

# Surgical emergencies in childhood

## Intussusception

**Intussusception** is where a segment of bowel becomes invaginated into the immediately distal bowel.

- It is the most common cause of intestinal obstruction in children aged 5 months to 3 years.<sup>[1]</sup>
- It accounts for 25% of all abdominal surgical emergencies in children aged younger than 5 years.
- It occurs in children aged 3 months to 6 years and, very occasionally, in the neonatal period.
- 66% are aged <1 year old and it is unusual after 3 years of age.<sup>[2]</sup> <sup>[3]</sup>
- The incidence in the UK is approximately 3 per 10,000 person-years in under-1s. The introduction of the rotavirus vaccine in the UK seems to have led to a reduction in the age at which intussusception develops, without increasing the overall risk.<sup>[4]</sup>
- Abdominal pain, lethargy and vomiting are reported in 78% of infants.<sup>[5]</sup>
- Diarrhoea occurs in up to 30% of children, meaning a diagnosis of gastroenteritis may mistakenly be made.<sup>[1]</sup>
- Ultrasound confirms the diagnosis in the majority of cases.

The 'classic' picture of intussusception might not be present, ie abdominal pain, vomiting and redcurrant jelly stools. Relying on 'classic' features alone might delay diagnosis and this is associated with poorer outcomes.<sup>[6]</sup> The morbidity and mortality rate are otherwise very low after treatment.

## Treatment and management<sup>[1]</sup>

Air (pneumostatic) or water (hydrostatic) reduction is successful in 82% cases.<sup>[5]</sup> Delayed repeated air enema is sometimes successful in partially reduced cases.<sup>[7]</sup> Children under 3 in whom a 'lead point' cannot be identified fare best with conventional treatment.

**NB:** in successful radiographic reduction the small bowel is usually visualised before the appendix. Visualisation of the appendix before visualisation of the small bowel may indicate that radiographic reduction is not possible and prevent further attempts. This is called the 'appendix sign'.<sup>[8]</sup>

Nonoperative reduction is contra-indicated in patients with signs of peritonitis or if bowel perforation is suspected. Factors associated with increased risk of intestinal resection include:

- Abdominal distension.
- [Bowel obstruction](#) on abdominal X-ray.
- [Hypovolaemic shock](#).

Open and laparoscopic approaches are both possible.

## Hypertrophic pyloric stenosis

This is complete pyloric obstruction.

- It usually presents at 3-8 weeks of age.
- It is caused by progressive hypertrophy of the pyloric muscle, leading to obstruction of gastric emptying.
- The baby starts to vomit after every feed, characteristically becoming projectile.
- The vomit is not bile-stained.
- The baby appears well and hungry, unless prolonged vomiting has produced dehydration.
- A 2 cm mass is normally palpable deeply below the liver during test feed, with the appearance of an 'olive'.

- Palpation of this hypertrophied pyloric muscle can diagnose the condition; however, ultrasound is now commonly used as the diagnostic test.<sup>[9]</sup>

## Treatment and management

- Fluid resuscitation to correct dehydration and electrolyte abnormalities should occur first.
- Definitive treatment is by the surgical procedure Ramstedt's pyloromyotomy. The laparoscopic route, now generally accepted as method of choice, has been shown to give a better cosmetic result without longer operation times or postoperative morbidity.<sup>[10]</sup>

A procedure called double-Y pyloromyotomy has been developed which may offer a better functional result than a Ramstedt's pyloromyotomy.

- The only non-operative option for management is intravenous atropine.<sup>[11]</sup> This requires a lengthy hospital admission and parenteral nutrition. It is probably only suitable for extremely high-risk infants, or for infants in areas of the world where it is not safe to perform neonatal surgery.<sup>[9]</sup>

## Strangulated inguinal hernia<sup>[12]</sup> <sup>[13]</sup>

- [Inguinal hernias](#) are common (affecting 1–5% of term babies), and are six times more common in boys than in girls.
- All infants with inguinal hernias should be referred to secondary care for surgical repair, as there is a substantial risk of incarceration in the first year of life.<sup>[12]</sup>
- Incarcerated hernias present as an irreducible groin lump. Strangulation of an incarcerated hernia causes pain (crying), and the lump may be erythematous and oedematous. Other signs and symptoms may include vomiting and abdominal distension.

## Treatment and management

- Paediatric surgeons will undertake repair soon after diagnosis, regardless of age or weight, in healthy full-term infant boys with asymptomatic reducible inguinal hernias. Emergency surgery is twenty times more likely to cause complications than an elective procedure.
- Premature infants with inguinal hernias are usually repaired prior to discharge from the neonatal intensive care unit (NICU) but this practice is changing, as infants are now being discharged home at much lower weights. Some surgeons prefer to postpone the surgery in these very small babies for 1-2 months to allow further growth.
- Immediate surgery is not always necessary in a case of strangulation: four out of five can be reduced manually.
- Tachycardia, fever or signs of obstructions are indications for surgery. Herniotomy is usually all that is required with ligation and excision of the patent processus vaginalis. If gangrenous bowel is present it should be excised and an end-to-end anastomosis performed.
- In girls, an inguinal hernia may contain an ovary.

It is very rare for the hernia to recur – less than 1 in 100. This is more common in children who have a wound infection after the operation or who do not avoid any excess physical activity for the first four to six weeks.

Rare complications can include infarction of the testis or ovary, iatrogenic orchidectomy or oophorectomy or intestinal injury.

## Acute appendicitis

Acute appendicitis can be difficult to diagnose, particularly in younger children.

Appendicitis is rare in children under the age of 6.<sup>[14]</sup>

In infants, appendicitis may present with nonspecific symptoms of other, more common, conditions, and therefore diagnostic delay often occurs.<sup>[15]</sup> Symptoms in infants include:

- Abdominal distention.

- Vomiting.
- Diarrhoea (often leading to misdiagnosis as gastroenteritis).
- Bilious vomiting.
- Refusal of feeds.
- Fever.
- Abdominal tenderness, although this is more likely to be generalised tenderness rather than isolated right lower quadrant tenderness, again making diagnosis difficult.<sup>[14]</sup>

In older children, who are able to communicate their symptoms, the clinical presentation may be more 'typical', with abdominal pain, fever, anorexia and localised right lower quadrant tenderness.<sup>[14]</sup> However, early diagnosis of appendicitis can still be challenging in any age group.<sup>[16]</sup>

Diagnosis may involve a combination of clinical assessment, laboratory testing, and imaging (usually ultrasound). Predictive models have been developed to aid diagnosis. The Alvarado score and Paediatric Appendicitis Score may be useful in excluding acute appendicitis, but high scores are not specific for appendicitis.<sup>[16]</sup>

Surgery has historically been the standard treatment. Laparoscopic appendectomy is the most common surgical approach.<sup>[17]</sup>

Non-operative management with antibiotics alone may be suitable for a select group of children with uncomplicated appendicitis<sup>[16]</sup> However, there is a lack of well-designed randomised controlled trials to support this approach,<sup>[18]</sup> and non-operative management of appendicitis remains a debated and evolving area.

## Swallowed foreign body<sup>[19]</sup>

Foreign body ingestions are common. Most pass harmlessly through the gut. Once objects have reached the stomach, they are likely to transit through the rest of the digestive tract eventually.

The significance (and management) of swallowed foreign bodies depends on their anatomical location, and the nature of the foreign body.

A foreign body lodged in the oropharynx or oesophagus may cause stridor, drooling, gagging, vomiting, food refusal, chest pain, or a sore throat. These require urgent removal.

Hazardous objects, such as batteries, magnets, and large or sharp objects, may need urgent removal.

### Critical information

**Button batteries** are particularly dangerous if swallowed. They can produce oesophageal necrosis within 15 minutes of prolonged contact. [20] Button batteries that have lodged in the oesophagus or airway require emergency removal.

Ingestion of two or more **magnets** (or a magnet and another metallic object) may lead to them attracting each other through layers of bowel, causing pressure necrosis of the gut and serious complications. Deaths have occurred after ingestion of 'super strong' rare earth magnets. [21]

## Treatment and management

Swallowed foreign bodies are a common presentation to paediatric emergency departments, and most will have a local or regional protocol for investigating and managing them. The PIER network guidelines are one example. [22]

In general:

- Safeguarding and mental health concerns should be considered and addressed if present.
- Asymptomatic children with a clear history of a non-hazardous, non-metallic foreign body ingestion (and no pre-existing GI pathology) can be discharged without investigations if they are able to eat and drink. Safety-netting advice should be provided.

- For asymptomatic children who have swallowed a non-hazardous metallic object (eg, a coin), a handheld metal detector can be used to determine if the object has passed into the stomach, or remains in the oesophagus. Chest, abdominal and/or neck X-rays can be used if this is inconclusive, or unavailable.
  - Non-hazardous metallic objects that have reached the stomach or beyond can be left to pass naturally; safety-netting advice should be given on discharge.
  - Metallic objects lodged in the oesophagus or pharynx are likely to require endoscopic or surgical removal.
- **Ingestion of a button battery or more than one magnet can cause serious harm, and should be managed as an emergency even if the child is asymptomatic.** These require urgent imaging to determine the location of the object(s). Urgent endoscopic or surgical removal is required if they are in the oesophagus or upper airway. If they have passed beyond the stomach, and the child is asymptomatic, it may be possible to observe to see if they spontaneously pass; follow-up X-rays may be requested to ensure that they are progressing through the GI tract.

Whilst most foreign bodies pass without any issues, retained oesophageal foreign bodies may cause:

- Mucosal ulceration.
- Inflammation or infection.
- Paraoesophageal or retropharyngeal abscess formation.
- [Mediastinitis](#).
- Empyema.
- Oesophageal perforation and aorta-oesophageal fistula formation. [\[23\]](#)

## Torsion of the testis

An acute scrotum in a child requires surgical exploration for a definitive diagnosis. A retrospective analysis of all boys aged less than 15 years old presenting with scrotal pain over a 2-year period revealed: [\[24\]](#)

- 27% had [testicular torsion](#).
- 57% had a torted appendage testis.
- 11% had [epididymitis](#).
- 1% had fat necrosis.
- 4% had no abnormality detected.

29% of the torted testes were unsalvageable and required excision.

There is some debate about the role of Doppler ultrasound in assessing an acute scrotum; the European Association of Urology (EAU) guidelines describe it as a useful investigation that may reduce the number of patients requiring surgical exploration, although it is operator-dependent and may be difficult to perform in pre-pubertal patients.<sup>[25]</sup> In contrast, joint UK guidelines from the Royal College of Surgeons, British Association of Paediatric Urologists, and British Association of Paediatric Surgeons states unambiguously that imaging studies should **not** be performed in patients with suspected torsion, as they may delay definitive surgical treatment and increase the risk that the testicle is unsalvageable at the time of the operation. They also consider a normal or negative surgical exploration as preferable to a missed diagnosis due to a false-negative imaging study.<sup>[26]</sup>

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## Further reading

- [Jenkins JT, O'Dwyer PJ](#); Inguinal hernias. BMJ. 2008 Feb 2;336(7638):269–72.
- [What to Do If Your Child Swallows Something](#); American Family Physician

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