



Contemporary Management of Appendicitis in Children

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Keywords

- Appendicitis • Appendectomy • Children • Nonoperative management
- Abdominal pain • Right lower quadrant • Scoring system • Laparoscopy

Key points

- Appendicitis presents less classically than commonly thought.
- Use of algorithms, imaging, and laboratory studies in combination should guide the workup for diagnosis.
- Standardized definitions and quality improvement initiatives are important in dealing with children with appendicitis to improve outcomes.
- Perforated appendicitis should be managed laparoscopic if possible.
- Appendicitis can be managed nonoperatively in selected children, but the risk of recurrent appendicitis is unknown.

INTRODUCTION

Appendicitis is the most common surgically emergent condition in children [1]. The United States incidence of appendicitis is approximately 1 per 1000 [2] or approximately 86 cases of appendicitis per 100,000 people annually [3,4] and is increasing [5–7]. Currently, the lifetime risk of appendicitis is 7% to 8% [8]. Globally, there are some variations with the incidence of appendicitis with South Korea [9] being higher than in Africa [10]. Appendicitis is increasing in Hispanics, Asians, and Native Americans, whereas the rates in whites and African Americans have declined [2,8]. The peak incidence occurs between

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10 and 19 years of age [6,7,11], with the mean age at diagnosis increasing [2]. Appendicitis is less common in very young children; less than 5% of cases occur in preschool-aged children [12]. There is a male predominance (55%–60%). Finally, the percentage of patients who present with perforated appendicitis (PA) varies widely from 15% to 50% [2,6,8,13–16]. Overall, approximately 60,000 to 80,000 pediatric appendectomies are performed annually, with a mean cost of about \$9000 [17].

Efforts in studying pediatric appendicitis have recently focused on reducing antibiotic durations and radiation exposure, the use of protocols, the nonoperative management of appendicitis, and the standardization in results reporting. Despite a decade of research aimed at making the diagnosis of appendicitis more protocolized, much variation exists in the diagnosis and management. This article summarizes the advances in the contemporary management of pediatric appendicitis.

PATHOPHYSIOLOGY AND FUNCTION

The cause of appendicitis and function of the appendix are still largely unknown. Currently, it is thought that in about half of cases appendicitis results from luminal obstruction from stool, appendicoliths, lymphoid hyperplasia, or neoplasm [7,18]. However, it does not explain the increased incidence in summer [19,20], racial or geographic variations [21], and genetic, environmental, and infectious causes [22,23]. A family history imparts a nearly 3-fold increased risk [21] with genetic factors accounting for 30% of appendicitis risk [24]. The appendix serves as a reservoir for normal intestinal flora and has the highest concentration of gut-associated lymphoid tissue in the intestine [18,25]. Appendectomy decreases the risk of ulcerative colitis and increases the risk of recurrent *Clostridium difficile*-associated colitis [7,18].

DIAGNOSIS

Most of the variation in pediatric appendicitis is seen in the diagnosis and management among different hospitals [26]. The wide variation in diagnostic approach to suspected appendicitis was evaluated in a retrospective cohort of 13,328 pediatric subjects presenting to a children's hospital, demonstrating 3.5-fold variation in preoperative imaging and 5-fold variation in laboratory utilization [27]. Two aspects in diagnosing appendicitis have taken on greater importance; namely, identifying the disease in a cost-efficient and time-efficient manner with minimal radiation, as well as identifying perforation. Despite diagnostic heterogeneity, the overall rate of negative appendectomy has decreased to about 5% [16,28–31].

Signs and symptoms

Classic symptoms of appendicitis, including the gradual onset of dull periumbilical pain migrating to the right lower quadrant over the course of a day, occurs in less than 50% of children [32]. Typically, perforation is thought to occur within 24 to 36 hours from the onset of symptoms of pain. Many other classic

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