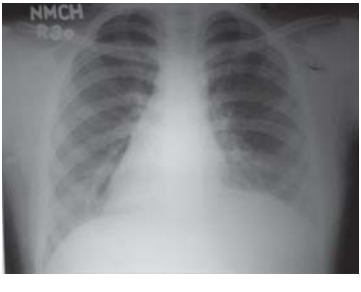


Fig. 65.18: *Dextrocardia with situs inversus and bronchiectasis* Note the apex of the heart on the right side and left done of diaphragm at higher level.

- Choledochal cyst
- Ovarian
- Intestinal duplication
- Pancreatic pseudocyst
- Abscess
- Meckle's diverticulum
- Lymphangioma
- Mesenteric lymphoma
- Intramural tumor

Absent Renal Outline on Plain Film

- Absent kidney
  - Congenital
  - Nephrectomy
- Small kidney
  - Renal hypoplasia
  - Renal atrophy
- Ectopic kidney
  - Pelvic
  - Intrathoracic
  - Crossed fused ectopia
- Obliteration of perirenal fat
  - Perirenal abscess
  - Perirenal hematoma
  - Renal tumor

Unilateral Small Kidney

- Congenital hypoplasia •
  Infarction •
  Atrophy
  - Postinflammatory
  - Postradiation
  - Postobstruction
  - Reflux
  - Ischemia (renal artery stenosis)

Bilateral Small Kidney

- Chronic glomerulonephritis
- Hypotension

- Alport syndrome
- Nephrosclerosis
- Embolic disease

Unilateral Large Kidney

- Acute pyelonephritis • Renal vein thrombosis • Obstructive uropathy • Arterial obstruction • Infarct
- Hypertrophy
- Duplication

Bilateral Large Kidney

- Glomerular disease
  - Acute glomerulonephritis
  - SLE
  - Diabetes insipidus
- Amyloidosis
- Edema of kidney
- Acromegaly
- Sickle-cell anemia
- Bilateral duplication
- Acute urate nephropathy
- Leukemia

Double Bubble Appearance

- Duodenal atresia (Figs 65.19 and 65.20)
- Annular pancreas
- Malrotation of midgut with volvulus
- Ladd's bands

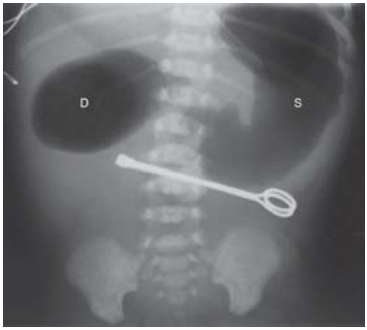


Fig. 65.19: Double bubble sign in duodenal atresia.

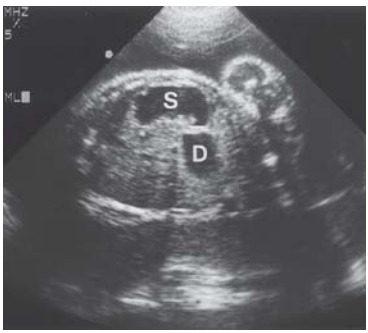


Fig. 65.20: Ultrasonography showing of double bubble sign.

Radiologic Fluid Levels (Neonate)

- Meconium ileus (Fluid levels + bubbles)
- Ileal atresia
- Maconium plug syndrome
- Atresia of colon

- Small left colon syndrome
- Hirschsprung's disease

Multiple Air-fluid Levels

- Intussusception (Fig. 65.21)
- Worms
- Tuberculosis

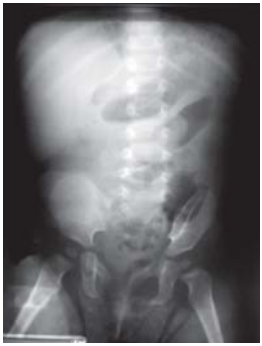


Fig. 65.21: Intussusception

Renal Radiopacities

- Calculi
- Tuberculous peritonitis
- Tuberculous lymph nodes

Adrenal Radiopacities

- Addison disease
- Wolman disease
- Calcification following neonatal shock

Bladder Radiopacities

- Calculi
- Foreign body
- Schistosomlasis

Liver Radiopacities

- Amebic cyst
- Hydated cyst
- Tuberculosis
- Hemangioma
- Hepatoma
- Calculi: Introhepatic biliary, gallbladder

Muscle Radiopacities

- Cysticercosis
- Myositis

Radiopaque Tumors (Abdominal)

- Nephroblastoma (Wilms tumor)
- Neuroblastoma
- Teratoma
- Dermoid

Absent Radii

- Fanconi's anemia
- VATER syndrome
- TAR syndrome
- Hold-Oram syndrome

Wormian Bones

(Intrasutural ossicles in lambdoid, posterior sagittal and temporosquamosal sutures)

- Normal: upto 6 months
- Hypothyroidism
- Hypophosphatasia
- Down syndrome
- Clerdocranial dysostosis (Fig. 65.22)
- Rickets (during healing)
- Progeria
- Menke's kinky hair disease
- Osteogenesis imperfecta
- Pyknodysostosis

Hair-on-end Appearance (Skull)

(Widening of diploic space and thinning of outer table with coarse trabeculae, giving rise to "hair-on-end appearance)

- Thalassemia (Fig. 65.23)
- Sickle-cell a nemia

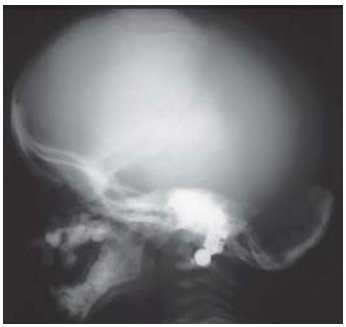


Fig. 65.22: Wormian bones in lambdoid sutures.

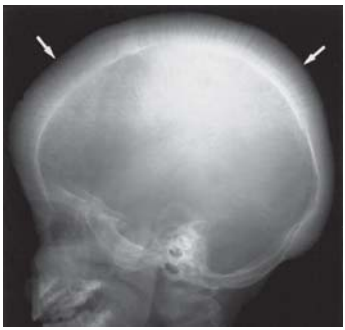


Fig. 65.23: Hair-on-end appearance in thalassemia major.

- Spherocytosis
- G-6-PD deficiency
- Chronic iron-deficiency anemia (IDA) (Fig. 65.24)

Abnormal Skull Shape

- Normal variant
- Craniosynostosis (Fig. 65.25)
- Rickets
- Chondrodystrophy

Craniosynostosis

(Premature closure of skull sutures)

- Primary •
  Secondary
  - Microcephaly •
    In association with syndromal states: Down, Apert, Carpenter, Trecher Collins, Hurler, achondroplasia • Metabolic: Rickets, hypercalcemia, hyperthyroidism, hypervitaminosis D
  - Hematologic: Sickel-cell anemia, thalassemia
  - Iatrogenic: After shunt operation

J-shaped Sella Turcica

- Normal variant
- Osteogenesis imperfecta

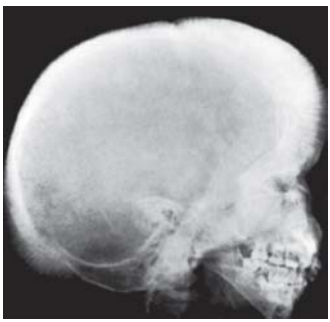


Fig. 65.24: Hair-on-end appearance in chronic iron deficiency anemia.

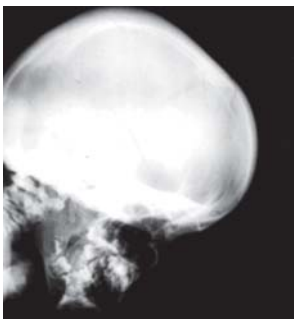


Fig. 65.25: Scaphocephaly with shoe-like sella in Hurler's syndrome.

- Neurofibromatosis
- Achondroplasia
- Mucopolysaccharidosis
- Chronic hydrocephalus
- Optic glioma

Intracranial Calcification

- CMV: seen as a calcified mold of the ventricles
- Toxoplasmosis: seen as diffuse intracranial calcifications spread in both cerebral hemispheres
- Rubella: Infrequent • Herpes simplex • Fahr syndrome (Fig. 65.26)
- Down syndrome • Hyperparathyroidism • Sturge-Weber's syndrome (tram-track appearance)
- Craniopharyngioma (Suprasellar calcification) (Fig. 65.27)
- Tuberculosis (basal calcification)

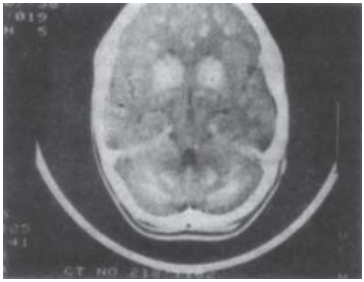


Fig. 65.26: *Fahr's syndrome* CT scan showing calcification in the basal ganglia in a patient who presented with hyperkinetic syndrome comprising agitation, restlessness, rigidity and tremor. There was no overt parathyroid disease. Some evidence suggested "familial" occurrence of the symptom-complex. Note that calcification of basal ganglia can also occur in hyperparathyroidism and, occasionally, in Down syndrome.

Sutural Diastasis

- Hydrocephalus (Figs 65.28 and 65.29) • Traumatic (after the closure of sutures)

Silver/Copper-beaten Appearance (Figs 65.30 and 65.31)

- Raised intracranial pressure (RICP)
- Meningomyelocele

Increased Bone Density

- Osteopetrosis
- Fluorosis

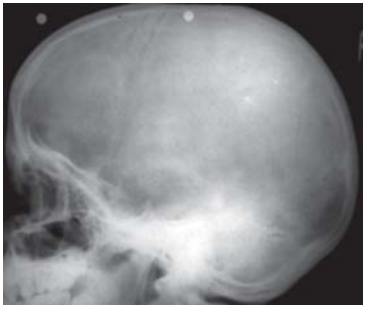


Fig. 65.27: *Craniopharyngioma* Note the enlarged sella turcica.

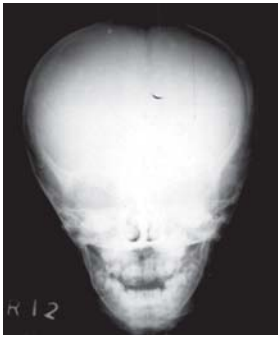


Fig. 65.28: *Hydrocephalus* Note the enlarged skull with sutural diastasis.

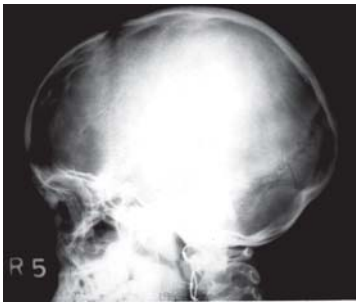


Fig. 65.29: *Hydrocephalus* Note the enlarged skull with sutural diastasis in the lateral view.

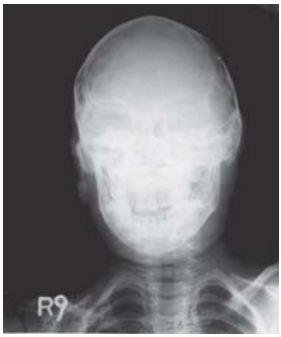


Fig. 65.30: *Intracranial space occupying lesion (ICSOL)* Note the lacunar skull with silver-beaten appereance.

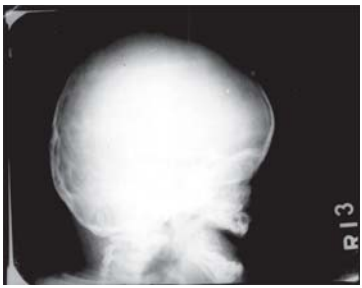


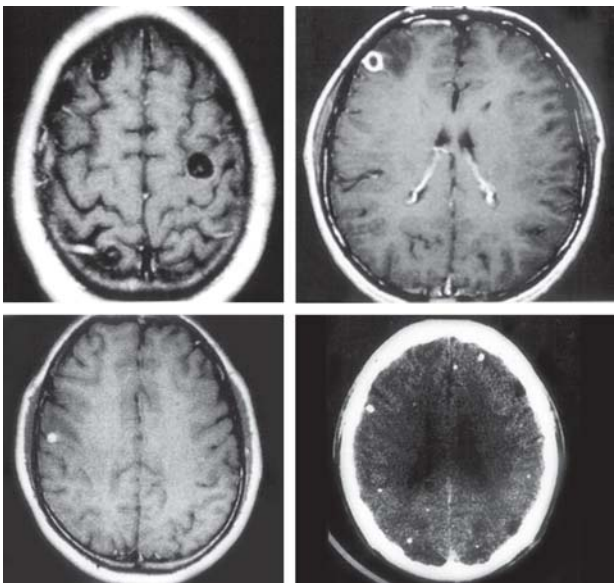
Fig. 65.31: *Intracranial space occupying lesion (ICSOL)* Note the lacunar skull with silver beaten apperance (lateral view).

Enhancing Lesions (Neuroimaging)

- Tuberculosis
- Neurocysticercosis (Figs 65.32 to 65.35)
- Abscess
- Early glioma
- Metastases
- Toxoplasmosis
- Ateriovenous malformations

Non-enhancing Lesions (Neuroimaging)

- Neurocysticercosis
- Hydatid disease
- Cystic astrocytoma
- Porencephaly
- Colloid cyst of 3rd ventricle



Figs 65.32 to 65.35: Four stages of neurocysticercosis.

Non-enhancing Several Cystic Lesions (Neuroimaging)

- Neurocysticercosis
- Multiple myeloma
- Hydatid cyst

Calcification (Neuroimaging)

- Tuberculosis
- Neurocysticercosis
- Tuberous sclerosis
- Toxoplasmosis
- Cytomegalovirus infection

Metacarpal Sign

- Shortening of metacarpals; 2nd being spared or least affected)
- Pseudohypoparathyroidism (Albright's hereditary osteodystrophy)
- Turner's syndrome

Pathologic Fracture

- Osteogenesis imperfects
- Nutritional rickets (Fig. 65.36)
- Scurvy

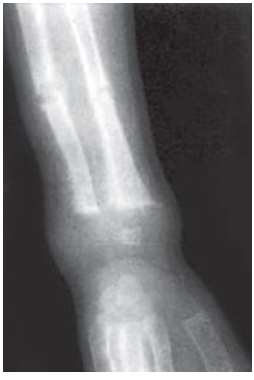


Fig. 65.36: *Nutritional rickets* Note the classical radiologic changes at the wrest: cupping, fraying (blurring like bristles of tooth brush) and flaring (splaying) of the metaphysis. Also seen are pathologic fractures of radius and ulna, poor bone density (because of osteoporosis) and increased distance between epiphysis and metathysis (due to loss of zone of provisional calcification).

Part

1

Color Atlas

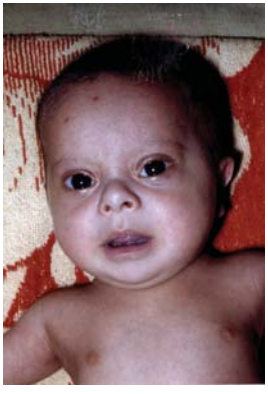


Fig. 1: *Down's syndrome* Note the characteristic facial and dysmorphic features–flat face, epicanthal folds and microcephaly with cheerful look and short neck. Flat nasal buldge and epicanthal fold give the impression of widely-placed eyes ("pseudohypertelorism"). In true hypertelorism, the inter-pupillary distance between the eyes is actually increased due to overgrowth of the lesser wing and hypoplasia of greater wing of sphenoid.

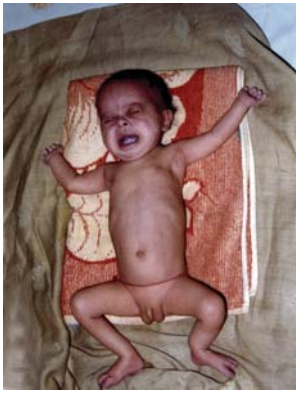


Fig. 2: *Down's syndrome* Note over and above the facial features, hypotonia.

Fig. 3: *Down's syndrome* Note the single palmar (simian) crease.

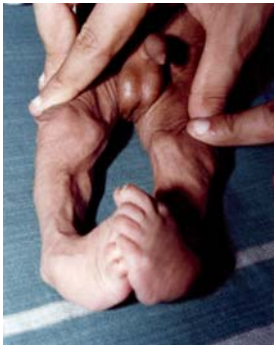
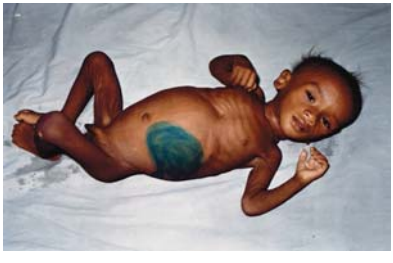
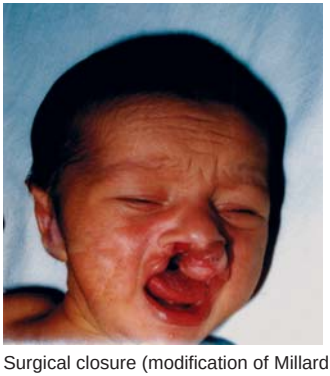
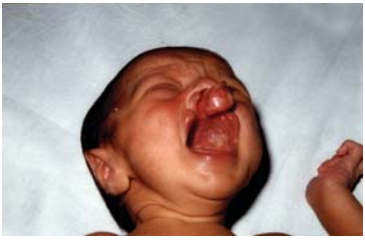


Fig. 4: *Congenital talipes equinovarus (CTEV)* Note additional features of arthrogryposis.

Fig. 5: *Wilms' tumor (nephroblastoma)* Note the large mass (not crossing the midline) in the child brought for increasing abdominal distention, failure to thrive (FTT) and hematuria. X-ray and imaging studies confirmed the diagnosis. Differential diagnosis includes neuroblastoma, non-Hodgkin's lymphoma, hepatoblastoma, hepatoma, etc.







Figs 6 and 7: *Cleft lips* Note the complete separation (bilateral) involving skin, muscle, mucosa and alveolar border. Associated cleft palate should carefully be excluded. Surgical closure (modification of Millard rotation-advancement technique) should be done by 3 months when a reasonable weight gain has occurred and the infant is infection-free.

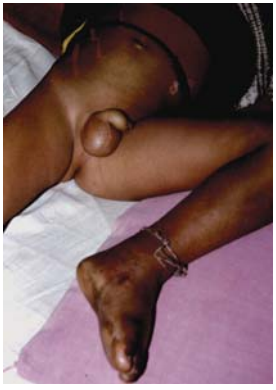
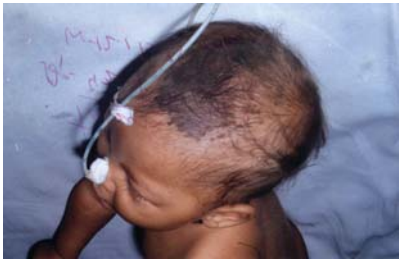


Fig. 8: *Snakebite* Note the inflammation all around and spreading to the leg.

Fig. 9: *Infantile seborrheic dermatitis (cradle cap)* Note the scaling and crusting of the scalp. The greasy erythematous papular lesions involving the face, neck, retroauricular areas, axillae and diaper area, which were initially mild, become quite pronounced–virtually resembling psoriasis. Differential diagnosis includes, besides psoriasis latopic dermatosis, candidiasis and dermatophytosis.



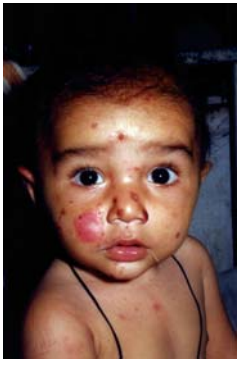


Fig. 10: *Atopic dermatitis (eczema)* Note the characteristic highly pruritic erythematous papules over face of the 8-month-old infant. Supportive features for this diagnosis include chronic remitting behaviour of the eczema with positive family history of atopy, say asthma, immediate skin test reactivity, hay fever, or high IgE. Differential diagnosis includes inflammatory skin diseases, infectious diseases, infestations, genetic disorders, immunodeficiency and skin malignancy.

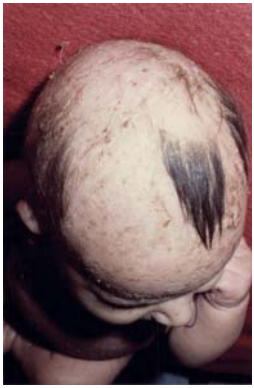


Fig. 11: *Atopic dermatitis (partially treated)* In addition to the erythematous papules over the scalp and face, intense pruritus was a dominant feature. Both parents and an elder sibling were asthmatic. It may coexist with infantile seborrhea.

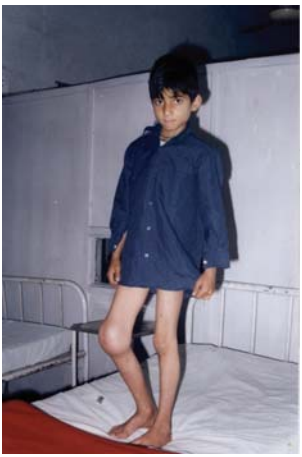


Fig. 12: *Hemophiliac arthorpathy* Note the chronic arthropathy involving the right knee joint, following cyclic recurrent bleeds.

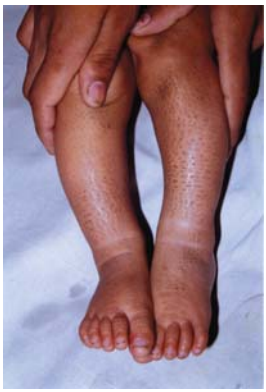


Fig. 13: *Ichthyosis vulgaris* Note the roughening and scaling over extensor aspects of legs in an 8-month-old. The flexureal surfaces were unaffected. Involvement of upper limbs and palms and soles was mild whereas face, neck and abdomen were spared. The lesion showed worsening in winter and improvement in summer. This is the most common amongst the hereditary causes of keratinization.

Fig. 14: *Salmonella (enteric) encephalopathy in a 9-year-old with sickle cell disease.* Complications such as encephalopathy, meningitis, fecal brown abscess, osteomyelitis, etc are more common in subjects with immunocompromised sites (HIV, leukemias, chronic granulomatous disease), sickle-cell disease, chronic malaria and schistosoma mansoni infection.

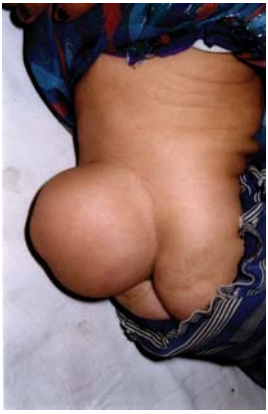


Fig. 15: *Sacral lipoma* Classically the swelling is soft, compressible, lobulated and subcutaneous. It is important to exclude occult spinal dysr -aphism (say, involvement of the conus) by MRI studies.

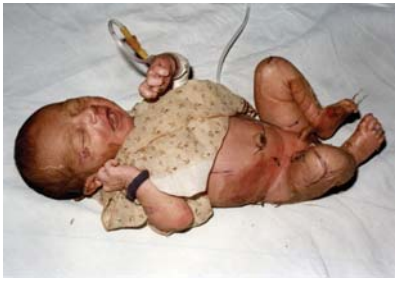


Fig. 16: *Ritter's disease* Note the conjunctivitis, circumoral lesions and areas of epidermis showing separation in response to gentle pressure (Nikolsky sign). An extensive sheet of epidermis may peel off, leaving behind raw and glistening areas. Risk of super added sepsis and fluid and electrolyte balance is considerable.

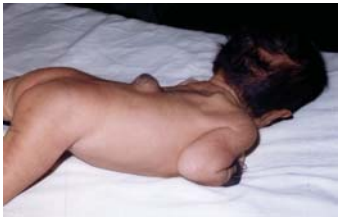
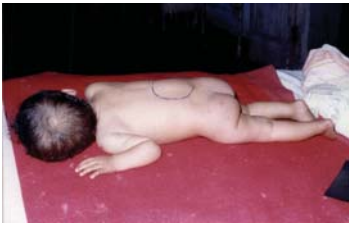


Fig. 17: *Dorsal meningocele* Note the well covered midline mass. Transillumination was positive, indicating lack of any neurologic tissues. The child was asymptomatic. Investigative workup, including MRI, showed neither any neural tissue involvement nor associated anomalies like teethered spinal cord, lipoma or diastematomyelia.

Fig. 18: *Lumbodorsal abscess* Note that the swelling is towards the right of the spine rather than midline. This was a part of the multiple pyemic abscesses.



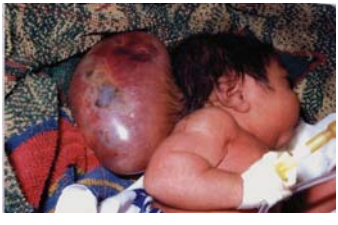
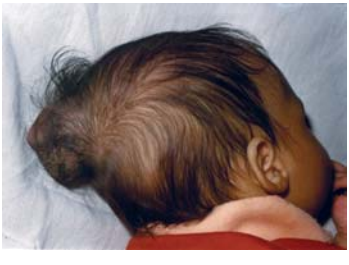


Fig. 19: *Cranial (occipital) encephalocele* Note the very large sac covered with skin (denuded at places) and containing neural tissue. The infant also had cleft lip and cleft palate., microcephally microphthalmia, ambiguous genitalia and polydactyly (Meckel-Gruber syndrome).

Fig. 20: *Cranial (occipital) meningocele* The transillumination of the sac showed that it was a sheer CSF filled sac protruding through a midline defect in the skull.



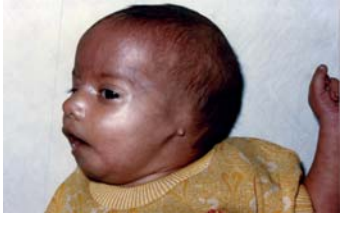


Fig. 21: *Anotia* Note almost complete absence of the pinna and ear canal together with facial paralysis and micrognathia. The infant also had ventricular septal defect (VSD).

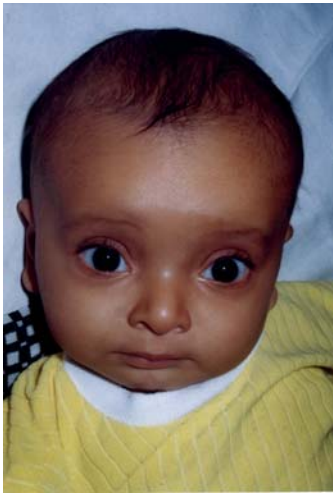


Fig. 22: *Hypertelorism* Note the wide separation of the eyes secondary to increased interorbital (to be exact interpupillary) distance. The depressed bridge of nose is also apparent. It may occur as a morphogenic variant or a secondary phenomenon in association with developmental anomalies.

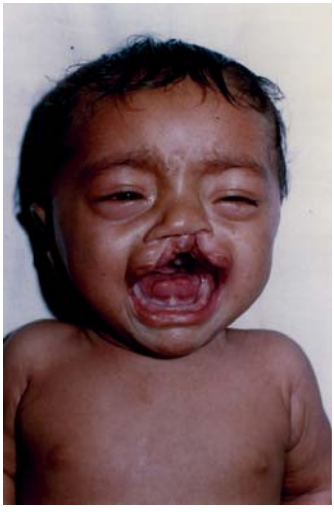


Fig. 23: *Cleft lip and palate* Note complete separation of lip involving all layers, including alveolar ridge (bilateral) plus defect involing the midline of the soft palate and extending into the hard palate. Surgical closure is recommended by 12 months of age to ensure normal speech development. Besides speech defects, sequelae may include recurrent otitis media and hearing loss.

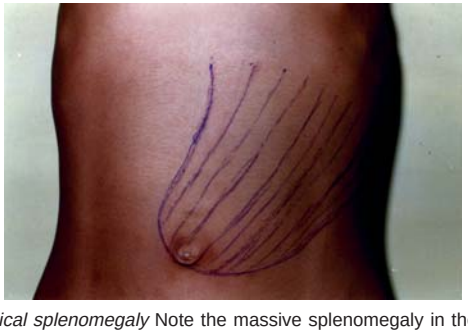


Fig. 24: *Tropical splenomegaly* Note the massive splenomegaly in the 10-year-old with moderate anemia and growth retardation. The boy came from a hyperendemic area for malaria.

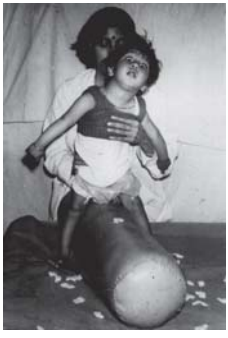


Fig. 25: *Spastic cerebral palsy* Note the spasticity of all the four limbs (quadriplegia) in the child with speech, visual and feeding difficulties, delayed milestones, mental retardation and seizures.

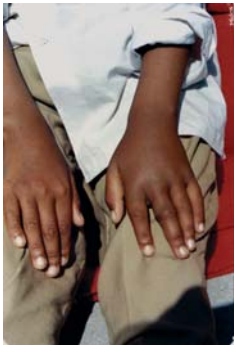


Fig. 26: *Juvenile polyarticular rheumatoid arthritis (JRA)* Note the symmetrical inflammatory swellings of metacarpophalangeal joints, proximal inter-phalangeal joints and distal interphalangeal joints together with involvements of wrists. In pauciarticular JRA, permanent involvement is of knee and ankle (lower limbs). Large joints of the upper limbs are usually spared.

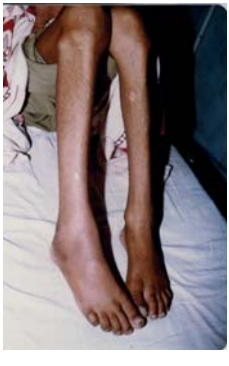


Fig. 27: *Pauciarticular juvenile rheumatoid arthritis* Note the involvement of the right knee and ankle. Large joints of the upper limb remain unaffected.

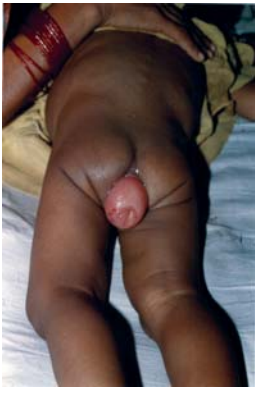


Fig. 28: *Rectal prolapse* Note the exteriorization of mucosa and other layers of the rectal wall through the anus. Predisposing conditions include PEM, heavy interstinal parasitosis, whooping cough, cystic fibrosis, chronic constipation, chronic diarrhea, meningocele and Ehler-Danlos syndrome. Occasionally, true rectal prolapse may need differentiation from polyps or intussusception.

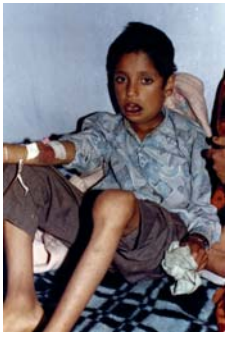


Fig. 29: *Hemophilia* Note swelling of the knee and ankle as a result of bleeding into joints, the so-called "hemarthrosis" which is considered the hallmark of the disease. Also, note bleeding from oral mucosa. Also had pain in the groin and difficulty to extend the hip. These were ascribed to probable bleeding into the ileopsoas muscle. Ultrasonography confirmed this impression. Laboratory diagnosis of hemophilia was established by APTT and Factor VIII.

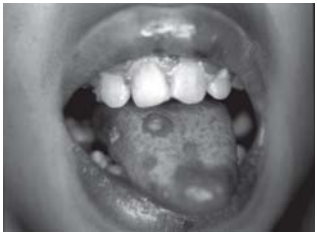


Fig. 30: *Aphthous stomatitis/ulcers* Note the distinct, well circumscribed ulcerative lesions having a white necrotic base surrounded by red halos. Such infections as *H.pylori,* herpes simplex virus and measles may have a causative role. Healing occurs in 10-14 days, leaving no scarring, treatment is purely palliative and mainly in the form of local analgesic anesthetic agent.

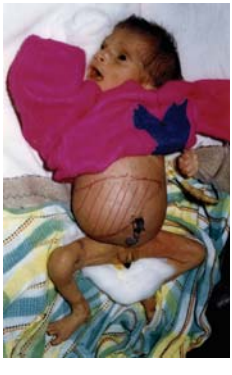


Fig. 31: *α-1-antitrypsin deficiency* Note the icterum with massive hepatomegaly. Stools were acholic. The infant eventually died of cirrhosis at 6 months of age. Diagnosis stool established by determination of an alfa-1antitrypsin (Pi) phenotype and liver biopsy. The sole curative treatment is liver transplantation.

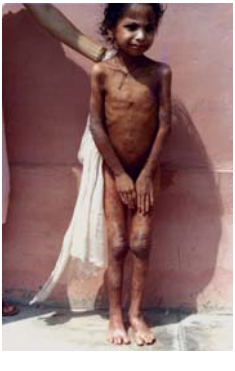


Fig. 32: *Psoriasis* Note the erythematous papules that, at places, coalesce to form plaques with irregular sharp borders. The valuable diagnostic signs of psoriasis are

- Pitting of nail plate
- Auspitz sign: removal of yellowish-white scale causing pinpoint bleeding
- Koebner/isomorphic response: Appearance of new lesions at sites of trauma.

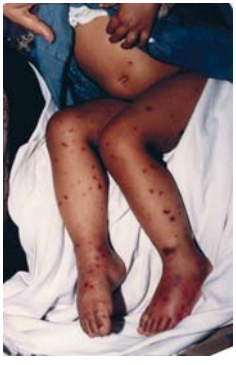


Fig. 33: *Scabies* Note the eczematous dermatitis, papules and nodules. In infants, involvement of palms and soles, face and scalp is more common than that of interdigital spaces.The classical thread-like burrows may not be seen in infants.

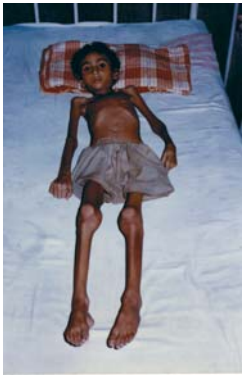


Fig. 34: *Celiac disease* Note the severe malnutrition (Wt. 15kg., height 120 cm midarm circumference 13 cm) with remarkable wasting of muscles and subcutaneous fat in the 10-year-old girl. A known case of chronic diarrhea since late infancy the diagnosis of celiac disease was confirmed on investigations (stool fat:25 g/24 hours, D-xylose absorption: grossly impaired, jejunal biopsy: subtotal villous atrophy) and response to gluten-free diet (GFD) and gluten challenge.

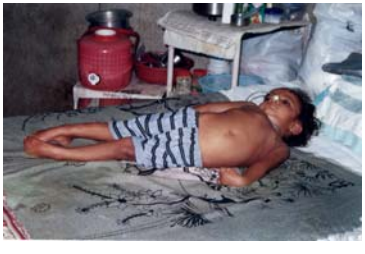


Fig. 35: *Tuberculous meningitis (TBM)* Note the features of third stage. Including coma and motor (neurologic) deficit.

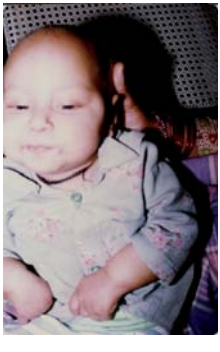


Fig. 36: *Microcephaly with mental retardation* The head circumference of this 5-month-old baby was 38 cm. Note the stunted forehead. History was suggestive of hypoxic encephalopathy as the cause of microcephaly and mental retardation.

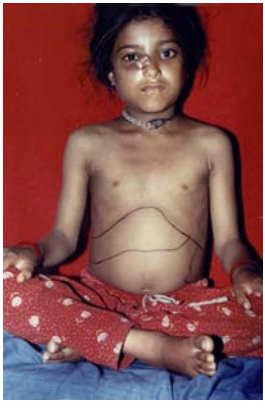


Fig. 37: *Systemic lupus erythematosis (SLE)* Note the hepatosplenomegaly, butterfly rash over bridge of nose and cheeks (with superadded infection on right side) in this 12-year-old girl who presented with prolonged, irregular fever with remissions, weight loss and joints pains of 3 months duration. Diagnosis of SLE was established by LE preparation and ANA.

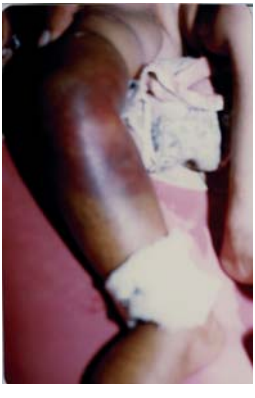


Fig. 38: *Thrombophlebitis* The cause was infected intravenous needle.

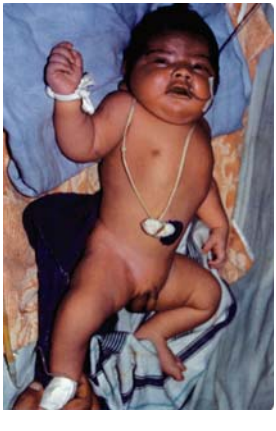


Fig. 39: *Overgrown (large-for-dates) baby* The infant, weighing 4.6 kg, was born to a tall and heavy mother with diabetes. Overgrowth of the fetus appears to be secondary to islet-cell hyperplasia and increase in the growth hormone-like substance (human placental lactogen). Differential diagnosis includes constitutional overgrowth, cerebral gigantism (Sotos syndrome), TGVs, hydrops fetalis, congenital hypothyroidism and overgrowth with advanced bone age (congenital adrenal hyperplasia, thyrotoxicosis, maternal intake of progestins).

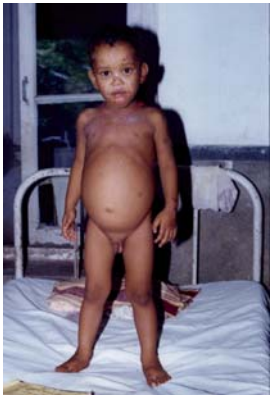


Fig. 40: *Abdominal distention secondary to massive ascariasis* Note growth failure and rickets in this 3-year-old boy despite voracious appetite. He was hospitalized for acute on recurrent abdominal pain of over a year's duration.

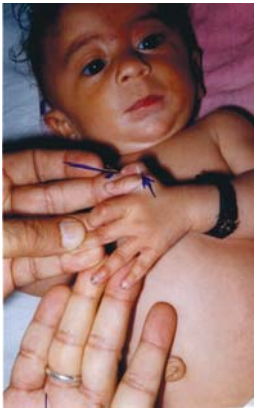


Fig. 41: *Polydactyly* Note the extra finger lateral to thumb. Though frequently a familial trait, it may be associated with several syndromes e.g. Laurence Moon-Biedl, trisomy 13, Carpenter, Ellis-van Crevald, Rubinstein-Taybi, Meckel-Gruber, Polysyndactyly, orofaciodigital, etc.

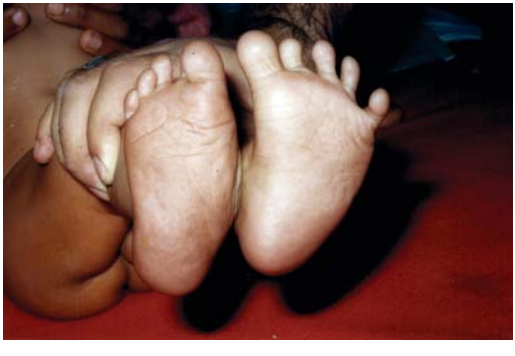


Fig. 42: *Flexible flat feet* A common finding in neonates and toddlers due to the laxity of bone ligament complexes of foot and fat in the region of medical longitudinal arch. By 6 years, most children demonstrate considerable improvement. Conditions causing rigid flat feet include cerebral palsy, tarsal coalitions, tendo-Achilles contracture. It may well be a familial trait.

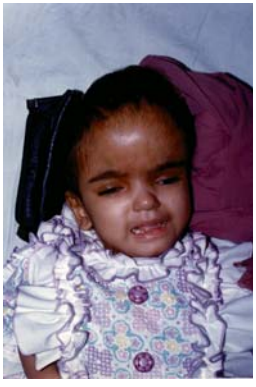


Fig. 43: *Craniosynostosis* Note the left sided frontal plagiocephaly due to premature fusion of the ipsilateral coronal suture together with the spheno-frontal suture. Surgical intervention is important from cosmetic angle.

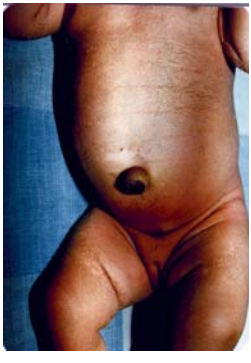


Fig. 44: *Umbilical granuloma* Note the persistence of granulation tissue which is soft, vascular, granular and dual red or pink with mucoid, mucopurulent or seropurulent discharge. Differential diagnosis is umbilical polyp which is bright red, firm and resistant.

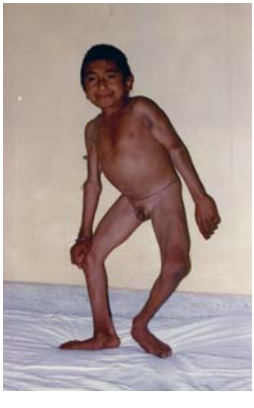


Fig. 45: *Pseudohypoparathyroidism* Note the short stature with round face, mental retardation and brachydactyly. The child suffered form recurrent attacks of tetany. The condition is also termed Albright hereditary osteodystrophy.

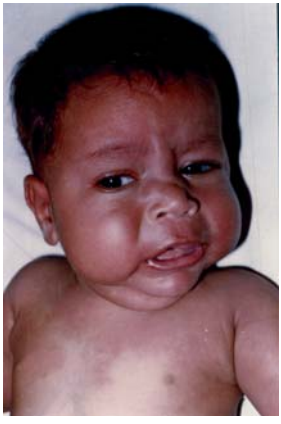


Fig. 46: *Glycogen storage disease (Von Gierke disease)* Note the doll-like faces with prominent fat cheeks. The infant also had protuberant abdomen with massive hepatomegaly and palpable kidneys. Hypoglycemia, lactic acidosis, hyperlipemia and hyperuricemia are the hallmarks of the disease which is caused by the absence or deficiency of G-6-P activity in the liver, kidneys and gut mucosa.

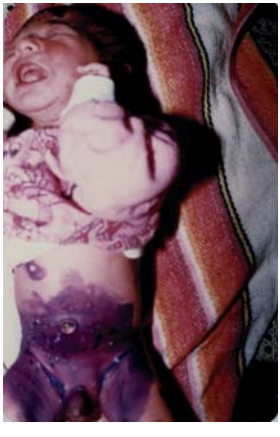


Fig. 47: *Neonatal septicemia* Note the pustules, septic umbilicus (omphalitis) and abdominal wall cellulitis.

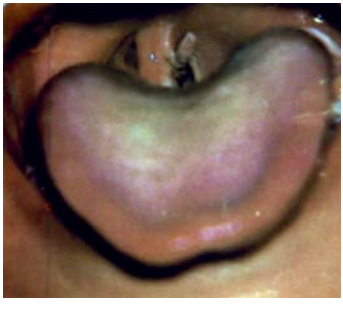


Fig. 48: *Tonsillar diphtheria* Note the grayish membrane formation over tonsils with extension to involve the uvula, soft palate, posterior oropharynx and hypopharynx. Underlying soft tissue edema together with lymphadenopathy may cause "bull-neck" appearance.

Fig. 49: *Vitiligo* Note the complete depigmented patches (more or less symmetrical) due to absence of melanocytes and melanin in the epidermis. On the contrary, in case of tinea versicolor and pityriasis, depigmentation is only partial.

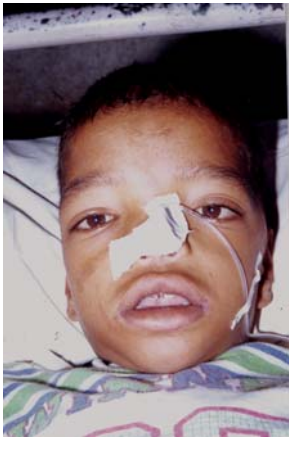


Fig. 50: *Cerebral gigantism (Sotos syndrome)* Note the large head (circumference 56 cm), hypertelorism, antimongoloid slant, prominent jaw in this 5-year-old boy who had large hands and feet and somewhat thickened subcutaneous tissue. His accelerated growth was reflected in his height (123 cm) and weight (25 kg). Thus the height and weight age was 8 years.

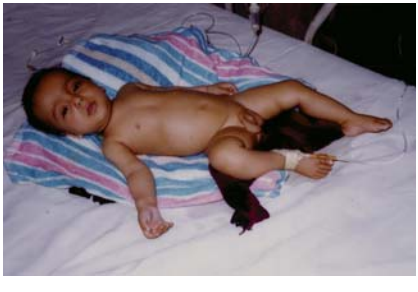


Fig. 51: *Poliomyelitis* Note the patchy and asymmetrical paralysis of extremities (of lower motor neuron type) with no sensory loss. Differential diagnosis includes Guillain-Barre syndrome (GBS) and other entities under the shield of acute flaccid paralysis (AFP).

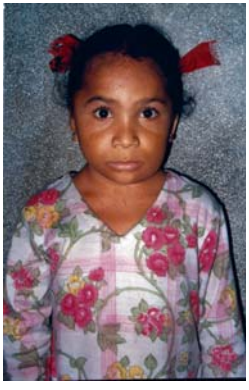


Fig. 52: *Goitrogenous hypothyroidism in a 12-year-old girl secondary to endemic iodine deficiency* Iodine deficiency causes deficient thyroid hormone production, TSH hypersecretion, increased iodine trapping with goiter and high T3:T4 ratio.

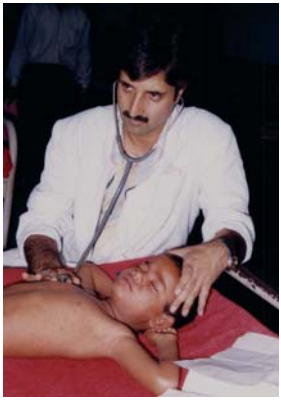


Fig. 53: *Measles encephalitis* Note the fading rash and progressive drowsiness. The child presented with recurrence of fever (after a 5 days afebrile period since appearance of rash), severe cough, severe headache, vomiting and worsening sensorium. There was doubtful history of atypical febrile seizures (thrice over the preceding 12 hours). Usually, recovery occurs but chances of permanent cerebral damage are high in measles encephalitis or post-measles encephalomyelitis.

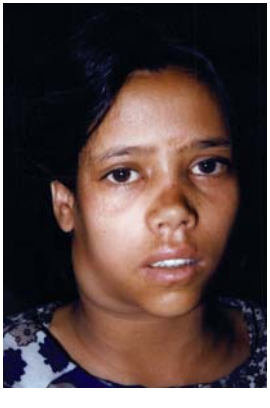


Fig. 54: *Hodgkin's lymphoma* Note the characteristic unilateral cervical lymphadenopathy, the involved lymph nodes being matted, firm, nontender and mobile. Over and above cervical lymphadenopathy, the presenting complaints were fever, anorexia, pruritus, weight loss and night sweats. The diagnosis of Hodgkin's lymphoma was confirmed by histopathologic study of the biopsy material from the involved nodes.

Figs 55 and 56: *Acute or chronic malnutrition* Note the wasting of muscles and subcutaneous adiposity in this 10-year-old boy whose height was 120 cm and weight 26 kg. He, therefore, had not only stunting (as a result of chronic malnutrition) but also superadded wasting (as a result of a recent attack of enteric fever which further cut down his dietary intake).

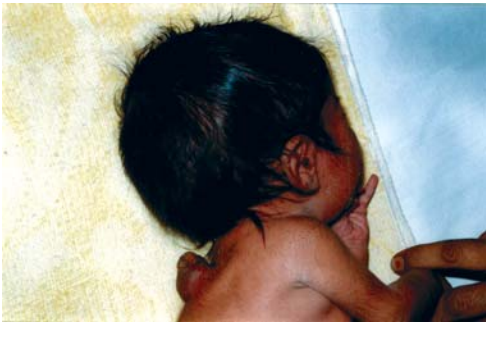


Fig. 57: *Congenital hydrocephalus with meningocele* Note the large head (circumference 43 cm) with a cystic mass at the upper back (cervical). The mass is covered with thick skin and does not contain the myelodysplasia or spinal cord. As a rule, there is no neurologic deficit (unlike meningomyelocele).

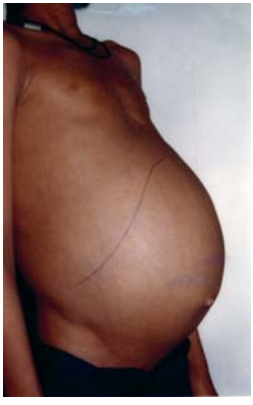
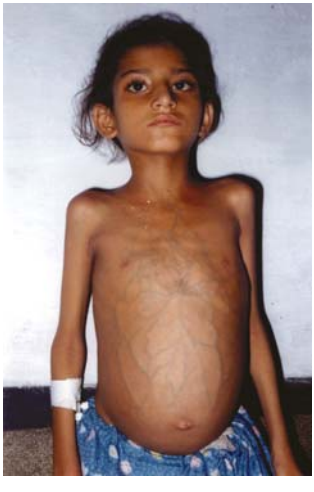
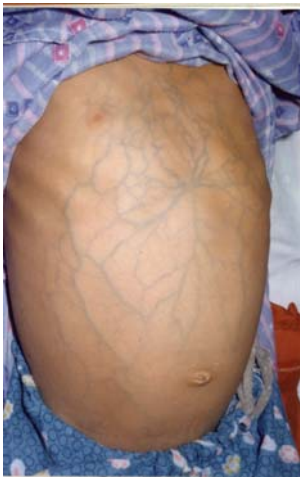


Fig. 58: *Massive tense ascites* Note the massive abdominal distention with hepatomegaly, engorged superficial abdominal wall veins and positive fluid thrill in a known care of hepatitis B. Serum-ascites abourning gradient (SAAG) was high (71.1g/dL). Liver biopsy confirmed clinical diagnosis of cirrhosis.





Figs 59 and 60: *Extrahepatic portal hypertension* Note the tortuous veins over anterior abdominal wall and splenomegaly in the girl who presented with recurrent bouts of hematemesis endoscopy showed both esophageal and gastric varices. Portal pressure turned out to be 16 mm Hg (normal 7mm; upper limit 10-12 mm Hg).

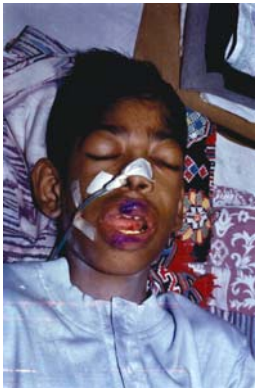
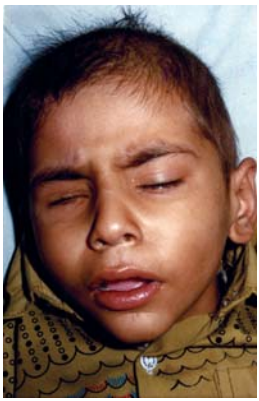


Fig. 61: *Peutz-Jeghers syndrome* Note the characteristic mucosal pigmentation of the lips. The boy, with history of recurrent abdominal pain and blood in stools over several years, was hospitalized for intestinal obstruction. Investigations revealed multiple polyps (pathologically hamartomas). This is a rare autosomal dominant syndrome. Vulnerability to cancer (colorectal, breast, gynecological) is as high as upto 50%.

Fig. 62: *Toxic alopecia* Note the acute loss of hair in a diffuse pattern during the initial treatment with cancer chemotherapy. Also termed "anagen effluvium", it is a temporary condition. Hair regrowth occurs after the offending therapy is discontinued. The causes include, besides cancer chemotherapy (alkylating agents, antimetabolites, mitotic inhibitors), hypervitaminosis A, heparin, coumarins, boric acid, thallium and thiouracil. Other causes of acquired diffuse alopecia include sudden severe weight loss, a febrile illness, psychiatric stress, surgery, acute blood loss/donation, discontinuation of high dose steroid therapy.



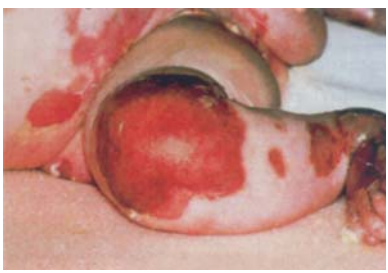


Fig. 63: *Epidermolysis bullosa simplex* Note the extensive hemorrhagic blisters with erosions (which are vulnerable to superadded infection) in a neonate.

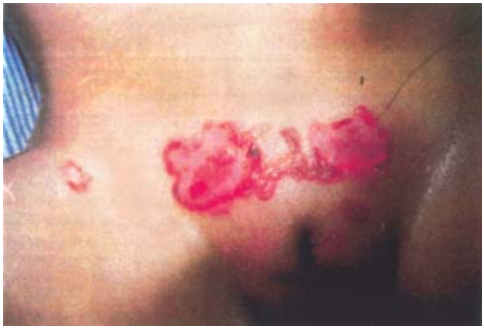


Fig. 64: *Chronic bullous dermatosis* Note the cluster of jewels with new bullae over older lesions.

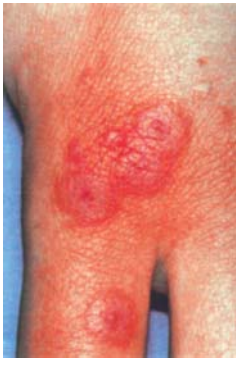


Fig. 65: *Erythema multiforme* Note the typical target lesions over the knuckles (series of concentric circles). Etiologic factors include viruses, bacteria, fungi, vaccination and drugs (especially sulfas, penicillins, and anticonvulsants).

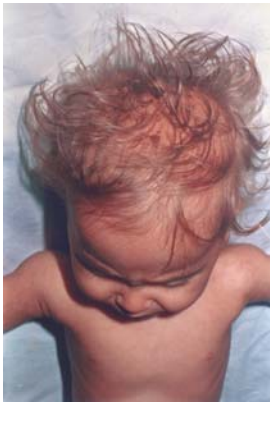


Fig. 66: *Sparse, light-colored hair* Differential diagnosis includes kwashiorkor, infantile tremor syndrome (ITS), acrodermatitis enteropathica, zinc deficiency and acrodynia.

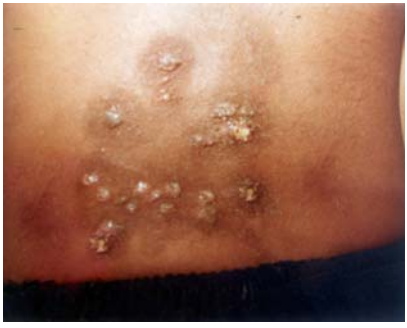


Fig. 67: *Herpes zoster* Note the vesicular lesions clustering within a dermatome. Unlike the disease in adults, neurologic manifestations (pain, hyperesthesia) are minimal and full recovery usually occurs. In immunocompromised children, however, severe disease may occur. Varicella in the mother in third trimester or in the child in the first year is particularly a risk factor for HZ.

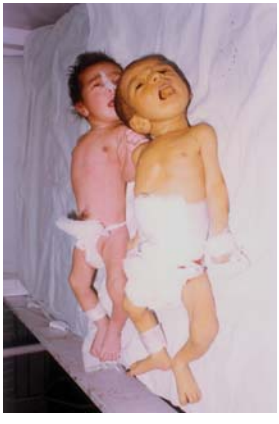


Fig. 68: *Rh isoimmunization* Note the severe icterus (in the neonate on right) which appeared in the first 24 hours and showed rapid progression to 22 mg/dL.

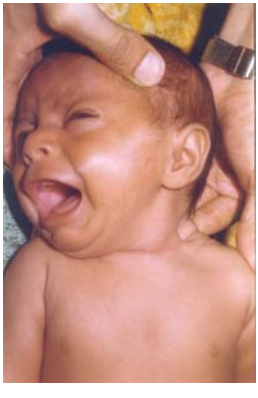


Fig. 69: *Sternomastoid tumor* Note the hard, immobile, fusi- form and well-defined mass in the middle of the sternomastoid muscle. Cause: Birth trauma from diffcult breech delivery.

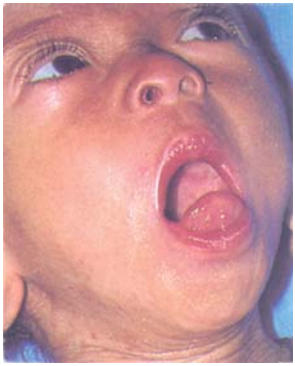


Fig. 70: *Pertussis (paroxysmal stage)* Note the hallmark of the stage, lasting 2-6 weeks after the catarrhal stage (1-2 weeks). As the child struggles to cough, his face gets congested, tongue protrudes, eyes bulge and chin and neck are held forward. After a machine-gun burst of uninterrupted coughs, coughing stops. At this point, a loud "whoop" results as the inspired air passes the still partially-closed airway. The child usually vomits after the whoop. Invariably, he becomes exhausted. More than one such attack per hour may occur at the peak of the paroxysmal stage.

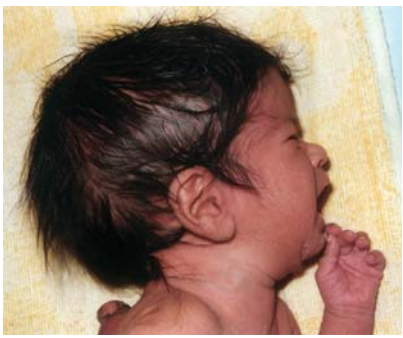


Fig. 71: *Congenital hydrocephalus with meningomyelocele* The infant also had congenital talipes equinovarus (CTEV).

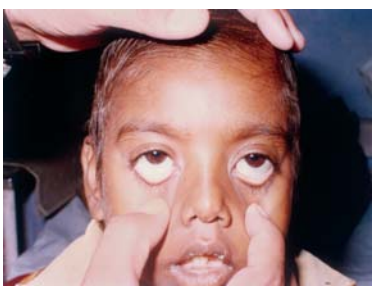
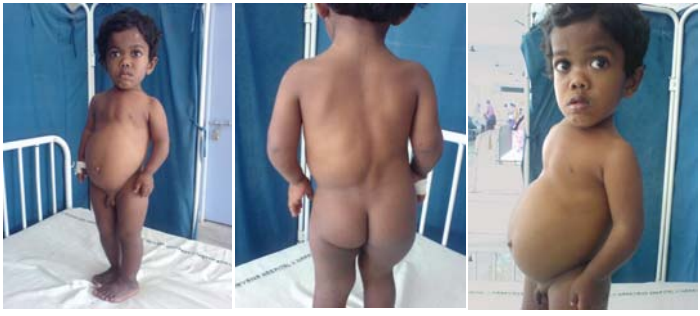
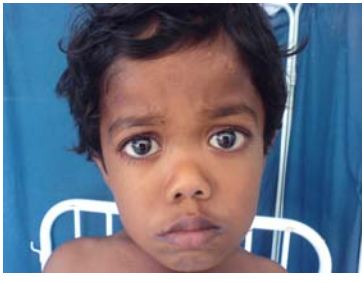


Fig. 72: *Chronic iron deficiency anemia (IDA)* Note the severe pallor of palpebral conjunctiva and skin. The child presented with progressive pallor, easy fatigability, anorexia and pica with recurrent abdominal pain. Stool was positive for occult blood. Stool microscopy showed *A. duodenale.*





Figs 73 to 76: *Anchondroplasia* Note the disproportionate short stature of short-limbed variety (Fig. 73: arms barely reaching the inguinal level; U/L segment ration 1.6:1), small chest compared to a large protuberant abdomen, exaggerated lumbar lordosis (Figs 73-75) and large head with prominent forehead and flat nasal bridge (Fig. 76). Hypochondroplasia is a milder form resulting from different mutations in figure 75 gene. Major differential diagnosis includes pituitary dwarfism, congenital hypothyroidism and Turner's syndrome.

Fig. 77: *Periorbital cellulitis* Note the periorbital inflammation with involvement of the lids and nose as a result of direct extension of the paranasal sinusitis. It may progress to true orbital cellulitis with proptosis and limitation of eye movements.

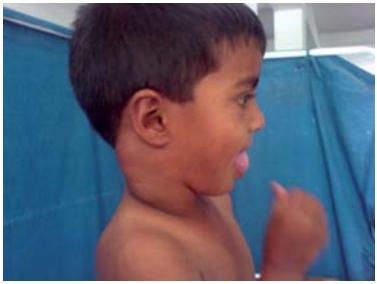
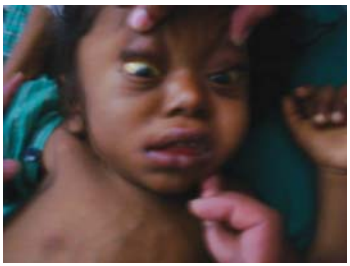
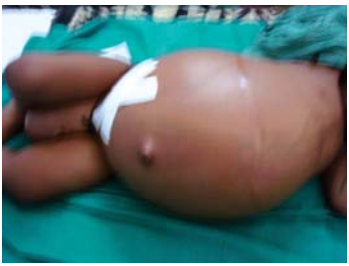
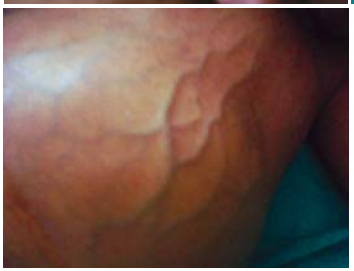


Fig. 78: *Tumor-bearing cervical lymphadenitis* The nodes are firm or matted and nontender and often fixed to the skin or underlying structures.

Fig. 79: *Tuberculous cervical lymphadenopathy* The nodes are typically matted. Note the hydrocephalus in this child recovering from tuberculous meningitis.







Figs 80 to 82: *Extrahepatic biliary atresia ending up as cirrhosis.* Note the icterus (Fig. 80), ascites recently undergone tapping (Figs 81, 82), and engorged superficial abdominal venous network. Surgical intervention well in time when the infant had presented with cholestatic jaundice in first few weeks of life could prevent progression to cirrhosis.

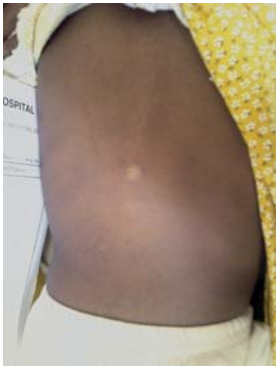
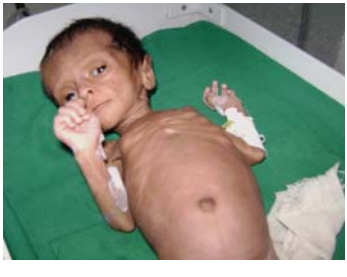
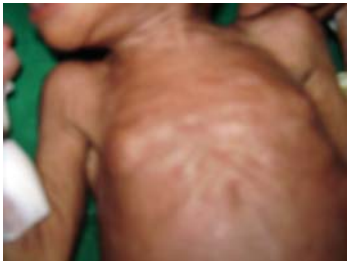


Fig. 83: *Tuberous sclerosis* Note the shagreen patch and hypopigmented spot. The child also had pink telangiectatic papules (adenoma sebaceum) in nasolabial folds. She was on carbamazepine for epilepsy. CT and MRI revealed a few tubers in cortex and subcortex.

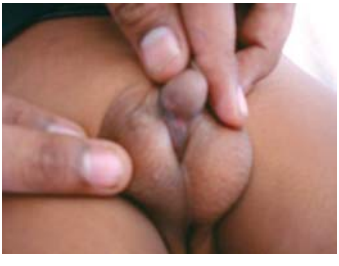
Fig. 84: *Familial ptosis* Note the presence of ptosis in the sister and the mother of the child as well.





Figs 85 and 86: *Bottle-baby disease* Note the remarkable wasting in this infant on bottle feeding employing highly diluted, contaminated and dirty formula.

Fig. 87: *Acquired hydrocephalus* Note the large head (52 cm) in this 3-year-old child convalescing from tuberculous meningitis.



Figs 88 and 89: *Hypospadias* Note the urethral opening at the ventral surface of the penis.

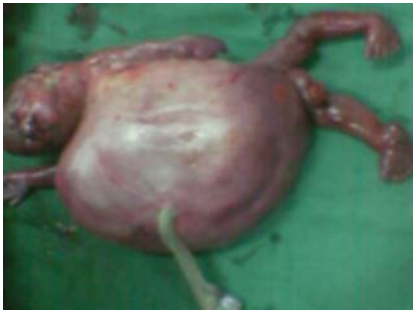
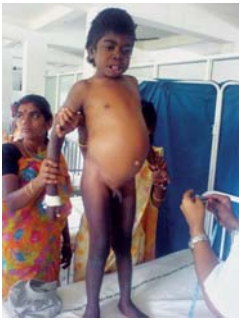
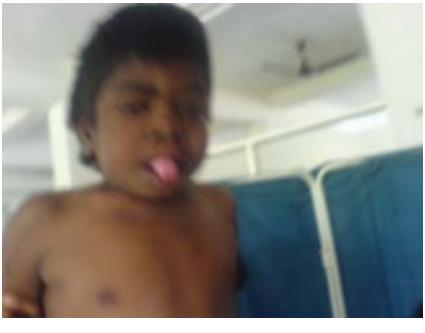


Fig. 90: *Hydrops fetalis* Note the clinical picture of excessive abnormal fluid in different fetal compartment such as skin, pleura, pericardium and peritoneum, causing death in utero or soon after birth.

Fig. 91: *Congenital inguinal hernia* Note the obvious bilateral inguinal swelling which showed impulse on crying.

Fig. 92: *Floppy infant* Note the head lag. It may well be physiological in a premature infant and an incidental nonspecific finding in an acutely sick infant. Differential diagnosis includes neuromuscular (hereditary spinal muscular atrophy, congenital myopathies, metabolic diseases, GBS, neonatal myasthenia), CNS (cerebral palsy), endocrinal (hypothyroidism), metabolic (rickets, renal tubular acidosis), nutritional (PEM) and chromosomal (Down's syndrome) disorders. Benign congenital hypotonia should also be borne in mind.





Figs 93 and 94: *Hurler's disease* Note mental retardation and grotesque facial features with hepatosplenomegaly (not highlighted in the photos).

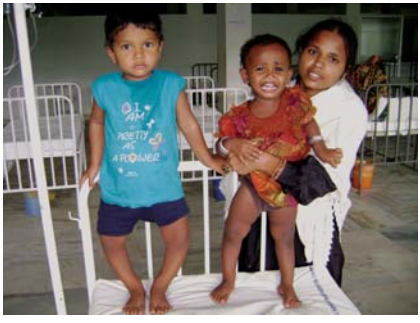


Fig. 95: *Vitamin D deficiency rickets* Note that both children are suffering from bow-leg deformity (genu varus) as a result of nutritional rickets. The poor nutritional environment in the family is known to affect the siblings with similar nutritional disorders.

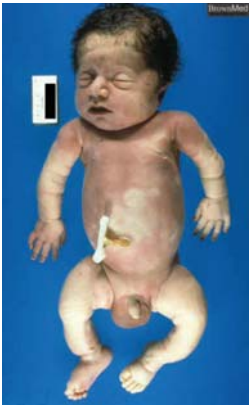


Fig. 96: *Congenital osteogenesis imperfecta (OI type II)* Note multiple deformities secondary to intrauterine fractures, hypotelorism with beaking of the nose, extremely short, deformed and bent limbs, broad thighs. X-ray studies reveal crumpled long bones and fractured and beaded ribs. The neonatal form is a lethal syndrome, incompatible with life. Around 50% are stillborn. The remaining 50% die soon after birth from respiratory insufficiency.

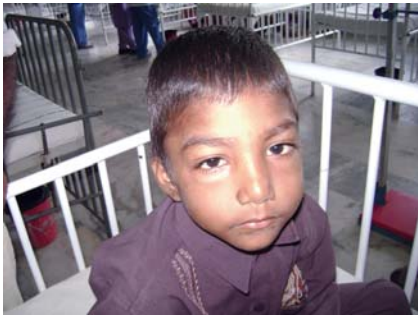


Fig. 97: *Acute nephritis* The child presented with periorbital puffiness, fever and hematuria with hypertension.

Fig. 98: *Subconjunctival hemorrhage* Note the bright hemorrhage in bulbar conjunctiva. The causes include violent coughing (pertussis), violent sneezing, bleeding diathesis (scurvy, ITP, leukemia) or inflammation (conjunctivitis).

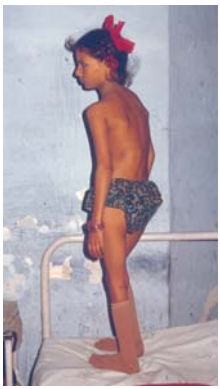


Fig. 99: *Pott's spine* Note the kyphosis as a consequence of tuberculous spondylitis causing destruction of vertebral bodies.

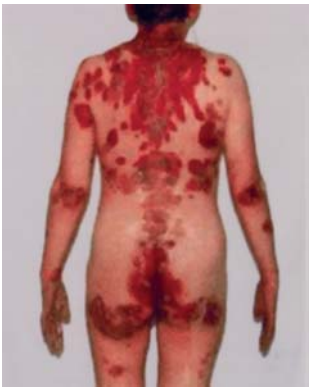
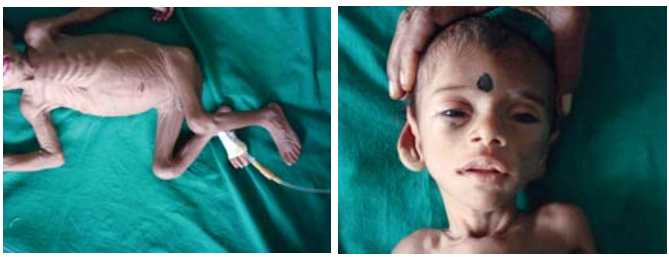


Fig. 100: *Pemphigus* Note the widespread skin lesions. The teenager had concurrent erosive gastritis too.



Figs 101 and 102: *Nutritional marasmus* Note the remarkable wasting of both muscle and subcutaneous fat with absence of edema.

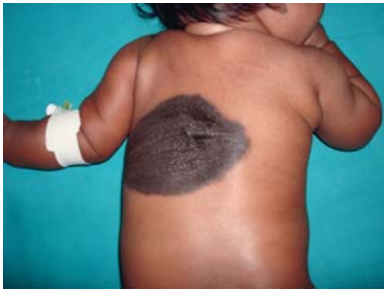
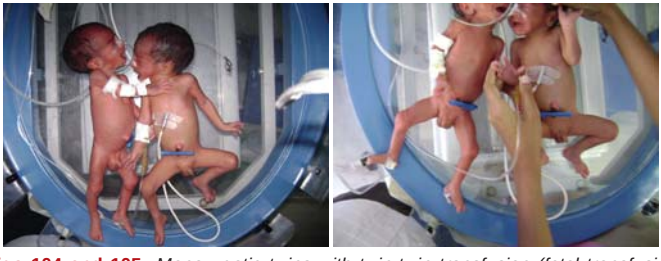
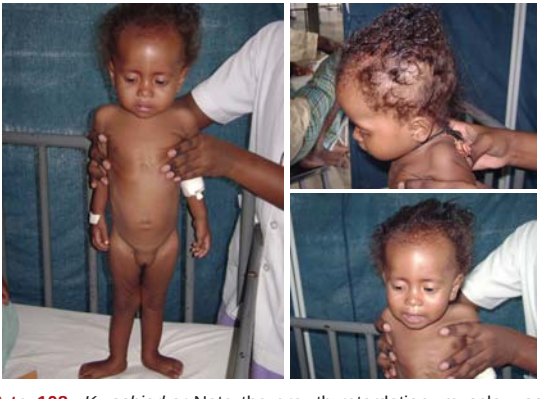


Fig. 103: *Congenital cutaneous nevus* Note its intermediate size (>2 cm and <20 cm or <5% of body surface) over the upper back of trunk. Differential diagnosis is from mongolian spots and café-au-lait spots.



Figs 104 and 105: *Monozygotic twins with twin-twin transfusion (fetal transfusion syndrome)*. There was history of maternal hydramnios. Over and above treatment for asphyxia. Whereas the recipient twin needed an exchange blood transfusion, the donor twin was given an immediate blood transfusion for severe anemia.



Figs 106 to 108: *Kwashiorkor* Note the growth retardation, muscle wasting with retention of some subcutaneous adiposity, psychomotor change and bilateral pedal edema. Hair changes, though not an essential feature of kwashiorkor, are seen.

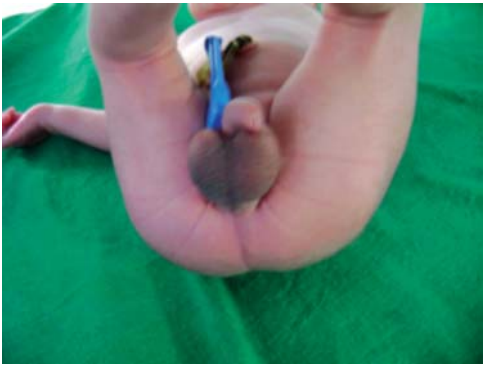
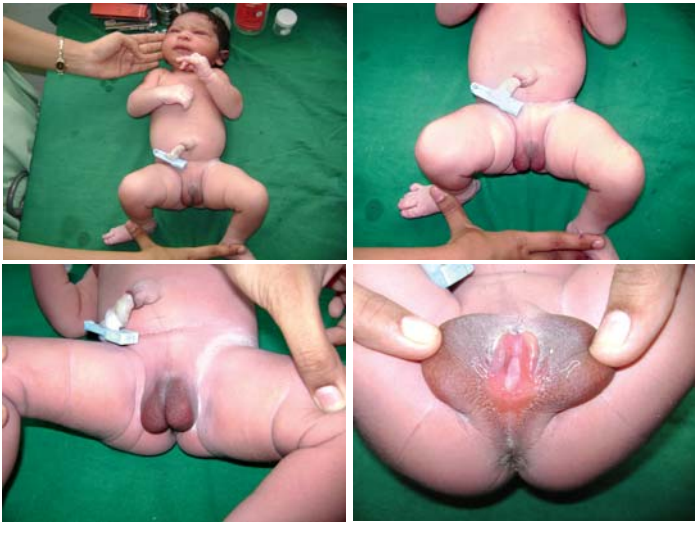


Fig. 109: *Imperforate anus* An invertogram (with infant held upside down, suspended by legs) is needed for finding the level of the anorectal defect.



Figs 110 to 113: *Ambiguous genitalia* Note the phenotype female. In case of suspicion of testicular feminization, it is important to screen the child with a buccal smear for Barr bodies and appropriate genetic evaluation.

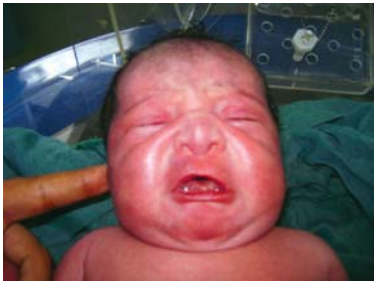


Fig. 114: *Natal teeth* Note that the teeth are present right at birth unlike the neonatal teeth that erupt in the first month of life. These may exist as an isolated finding (often as a familial trait) or in association with cleft palate, Pierre Robin syndrome, Ellis-van Crevald syndrome, Hallermann-Stroff syndrome, congenital paronychia and other congenital anomalies. These may be harmless but are prone to cause pain, refusal to feed, maternal discomfort, and, very infrequently, entry into the airways.

Fig. 115: *Infant of diabetic mother* This baby was born to a mother with poorly-controlled diabetes. Note the large-sized plum baby with puffy and plethoric facies despite birth at 38 week of gestation. Such an infant has an enhanced chances of congential anomalies (including congenital heart disease e.g. VSD, ASD, TGV, TA, COA, etc), respiratory distress syndrome and hypoglycemia.

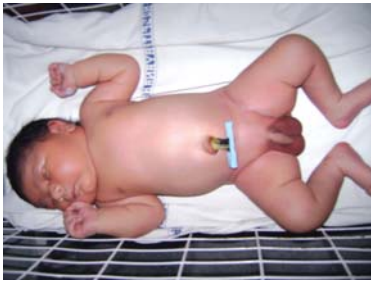


Fig. 116: *Intrauterine growth retardation (IUGR)* Note the baby looks marasmic, long and thin with skin losing its normal elasticity and hanging in folds (malnourished type). Differential diagnosis is from hypoplastic infant who is proportionally small in all parameters due to reduction in cell population.

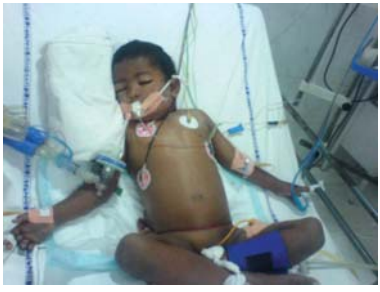
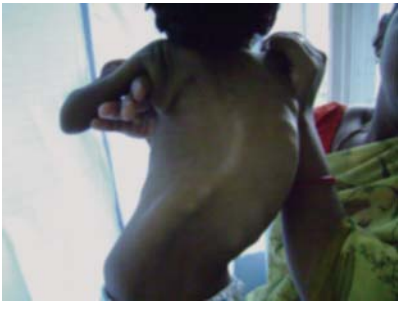


Fig. 117: *Transposition of great arteries (TGAs) with congestive cardiac failure and hospital-acquired bronchopneumonia* Note that the infant is quite large in size, weighing 4.5 kg at birth. The mother was a known diabetic under treatment.

Fig. 118: *Scoliosis* Note the severe lateral deformity of the spine (the angle of curvature, measured by Cobb's technique) being far beyond 10 degrees in PA view of the X-ray of chest) in a child who developed chest wall restriction, resulting in lung impairment in the form of decrease in vital capacity, forced expiratory volume in 1 see (FEV1), work capacity, diffusion capacity, chest wall compliance and PaO_2.



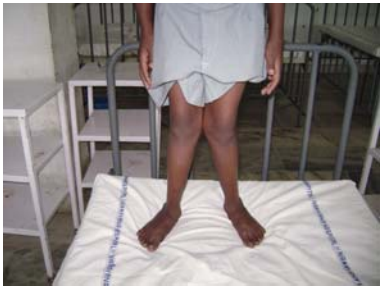
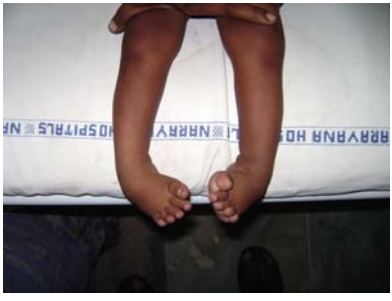


Fig. 119: *Advanced refractory rickets* Note the gross knock-knee deformity (genu valgum) in a child with poorly controlled celiac disease despite massive doses of vitamin D with supplements of calcium and phosphorus.



Figs 120 and 121: *Congenital talipes equinovarus (CTEV)* Note the clubfoot deformity in the form of forefoot cavus and adductus and hindfoot varus and equinus. It is sound principle to examine the spine for occult dysraphism.

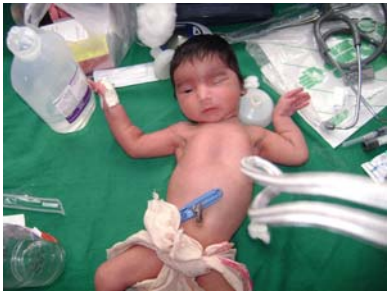
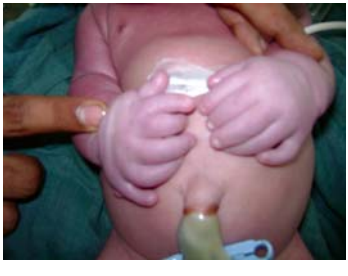
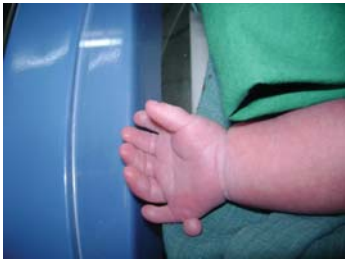


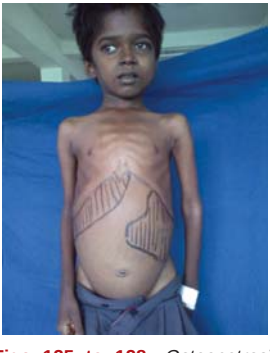
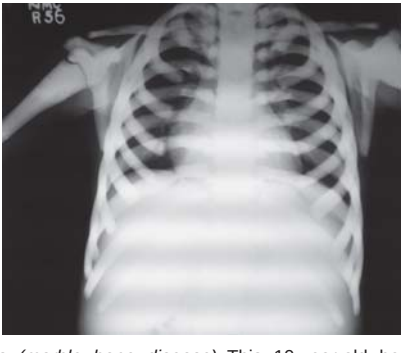
Fig. 122: *Facial palsy* Note inability to close left eye following birth trauma. Facial palsy at birth is, as a rule, a compression neuropathy resulting from forceps application during delivery. In a large majority of the cases, it regresses in a matter of days or weeks.





Figs 123 and 124: *Polydactyly* Note the presence of supernumerary digits on the ulnar border of hands (preaxial). Association with many syndromes (e.g. Carpenter syndrome, Ellis-van Crevald syndrome, Meckel-Gruber syndrome, polysyndactyly, etc.) is known.



Figs 125 to 128: *Osteopetrosis (marble bone disease)* This 10-year-old boy presented with short stature and growth retardation (height 123 cm, weight 28 kg) anemia, hepatosplenomegaly (Figs 125 to 127), and lymphadenopathy. There was history of long bone fracture thrice in the past years following trivial trauma. The diagnosis is established by radiology which shows remarkably high bone density with vertical striations of long bones and transverse bands in shaft (Fig. 128) and soft tissue opacities due to calcification. Differential diagnosis of radiological picture includes fluorosis, lead poisoning and idiopathic hypercalcemia.

Fig. 129: *Scorbutic rosary* Note that the costochondral beading in scurvy is sharp, angular and tender against the smooth, rounded and nontender costochondral beading seen in rickets.

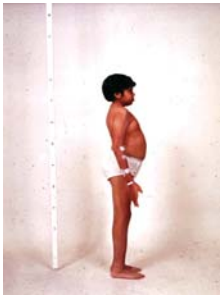


Fig. 130: *Pituitary dwarf* The upper/lower segment ratio was 1:1 with an IQ of around 100. Response to therapy with growth hormone turned out to be remarkable.

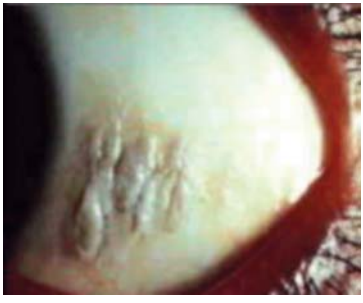
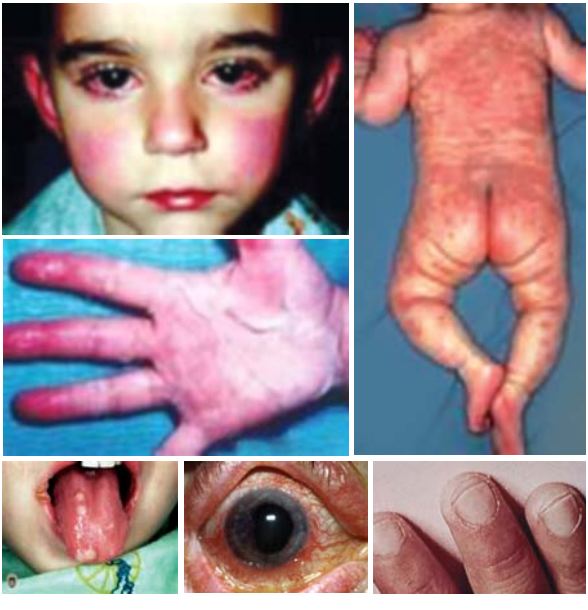


Fig. 131: *Bitot spot* Note the more or less triangular spot with the base adjoining the corneal limbus. The finding corresponds to XIb stage of xerophthalmia as per WHO.



Figs 132 to 137: *Kawasaki disease* Note the salient features such as typical rash involving face (Fig. 132), body (Fig. 133), palms (Fig. 134), tongue (Fig. 135), and eyes (Fig. 136): Note also peeling of skin (Fig. 137).

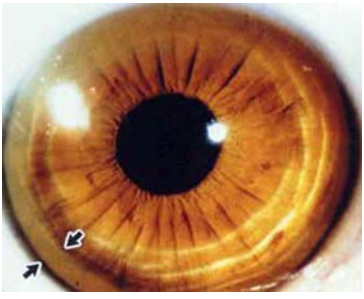
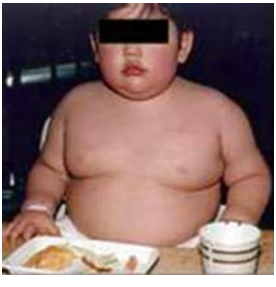
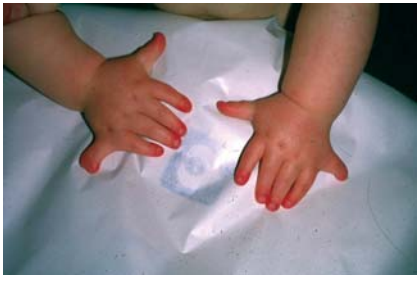


Fig. 138: *Kayser-Fleischer ring* Note the brown ring around the limbus of cornea. The cause is copper deposition in the Descemet membrane in a 17-year-old teenager suffering from Wilson's disease who presented exclusively with neurological manifestations, including extrapyramidal signs like rigidity, dysarthria, dysphagia, drooling and intellectual deterioration.





Figs 139 and 140: *Laurence-Moon-Biedl syndrome* Note the obesity and polydactyly. The child also suffered from mental retardation, short stature and hypogenitalism.

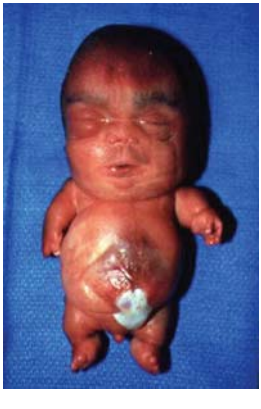


Fig. 141: *Rhizomelic chondrodysplasia* Note the symmetrical rhizomelia, and craniofacial dysmorphism. The rare condition is an autosomal recessive disorder.

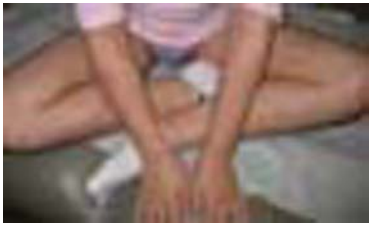


Fig. 142: *Scabies* Note the characteristic itchy lesions with burrows in the skin involving particularly the hands (especially interdigital space and sides of fingers), wrists, elbows, feet, buttocks, axillae and external genitalia. The child developed superimposed infection (presumably with Group A beta-hemolytic streptococcal followed by acute glomerulonephritis.

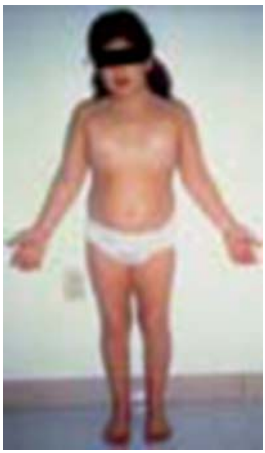


Fig. 143: *Turner's syndrome* Note the short stature, short webbed neck, shield chest with widely-spaced nipples and increased carrying angle (cubitus valgus) in this mentally-challenged girl. She also suffered from coarctation of aorta, a well-known association with this syndrome. Cytogenetic studies confirmed 45XO chromosomal pattern.

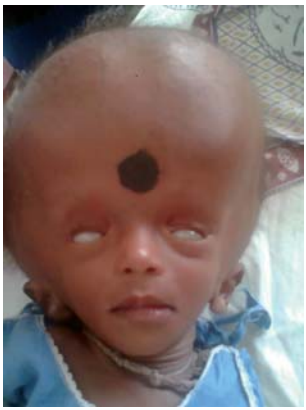


Fig. 144: *Congenital hydrocephalus* Note the very large head size with sun-set sign and scalp vein distention with taut skin over the scalp. The "sunset sign" is due to loss of upward conjugate gaze.

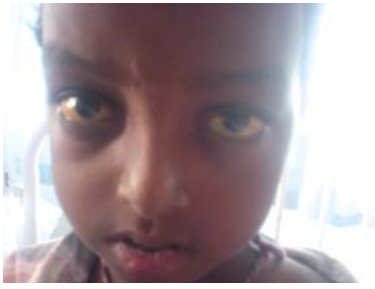


Fig. 145: *Viral hepatitis* Note the jaundice in a child who presented with anorexia, nausea and vomiting, abdominal discomfort and tender hepatomegaly.

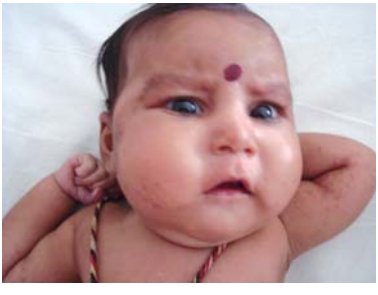


Fig. 146: *Von Gierke disease* (Glycogen storage disease type I). Note the classical "doll face". The infant also had enlarged liver and kidneys, growth retardation, and tendency for hyperlipidemia, hypoglycemia, lactic acidosis, bleeding and gout.

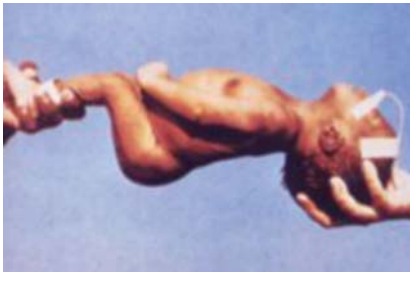


Fig. 147: *Neonatal tetanus* Note the generalized spasm and stiffness. Preceding this typical picture the baby developed inability to suck and swallow on 4th day of birth. He was born to a mother who had not been immunized against tetanus. The delivery was conducted in unhygienic conditions. So was the management of umbilical cord. Terminally, the baby developed seizures and bronchopneumonia.

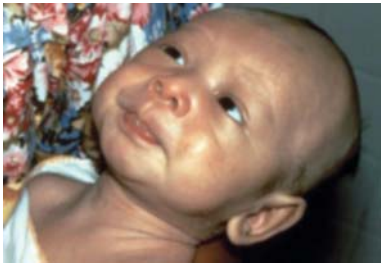
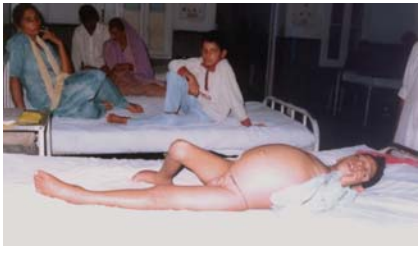


Fig. 148: *Neonatal tetanus* Note the characteristic facial appearance during the course of a spasm.

Fig. 149: *Japanese encephalitis* An 8-year-old, known for exposure to night-biting mosquitoes in an endemic area during transmission season, convalescing from JE. After the acute onset of excephalitic manifestations, characterized by fast changing CNS signs, he passed through subacute stage. Diagnosis of JE was confirmed by demonstration of virus-specific. IgM antibodies in the serum on third day of onset of manifestations.



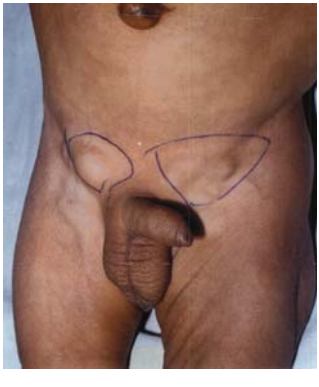


Fig. 150: *Bilateral inguinal lymphadenopathy (chronic)* Note that though tuberculosis is the most common cause, differential diagnoses includes other infections, immunologic disorders, neoplastic disease and drugs.

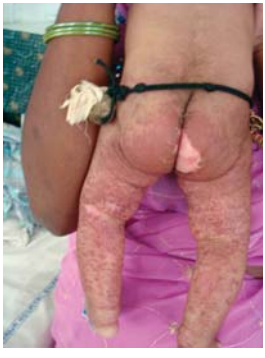


Fig. 151: *Flaky-paint dermatosis* Note the characteristic skin lesions and pedal edema in an infant with kwashiorkor.

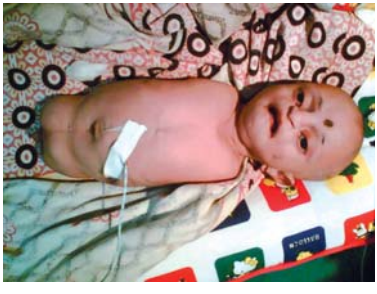


Fig. 152: *Amelia* Note the complete absence of both upper and lower extremities in the neonate.

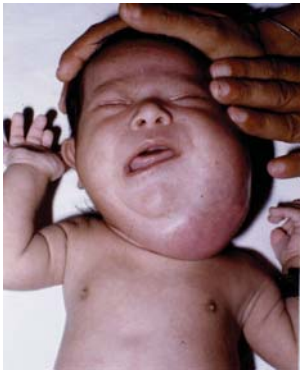


Fig. 153: *Large abscess* Noteworthy differential diagnosis includes cervical lymphadenitis, mumps and cystic hygroma.

Fig. 154: *Postpolio residual paresis (PPRP)* Currently, this is the most common cause of childhood disability in India and other developing countries. With eradication of polio, the incidence of handicap from this disease will gradually wane.

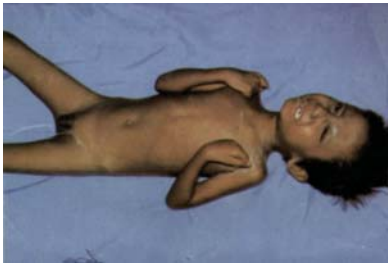


Fig. 155: *Tetanus* Note the characteristic spasm following a provocative stimulus.

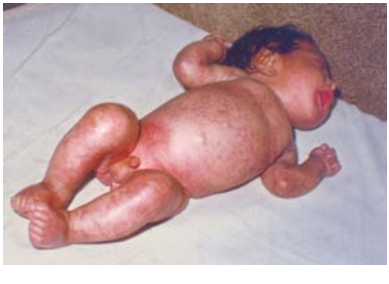


Fig. 156: *Acrodermatitis enteropathica* Note the vesicobullous and eczematous skin and perioral lesions (symmetrically distributed), blepharitis, some alopecia, growth failure and paronychia in an artificially-fed infant with chronic diarrhea. Response to oral zinc was excellent. In some cases, psoriasiform skin lesions may be encountered. Skin lesions of AE may be seen in maple syrup urine disease, organic aciduria, essential fatty acid deficiency, cystic fibrosis and kwashiorkor.

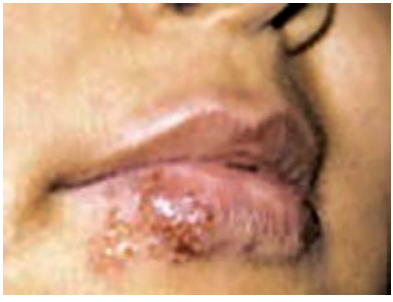


Fig. 157: *Herpes labialis* Note the painful lesions (vesicles) over lips together with erythema and edema preceded by a prodrome of fever. Accompanying these lesions, the child had gingivostomatitis and cervical lymphadenitis. Healing occurred by ulceration and crust formation in the following 3 weeks. Caused by herpes simplex virus, the disease has a tendency for recurrences.

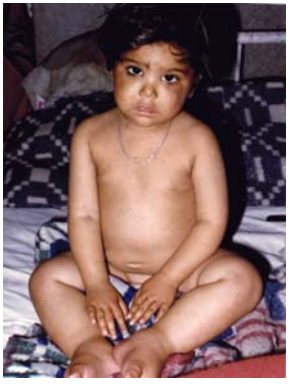


Fig. 158: *Nephrotic syndrome* Note the generalized edema. The 24-hr urine protein was 10 g, serum cholesterol 310 mg/dl, serum albumin 1.8 g/dl. Response to steroids was excellent.

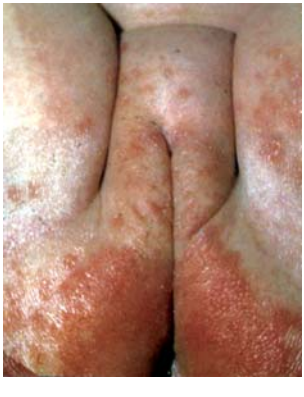


Fig. 159: *Nappie (diaper) rash* Note that erythema is apparent on convexities with sparing of the inguinal folds, giving it the W-shape.

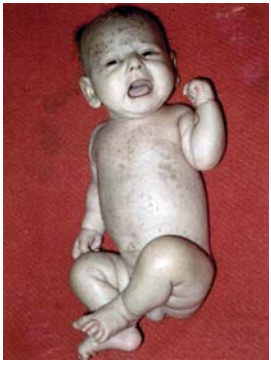


Fig. 160: *Seborrheic dermatitis* Note the cradle cap and poorly circumscribed erythematous rash extending downward to involve forehead, ears, eyebrows, nose and trunk.

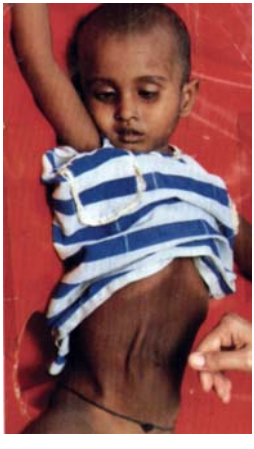


Fig. 161: *Severe dehydration* accompanying acute *gastroenteritis* Note loss of skin turgor (elasticity), listlessness, and sunken eyes.

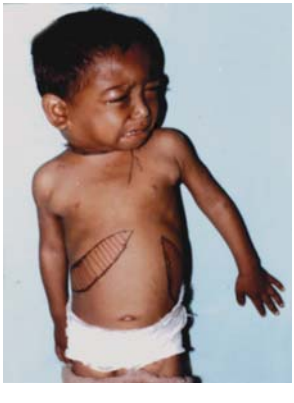


Fig. 162: *Disseminated tuberculosis* Note the generalized lymphadenopathy, hepatosplenomegaly and malnutrition. Mantoux was 30 × 30 mm. X-ray of chest showed miliary mottling.

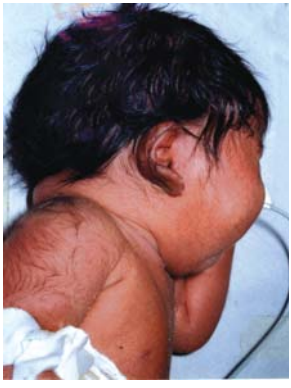


Fig. 163: *Infant of the diabetic mother* Note the characteristic plethoric chubby appearance with hairy pinna.

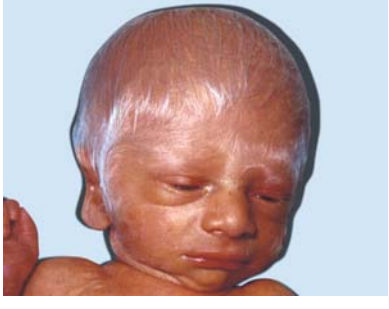
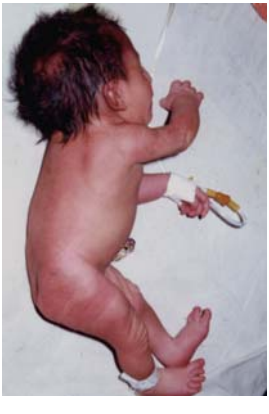
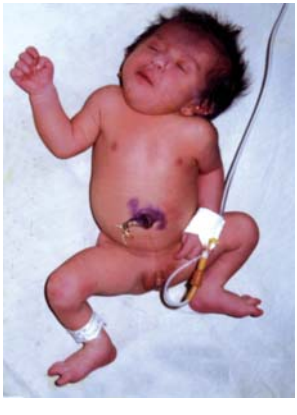


Fig. 164: *Generalized (oculocutaneous) albinism* Note the remarkable hypopigmentation of hair and skin. Irides were translucent and pink and there was marked photophobia. When seen last, the patient was 2-year-old and had developed strabismus and the irides had become light blue.





Figs 165 and 166: *Turner's syndrome* Note the short webbed neck, pedal edema, shield chest and ambiguous genitalia. Karyotyping showed 45XO configuration.

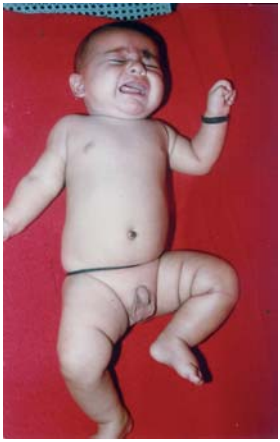
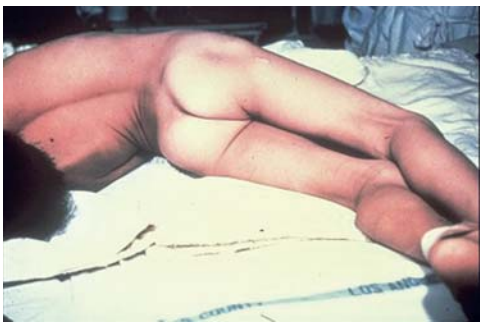


Fig. 167: *Turner's syndrome* Note the shield chest with widely apart nipples.



Figs 168 and 169: *Opisthotonos* Note the arching back of the body with the head thrown backward. Causes of opisthotonos include dsytonia (Fig. 168), meningitis (Fig. 169), tetanus, severe head injury, brain tumor, Arnold-Chiari malformation, subarachnoid hemorrhage, seizures and strychnine poisoning.

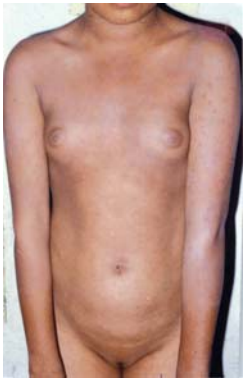


Fig. 170: *Precocious puberty* Note the premature breast development (gynecomastia) in this 7- year-old girl.

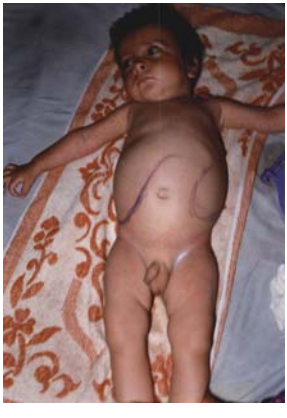


Fig. 171: *Glycogen-storage disease* Note the massive hepatosplenomegaly.

Fig. 172: *Anhidrotic ectodermal dysplasia* Note the hypotrichosis with absence of eyebrows in this 15-month-old. There was yet no dental eruption. He was brought for unexplained pyrexia. Even in peak summer, he hardly exhibited any sweating.

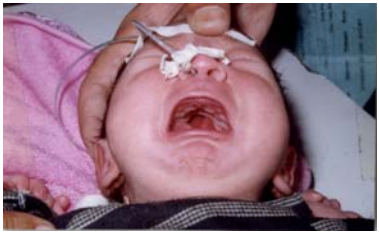
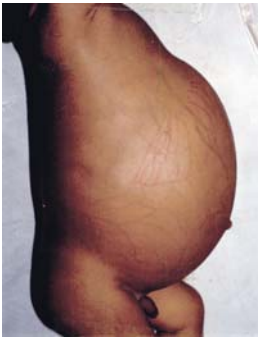
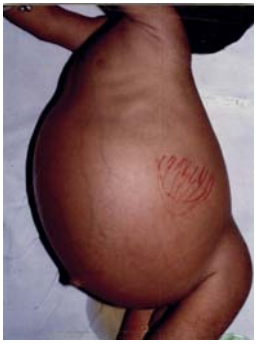
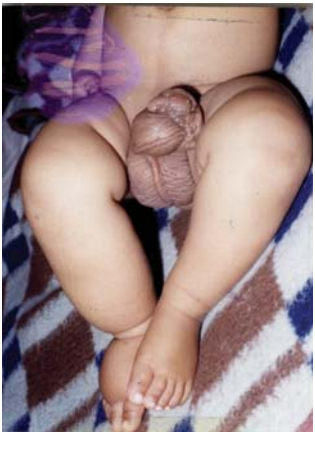


Fig. 173: *Pierre-Robin syndrome* Note the glossoptosis, micrognathia and high-arched palate.





Figs 174 and 175: *Chronic liver disease with cirrhosis* Note the massive ascites with hepatosplenomegaly. The history was strongly suggestive of neonatal cholestasis.



Figs 176 and 177: *Milroy disease* Note the lymphedema which was present since birth and showed pitting only on firm pressure. Involvement of the external genitalia with disfigurement is also seen. This autosomal dominant disorder should be differentiated from lymphedema present in Turner's syndrome and Noonan's syndrome (male Turner).

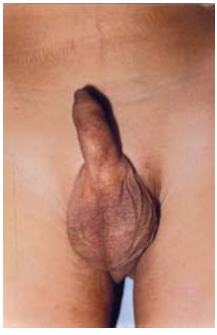


Fig. 178: *Priapism* The modus operandi in this child with sickle-cell anemia was obstruction of venous outflow secondary to excessive pooling of blood in the corpora cavernosa. The differential diagnosis includes leukemias (especially chronic myeloid leukemia) and perineal trauma. Impotence is an important sequelae.

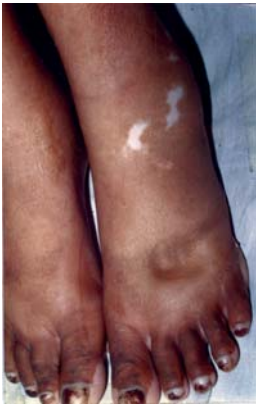
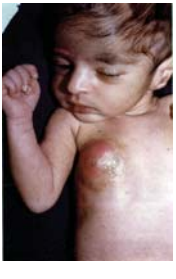
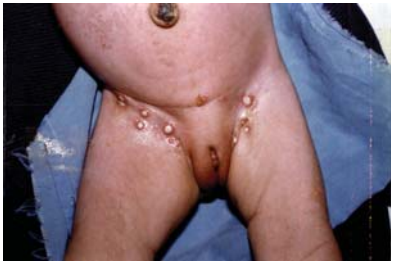
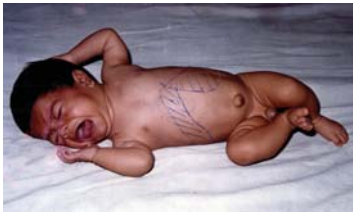


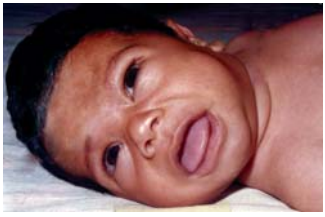
Fig. 179: *Vitiligo* Note the sharply-circumscribed depigmented macules of varying size and shape. The subject also suffered from uveitis and premature graying of hair. The disorder is more prevalent in subjects with thyroid disease (both hypo- and hyperthyroidism), adrenal insufficiency, pernicious anemia and diabetes mellitus.





Figs 180 and 181: *Neonatal septicemia* Note the large pyemic abscess and multiple pustules.





Figs 182 and 183: *Hurler syndrome (MPS-IH)* Note the grotesque-like coarse facies, large protruding tongue, dwarfism, somewhat cloudy corneas, mental retardation and hepatosplenomegaly. X-ray skull showd J-shaped sella turcica and X-ray spine demonstrated ovoid-shaped lower dorsal and upper lumbar vertebral bodies beak-like projections anteriorly.

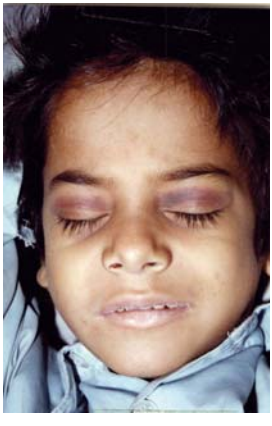


Fig. 184: *Acute lymphoblastic leukemia* Note severe anemia with ecchymosis.

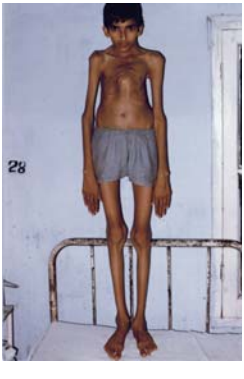


Fig. 185: *Marfan syndrome (arachnodactyly)* Note the tall stature, slimness, pectus excavatum, pes planus and arachnodactyly. Steinberg and wrist signs were positive.

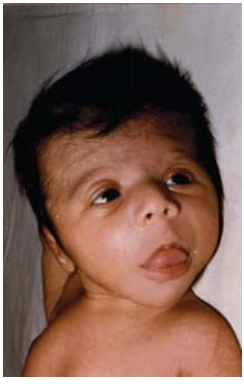


Fig. 186: *Treacher Collins syndrome* Note the mandibulofacial dysostosis and antimongoloid slant of the eyes.

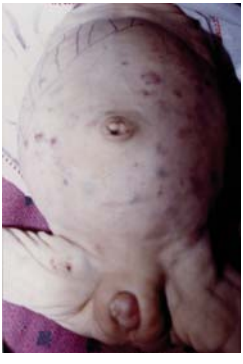


Fig. 187: *Purpura complicating. Gram-negative septicemia* Note the widespread purpuric spots.

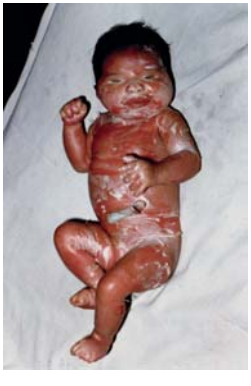


Fig. 188: *Collodion baby.* Note the remnants of the thick taut membrane, flat nose and ears and ectropion. Now over 4 years of age, the child has ichthyosis.

Fig. 189: *Breastfeeding* Note that the baby is well attached to the breast as shown by his widely-open mouth with everted lower lip so that he sucks not just the nipple but also the areola, nostrils are free enough to breathe properly and chin touch the breast. Semisitting position in mother's lap is the best for good breastfeeding.

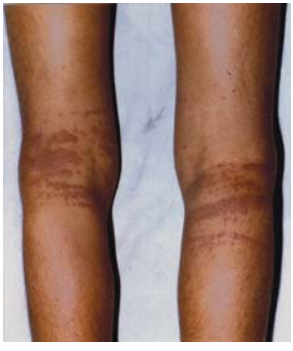


Fig. 190: *Henoch-Schönlein purpura (anaphylactoid purpura)* Note the characteristic involvement of the back of the legs. The purpura was accompanied by abdominal pain and slight arthritis. BT, CT and platelet count were normal. Hess test was positive.

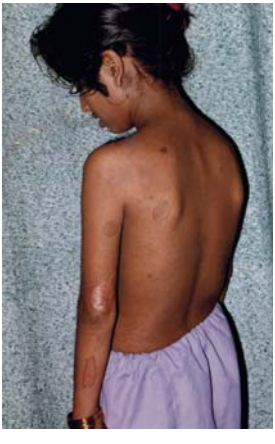


Fig. 191: *Cafe-au-lait spots* More than 6 spots are considered pathologic (as was the case in this girl with neurofibromatosis). Differential diagnosis includes neurofibromatosis, ataxia telangiectasia, Fanconi's anemia, tuberous sclerosis, Gaucher's disease and McCune-Albright syndrome.

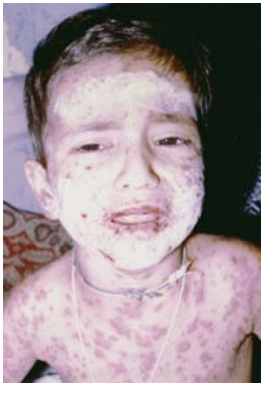


Fig. 192: *Stevens-Johnson syndrome* Note the extensive lesions involving both skin and mucous membrane. The offending agent was phenobarbital.

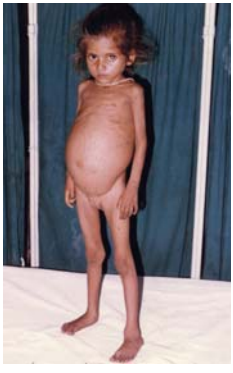


Fig. 193: *Celiac disease (gluten-induced enteropathy)* Note the growth retardation with pot-belly and corneal opacity secondary to vitamin A deficiency (keratomalacia) that developed 6 months earlier. Besides investigations, elimination of gluten from diet and later challenge with it established the diagnosis.

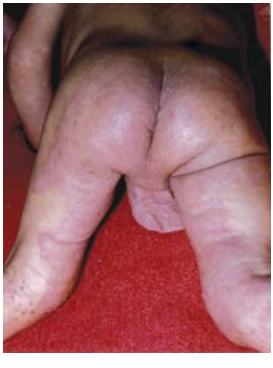


Fig. 194: *Acrodermatitis enteropathica* Note the characteristic perineal lesions with symmetrical distribution. Other manifestations included perioral lesions, light-colored scalp hair, blepharitis, nail dystrophy and chronic diarrhea. Response to oral zinc supplementation was dramatic.

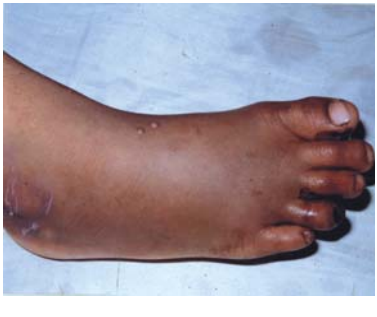


Fig. 195: *Snake bite* Note the extensive inflammatory swelling of the foot and bleeding. The clotting time on admission was 25 min. The subject showed full recovery following therapy, including 300 ml of AVS.

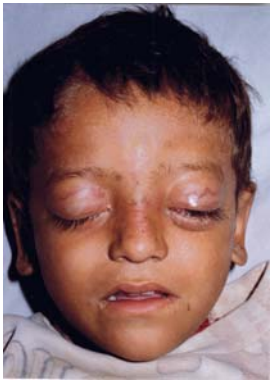


Fig. 196: *Cavernous sinus thrombosis* Noteworthy conditions that need to be considered in differential diagnosis are periorbital cellulitis and subperiosteal abscess. In the former vision and eye movements are normal. In the latter, ophthalmoplegia is present and vision begins to diminish.

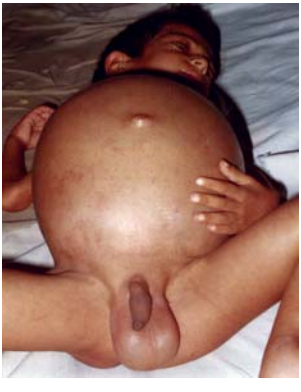


Fig. 197: *Massive abdominal distention* The child had massive ascites with scrotal edema. Abdominal tap and other investigations clinched the diagnosis of tuberculosis.

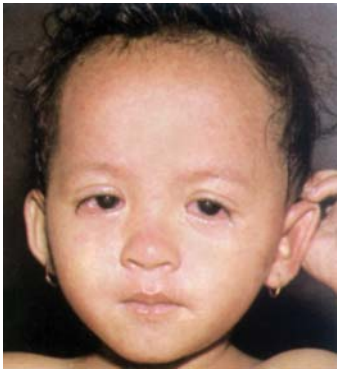


Fig. 198: *Measles* Note the maculopapular rash (red blochy pattern) over the face in the child who started with high fever, cough, coryza and conjunctivitis. The rash then spreaded downward to the torso and extremities.

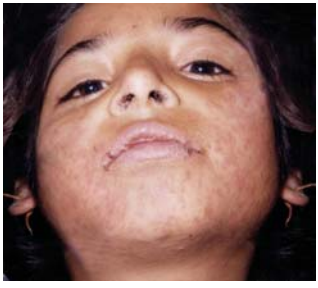
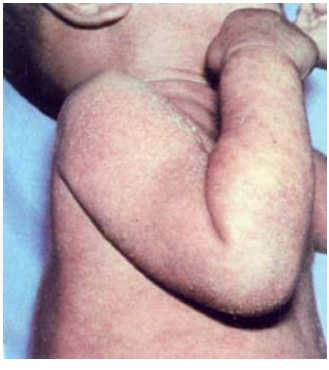
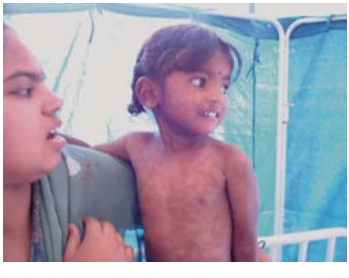
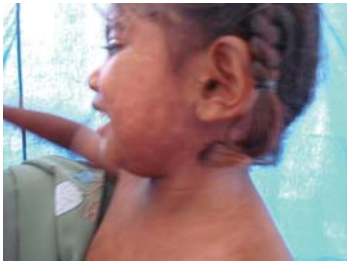


Fig. 199: *Measles* Note the characteristic maculopapular rash in this unvaccinated girl.

Fig. 200: *Measles* Note the rash showing disappearance in the some progression as it evolved, leaving behind a fine desquamation (peeling) of skin.







Figs 201 and 202: *Postmeasles pigmentation* Note the darkened patches during convalescence.

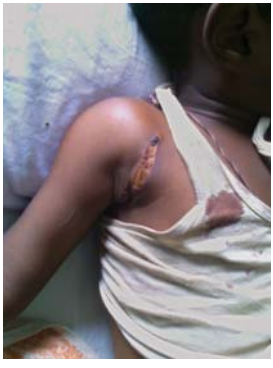


Fig. 203: *Child abuse* Note the consequence of branding.

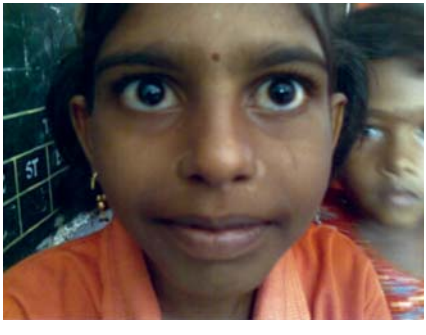


Fig. 204: *Hyperthyroidism* Note the characteristic staring, wide palpebral who presented for weight loss in spite of enormous dietary intake, excessive irritability and poor school performance.

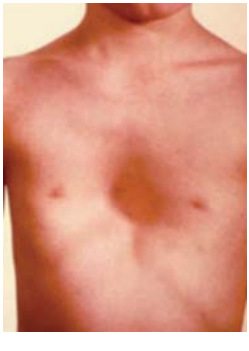


Fig. 205: *Funnel chest* Most frequently, it is a congenital defect. Infrequently, it may be secondary to rickets.

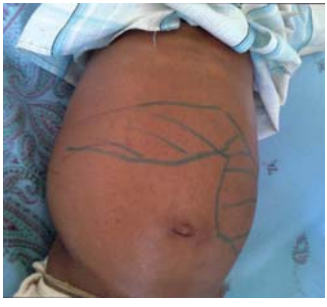


Fig. 206: *Hepatosplenomegaly in a case of suspected chronic liver disease* The child suffered from viral hepatitis some to 6 months back with only partial recovery.

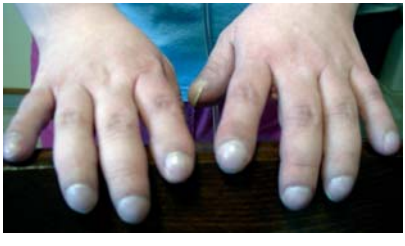


Fig. 207: *Clubbing in cystic fibrosis* Recurrent respiratory infection, chronic diarrhea and growth retardation dominated the clinical picture. Sweat chloride turned out to be 110 mEq/l.

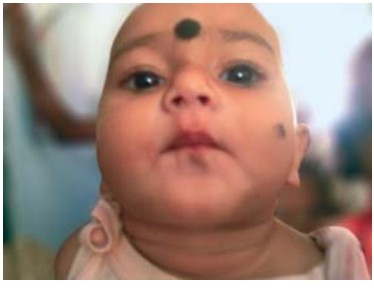


Fig. 208: *Microcephaly secondary to premature closure of all sutures* Note the symmetrical reduction in head size and shape.

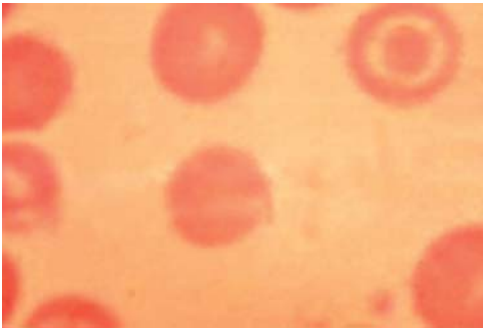


Fig. 209: *Target cells*

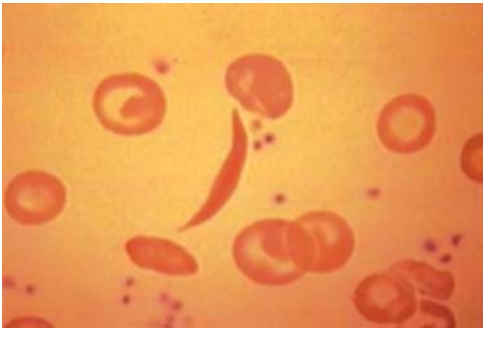


Fig. 210: *Sickle cells*

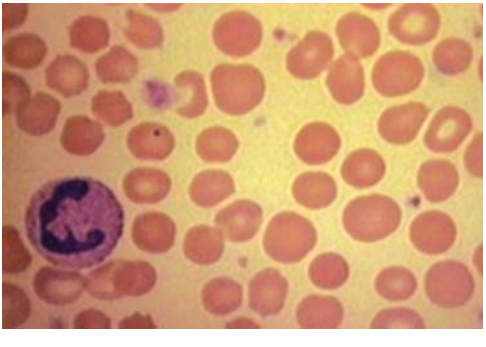


Fig. 211: *Spherocyte*

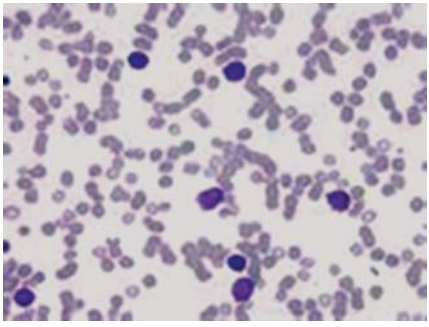


Fig. 212: *Acute lymphocytic leukemia (ALL)*

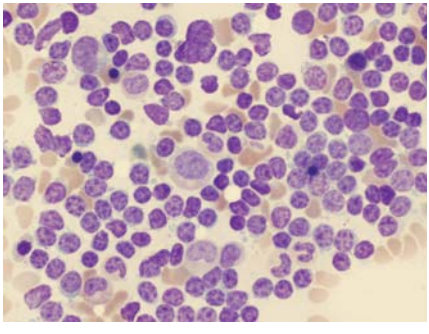


Fig. 213: *Chronic lymphocytic leukemia (CLL)*

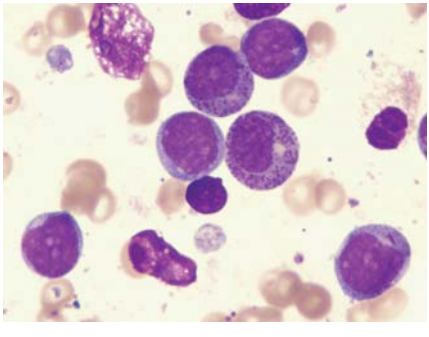


Fig. 214: *Acute-myeloid leukemia (AML)*

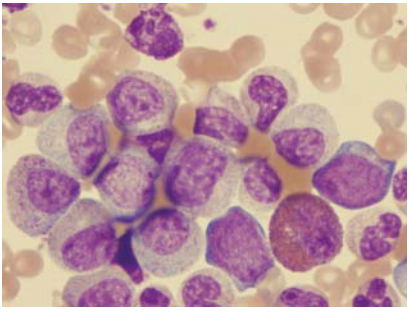


Fig. 215: *Chronic myeloid leukemia (CML)*

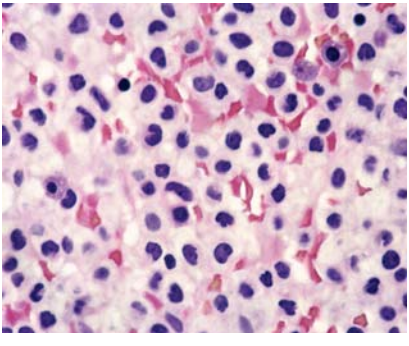


Fig. 216: *Hairy-cell-leukemia*

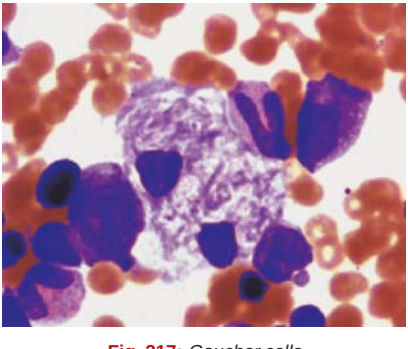


Fig. 217: *Gaucher cells*

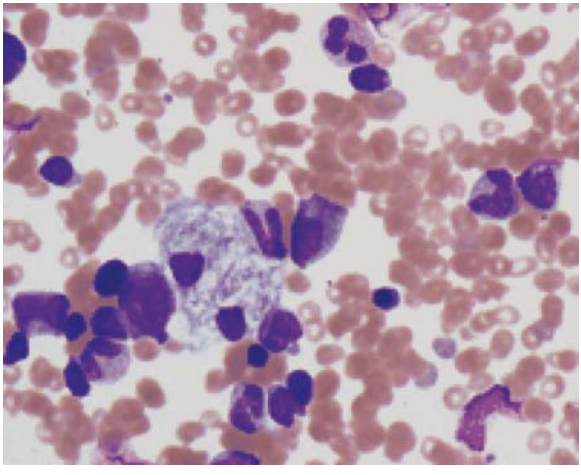


Fig. 218: Gaucher cells

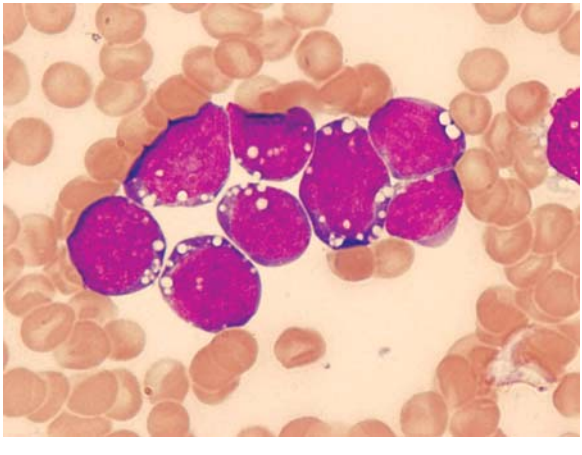


Fig. 219: *Burkitts lymphoma*

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