Practical Approach to **Paediatric Gastroenterology, Hepatology** and **Nutrition**

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Jane Hartley
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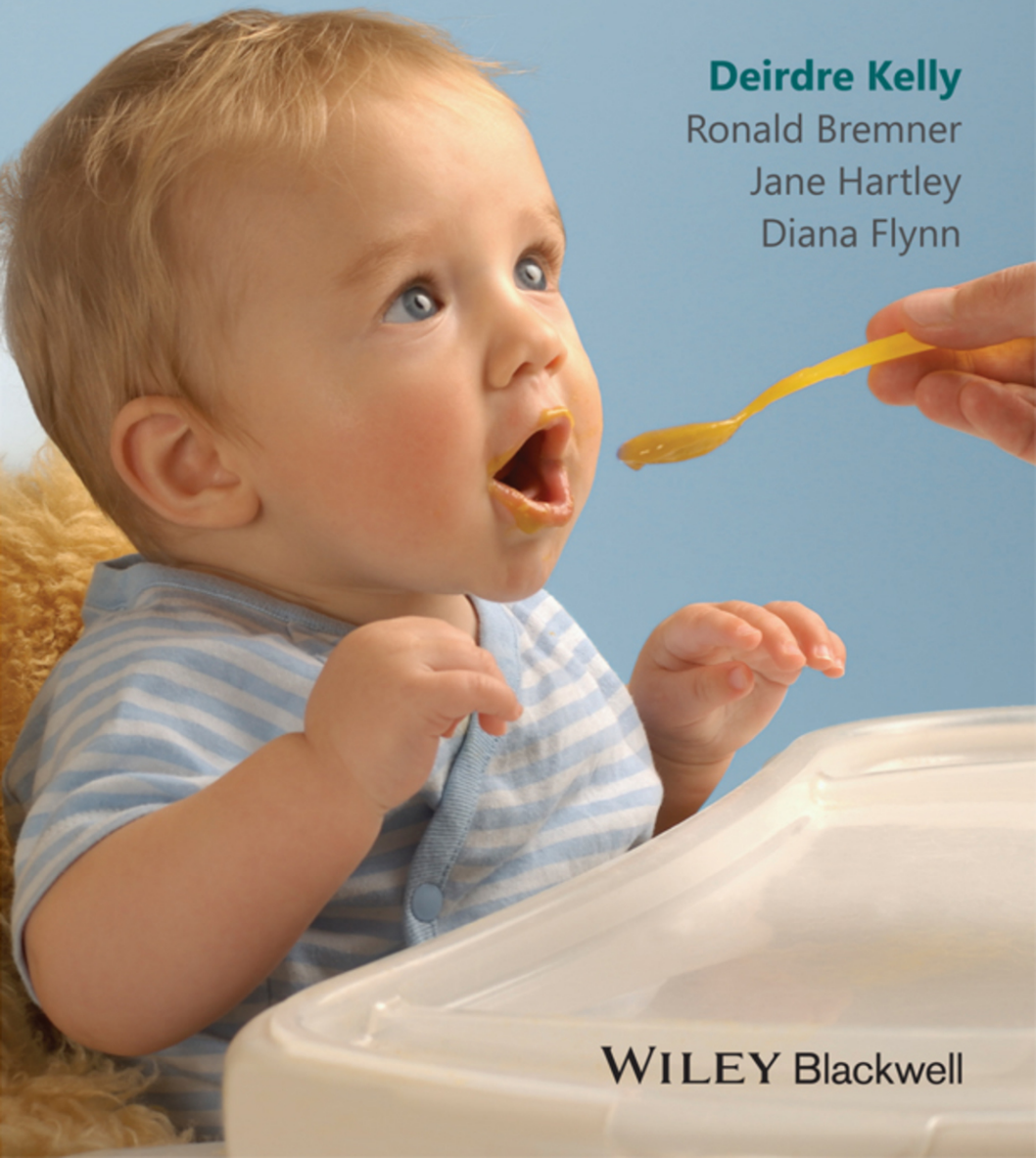

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Preface

Paediatrics is a rapidly evolving field of medicine, particularly in the sub-specialties. This makes it difficult for trainees, junior doctors and allied health professionals to keep up with new developments.

This book aims to provide problem-orientated clinical scenarios in paediatric gastroenterology, hepatology and nutrition, and is designed to make initial assessment, management and referral of children easy to follow.

The book is up to date with current practice, user friendly, with links to the latest guidance, protocols and information, and should be a popular book no trainee doctor should be without.

We hope you enjoy using it and that it will help you improve how you manage children with these specialist conditions.

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Gastroenterology

PART I

Abdominal symptoms are often non-specific, with a wide differential diagnosis. We aim to provide a framework for evaluation, with information for both common and important rare conditions. A multidisciplinary model of care supports optimal management and outcomes. Specialist nursing, dietetics and psychology are central to supporting therapy, especially in chronic illness. Specialist advice and management for rare or complex problems are important, as is recognising non-gastrointestinal illness and conditions requiring surgical intervention, often provided through a defined network of units with pathways for referral, and shared-care with community and hospital teams.

Practical Approach to Paediatric Gastroenterology, Hepatology and Nutrition, First Edition.
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The infant with abdominal pain

CHAPTER 1

It can be difficult to distinguish between 'normal' colic and pathological conditions.

Infantile colic is common in the first months of life. Babies scream, draw up their knees and experience severe pain. Episodes may last up to 3 hours and occur several times per week. Causes are listed in Table 1.1.

Pathological pain from any site may be interpreted as abdominal in origin, e.g. corneal abrasion, renal tract obstruction, bony fracture.

Investigations

Normal results from screening blood tests can help reassure that underlying renal, liver or metabolic diseases are unlikely.

- FBC, renal, liver and bone biochemistry, blood gases
- Urine analysis and culture
- Plain abdominal radiograph: volvulus in the ill child or with bilious vomiting
- Abdominal ultrasound scan: when intussusception suspected
- Barium swallow and follow to the duodenal–jejunal flexure: to exclude malrotation
- Endoscopy is rarely indicated

Management

In the absence of other obvious cause, a time-limited trial of hypoallergenic feed can be useful to exclude milk allergy/intolerance (see Chapter 12), and antacid therapy can be used if there is acid reflux-related oesophagitis. Most often, colic settles within a few weeks or with changes in routine.

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Table 1.1 Causes, cardinal signs and diagnostic investigations in a child with abdominal pain

Causes	Cardinal features	Diagnostic test
Infantile colic	No abnormal findings	None
Gastro-oesophageal reflux	Regurgitation, back arching	Trial of acid suppression
		Oesophageal (+gastric) pH probe
		Oesophageal impedance study
		Endoscopy and histology
Milk or soya allergy/intolerance	Diarrhoea, rashes	See Chapter 12
Gastroenteritis	Watery stools, fever	Stool virology/ microbiology
Constipation	Straining, hard stool, retentive behaviour	See Chapter 14
Urinary tract infection	Fever, pyuria	Urine dipstick test for leukocytes and nitrites, or microscopy
		Microbial culture
Intussusception	Ill child, red currant jelly stools (late sign)	Fluoroscopy with air enema reduction
	Blood on digital rectal examination	
Volvulus	Distension, bilious vomiting	Abdominal radiograph
Incarcerated hernia	Tender groin swelling	Ultrasonography

Table 1.1 (*Continued*)

Causes	Cardinal features	Diagnostic test
Testicular torsion	Scrotum swollen and/or discoloured and/or tender	Ultrasonography
Hirschsprung's disease	Delayed passage of meconium, ribbon stools	Full thickness rectal biopsy
Renal pelviceal/ ureteric obstruction	Recurrent urinary tract infection, episodic pain	Ultrasonography
Metabolic disease (e.g. Reye's syndrome, MCADD)	Acidosis, encephalopathy	Blood gases, glucose, ammonia, lactate, serum amino acids, urine amino and organic acids, acyl carnitines

MCADD, medium-chain acyl-CoA dehydrogenase deficiency.

Red flags: When colic is concerning

- Abdominal distension (see Chapter 6)
- Faltering growth: feeding problem (see Chapters 37, 38 and 39) or malabsorption (see Chapter 9)
- Abnormal developmental progress: severe oesophagitis more likely, underlying metabolic disorder

The child with abdominal pain

CHAPTER 2

Abdominal pain is common in school-aged children and is rarely organic.

History

- Duration and location [right upper quadrant pain in hepatitis, Gilbert's syndrome and non-alcoholic steatohepatitis (NASH)]
- Associated symptoms: vomiting, dyspepsia, diarrhoea, fever, groin pain, urinary symptoms
- Blood in stool
- Vaginal discharge
- Foreign travel
- Gynaecological and sexual history
- Family history: inflammatory bowel disease, coeliac disease, migraine, irritable bowel syndrome, gallstones, pancreatitis

Investigations

- Urinalysis: haematuria in renal stones, pyuria in urinary tract infection
- Urine microscopy, culture, sensitivities
- Blood tests: blood glucose, FBC, renal function, liver function, inflammatory markers, amylase, cholesterol, triglycerides
- Other blood tests if indicated, e.g. paracetamol levels, thyroid function tests
- Stool samples if diarrhoea: microscopy, culture, sensitivity, ova, cysts, parasites

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- Abdominal imaging:
  - Abdominal X-ray, e.g. if looking for obstruction
  - Chest X-ray, e.g. for pneumonia or air under the diaphragm
  - Ultrasound scan of the abdomen, kidneys, pelvis (females) and testes (males)
  - CT scan may also be appropriate, especially if there is a mass, trauma, jaundice or pancreatitis
- Endoscopy: will depend upon preliminary findings and history; in the absence of any abnormality on blood screen and imaging, negative endoscopy is very likely

Causes

Well child

- Functional bowel disease: recurrent abdominal pain of childhood, abdominal migraine
- Lactose intolerance: worse with dairy products (ice cream and chocolate are high lactose)
- Gastro-oesophageal reflux ± oesophagitis: dyspepsia, epigastric pain, regurgitation
- Constipation: hard, infrequent stools, soiling
- Renal pelvic/ureteric obstruction: intermittent colicky loin pain
- Coeliac disease: variable association with iron deficiency, diarrhoea, oral ampthous ulceration
- Food allergy (see Chapter 12)
- NASH: associated with obesity and metabolic syndrome

Febrile child

- Gastroenteritis (bacterial or viral)
- Mesenteric adenitis
- Urinary tract infection (lower abdominal pain, loin pain – suggests pyleonephritis)
- Pneumonia
- Inflammatory bowel disease
- Liver abscess

The ill child

- Diabetic ketoacidosis: check urine for glucose, blood gases
- Mesenteric lymphadenitis: fever, often with associated tonsillitis or pharyngitis
- Peptic ulcer disease: sharp epigastric pain after meals
- Hepatitis: raised liver transaminases ± jaundice; see Chapter 21

- Pancreatitis: high amylase, bilirubin and transaminases may be raised
- Ultrasound: biliary dilatation may be seen in acute pancreatitis
- DNA: *PRSS1* mutations in familial pancreatitis, raised serum amylase and lipase
- Sickle cell anaemia/crisis: blood film shows sickle cells
- Henoch–Schönlein purpura: characteristic vasculitic rash, haematuria or proteinuria
- Acute adrenal failure: hyponatraemia ± hyperkalaemia, check for inappropriate urinary sodium losses

Surgical causes

- Appendicitis: low-grade fever, central then right iliac fossa pain, unable to stand (psoas irritation), beware of atypical symptoms
- Bowel obstruction, e.g. intussusception, volvulus: bilious vomiting, abdominal distension, tenderness
- Trauma, e.g. haematoma, pancreatitis, liver trauma: may present several days after the event. Low haemoglobin, CT scan will identify liver laceration/pancreatic transection or liver abscesses
- Incarcerated hernia: groin or scrotal swelling/discolouration/pain
- Peritonitis: rigid abdomen or distension with tenderness
- Liver abscess: ultrasound – abscess(es) in liver, raised white cell count, blood culture or aspirate from the abscess may grow pathogen (most commonly *Streptococcus* or *Klebsiella*)
- Gallstones/cholecystitis: sickle cell on blood film, raised bilirubin if obstruction, abnormal transaminases, high amylase if the ampulla of Vater is affected, cholesterol or triglycerides may be high, ultrasound – acoustic shadow (Figure 2.1), biliary dilatation if the gallstone is causing obstruction
- Testicular torsion: scrotal swelling, tenderness, discolouration
- Ureteric calculi: colicky pain, macro- or micro-scopic haematuria

Gynaecological causes

- Dysmenorrhoea or endometriosis: prior and/or during menstrual bleed
- Mittelschmerz: mid-cycle colicky pain
- Pelvic inflammatory disease: fever variable

Obstetric causes

- Ectopic pregnancy: sudden onset with shock or peritonism
- Ovarian cyst rupture/torsion
- Miscarriage/abortion/retained foetal products

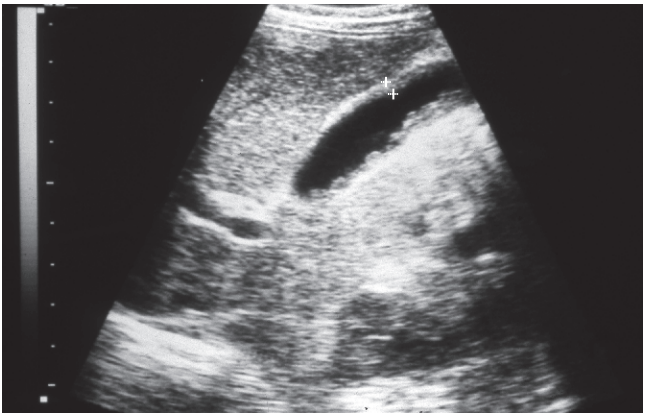

Figure 2.1 Ultrasound scan appearance of gallstones with acoustic shadows. The gallbladder wall (marked with crosses) is irregular and thick, consistent with chronic cholecystitis.

Drugs/toxins

- Paracetamol overdose
- Iron overdose
- Venoms: spider bite, scorpion sting
- Soap ingestion
- Erythromycin

Referred pain

- Usually musculoskeletal: examine for scoliosis, joint tenderness

Rare causes

- Angioneurotic oedema: episodic, rash or facial/lip swelling – allergy/immunology referral
- Familial Mediterranean fever or systemic lupus erythematosis: episodic fever and raised inflammatory markers with extra-intestinal symptoms – rheumatology referral
- Acute intermittent porphyria: episodic, send urine for porphyrins during an attack
- Peptic ulcer disease – often associated with *Helicobacter pylori* infection

Information: Rome III criteria for functional bowel diseases

- No evidence of an inflammatory, anatomical, metabolic or neoplastic process
- Symptoms: at least once a week for at least 2 months before diagnosis

Functional dyspepsia
- Persistent or recurrent pain or discomfort above the umbilicus
- Not relieved by defecation or associated with the onset of a change in stool frequency or stool form

Irritable bowel syndrome

Abdominal discomfort or pain associated with two or more of the following at least 25% of the time:
- Improved with defecation
- Onset associated with a change in frequency of stool
- Onset associated with a change in form (appearance) of stool

Functional abdominal pain
- Episodic or continuous abdominal pain
- Insufficient criteria for other functional gastrointestinal disorders

Functional abdominal pain syndrome
- Must include: functional abdominal pain at least 25% of the time and either some loss of daily functioning or additional somatic symptoms such as headache, limb pain or difficulty in sleeping

Information: Abdominal migraine

Criteria:
- Two or more times in the preceding 12 months
- Paroxysmal episodes of intense peri-umbilical pain lasting >1 hour
- Intervening periods of usual health lasting weeks to months
- Pain interferes with normal activities
- Pain is associated with two or more of the following:
  - Anorexia
  - Nausea
  - Vomiting
  - Headache
  - Photophobia
  - Pallor

Red flags: When to be concerned about abdominal pain

- Unintentional weight loss
- Growth failure or slowing
- Unexplained fever
- Chronic severe diarrhoea or significant vomiting
- Gastrointestinal bleeding
- Family history of inflammatory bowel disease
- Persistent chronic right iliac fossa or right upper quadrant pain
- Recurrent pancreatitis: consider hereditary pancreatitis or lipidaemia

Information: Gallstones

Associated with:

- Haemolysis
- Prematurity
- Cystic fibrosis
- Down's syndrome
- Bone marrow and cardiac transplantation
- Childhood cancer
- Spinal surgery/injury
- Hepatobiliary trauma
- Selective IgA deficiency
- Dystrophia myotonica
- Chronic intestinal pseudo-obstruction
- Cholestatic liver disease (especially progressive familial intrahepatic cholestasis)
- Congenital anomalies

There is a bimodal incidence with initial peaks in infancy and adolescence; more common in females.

Presentation

- In infancy: poor feeding, vomiting and jaundice
- In older children: right upper quadrant or epigastric pain, nausea, vomiting and obstructive jaundice

Diagnosis

- Stones cast acoustic shadow on ultrasound and a thick-walled gallbladder (see Figure 2.1)

(*Continued*)

Outcome
- Infants: gallstones may resolve
- Older children: resolution is unlikely
- Surgery is only required if symptomatic or there is bile duct dilatation
- Laparoscopic cholecystectomy is advisable

Management

Functional abdominal pain
- Reassurance that there is no evidence of organic pathology
- Significant persistent symptoms require multidisciplinary input with a family-based holistic approach

Medications
- Functional abdominal symptoms respond poorly to acid reduction therapy or antispasmodics
- Peppermint oil (one or two capsules three times daily) is most likely to be effective
- Mebeverine hydrochloride: 25 mg three times daily (age 3–4 years); 50 mg three times daily (age 4–8 years); 100 mg three times daily (age 8–10 years); 135–150 mg three times daily (age over 10 years)
- Dicycloverine hydrochloride: 5–10 mg before feeds (age 6 months–2 years); 10–20 mg three times daily (over age 2 years)
- Hyoscine butylbromide: 0.5 mg/kg, max. 5 mg three times daily (age 1 month–2 years); 5 mg three times daily (2–5 years); 10–20 mg three times daily (over 5 years)
- Abdominal migraine can be prevented or ameliorated by using a serotonin 2A receptor antagonist, pizotifen 0.25–0.5 mg twice or three times daily

Dietary management
Food allergy and intolerance is common in small children, and dietary manipulation is often attempted by families prior to seeking advice from health professionals. In practice, this is rarely effective and puts children at risk of nutrient deficiency (e.g. dairy exclusion and suboptimal calcium intake).

A careful history will identify those with food allergy or intolerance (see Chapter 12). Lactose intolerance is common in Asian and Afro-Caribbean populations. There is little evidence that functional abdominal pain improves with a lactose-free diet in either lactase-deficient or -sufficient children.

Probiotics and prebiotics have not been shown to be effective, though do no harm.

Psychological management

Functional abdominal pain may stem from learned-behaviour responses to environmental and social stimuli that interact with the child's experience of physical illness. This hypothesis is supported by psychological studies showing altered subliminal responsiveness to pain- and stress-related cues, and that maternal anxiety is a predictor. Psychological interventions, including family therapy, hypnotherapy and cognitive behavioural therapy, are effective in reducing the severity and duration of symptoms, and improving school attendance.

Gallstones

- Ursodeoxycholic acid 10–20 mg/kg/day with fat-soluble vitamins if there is obstructive jaundice
- Biliary dilatation requires removal of the stone by endoscopic manipulation through the ampulla of Vater using endoscopic retrograde cholangiopancreatography (ERCP)
- Laparoscopic cholecystectomy only when acute inflammation has resolved

Liver abscess

- Drainage of abscess
- Antibiotics (antifungals in immunosuppressed patients or if there is no response to antibiotics without culture sensitivities)

Liver trauma

- Resuscitation, pain relief, identify other injuries
- Conservative management unless haemorrhage is uncontrolled and then surgical intervention

Further reading

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Key web links

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http://www.naspghan.org/user-assets/Documents/pdf/diseaseInfo/Pancreatitis-E.pdf

Classification of functional GI disorders: the Rome III Criteria: http://www.romecriteria.org/criteriaEvidence-based Guidelines from ESPGHAN and NASPGHAN for *Helicobacter pylori* infection in children: http://espghan.med.up.pt/position_papers/Koletzko_Evidence_based_Guidelines_From_ESPGHAN_and_NASPGHAN_for_Helicobacter_pylori_Infection_in_Children.pdf – accessed 3/8/13

The infant with vomiting

CHAPTER 3

Around half of infants regurgitate, and this on its own is not significant. However, vomiting is the cardinal feature of many gastrointestinal, renal, metabolic or neurological diseases. Persistent, effortless vomiting or posseting are characteristic of gastro-oesophageal reflux, and this is associated with a wide range of conditions, adding to the difficulty in management.

Important features from history

- Acute onset: infectious or surgical causes
- Fever: infection
- Antenatal history: maternal infection, antenatal ultrasound scan findings
- Birth history: prematurity, resuscitation
- Assess frequency and feed volume, characterise any feeding difficulties, effect of any changes in formulae
- Weight loss: systemic disease more likely
- Oesophagitis symptoms, e.g. irritability, back arching, feed refusal, haematemesis
- Failure to growth: no weight gain 2 weeks after birth or dropping through centiles
- Neurological symptoms and developmental progress: consider metabolic disease
- Family history of bowel surgery: malrotation, hiatus hernia, Hirschsprung's disease

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- Cough or frequent chest infections: recurrent aspiration, cystic fibrosis, tracheo-oesophageal fistula
- Stridor or apnoea: seek ENT review
- Eczema, diarrhoea, urticaria or family history of atopy: suggest possible food allergy

Red flags: What to look for in a vomiting infant

- Exclude infection
- Always consider raised intracranial pressure: bulging fontanelle, climbing head circumference centiles
- Be alert to factitious or induced illness

Causes

Neonate

- Overfeeding: usual intake is 150–200 mL/kg/day
- Gastro-oesophageal reflux ± cow's milk intolerance/allergy
- Bowel obstruction: duodenal web, small bowel atresia, volvulus, malrotation, Hirschsprung's disease, imperforate anus
- Infection: gastroenteritis, septicaemia, urinary tract infection, pneumonia, meningitis
- Neonatal abstinence syndrome: opiate or amphetamine withdrawal
- Intracranial bleed or injury: bulging fontanelle
- Inborn error of metabolism, e.g. urea cycle disorder, fructosaemia
- Congenital adrenal hyperplasia: abnormal serum electrolytes
- H-type tracheo-oesophageal fistula: cough, recurrent aspiration
- Upper airway or ENT anomaly: apnoea, cough, choking

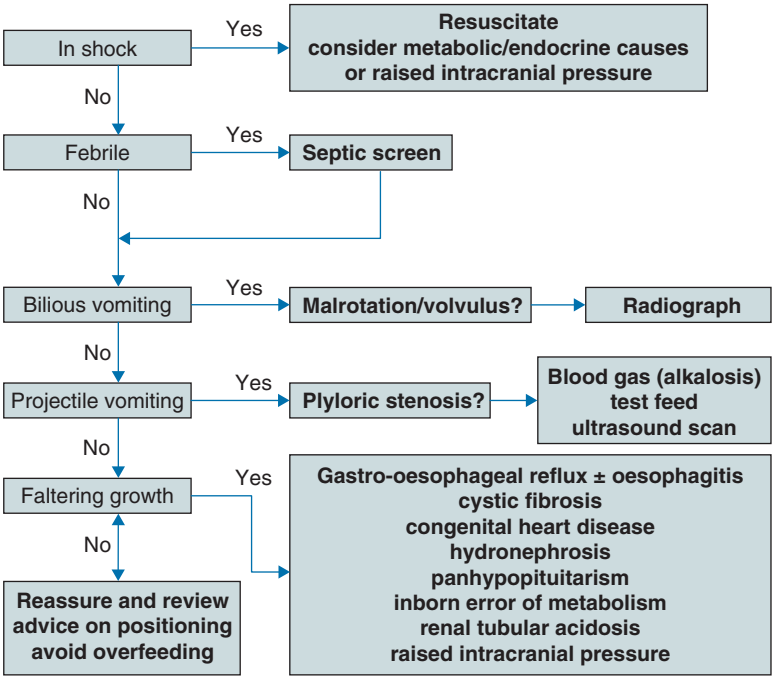
Older infant

- Overfeeding: usual intake is 120–150 mL/kg/day
- Gastro-oesophageal reflux
- Pyloric stenosis: blood gas for alkalosis, ultrasound scan, refer to surgeon for test feed
- Cow's milk protein intolerance/allergy: trial of hypoallergenic feed, or maternal milk/soya restriction
- Infection: gastroenteritis, urinary tract, otitis media, pneumonia, meningitis, septicaemia
- Intracranial mass, bleed or head injury: consider CT scan
- Bowel obstruction: abdominal radiograph, refer to surgeon
- Testicular torsion: urgent referral to surgeon

- Intussusception: ultrasound scan, refer to surgeon, air enema reduction
- Ketoacidosis: blood sugar, blood gas for acidosis
- Appendicitis: fever and abdominal pain, ultrasound scan, refer to surgeon
- Cystinosis: hypophosphataemia, renal tubular leak

Screening investigations (see Algorithm 3.1)

- Blood pressure
- Urine dipstix: ketones, sugar
- Blood sugar
- Septic screen if febrile or unwell
- Blood gases ± metabolic disease screen: blood ammonia, serum amino acids, urine amino and organic acids
- Serum biochemistry: U&E, LFT, bone profile
- Abdominal radiograph if obstruction suspected
- Barium swallow and follow through to the duodenal–jejunal flexure to exclude malrotation



Algorithm 3.1 Investigation of vomiting in infants

Information: Tests for gastro-oesophageal reflux

Reflux events are common in normal infants, and not always symptomatic.

A barium meal is useful for malrotation or hiatus hernia, but not reflux.

Oesophageal pH (±impedance) probe studies (48–72 hours off antacids) confirm acid reflux, but often do not alter management. Acid detection greater than 10% of the time (the reflux index) indicates severe acid reflux, which is associated with oesophagitis. False-negative results are common, as are technical problems (misplaced or dislodged probe, inadequate symptom diary, non-acid reflux events). Impedance studies provide more information about non-acid events, but normative data are lacking.

Table 3.1 Doses for antacids in gastro-oesophageal reflux

	Neonate	Infant	1–12 years	Over 12 years
Ranitidine	2 mg/kg tds	1–3 mg/kg tds	2–4 mg/kg (max 150 mg) bd	150 mg bd
Omeprazole	700 µg/kg od, can increase to 2.8 mg/kg od	700 µg/kg od, can increase to 3 mg/kg (max 20 mg) od	10–20 mg od	20–40 mg od
Lanzoprazole	–	–	0.5–1 mg/kg (max 15 mg) od	15–30 mg od

Management of gastro-oesophageal reflux

Medication

- Thickeners, e.g. Carobel, Gaviscon infant
- Antacids: useful in oesophagitis (Table 3.1)
- Lower respiratory tract infections and gastroenteritis are more common in infants receiving proton pump inhibitors, e.g. omeprazole
- Prokinetics, e.g. domperidone, erythromycin, metoclopramide: often ineffective and associated with adverse events, though can be useful in difficult cases