

Acute appendicitis

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Abstract

Appendicitis is the inflammation of the vermiform appendix and is the commonest clinical differential diagnosis made in young adults presenting with acute abdominal and right iliac fossa pain. The diagnosis is largely clinical but ultrasound or CT may be helpful in some cases. Antibiotic treatment is used for uncomplicated appendicitis in some centres based on the principle that other intra-abdominal infections, such as diverticulitis are appropriately managed with antibiotics. The gold standard of treatment, however, is still appendicectomy with the more frequent use of laparoscopic appendicectomy, particularly in the female patient. The most common complication is that of wound infection.

Keywords Alvarado score; appendicitis; laparoscopic appendicectomy; Mc Burney's point; Rovsing's sign

Introduction

Appendicitis is the inflammation of the vermiform appendix. The appendix originates 1.7–2.5 cm below the terminal ileum. The base is fixed in position at the confluence of the three taeniae coli of the caecum, which fuse to form the outer longitudinal muscle of the appendix. During appendicectomy location of this landmark will help identify the base of the appendix. The tip of the appendix is more varied in position and can affect clinical presentation when inflamed. The majority, 74%, are retrocaecal, 21% pelvic, 2% paracaecal, 1.5% subcaecal, 1% pre-ileal and 0.5% post-ileal. Patients may also have their appendix behind the ascending colon and liver making clinical presentations more variable. Congenital agenesis, duplication and triplication of the appendix are extremely rare. Appendicitis was first described in the 16th century as perityphlitis. McBurney described the clinical findings in 1889 and appendicectomy is still the mainstay of treatment. It is the current belief that appendicitis gets worse with time and if left untreated will lead to perforation. About one in five patients present with complicated appendicitis and a perforation rate of 15–20% has been reported.

Aetiology

The pathophysiology of appendicitis is not fully elucidated, but obstruction of the appendiceal lumen is the most common process leading to infection of the wall by gut flora. Faecoliths and less frequently lymphoid hyperplasia secondary to gastroenteritis, amoebiasis or Crohn's are responsible for luminal obstruction leading to appendicitis. Parasites, more common in

the eastern countries, and more rarely, neoplasia and foreign bodies can cause luminal obstruction. This obstruction leads to congestion, inflammation and ischaemia of the appendix.

Epidemiology

Appendicitis is the most common cause of the acute abdomen in the UK and about 10% of the population will develop acute appendicitis. It occurs in about 7% of the US population. It is suspected to be lower in incidence in African and Asian countries due to the higher fibre content in the diet. Higher fibre decreases the formation of faecoliths and hence reduces risk of obstruction. It can occur at any age but tends to be highest in the 10 to 20 age group.¹ It is rare in infants under 3 years of age. In the paediatric population the average age of occurrence is between 6 and 10 years. It is more common in males than females. Appendicitis in pregnancy is associated with up to a 5% risk of fetal loss. This increases to 20% if perforation occurs.

Pathology and pathogenesis

Obstruction of the lumen of the appendix leads to congestion within the appendix resulting in an increase in luminal pressure due to the secretion of inflammatory exudate and mucous. This obstructs lymphatic drainage leading to further oedema, ulceration, bacterial growth and formation of pus due to recruitment of white blood cells leading to ischaemia of the appendix. The loss of integrity leads to bacterial invasion of the submucosa and muscularis propria resulting in acute appendicitis. Thrombosis of the appendiceal artery and veins leads to ischaemic necrosis resulting in perforation and gangrene. This may lead to a phlegmon, appendix abscess or frank peritonitis. On the rare occasion when the initial stages of infection resolves, the appendix gets distended with mucus resulting in a mucocele.

Diagnosis

The diagnosis of acute appendicitis is mainly clinical. There is no single investigation that can specifically identify appendicitis and therefore a combination of the history, clinical examination, haematological investigations, radiological investigations and diagnostic laparoscopy may be required for diagnosis.

History (Box 1)

A thorough history is essential given the vast differential of right lower quadrant pain. It is important to enquire about gastrointestinal, upper respiratory and genitourinary symptoms

Symptoms of appendicitis

- Peri-umbilical colicky abdominal pain
- Loss of appetite
- Nausea
- Diarrhoea/constipation
- Malaise
- Abdominal swelling
- Fever

Box 1

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in the patient's history of abdominal pain. The patient may give an initial history of acute onset poorly localised, colicky, abdominal pain. This pain may initially be central due to appendiceal inflammation and obstruction causing visceral pain but as infection worsens it becomes more localized to the right lower quadrant. There is associated nausea and sometimes vomiting (mostly in children). This vomiting comes after the onset of pain. A persistent anorexia is almost always present. The pyrexia associated with appendicitis usually follows the first 6 hours of the onset of symptoms. These symptoms progress over several hours or days, and may not be apparent during the early presentation but develop after a short period of observation. Hence, repeated observations and re-assessment is necessary.

Physical examination

As standard, the examination should begin with preliminary markers such as pulse rate, temperature, rate of respiration and blood pressure. Temperature ranges from 37.2 to 37.8°C and is rarely above 38°C. In children such a high temperature is suggestive of an alternative cause such as mesenteric adenitis and examination of the ear, nose and throat should be included. Tachycardia usually corresponds to the rise in temperature.

A thorough examination of the abdomen is expected including a digital rectal examination. This should take the form of inspection, palpation, percussion and auscultation. There are signs that are pathognomonic for appendicitis and these include the Pointing sign in which the patient identifies the area of maximal tenderness. Before touching the patient ask them to cough which may elicit abdominal pain, Dunphy's sign. In more advanced appendicitis the abdomen may be firm as the patient is guarding the abdominal wall muscles. Gentle superficial palpation from left iliac fossa to right in an anticlockwise fashion will highlight the point of maximal tenderness, that is, McBurney's point. Deep palpation of the left iliac fossa may elicit pain in the right iliac fossa, known as Rovsing's sign. Pain on percussion over the right iliac fossa will indicate localized peritonitis. The psoas sign is right lower quadrant pain that is produced on passive extension of the right hip or active flexion when standing. The pain is due to inflammation in the peritoneum overlying the iliopsoas muscle. The patient may be lying with the knee in flexion and straightening out the leg causes pain because it stretches the muscles. When an inflamed appendix is in contact with the obturator internus, the obturator test of flexion and internal rotation of the hip causes spasm of the muscle and pain in the hypogastrium. It is important to note that the location of the appendix can alter its presentation and clinical signs. A retrocaecal appendix may only be tender on deep palpation. A pelvic appendix may cause diarrhoea and the patient's tenderness is just supero-lateral to the symphysis pubis. An inflamed appendix abutting the bladder may trigger urinary symptoms.

Differential diagnosis (Table 1)

Many other conditions may mimic appendicitis including chest pathology and the differential for acute abdominal pain can be age and gender specific.

Children

In the paediatric age group, the most common disease mistaken for appendicitis is gastroenteritis or mesenteric adenitis. Enlarged cervical lymph nodes may indicate the latter. In Meckel's diverticulitis, the only discerning factor may be central and left-sided pain and possible lower gastrointestinal bleeding. Appendicitis is unusual below the age of 3 and the average age for intussusception is 18 months. Henoch–Schonlein purpura is preceded by sore throat or previous respiratory infection and ecchymosis on the extensor surfaces and buttocks with facial sparing. These patients commonly have microscopic haematuria.

Adults

Terminal ileitis due to Crohn's or *Yersinia* infection may produce a palpable mass of inflamed ileum. These patients will give a history of cramping abdominal pain, weight loss and diarrhoea. Ureteric colic presents with loin to groin pain and a positive urine dipstick. Pyrexia is not usually associated and a plain film radiograph, ultrasound or CT may be diagnostic. Right-sided pyelonephritis is associated with a high temperature, rigors and urinary symptoms. The tenderness is maximal in the loin. A perforated peptic ulcer leaks duodenal contents which track along the paracolic gutter to the right iliac fossa. The history may include dyspepsia and an acute onset of epigastric pain. An erect chest film will elucidate free air under the diaphragm in 70% of cases. The pain of testicular torsion can radiate to the right iliac fossa. The scrotum should be examined in all cases, especially in younger males. A rectus sheath haematoma although rare, can present with acute pain, tenderness and a mass in the right iliac fossa, particularly in patients on warfarin or other anti-platelet agents. There may be a history of recent strenuous exercise and there is no gastrointestinal upset.

Women

A thorough history should be taken in all female patients, especially those of childbearing age, to include their gynaecological history. A history of the menstrual cycle, dysmenorrhoea, vaginal discharge, hormonal contraception and pregnancy are very useful in narrowing down the myriad of causes that can present in a similar fashion to appendicitis. A urine pregnancy test, blood β -human chorionic gonadotropin (β -HCG) and abdominal or transvaginal ultrasound may be useful in diagnosis.

Elderly

In the elderly age group a long sigmoid may lie to the right of the midline making differentiation from appendicitis difficult. An abdominal CT will be useful in this scenario. Colon cancer in the elderly that has obstructed or perforated may mimic appendicitis. The history may clarify the difference with anaemia, weight loss and change in bowel habit but a CT is diagnostic.

Investigations

Laboratory-based investigations help reduce the removal of the normal appendix that happens in up to a third of patients. Haematological and bedside tests help to reduce the incidence of

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