CHAPTER 74
Appendicitis

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Introduction

Acute appendicitis is the commonest and one of the most important causes of intraabdominal surgical conditions in children, particularly in adolescents. The time-honoured tradition of appendectomy through a midline or Lanz incision is considered to be the one basic requirement for trainee surgeons in both adult and paediatric surgical practice. Depending on the pathology of the appendix, acute appendicitis is divided into either simple or complicated appendicitis, with perforation and/or abscess formation occurring in the latter.

Demographics

In most First World countries, the lifetime incidence of appendicitis is considered to be around 7%, with a slightly higher incidence in males, and more than half occurring in childhood. In Africa, the incidence of appendicitis is much less, with a reported lifetime incidence rate of <1%.[1,2] This is probably due to the higher amount of fibre in the African diet compared to the refined food diet of Western Europe and North America.[3]

Although the condition is relatively uncommon during infancy and early childhood, a disproportionately higher incidence of complicated appendicitis occurs in children <5 years of age, potentially due to late presentation and difficulties in establishing an early diagnosis.

Pathophysiology

Most authors believe that the cause of appendicitis is intraluminal obstruction caused by lymphoid hyperplasia, parasite-infected faecal matter and ingested foreign bodies.[4] This may explain the increased rate in teenagers, as the submucosal lymphoid tissue reaches its peak number in adolescence followed by a gradual decrease after age of 30 years. Once the lumen is obstructed, mucus and bacterial proliferation result in venous congestion, which in turn will cause arterial flow obstruction, ischaemia, necrosis, and free perforation into the peritoneal cavity. The human defense system of omentum often wraps itself around the organ and limits the free perforation and result in appendix mass formation.

Clinical Presentation

Just as for most human diseases, the diagnosis of acute appendicitis can usually be made on careful history and clinical evaluation. The need for an appendectomy is usually based on the diagnosis of acute appendicitis, which is made on clinical grounds in most cases. Medical students are taught to look for a history that classically includes anorexia without vomiting, and umbilical pain that then moves to the right iliac fossa.

Once localized, any movement causes exacerbation of the pain, which is described as sharp in nature. Fever is usually low grade unless perforation has occurred, in which case there is generalized peritonitis and high fever. Other classic signs are that of rebound tenderness, which is best elicited with gentle "tapping" over the right iliac fossa. However, in obese children and patients with retrocaecal appendicitis, the signs are often absent or equivocal in nature.

Complicated appendicitis occurs as a result of perforated appendix with or without abscess formation. Physical findings may reveal diffuse peritonitis or a tender right lower quadrant mass, which is due to an organized abscess. It is more common to have diffuse peritonitis in young children because they have less omental fat to isolate the infection. Older children are more likely to have an appendiceal abscess. However, simple appendicitis may not always be differentiated from complicated cases prior to surgery. Diagnostic laparoscopy and appendectomy can be employed when the preoperative diagnosis of appendicitis is uncertain.[5]

Investigation

Most surgeons request blood tests and expect to find an elevated white cell count, with a disproportionately elevated neutrophil percentage and a high C-reactive protein. A urine dipstick is also done, which, in the case of appendicitis, should show no or a few red cells and white cells.

Plain abdominal x-ray is usually not helpful but may show a faecolith (Figure 74.1), dilated sentinel small loop, relative absence of bowel gas in the right iliac fossa, mild scoliosis, and even free air under the right subdiaphragm.

Sonar and computed tomography (CT) scans are done more frequently than x-rays, especially in academic and private hospitals worldwide to identify and decrease the rate of negative appendectomies. Shortcomings are due to lack of expertise and experience of the radiologists performing the sonar and the expense and radiation concern (and safety consideration for intravenous contrast material) used for CT scans. However, a good-quality CT scan has a very high sensitivity and specificity in children (>95%)[6] (see Figure 74.2).

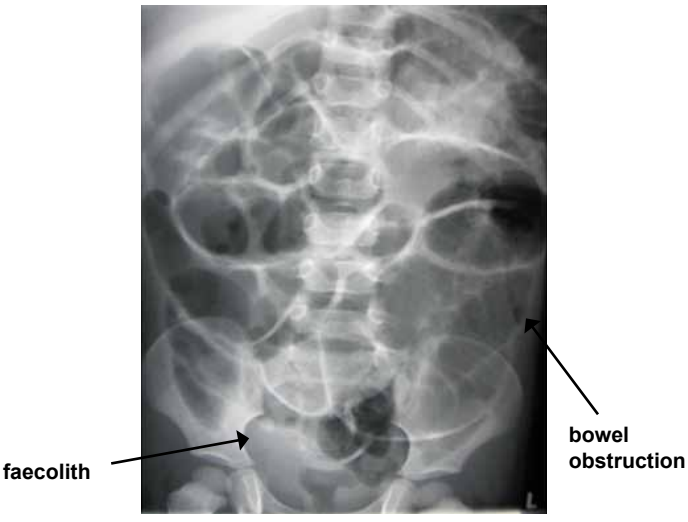

Figure 74.1: Abdominal radiograph showing a faecolith.

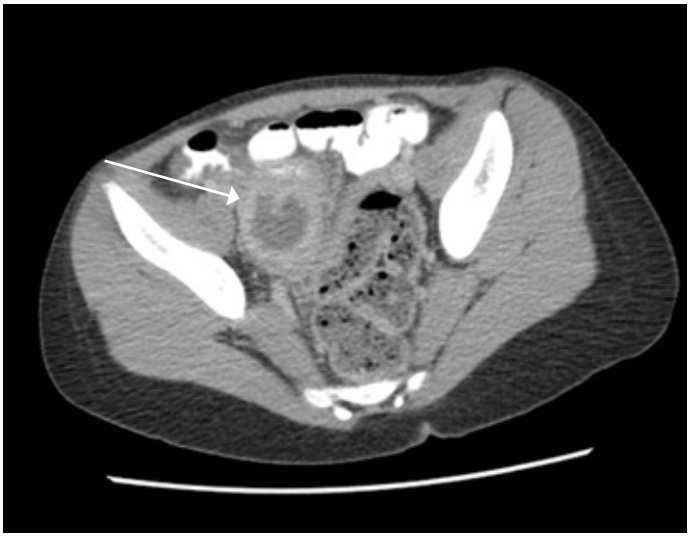

Figure 74.2: CT scan showing perforated appendix with collection (arrow).

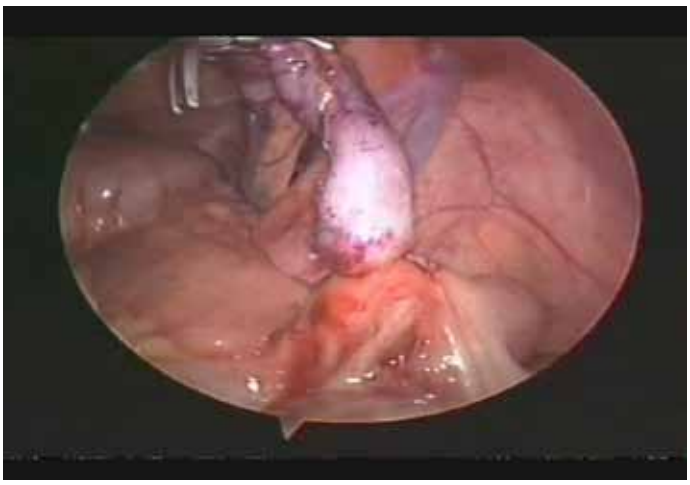

Figure 74.3: Laparoscopic interval appendectomy for a 15-year-old girl.

Management

Nonoperative Treatment

Occasionally, a child is admitted with a palpable right iliac fossa mass and low-grade fever but is otherwise well and can tolerate oral fluid. The current management for this subgroup of patients is to treat them as having an "appendix mass". Intravenous antibiotics alone usually resolve this mass, and the child can be discharged 7–10 days later. Most, but not all, surgeons normally readmit the child 6–8 weeks later and perform an interval appendectomy, which can be done open or laparoscopically (Figure 74.3).

Open Surgery

Even though surgery remains the most generally accepted treatment for simple acute appendicitis, the management for complicated disease—namely, perforated appendicitis and appendiceal mass—has been controversial for decades. The surgical treatment of acute appendicitis has evolved over the past few decades.

Appendectomy can be simply defined as surgical resection of the appendix. Although it is usually done in an urgent setting for a patient with acute appendicitis, a number of studies have demonstrated no deleterious effect from a period of hydration and antibiotics of up to 24 hours prior to appendectomy.[7,8]

Right lower quadrant abdominal incisions for simple appendictitis and extended incision for delayed presentation of perforated appendicitis have stood as the gold standard approach for appendectomy for more than a century. Ever since the classic description by McBurney in 1889, surgeons have largely employed a transverse right lower quadrant (Lanz) incision for simple appendectomy. Abdominal muscles are split in the direction of the fibres. After locating the appendix, the mesoappendix is divided before the appendix is excised close to its base. Management of the appendiceal stump varies from simple ligation, to ligation with inversion using a purse string, to inversion without ligature, depending on the surgeon's preference. In cases of retrocaecal appendicitis, the base is tied first and the appendix is delivered in an antegrade manner; alternatively, the incision is extended laterally and the caecum is mobilized medially and eviscerated, revealing the entire appendix.

In cases of perforation, a methodical abdominal washout with warm water is completed by most surgeons. Closure is accomplished with continuous suturing, and drains are used based on the pathology and surgeon's preferences. The skin may be closed with interrupted nonabsorbable sutures.

Intravenous antibiotics such as ampicillin, cephalosporins, aminoglycosides, and metronidazole are given before surgery. The choice and duration of antibiotic therapy is determined by the operating surgeon based on the severity of the disease and perforation, and can last from 1 to 10 days.

Laparoscopic Appendectomy

In recent years, laparoscopic appendectomy has gained wide popularity. It seems reasonable to state that laparoscopic appendectomy, performed by an experienced laparoscopist, is considered to be at least equivalent to open surgery.[9]

Laparoscopic appendectomy usually involves a 3-trocar technique. A 5- or 10-mm cannula is usually placed in the umbilicus to allow the passage of the telescope and the retrieval of the appendix. One 5-mm cannula is placed below the bikini line in the left lower quadrant and in the right upper quadrant. Uni- or bipolar diathermy is used for division of the mesoappendix, but close to the appendix because these vessels are small in caliber and will not re-bleed with coagulation. The base of the appendix can be ligated inside the abdomen with endoloops, suture ligated, or simply secured extracorporeally with the appendix drawn out through a skin stab incision at the right lower quadrant. If possible, the appendix should be extracted through the umbilical cannula to avoid direct contact with the wound. If the appendix is too thick, it should then be placed in a retrieval bag, which is withdrawn through the port site. A cheap sterile retrieval bag can be made by cutting one of the "fingers" of a surgical glove.

Prognosis and Outcomes

Appendectomy is one of the safest surgical procedures, with minimum mortality. Morbidity after surgery for acute nonperforated appendicitis is confined to superficial wound sepsis, which often requires reopening the skin and releasing the pus. Secondary suturing may be required if the wound is extensively dehisced. In contrast, perforated appendicitis is known to have an increased risk of intraabdominal abscess (5–10% in most reports), frequently requiring relook laparotomy and per rectal draining of the collection.[10,11] Mortality is limited to the patients who are admitted with a prolonged delay and often a misdiagnosis of appendicitis. Many of these patients are in a moribund state on admission and succumb to multiorgan failure secondary to gram-negative septic shock.

Prevention

Currently, there are no known dietary measures to decrease the risk of appendicitis; however, a high-fibre diet is possibly associated with a decreased incidence.

Ethical Issues

In Africa, many patients with appendicitis are taken to traditional healers or so-called "witch doctors", who give affected children herbal

medication and herbal laxative enemas. The content of these enemas can be quite toxic and result in renal or liver failure in an already compromised child, further delaying definitive surgical treatment. This group of children is at highest risk for multiple organ failure and death. Marks on the body made by traditional healers may identify the area of the pathology in a patient with communication difficulties.

Evidence-Based Research

Table 74.1 presents an analysis of the diagnostic accuracy of appendicitis.

Table 74.1: Evidence-based research.

Title	Acute appendicitis in children: emergency department diagnosis and management
Authors	Rothrock SG, Pagane J
Institution	Department of Emergency Medicine, Orlando Regional Medical Center, Orlando, Florida, USA
Reference	Ann Emerg Med 2000; 36:39–51
Problem	Despite considerable recent expansion of knowledge concerning appendicitis, accurate diagnosis remains suboptimal.
Intervention	Analysis of diagnostic accuracy of appendicitis.
Comparison/ control (quality of evidence)	State-of-the-art lecture.
Outcome/effect	Despite modern laboratory tests and imaging, the diagnosis is essentially clinical.

Key Summary Points

1. Appendicitis is rare in the African population.
2. Adolescence is the common age group for appendicitis.
3. Diagnosis is usually made based on a clinical evaluation.
4. Imaging usually is helpful in assessing complicated appendicitis.
5. The outcome is the same for open and laparoscopic appendectomy.

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