### 4.1 The differential diagnosis of common or serious presenting symptoms and signs in children

#### 4.1.A The child with diarrhoea

There are several groups of causes of diarrhoea. For the management of acute and chronic diarrhoea, see Sections 5.12.A and 5.12.B.

**Causes of diarrhoea**

**Infective**
- Acute (< 14 days).
- Persistent (> 14 days).

Viruses, bacteria and parasites are the agents of infection.

**Secondary diarrhoea**
- Malnutrition.
- HIV.
- Disaccharide intolerance.
- Malaria.

**Chronic (non-infectious)**
- Food intolerance:
  - Milk protein, soy protein
  - Coeliac disease (gluten sensitivity)
  - Multiple food intolerances.
- Inflammation:
  - Crohn's disease
  - Ulcerative colitis.
- Pancreatic disease:
  - Cystic fibrosis
  - Shwachman syndrome (cyclic neutropenia).

**Miscellaneous**
- Non-specific ‘toddler’s diarrhoea’.
- Irritable bowel syndrome.
- Excessive intake of squash/fruit drinks.

**History**
- Duration of symptoms.
- Nature of stool (e.g. fatty, floating, watery, with blood).
- Number per day.
- Dietary intake.
- Other accompanying symptoms.
- History of foreign travel.

- Possible food poisoning exposure.

**Examination**
- Chart growth/nutritional status.
- Document degree of dehydration.
- Look for fever, anaemia, lymphadenopathy, hepatosplenomegaly and finger clubbing.
- Look for signs of vitamin or mineral deficiency, oral ulcers and anal fissures.
- Look for candidiasis.

**Investigations**

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stool microscopy (warm stool for <em>Entamoeba histolytica</em>), white blood cell count (WBC), red blood cell count (RBC), ova, parasites</td>
<td>Infection</td>
</tr>
<tr>
<td>Stool Culture</td>
<td>Lactose intolerance</td>
</tr>
<tr>
<td>Stool pH (&lt; 5.5) Clinitest tablets or Benedict’s solution</td>
<td>Pancreatic disease</td>
</tr>
<tr>
<td>Stool Fat globules</td>
<td></td>
</tr>
<tr>
<td>Hydrogen breath test</td>
<td>Lactose intolerance</td>
</tr>
<tr>
<td>Blood culture (high temperature, rigors)</td>
<td>Septicaemia (e.g. <em>Salmonella</em> )</td>
</tr>
<tr>
<td>Urea, creatinine, electrolytes (if oliguria)</td>
<td>Haemolytic uraemic syndrome</td>
</tr>
<tr>
<td>Haemolytic uraemia/ hyponatraemia</td>
<td></td>
</tr>
<tr>
<td>Full blood count</td>
<td>Hidden bleeding</td>
</tr>
<tr>
<td>Albumin</td>
<td>Chronic diarrhoea</td>
</tr>
<tr>
<td>X-ray of abdomen, ultrasound scan</td>
<td>Ileus, bowel perforation</td>
</tr>
<tr>
<td>Urine microscopy</td>
<td>Haemolytic uraemic syndrome</td>
</tr>
</tbody>
</table>

#### 4.1.B The child with jaundice

**Causes of jaundice**
- Neonatal jaundice (see Section 3.4).
- Excess haemolysis (pre-hepatic):
  - sickle-cell disease (see Section 5.11.B)
  - thalassaemia (see Section 5.11.C)
  - hereditary spherocytosis (see Section 5.11.C)
Section 4.1

— malaria (see Section 6.3.A.d).

Liver disease (see Sections 5.7.A and 5.7.B):
  — hepatocellular
  — obstruction to bile secretion
  — infective hepatitis
  — acute liver failure
  — chronic liver disease.

History

— Family history of hereditary haemoglobinopathy or liver disorder.
— Blood transfusion.
— Anorexia.
— Abdominal pain.
— Pruritus.
— Colour, nature and contents of stools and urine.

Examination

— Assess growth/nutritional state.
— Look for skin signs of chronic liver disease (e.g. spider naevi, clubbing, leuconychia, liver palms, scratches from pruritus).
— Assess liver and spleen (for enlargement and tenderness).
— Check for anaemia.

— Check for ascites.
— Look for frontal bossing or maxillary overgrowth (sickle-cell disease or thalassaemia).
— Observe colour of stool and urine.

Investigations

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full blood count and film</td>
<td>Anaemia</td>
</tr>
<tr>
<td>Reticulocytes</td>
<td>Haemolysis</td>
</tr>
<tr>
<td>Haemoglobin electrophoresis</td>
<td>Sickle-cell disease and</td>
</tr>
<tr>
<td></td>
<td>thalassaemia</td>
</tr>
<tr>
<td>Urine</td>
<td>Bilirubin and urobilinogen</td>
</tr>
<tr>
<td>Liver function tests:</td>
<td></td>
</tr>
<tr>
<td>Liver transaminases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bilirubin conjugated (liver disease or biliary obstruction) or unconjugated (haemolysis) hepatitis</td>
</tr>
<tr>
<td>Serology</td>
<td>Identification of viral causes</td>
</tr>
<tr>
<td>Coagulation</td>
<td>Liver failure</td>
</tr>
<tr>
<td>Auto-antibodies</td>
<td>Chronic active hepatitis</td>
</tr>
</tbody>
</table>

4.1.C The child with lymphadenopathy

Common causes of generalised lymphadenopathy

— HIV infection.
— Infectious mononucleosis.
— Tuberculosis (TB).
— Leukaemia.
— Cytomegalovirus (CMV), toxoplasmosis.
— African trypanosomiasis.

Infective causes of local lymphadenopathy

— Local skin (especially scalp) infections.
— Tuberculosis (TB), see Section 6.1.N.
— Environmental mycobacteria.
— Cat scratch disease.

History

— Known epidemiology of HIV and trypanosomiasis in the area.
— Contact with TB.
— Chronic ill health (e.g. malignancy, HIV, TB).
— Determine whether nodes are static or increasing in size.

Examination

— Chart growth and nutritional status.
— Check for fever.
— Check for liver or spleen enlargement.
— Check for purpura or anaemia.
— Check for Candida infection.
— Conjunctivitis, red cracked lips and persistent high fever, if present, suggest possible Kawasaki’s disease.

<table>
<thead>
<tr>
<th>Investigations</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full blood count</td>
<td>Atypical lymphocytes, leukaemic picture</td>
</tr>
<tr>
<td>Thick blood film</td>
<td>Trypanosomiasis</td>
</tr>
<tr>
<td>Bone marrow</td>
<td>Malignancy</td>
</tr>
<tr>
<td>HIV tests</td>
<td>HIV</td>
</tr>
<tr>
<td>Paul-Bunnell test</td>
<td>Infectious mononucleosis (positive 60%)</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP)</td>
<td>Infection, TB</td>
</tr>
<tr>
<td>Mantoux test</td>
<td>TB, environmental mycobacteria</td>
</tr>
<tr>
<td>Serology</td>
<td>Epstein–Barr virus, CMV, toxoplasmosis</td>
</tr>
<tr>
<td>Chest X-ray</td>
<td>TB, malignancy</td>
</tr>
<tr>
<td>Lymph node biopsy</td>
<td>Diagnostic (lymphomas, etc.)</td>
</tr>
</tbody>
</table>
4.1.D The child with abdominal pain

Note that this group includes adolescent girls who may be pregnant.

Causes of acute and chronic abdominal pain

- Idiopathic:
  - Irritable bowel syndrome (intermittent stool variability).
  - Migraine (headaches with photophobia).
- Psychogenic.
- Gastrointestinal:
  - Appendicitis (central pain moving to right lower abdomen).
  - Peptic ulcer (upper abdominal pain, vomiting, blood in vomit/melaena stool).
  - Gastroenteritis (contact history, watery and/or bloody diarrhoea).
  - Intussusception (redcurrant-jelly stool, spasms of pain, mass in left lower abdomen).
  - Oesophagitis (retrosternal pain).
  - Inflammatory bowel disease (loose bloody, mucousy stool, weight loss, systemically unwell).
  - Constipation (hard, painful infrequent stool).
  - Bowel obstruction ( bile-stained vomiting, abdominal swelling).

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full blood count</td>
<td>Anaemia, eosinophilia, infection</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate (ESR)/C-reactive protein (CRP)</td>
<td>Inflammation</td>
</tr>
<tr>
<td>Urea, electrolytes</td>
<td>Renal disease</td>
</tr>
<tr>
<td>Amylase</td>
<td>Pancreatitis</td>
</tr>
<tr>
<td>Liver function tests</td>
<td>Liver dysfunction, hepatitis</td>
</tr>
<tr>
<td>Urine stick test: blood, protein, glucose</td>
<td>Glomerulonephritis, nephritic syndrome, diabetes, urinary system calculi</td>
</tr>
<tr>
<td>Urine microscopy for organisms, casts, culture</td>
<td>Infection, glomerulonephritis</td>
</tr>
<tr>
<td>Stool, ova, cysts, parasites, white blood cell count (WBC) and red blood cell count (RBC)</td>
<td>Infestation, dysentery, inflammatory bowel disease</td>
</tr>
<tr>
<td>Pregnancy test</td>
<td>See Section 2</td>
</tr>
<tr>
<td>Ultrasound scan (abdomen and pelvis), X-ray (straight abdominal film)</td>
<td>Bowel obstruction, constipation, lead poisoning, ovarian cyst, pregnancy, calculi</td>
</tr>
<tr>
<td>Barium studies and endoscopy</td>
<td>Peptic ulcer, inflammatory bowel disease</td>
</tr>
<tr>
<td>Barium studies and endoscopy</td>
<td>Peptic ulcer, inflammatory bowel disease</td>
</tr>
</tbody>
</table>

Differentiating between organic and non-organic (psychological) abdominal pain

<table>
<thead>
<tr>
<th>Nature of pain</th>
<th>Organic</th>
<th>Non-organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>Weight loss/reduced appetite, Lack of energy, Fever, Change in bowel habit, Urinary symptoms, Intestinal symptoms, Vomiting: bile stained, continuous, blood, Rectal bleeding</td>
<td>Migraine, School and family problems, Isolated vomiting, not bile stained</td>
</tr>
<tr>
<td>Examination</td>
<td>Appears ill, Weight loss, Distension, Absent or accentuated bowel sounds, Shock, Abdominal mass: constipation, other</td>
<td>Normal, thriving</td>
</tr>
</tbody>
</table>
Section 4.1

Food intolerance (e.g. milk protein, gluten) (dietary history).
- Meckel’s diverticulum.
- Henoch–Schönlein purpura (purpuric rash and/or arthropathy).
- Sickle-cell disease (history, anaemia).

Urinary tract:
- Infection.
- Calculi.
- Hydronephrosis.

Liver:
- Hepatitis.

Pancreas:
- Inflammation (pancreatitis).

Malignancy:
- Lymphoma.
- Gynaecological:
  - Dysmenorrhea.
  - Pelvic inflammatory disease.
  - Ovarian cyst.
- Pregnancy related (see Section 2).
- Respiratory:
  - Pneumonia/pleurisy.
- Trauma.
- Poisoning:
  - Lead.

Urinary tract:
- Infection.
- Calculi.
- Hydronephrosis.

Liver:
- Hepatitis.

Pancreas:
- Inflammation (pancreatitis).

Malignancy:
- Lymphoma.
- Gynaecological:
  - Dysmenorrhea.
  - Pelvic inflammatory disease.
  - Ovarian cyst.
- Pregnancy related (see Section 2).
- Respiratory:
  - Pneumonia/pleurisy.
- Trauma.
- Poisoning:
  - Lead.

4.1.E The child with anaemia

Anaemia, especially that due to iron deficiency, is very common in resource-limited communities. Anaemia can be caused by a combination of inadequate nutrition and recurrent infections, such as malaria. Intestinal parasites such as hookworm are important causes. Genetic disorders such as sickle-cell disease and thalassaemia should always be considered in relevant ethnic groups. Acute worsening of anaemia may present as heart failure in young children. For children aged < 6 years, normal haemoglobin concentration is > 11.0 g/dL (haematocrit is > 33%), see Section 5.11.A.

- Moderate anaemia: haemoglobin concentration is 6–9.3 g/dL.
- Severe anaemia: haemoglobin concentration is ≤ 6 g/dL, severe pallor (palmar/conjunctival), may have heart failure; gallop rhythm, enlarged liver and pulmonary oedema (fine basal crepitations in the lungs).

Causes of anaemia

Decreased production
- Prematurity: at 6–8 weeks postpartum.
- Hypochromic: iron deficiency (diet, blood loss, chronic inflammation).
- Normochromic: chronic infection or inflammation:
  - nutritional: malnutrition, scurvy
  - infiltration: leukaemia, malignancy
  - metabolic: renal and liver disease.
- Megaloblastic:
  - folic acid deficiency: infection, coeliac disease, anticonvulsants, haemolysis
  - vitamin B12 deficiency: intestinal resections, Crohn’s disease, vegan diet.
- Hypoplastic: sickle-cell crises, drugs (e.g. chloramphenicol), malignancy.

Increased haemolysis
- Haemoglobinopathies: sickle-cell disease, thalassaemia major.
- Non-immune: drugs, infection, hypersplenism, burns, haemolytic uraemic syndrome, disseminated intravascular coagulation, porphyria, snake venoms.
- Enzyme deficiency: drug-induced and spontaneous glucose-6-phosphate dehydrogenase (G6PD) deficiency, glutathione synthetase deficiency, pyruvate kinase deficiency.
- Immune: Rhesus and ABO incompatibility, autoimmune (e.g. reticuloses), Mycoplasma infection, systemic lupus erythematosus, drugs.
- Membrane defects: spheroctosis, elliptocytosis, stomatocytosis, erythropoietic porphyria, abetalipoproteinaemia.

Blood loss
- Perinatal:
  - placental and cord accidents
  - feto–maternal, twin-to-twin transfusions
  - birth injury (e.g. cephalhaematoma, sub-aponeurotic haemorrhage, severe bruising)
  - haemorrhagic disease of the newborn.
- Epistaxis.
- Trauma.
- Alimentary tract: haematemesis, rectal bleeding, hookworm.
- Blood clotting disorder (e.g. haemophilia, thrombocytopenia).
- Renal tract: haematuria.

History
- Symptoms of anaemia: lethargy, tiredness, shortness of breath on exertion, poor growth.
- Obvious blood loss: epistaxis, haematemesis, haematuria, blood in stools.
- Assess the diet (e.g. inadequate weaning diet).
- Steatorrhoea.
- Chronic infection, inflammation.
- Drugs: especially antibiotics, antimalarial drugs, anticonvulsants, analgesics, cytotoxic agents.

Examination
- Chart growth/nutritional state.
- Conjunctivae, nails and palms for pallor.
- Stomatitis.
- Jaundice.
- Bruising, lymphadenopathy or petechiae.
- Hepatosplenomegaly.
- Tachycardia, flow murmur, cardiac failure.
Investigations

TABLE 4.1.E.1 Investigations in the child with anaemia

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full blood count</td>
<td>Haemoglobin concentration, white blood cell count, platelet count</td>
</tr>
<tr>
<td>Blood film</td>
<td>Red blood cell morphology, malaria, target cells, haemolysis</td>
</tr>
<tr>
<td>Haemoglobin electrophoresis</td>
<td>Sickle-cell disease, thalassaemia</td>
</tr>
<tr>
<td>Mean corpuscular volume (MCV), reticulocytes</td>
<td>Iron deficiency, haemolysis</td>
</tr>
<tr>
<td>Coombs’ test</td>
<td>Haemolysis</td>
</tr>
<tr>
<td>Bone marrow</td>
<td>Leukaemia, malignant infiltration, aplasia</td>
</tr>
<tr>
<td>Bilirubin, liver function tests</td>
<td>Direct/indirect bilirubin</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>Red blood cells, casts, bacteria, white blood cells, protein, culture</td>
</tr>
<tr>
<td>Serum ferritin</td>
<td>Iron stores</td>
</tr>
<tr>
<td>Barium meal/endoscopy</td>
<td>Inflammatory bowel disease</td>
</tr>
<tr>
<td>Platelets and clotting</td>
<td>Coagulation disorder</td>
</tr>
<tr>
<td>Stool microscopy, culture and occult blood</td>
<td>Hookworm (egg count), gastrointestinal blood loss</td>
</tr>
</tbody>
</table>

4.1.F The child who is vomiting

The history of the acute, recurrent or chronic nature of this symptom indicates the approach to the diagnosis.

Common causes (depending on age)

Infants

- Gastroenteritis.
- Gastro-oesophageal reflux (distinguish from possetting).
- Overfeeding.
- Bowel obstruction:
  - pyloric stenosis
  - intussusception
  - congenital bowel anomalies.
- Infection:
  - urinary tract in particular
  - meningitis
  - otitis media
  - pertussis.
- Poisoning:

Children

- Gastroenteritis.
- Appendicitis (with pain).
- Infection:
  - especially urinary tract
  - meningitis (including TB)
  - malaria.
- Bowel obstruction.
- Ingestion of drugs or poisons.
- Migraine.
- Pregnancy.
- Bulimia (but rarely does a child admit this).
- Raised intracranial pressure (RICP).
- Hypertension.
- Diabetic ketoacidosis.

History

- Accidental drug ingestion.
- Check whether it is vomiting, regurgitation or possetting (especially in an infant).
- Is it associated with coughing or a whoop?
- Is it projectile?
- Does it contain blood or bile?
- Is there any diarrhoea or constipation?
- Is there abdominal pain?
- Are there urinary or ear symptoms?
- Is there a family history of migraine?
- Are there difficulties in coordination during physical activity? Consider the possibility of a middle ear or brainstem problem.

Examination

- Does the child look ill?
- Is the child febrile? Is there neck stiffness, a full fontanelle and/or a rash?
- Measure the head circumference, especially in infants, and check fontanelles and sutures.
- Is the child dehydrated? Is there an odour?
- Assess growth and nutritional status.
- Examine vomit:
  - bile-stained vomit suggests bowel obstruction
  - blood (coffee grounds).
- Full examination (include blood pressure, fundoscopy and anorectal examination as indicated).
- Abdomen:
  - test feed for pyloric stenosis: swelling or visible peristalsis
  - tenderness or mass
  - check whether bowel sounds are present and, if so, what they are like.
Investigations

**TABLE 4.1.F Investigations in the child who is vomiting**

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine microscopy</td>
<td>Urinary tract infection</td>
</tr>
<tr>
<td>Full blood count</td>
<td>Infection</td>
</tr>
<tr>
<td>Thick film</td>
<td>Malaria</td>
</tr>
<tr>
<td>Urea and electrolytes</td>
<td>Pre-renal or renal failure, pyloric stenosis</td>
</tr>
<tr>
<td>Blood culture</td>
<td>Infection</td>
</tr>
<tr>
<td>Lumbar puncture</td>
<td>Meningitis</td>
</tr>
<tr>
<td>Stool microscopy and culture</td>
<td>Ova, cysts, parasites, bacteria and viruses</td>
</tr>
<tr>
<td>Liver function tests</td>
<td>Hepatitis</td>
</tr>
<tr>
<td>Abdominal ultrasound</td>
<td>Masses, obstruction, free fluid</td>
</tr>
<tr>
<td>Straight abdominal X-ray/chest X-ray</td>
<td>Bowel obstruction, free air</td>
</tr>
<tr>
<td>Barium studies and/or endoscopy</td>
<td>Specific diagnosis</td>
</tr>
<tr>
<td>Pregnancy test</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Mantoux test</td>
<td>TB, meningitis</td>
</tr>
<tr>
<td>Brain imaging</td>
<td>Raised intracranial pressure</td>
</tr>
</tbody>
</table>

**4.1.G The child with a rash**

**Causes of a rash**

**Macular rash**
- Viral infections such as measles, sometimes meningococcal infection.
- Juvenile rheumatoid arthritis.
- Erythema marginatum: rheumatic fever.

**Papular (vesicles, pustules) or bullae (blisters of various sizes)**
- Chickenpox.
- Herpes simplex.
- Impetigo.
- Scabies.

**Purpuric, petechial, ecchymosis**
- Meningococcal disease.
- Henoch–Schönlein purpura.
- Dengue fever.
- Thrombocytopenia.

**Desquamation with or without mucosal involvement**
- Scalded skin syndrome.
- Toxic epidermal necrolysis.
- Kawasaki disease.
- Post-scarlet fever.
- Post-toxic shock syndrome.
- Stevens–Johnson syndrome.
- Epidermolysis bullosa.

**Erythema multiforme**
- Allergic reaction to drug or infection.
- Stevens–Johnson syndrome if very severe (then with bullae and mucous membrane redness).

**TABLE 4.1.G.1 Investigations in the child with a rash**

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP)</td>
<td>Systemic bacterial infection (e.g. meningococcal disease) Kawasaki disease Thrombocytopenia</td>
</tr>
<tr>
<td>Blood culture</td>
<td>Bacterial infection</td>
</tr>
<tr>
<td>Skin swab</td>
<td>Bacterial infection</td>
</tr>
<tr>
<td>Skin scraping</td>
<td>Scabies</td>
</tr>
<tr>
<td>Throat swab and antistreptolysin O titre (ASOT)</td>
<td>Streptococcal infection</td>
</tr>
<tr>
<td>Urinalysis (red blood cell count, casts, protein)</td>
<td>Nephritis (e.g. Henoch–Schönlein purpura) or connective tissue disorders</td>
</tr>
<tr>
<td>Skin biopsy</td>
<td>Epidermolysis bullosa</td>
</tr>
<tr>
<td>Auto-antibodies</td>
<td>Connective tissue disorders</td>
</tr>
</tbody>
</table>
Erythema nodosum
Lesions begin as flat, firm, hot, red, painful lumps approximately 2.5 cm across. Within a few days they may become purplish, then over several weeks fade to a brownish, flat patch. Erythema nodosum is most common on the shins, but it may also occur on other areas of the body (buttocks, calves, ankles, thighs, and arms).

4.1.H The child with failure to thrive

Approach to failure to thrive
- Failure to thrive is due to inadequate delivery of nutrients to developing tissues.
- It is usually manifested by failure to gain weight as expected.
- In extreme circumstances, height (length) and head circumference may be affected. Plot the mid-parental height.
- The majority of cases are related to gastrointestinal disorders: poor intake/malabsorption.
- Observe feeding, mother’s interaction, child’s behaviour, vomiting, diarrhoea and weight gain before embarking on investigations.
- Investigations should take place when a likely system and/or disorder has been identified.
- Always remember the possibility of child abuse.
- See relevant sections on gastroenterology, chronic infections, organ failure, hyperimmune disorder.

Failure to thrive: gastrointestinal disorders
- Oropharynx: cleft palate.
- Oesophagus: incoordination of swallowing (e.g. cerebral palsy).
- Stomach:
  - Gastro-oesophageal reflux
  - Pyloric stenosis.
- Digestion:
  - Pancreas: cystic fibrosis
  - Liver: cirrhosis.
- Small gut disorders:
  - Milk protein intolerance
  - Coeliac disease
  - Carbohydrate malabsorption
  - Protein-losing enteropathy
  - Short gut syndrome
  - Crohn’s disease.
- Large gut disorders:
  - Ulcerative colitis
  - Crohn’s disease
  - Hirschsprung’s disease.

Causes of failure to thrive

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Systems involved</th>
</tr>
</thead>
</table>
| Inadequate intake | Anorexia  
  Breastfeeding failure  
  Feeding mismanagement  
  Swallowing disorders |
| Loss | Vomiting  
  Diarrhoea  
  Malabsorption |
| Structural dysfunction of organs | Brain (cerebral palsy, learning difficulties)  
  Respiratory  
  Cardiac  
  Urinary tract  
  Gastrointestinal tract |
| Increased requirement for nutrients or metabolites | Infection  
  Connective tissue disorders  
  Immune disorders |
| Failure of end-organ response | Metabolic (e.g. amino acid disorders, organic acid disorders)  
  Endocrine (e.g. thyroid disorder)  
  Malignancy  
  Chromosomal abnormalities |
| Emotional and/or psychological | Parental problem:  
  - Neglect  
  - Abuse  
  - Family dysfunction  
  Child problem:  
  - Feeding/behaviour disorders  
  - Anorexia nervosa  
  - Bulimia |
4.1.1 The child with fits, fainty and apparent life-threatening events (ALTEs)

**Common causes of fits, fainty and ALTEs**
- Febrile convulsions.
- Epileptic seizures.
- Hypoglycaemia.
- Infantile apnoea/hypoxaemic events.
- Premature birth.
- Respiratory infection (e.g. bronchiolitis, pertussis).
- Sleep-related upper airway obstruction (see Section 5.1.D).
- Vaso-vagal episodes (simple fainty).
- Cardiac arrhythmias.
- Cyanotic breath-holding.
- White breath-holding (reflex anoxic seizures).

**History**
- Cyanosed:
  - Occurs with infant apnoea
  - Some febrile convulsions/epileptic seizures.
- Extreme pallor:
  - Vasovagal
  - Cardiac arrhythmia.
- Trauma/illness related (especially to head): white breath-holding.
- Emotional upset: cyanotic breath-holding.
- Snoring/inspiratory stridor during sleep, often with chest recession and restlessness: sleep-related upper airway obstruction (see Section 5.1.D).
- Exercise related: cardiac arrhythmia (see Section 5.4.C).
- Drug abuse.
- Fabricated or induced illness (see Section 7.6).
- Convulsions (see Sections 5.16.D and 5.16.E).
- Preterm infant in first few weeks (see Section 3.4).
- Respiratory illness.
- Diabetes/starvation (see Section 5.8.A).

**Examination**
- Growth and nutritional status.
- Signs of respiratory infection.
- Signs of anaemia (associated with cyanotic breath-holding and infant apnoea).
- Signs of fever.
- Neurological examination (to exclude or identify neurological abnormalities).
- History of breath-holding (see Section 5.16.I).
- Signs of cardiac disorder.
- Blood pressure lying and standing, for vasovagal episodes.
- Mouth and throat for enlarged tonsils or retrograde/small mandible for predisposition to sleep-related airway obstruction (the latter is also common in sickle-cell disease and Down’s syndrome).

**Investigations**

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full blood count</td>
<td>Anaemia, infection</td>
</tr>
<tr>
<td>Blood glucose concentration</td>
<td>Hypoglycaemia</td>
</tr>
<tr>
<td>Haemoglobin electrophoresis</td>
<td>Sickle-cell disease</td>
</tr>
<tr>
<td>ECG</td>
<td>Wolf–Parkinson–White syndrome and long QT syndrome</td>
</tr>
<tr>
<td></td>
<td>Structural lesion of heart</td>
</tr>
<tr>
<td>Oxygen saturation during sleep</td>
<td>Low baseline SaO2 predisposes to infant apnoea/hypoxaemic events</td>
</tr>
<tr>
<td></td>
<td>Should be &gt; 94% (at sea level) (see Section 9, Appendix)</td>
</tr>
<tr>
<td></td>
<td>Especially common in preterm infants and infants aged &lt; 6 months with</td>
</tr>
<tr>
<td></td>
<td>respiratory infection</td>
</tr>
<tr>
<td>Video (if available) during sleep (parents can do this with a mobile phone)</td>
<td>Sleep-related upper airway obstruction</td>
</tr>
<tr>
<td>EEG and video during episode</td>
<td>Epileptic cause</td>
</tr>
<tr>
<td>Chest X-ray</td>
<td>Lung disease in infantile apnoea/hypoxaemic events</td>
</tr>
</tbody>
</table>
4.1.J The child with generalised oedema

The major differential diagnosis relates to the presence or absence of hypoalbuminaemia.

Common pathophysiology
- Heart failure:
  - Jugular vein pressure increased, liver enlarged, triple rhythm, murmurs, basal lung crepitations.
  - Cardiovascular disorders.
  - Severe anaemia.
- Acute glomerulonephritis.
- Low serum albumin:
  - Nephrotic syndrome.
  - Liver disorders.
  - Protein-losing enteropathy (e.g. malabsorption, intestinal lymphangiectasia).
  - Malnutrition.
- Increased vascular permeability:
  - Anaphylaxis (history).
  - Shock.
- Over-hydration (particularly excessive IV solutions such as 5% dextrose).

History
- Shortness of breath, chest pain (pericarditis).
- Blood in urine (nephritis).
- Facial swelling (nephrotic syndrome or acute glomerulonephritis, anaphylaxis).
- Nutritional history (malnutrition).
- Gastrointestinal symptoms (protein-losing enteropathy).
- Exposure to allergen or sting (anaphylaxis).
- Excess and/or inappropriate IV fluids.

Examination
- Chart growth and nutritional status, and look for features of kwashiorkor and vitamin deficiencies.
- Cardiovascular system, including blood pressure.
- Rash with or without wheeze/stridor (anaphylaxis).
- Widespread purpuric rash/very ill patient (meningococcal septicaemia).
- Jaundice or other signs of liver disease.
- Anaemia and lymphadenopathy.
- Enlarged liver and/or spleen.
- Ascites (especially nephrotic syndrome). Ascites may be transudate (e.g. nephrotic syndrome) or inflammatory (e.g. TB, peritonitis). Abdominal malignancy may cause ascites and obstructive oedema of the lower limbs.

Investigations

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full blood count</td>
<td>Anaemia</td>
</tr>
<tr>
<td>Urinalysis:</td>
<td></td>
</tr>
<tr>
<td>Dipstick: protein, blood</td>
<td>Nephrotic syndrome, nephritis</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>Liver disease</td>
</tr>
<tr>
<td>Microscopy: red blood cell count, casts</td>
<td>Nephritis</td>
</tr>
<tr>
<td>Stool</td>
<td>Hookworm</td>
</tr>
<tr>
<td>Serum albumin</td>
<td>Low albumin levels</td>
</tr>
<tr>
<td>Imaging: abdominal ultrasound</td>
<td>Hepatosplenomegaly</td>
</tr>
<tr>
<td></td>
<td>Malignancy</td>
</tr>
<tr>
<td></td>
<td>Ascites (transudate/inflammation)</td>
</tr>
<tr>
<td>Echocardiogram</td>
<td>Cardiac disorders</td>
</tr>
<tr>
<td>Ascitic fluid</td>
<td></td>
</tr>
<tr>
<td>Colour: clear, cloudy, bloody, chylous</td>
<td>Inflammation (e.g. from TB)</td>
</tr>
<tr>
<td>Cells: white blood cell count, malignant cells</td>
<td>Infection, malignancy</td>
</tr>
<tr>
<td>Protein: &lt; 25 grams/litre transudate</td>
<td>TB</td>
</tr>
<tr>
<td>&gt; 25 grams/litre exudate</td>
<td>TB/general</td>
</tr>
<tr>
<td>Ziehl–Neelsen stain</td>
<td></td>
</tr>
<tr>
<td>Culture:</td>
<td></td>
</tr>
</tbody>
</table>
4.1.K The child with headaches

- Headaches are common in children.
- They should be taken seriously if they persist.
- Their prevalence increases with age.

**Acute headache**
Common causes of acute headache include the following:
- Febrile illness.
- Meningitis/encephalitis.
- Acute sinusitis: pain and tenderness (elicited by gentle percussion) over the maxilla; there is usually a history of preceding upper respiratory tract infection and a postnasal discharge may be present.
- Head injury.
- Raised intracranial pressure.
- Intracranial haemorrhage (severe sudden headache, with rapid loss of consciousness).
- Migraine.

A careful history and physical examination will usually reveal the cause.

**Raised intracranial pressure (RICP)**
- Headache may be sudden or gradual in onset, often occipital in location and becomes progressively more severe.
- Made worse by lying down (in contrast to migraine and tension headache, which are relieved by lying down), by coughing, stooping and straining, and may wake the child from sleep.
- Worse in the morning and often associated with nausea and vomiting.
- Other signs of raised intracranial pressure may be present, such as impaired consciousness, bilateral abducens sixth nerve palsies (false localising sign) and, when severe, bradycardia and hypertension.
- Papilloedema is a late sign.
- Localising neurological signs may be present, depending on the site of the lesion. Ataxia suggests a posterior fossa tumour; cranial nerve palsies suggest a brainstem lesion; visual field defect suggests a craniopharyngioma; unequal pupils suggest a supratentorial lesion such as subdural haematoma.
- In endemic areas, cerebral malaria and neurocysticercosis are important causes.

**Benign intracranial hypertension**
- Raised intracranial hypertension without any space-occupying lesion or obstruction of the CSF.
- Can be caused by drugs (corticosteroids, especially during withdrawal, ampicillin, nalidixic acid) and sagittal sinus thrombosis.
- Most without cause, especially in young adolescent girls.

**Recurrent or chronic headaches**
Two common causes are anxiety (tension) and migraine.

**Tension headache**
- This affects around 10% of schoolchildren.
- Typically the headache is symmetrical and described as hurting or aching over the cranial vault.
- The headache develops gradually and is not associated with other symptoms.
- It is induced by stress (e.g. due to school examinations, assignments, etc.) and can coexist with migraine in the same child.
- It may be caused by isometric contraction of the head and neck muscles in anxious children.

**Migraine**
See Section 5.16.J.

**Conversion (hysterical) headache**
- Headache can be a conversion symptom used by the child to gain attention.
- The initial headache may have been due to an organic cause (e.g. febrile illness), but its persistence and recurrence are due to psychological factors.

**Management of headaches**
See also Section 5.16.A relating to an acute onset of headache.
- A detailed history and a careful full examination should be undertaken in order to rule out serious underlying causes.
- Investigations are rarely needed.
- X-ray of the sinuses will confirm sinusitis and CSF examination will confirm meningitis/encephalitis.
- A CT scan of the brain is essential if raised intracranial pressure is suspected or if there are localising neurological signs.
- Treatment is directed at the underlying cause and at pain relief.
- Benign intracranial hypertension can be alleviated with corticosteroids (dexamethasone 0.6 mg/kg/day in two divided doses) and/or acetazolamide (8 mg/kg 8-hourly, increasing to a maximum of 32 mg/kg/day) and repeated lumbar puncture.
- For tension and conversion headaches, counselling and stress management are important.

**Relief of pain**
For most headaches, simple analgesics alone or combined with non-steroidal anti-inflammatory drugs (NSAIDs) will suffice (e.g. paracetamol with or without ibuprofen). Remember that frequent or recurrent use of analgesics can cause headaches.
4.1.L The child with respiratory distress

**Presenting features**
- Tachypnoea.
- Increased effort of breathing: tracheal tug, inter/sub-costal recession.
- Poor feeding, sleep disturbance.
- Grunting.
- Unable to speak in sentences.
- Positioning: sitting up/forward, neck extension, splinting chest.
- Tachycardia.
- Altered mental state: agitation (hypoxaemia)/drowsiness (hypercapnia).
- Pallor/cyanosis (late sign).

**Causes**

<table>
<thead>
<tr>
<th>Common cause</th>
<th>Findings on examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper airway obstruction</td>
<td>Stridor, hoarse voice, drooling, sitting up, head held forward</td>
</tr>
<tr>
<td>Inhaled foreign body</td>
<td>Suggestive history, tracheal deviation, unilateral hyper-expansion on chest X-ray</td>
</tr>
<tr>
<td>Asthma</td>
<td>Hyper-expansion, wheeze, reduced air entry, reduced peak flow, hypoxaemic (SaO₂ &lt; 94% at sea level)</td>
</tr>
<tr>
<td>Bronchiolitis</td>
<td>Inspiratory crackles, wheeze, hypoxaemic (SaO₂ &lt; 94% at sea level)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>Fever, grunting, pleuritic or abdominal pain, signs of consolidation or effusion. Clubbing indicates chronic disease (e.g. bronchiectasis)</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Contact history, lymphadenopathy, fever, weight loss</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>Unilateral hyper-resonance on percussion, tracheal deviation, apex displacement</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>Recurrent respiratory infections, failure to thrive, fat malabsorption, family history</td>
</tr>
<tr>
<td>Heart failure/pulmonary oedema</td>
<td>Sweaty, gallop rhythm, hepatomegaly, heart murmurs, basal lung crepitations, raised jugular venous pressure (JVP)</td>
</tr>
<tr>
<td>Sickle-cell disease/acute chest syndrome</td>
<td>Hypoxaemia (SaO₂ &lt; 94% at sea level), chest pain</td>
</tr>
</tbody>
</table>

**Investigations**

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Looking for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen saturation (pulse oximeter)</td>
<td>Hypoxaemia &lt; 94% at sea level</td>
</tr>
<tr>
<td>Chest X-ray</td>
<td>Lung disorder</td>
</tr>
<tr>
<td>ECG, echocardiogram</td>
<td>Heart disorder</td>
</tr>
<tr>
<td>Mantoux</td>
<td>TB</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate (ESR), C-reactive protein (CRP)</td>
<td>Inflammation</td>
</tr>
<tr>
<td>Full blood count</td>
<td>Infection</td>
</tr>
<tr>
<td>Haemoglobin electrophoresis</td>
<td>Sickle-cell disease</td>
</tr>
<tr>
<td>Bronchoscopy</td>
<td>Foreign body</td>
</tr>
<tr>
<td>Sweat test or DNA analysis</td>
<td>Cystic fibrosis</td>
</tr>
</tbody>
</table>
4.1.M The child with pyrexia (fever) of unknown origin (PUO)

**Definition**
Pyrexia of unknown origin (PUO) is defined as a minimum temperature of at least 38.3°C for 1–3 weeks with at least 1 week of hospital investigation. It is very important to determine whether fever is continuous or recurrent by plotting it on a chart (see Section 9, Appendix).

**Baseline investigations**
- Full blood count and film.
- Erythrocyte sedimentation rate (ESR)/C-reactive protein (CRP).
- Blood cultures.
- Thick film and/or rapid diagnostic test (RDT) for malaria (endemic areas/recent foreign travel).
- Mantoux test.
- Epstein–Barr and other viral serology.
- Urine microscopy/culture.
- Chest X-ray.
- Lumbar puncture (if meningeal signs are present).

**TABLE 4.1.M.1 Relatively common causes of pyrexia of unknown origin in children**

<table>
<thead>
<tr>
<th>Cause</th>
<th>Specific investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial infection</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Chest X-ray, tuberculin skin test, lumbar puncture</td>
</tr>
<tr>
<td>Campylobacter</td>
<td></td>
</tr>
<tr>
<td>Typhoid</td>
<td></td>
</tr>
<tr>
<td>Brucellosis</td>
<td></td>
</tr>
<tr>
<td>Cat scratch disease</td>
<td></td>
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<tr>
<td>Rheumatic fever</td>
<td></td>
</tr>
<tr>
<td>Campylobacter</td>
<td></td>
</tr>
<tr>
<td>Typhoid</td>
<td></td>
</tr>
<tr>
<td>Brucellosis</td>
<td></td>
</tr>
<tr>
<td>Cat scratch disease</td>
<td></td>
</tr>
<tr>
<td>Rheumatic fever</td>
<td></td>
</tr>
<tr>
<td>Localised infection</td>
<td></td>
</tr>
<tr>
<td>Hidden abscess</td>
<td>Abdominal ultrasound scan</td>
</tr>
<tr>
<td>Bacterial endocarditis</td>
<td></td>
</tr>
<tr>
<td>Osteomyelitis</td>
<td></td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td></td>
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<tr>
<td>Cholangitis</td>
<td></td>
</tr>
<tr>
<td>Spirochaete infection</td>
<td></td>
</tr>
<tr>
<td>Borrelia</td>
<td>Serology</td>
</tr>
<tr>
<td>Syphilis</td>
<td>Serology</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>Serology blood and urine culture</td>
</tr>
<tr>
<td>Viral infection</td>
<td></td>
</tr>
<tr>
<td>HIV</td>
<td>Serology</td>
</tr>
<tr>
<td>Epstein–Barr virus</td>
<td>Serology, Paul-Bunnell test, blood film; atypical lymphocytes</td>
</tr>
<tr>
<td>Chlamydia infection</td>
<td></td>
</tr>
<tr>
<td>Psittacosis</td>
<td>Serology</td>
</tr>
<tr>
<td>Rickettsial infection</td>
<td></td>
</tr>
<tr>
<td>Q fever</td>
<td>Serology</td>
</tr>
<tr>
<td>Fungal infection</td>
<td></td>
</tr>
<tr>
<td>Histoplasmosis</td>
<td>Serology and culture</td>
</tr>
<tr>
<td>Parasitic infection</td>
<td></td>
</tr>
<tr>
<td>Giardiasis</td>
<td>Fresh stool microscopy</td>
</tr>
<tr>
<td>Malaria</td>
<td>Blood film, rapid diagnostic test</td>
</tr>
<tr>
<td>Trichomoniasis</td>
<td>Thick blood film</td>
</tr>
<tr>
<td>Toxoplasmosis</td>
<td>Serology</td>
</tr>
<tr>
<td>Toxocariasis</td>
<td>Serology, blood eosinophil count</td>
</tr>
<tr>
<td>Leishmaniasis</td>
<td>Serology, bone marrow</td>
</tr>
<tr>
<td>Connective tissue disorder</td>
<td></td>
</tr>
<tr>
<td>Juvenile idiopathic arthritis</td>
<td>Auto-antibodies</td>
</tr>
<tr>
<td>Systemic lupus erythematosus</td>
<td></td>
</tr>
<tr>
<td>Auto-antibodies</td>
<td></td>
</tr>
<tr>
<td>Neoplasia</td>
<td></td>
</tr>
<tr>
<td>Lymphoma</td>
<td>Node biopsy</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>Blood film/bone marrow</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>Urinary VMA</td>
</tr>
<tr>
<td>Wilms’ tumour</td>
<td>Ultrasound or CT scan</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
<tr>
<td>Kawasaki disease</td>
<td>Erythrocyte sedimentation rate (ESR), platelets, clinical findings</td>
</tr>
<tr>
<td>Inflammatory bowel disease</td>
<td></td>
</tr>
<tr>
<td>Fabricated illness</td>
<td></td>
</tr>
</tbody>
</table>

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