Appendicitis and non-specific abdominal pain in childhood

Sumita Chhabra
Simon E Kenny

Abstract

Abdominal pain is a common experience during childhood and frequently presents to secondary healthcare facilities. Although non-specific abdominal pain and appendicitis are the most common causes, the clinician should also be aware of the diagnosis and management of all causes of abdominal pain in children. This article provides an overview of abdominal pain in children, including history and examination, initial management, diagnostic categories, modes of investigation, and definitive treatment.

Keywords Acute abdomen; appendicitis; children; non-specific abdominal pain; peritonitis

Overall assessment

History and examination

The evaluation of the child with non-specific abdominal pain remains challenging and good communication between the clinician, child, and parents is essential. Successful evaluation requires patience and a careful and meticulous approach to history taking and physical examination. General principles include addressing the child directly whenever possible and allowing them time to answer questions; these should give the child several options without biasing their choice of answer: e.g. 'is the pain getting better, worse, or staying the same?, is the pain bad all the time or does it come and go?' A calm demeanour is essential and the surgeon should try to sit or kneel at the same level or lower than the child to reduce anxiety. With extremely anxious children, often initiating with time spent talking to siblings and 'ignoring' the unwell child can help them to relax and even want to interact. History taking should be tailored to the age of the child; for instance in older children tactful enquiry into gynaecological matters and sexual history should be made where appropriate, the latter is best achieved when the parents are absent. Perhaps the most important aspect to ascertain in the history is whether the pain is accompanied by vomiting. In particular, bilious vomiting should be regarded as having a surgical cause until proven otherwise. On this note, care should be taken to characterize the nature of 'bilious vomiting'. The term 'bilious' means different things to different people and careful enquiries should be made as to whether the vomit was truly green. The presence of bloody mucus in the stool can be suggestive of a surgical cause but can also be found in bacterial gastroenteritis.

Little diagnostic information can be gleaned by attempting to examine the abdomen of a crying child who is being pinned to the examination couch by his/her parents. Often the child picks up on the anxiety of his/her parents and attempts should be made to calm their fears. It is important to be adaptable and sometimes abdominal examination is best performed in an unorthodox manner. Examination of the child on a parent's lap or when they are standing up, often makes the child feel safer and can allow relevant clinical signs to be detected. If the clinical condition allows, a useful strategy in the case of the uncooperative child is to defer examination. Indeed, the fretful tearful child in the emergency room often becomes more cooperative when in the calmer environment of a children's ward. Play specialists can also be invaluable when children are being examined and when any invasive procedures need to be performed. Rebound tenderness should not be sought in the presence of localized tenderness and guarding. Getting the child to hop on one leg can help elicit peritonism in a way that fully engages the child in the examination process (clearly this should not be attempted in the unwell child). It is mandatory to examine the inguinal region in all children with abdominal pain and the testes in males to avoid missing the diagnoses of strangulated herniae and testicular torsion, respectively. The issue of digital rectal examination is a contentious one; the balance between clinical information gained versus emotional trauma caused and potential trust lost is such that the authors do not practise this procedure in the evaluation of children with abdominal pain and have not been aware of diagnostic lapses that would have been avoided had this examination been performed. In addition to the abdominal examination, an ENT and respiratory examination should be performed, as pathology in these sites can commonly cause pain referred to the abdomen.

Common and serious causes of abdominal pain in children are listed in Box 1. The clinical skills required to differentiate between them should not be underestimated.

Initial management

Initial evaluation should incorporate assessment of *A*irway, *B*reathing, *C*irculation. In the shocked or listless child, 100% oxygen via a rebreathing circuit should be administered and continuous pulse oximetry readings taken. Intravenous or intraosseous access should be obtained where there is evidence of shock or dehydration: initial crystalloid infusions should be administered as a bolus of 20 ml/kg. It is not uncommon for children to require over 40 ml/kg of intravenous fluids: establishing an adequate capillary refill time (<5 seconds) should be used as an end-point. Oral, rectal or intravenous analgesics should be administered as appropriate: intramuscular morphine should be avoided especially in the presence of shock. Physical signs of peritonitis are *not* masked by the administration of opiate analgesia and analgesia should not be withheld pending surgical assessment.

Serum biochemistry should be obtained if there has been significant vomiting, and liver function tests and serum amylase

Sumita Chhabra *BMBS BMedSci(Hons) MRCS DCH is a Specialist Registrar in Paediatric Surgery at Royal Manchester Children's Hospital, Manchester, UK. Conflicts of interest: none declared.*

Simon E Kenny *BSc MBChB(Hons) MD FRCS(Paed Surg) FAAP(Hons) is a Consultant Paediatric Surgeon at Alder Hey Children's NHS Foundation Trust, Liverpool, UK. Conflicts of interest: none declared.*

Common and serious abdominal emergencies in children

Common causes of abdominal pain in childhood

- Appendicitis
- Gastroenteritis
- Urinary tract infection
- Constipation
- Mesenteric adenitis
- Ovulatory/perimenstrual pain
- Non-specific abdominal pain

Serious causes of abdominal emergencies in childhood

- Appendicitis
- Intussusception
- Malrotation/volvulus
- Bleeding Meckel's diverticulum
- Bacterial enterocolitis
- Ovarian/testicular torsion
- Pancreatitis
- Obstruction/strangulated hernia
- Perforated duodenal ulcer

Box 1

if there are clinical indications of hepatobiliary disorders or pancreatitis. Capillary or arterial blood gases are useful in assessment of associated acid–base disorders and response to treatment. Metabolic acidosis is a common finding in hypovolaemic shock; failure of the acidosis to respond to fluid resuscitation and supportive measures is suspicious of ischaemic or infarcted bowel (especially in the presence of a raised serum lactate levels). Serial C-reactive protein (CRP) levels and white cell count with differential can be of use as discriminatory factors in cases where the diagnosis is uncertain when taken together with the history and examination findings. Intravenous broad-spectrum antibiotics should be administered in children with obvious peritonitis who are being prepared for theatre; a more circumspect approach should be adopted in children where the diagnosis is less clear. It is mandatory for all post-menarchal girls to have a pregnancy test.

Appendicitis

Appendicitis is inflammation of the appendix. Typically this is caused by luminal obstruction, usually by a faecolith (impacted faeces) but other causes of obstruction are listed in Box 2. The clinical and pathological course of appendicitis is variable and dependent on the anatomical location of the appendix and the host response to infection. Pathologically, luminal obstruction is followed by localized infection and inflammation confined to the wall of the appendix. If left untreated then ischaemia and infarction may supervene with localized bacterial translocation potentially followed by appendicular perforation and peritonitis, which may be generalized or localized depending on (1) the location of the appendix (if retrocaecal then will remain localized) and (2) the omental response (if the omentum is able to contain the perforation then a localized inflammatory mass/abscess will form).

Clearly generalized peritonitis is the most severe inflammatory reaction and death can result from generalized sepsis if sepsis is not promptly treated.

Causes of appendicitis

- Faecolith (impacted calcified faeces)
- Lymphoid hyperplasia (viral)
- Parasitic infestation (typically threadworm)
- Gallstone
- Tumours – typically carcinoid

Box 2

Symptoms

The clinical history in 'classic' appendicitis is of abdominal pain associated with nausea and anorexia, followed by vomiting and in some instances, diarrhoea, particularly with pelvic appendicitis. Some children may also experience lower abdominal pain on micturition. Whereas during the early stages the pain is located in the periumbilical region due to referred midgut pain, the pain classically migrates to the right iliac fossa due to local peritoneal irritation. The pain is usually worse on walking or when coughing and is relieved by flexing the right hip and bringing the knee upwards to decrease psoas irritation. In cases of perforated appendicitis with generalized peritonitis, the pain is generalized and severe. When spontaneously recounted without prompting, exacerbation of pain when the car or ambulance went over speed-humps during transit to hospital, is strongly suggestive of peritonitis!

Bleeding per rectum is not characteristic of appendicitis and alternative diagnoses such as intussusception (Figure 1), Meckel's diverticulum (Figure 2) or inflammatory bowel disease should be sought.

Signs and examination findings

Classically, children with appendicitis have a low grade pyrexia with or without tachycardia and prolonged capillary refill depending on the degree of dehydration. If the child has a high temperature, this either suggests that the appendix is perforated or suggests a different pathology (e.g. urinary tract infection or viral mesenteric adenitis). Children with appendicitis usually appear flushed and may have fetor oris. On examination of the abdomen there is maximal tenderness in the right lower quadrant with guarding. It is important to distinguish between actual guarding and voluntary guarding which can be misleading in children. Distraction techniques such as using the diaphragm of a stethoscope to 'listen' for bowel sounds or conversing with the child during examination can be very useful to differentiate between these. Generalized tenderness and guarding or a 'rigid' abdomen point towards perforated appendicitis with generalized peritonitis. In some instances, an inflammatory mass may be palpable in the right lower quadrant if the appendix is walled off or an abscess has formed, particularly if the history is suggestive of a prolonged course of illness. This is not always picked up preoperatively, however, and the child should always be examined on the operating table