Pediatric Appendicitis

- Overview
- Presentation
- DDx
- Workup
- Treatment
- Medication

Updated: Nov 18, 2014

Background

Acute appendicitis is acute inflammation and infection of the vermiform appendix, which is most commonly referred to simply as the appendix. The appendix is a blind-ending structure arising from the cecum. Acute appendicitis is one of the most common causes of abdominal pain and is the most frequent condition leading to emergent abdominal surgery in children. The appendix may be involved in other infectious, inflammatory, or chronic processes that can lead to appendectomy; however, this article focuses on acute appendicitis. Appendicitis and acute appendicitis are used interchangeably. (See Anatomy, as well as Pathophysiology.)

Images of pediatric appendicitis are provided below.
Ultrasonographic examination of the right lower quadrant reveals a greater than 6-mm noncompressible tubular structure shown in cross section. Discomfort was noted as the probe was depressed over this structure. A small amount of free fluid is also noted surrounding the appendix. 

CT scan depicting a distended tubular structure descending into the pelvis and containing a round calcification (ie, an appendicolith). Common symptoms of acute appendicitis include abdominal pain, fever, and vomiting. The diagnosis of appendicitis can be difficult in children because the classic symptoms are often not present. (See Clinical Presentation.)

A delay in the diagnosis of appendicitis is associated with rupture and associated complications, especially in young children. Improvements in rupture rates have been made with advanced radiologic imaging. Appendicitis is a clinical diagnosis with imaging used to confirm equivocal cases. (See Workup.)

See Appendicitis: Avoiding Pitfalls in Diagnosis, a Critical Images slideshow, to help make an accurate diagnosis.

The definitive treatment for appendicitis is appendectomy. Initiation of antibiotics upon diagnosis is important to slow the infectious process and help prevent progression of a nonperforated appendix. Key to any evaluation and treatment plan are the following: relieve the patient's pain and discomfort early and consistently; communicate with the patient and family about the plans; repeat the examination often; adjust the differential diagnosis as appropriate; and keep the patient for observation if a firm diagnosis is not made. (See Treatment and Management.)

The most widely used antibiotic regimen is the combination of ampicillin, clindamycin (or metronidazole), and gentamicin. (See Medication.)

**Patient education**

For patient education information, see the Esophagus, Stomach, and Intestine Center, as well as Appendicitis and Abdominal Pain in Children.
Anatomy

The vermiform appendix is generally 5-10 cm in length. It arises from the cecum, which in most children is located in the right lower quadrant of the abdomen.

Although the base of the appendix is fixed to the cecum, the tip can be located in the pelvis, retrocecum, or extraperitoneum. Note that the anatomic position of the appendix determines the symptoms and the site of tenderness when the appendix becomes inflamed.

The appendix is lined by typical colonic epithelium. The submucosa contains lymphoid follicles, which are very few at birth. This number gradually increases to a peak of about 200 follicles at age 10-20 years and then subsequently declines. In persons older than 30 years, less than half that number is present, and the number continues to decrease throughout adulthood.

Pathophysiology

Once the appendix becomes obstructed, bacteria trapped within the appendiceal lumen begin to multiply, and the appendix becomes distended. The increased intraluminal pressure obstructs venous drainage, and the appendix becomes congested and ischemic.

The combination of bacterial infection and ischemia produce inflammation, which progresses to necrosis and gangrene. When the appendix becomes gangrenous, it may perforate. The progression from obstruction to perforation usually takes place over 72 hours.

One study noted that appendiceal perforation is more common in children, specifically younger children, than in adults. A substantial risk of perforation within 24 hours of onset was noted (7.7%) and was found to increase with duration of symptoms. While perforation was directly related to the duration of symptoms before surgery, the risk was associated more with prehospital delay than with in-hospital delay.[1]

During the initial stage of appendicitis, the patient may feel only periumbilical pain due to the T10 innervation of the appendix. As the inflammation worsens, an exudate forms on the appendiceal serosal surface. When the exudate touches the parietal peritoneum, a more intense and localized pain develops.

Perforation results in the release of inflammatory fluid and bacteria into the abdominal cavity. This further inflames the peritoneal surface, and peritonitis develops. The location and extent of peritonitis (diffuse or localized) depends on the degree to which the omentum and adjacent bowel loops can contain the spillage of luminal contents.

If the contents become walled off and form an abscess, the pain and tenderness may be localized to the abscess site. If the contents are not walled off and the fluid is able to travel throughout the peritoneum, the pain and tenderness become generalized.

Etiology
Acute appendicitis is due to obstruction of the blind ending appendix, resulting in a closed loop. In children, obstruction usually results from lymphoid hyperplasia of the submucosal follicles. The cause of this hyperplasia is controversial, but dehydration and viral infection have been proposed. Another common cause of obstruction of the appendix is a fecolith.

Rare causes include foreign bodies, parasitic infections (eg, nematodes), and inflammatory strictures.

**Epidemiology**

Appendicitis has an incidence of 70,000 pediatric cases per year in the United States. The incidence between birth and age 4 years is 1-2 cases per 10,000 children per year. The incidence increases to 25 cases per 10,000 children per year between 10 and 17 years of age. Overall, 7% of people in the United States have their appendix removed during their lifetime. The male-to-female ratio is approximately 2:1.

Appendicitis is much more common in developed countries. Although the reason for this discrepancy is unknown, potential risk factors include a diet low in fiber and high in sugar, family history, and infection.

Appendicitis occurs in all age groups but is rare in infants. Appendicitis is most common in the second decade of life (age 10-19 y), occurring at a rate of 23.3 cases per 10,000 per year. Thereafter, the incidence continues to decline, although appendicitis occurs in adulthood and into old age.

**Prognosis**

Generally, the prognosis is excellent. At the time of diagnosis, the rate of appendiceal perforation is 20-35%. The rate of perforation is 80-100% for children younger than 3 years, compared with 10-20% in children 10-17 years old. Children with ruptured appendicitis are at risk for intra-abdominal abscess formation and small bowel obstruction, and they can have a prolonged hospital stay (several weeks or more). The mortality rate for children with appendicitis is 0.1-1%.

Death from appendicitis is most common in neonates and infants for the following 2 reasons:

- Appendicitis is rare in this age group; thus, unless the physician’s index of suspicion is high, appendicitis is often low on the list of suspected differential diagnoses.
- Very young patients are unable to communicate the location and nature of their pain. Some neonates may not even become febrile. Often, the patient’s only symptom is irritability or inconsolability.

**References**


