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Chapter 20

Management of Acute Uncomplicated Appendicitis in Pediatric Patients: A Review

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Abstract

Acute appendicitis is the most prevalent surgical emergency in children and a primary cause of acute abdominal pain necessitating surgical intervention. Despite advancements in diagnostic techniques and perioperative care, diagnosing pediatric patients remains challenging due to age-related symptom variability, communication difficulties, and symptom overlap with other abdominal conditions. Delayed diagnosis can lead to perforation, abscess formation, sepsis, and extended hospitalization. Conversely, overdiagnosis may result in unnecessary appendectomies and increased healthcare costs. Management of acute uncomplicated appendicitis in children includes non-operative treatment with antibiotics and laparoscopic appendectomy. Laparoscopic appendectomy remains the standard treatment for uncomplicated appendicitis; however, an antibiotic-first approach may be suitable for selected patients. This review examines the roles of non-operative treatment and laparoscopic appendectomy in managing acute, uncomplicated appendicitis. Additionally, it evaluates the role of appendicolith in the non-operative management of acute appendicitis in children.

Keywords: Acute Appendicitis, Non-operative treatment, Conservative Treatment, Laparoscopic Appendectomy, Appendectomy, Appendicolith, and Complications.

Introduction

Acute appendicitis is a prevalent acute abdominal emergency in children, typically occurring at a median age of 9 to 12 years, with a slightly higher incidence in males. The incidence rate in children is 80 to 90 cases per 100,000 population. Clinically, it presents with central abdominal pain that localizes to the right iliac fossa, accompanied by nausea, vomiting, and fever. Abdominal examination reveals guarding and rigidity in the right iliac fossa. Laboratory investigations include a full blood count to identify leukocytosis and elevated inflammatory markers, such as C-Reactive Protein (CRP). Ultrasound is the preferred imaging modality due to its availability and lack of radiation exposure. Computerized tomography is utilized when ultrasound results are inconclusive or when complications such as perforation and mass formation are suspected. However, the use of computerized tomography involves exposure to ionizing radiation (Podany, 2017; Rentea & St. Peter, 2017).

The management of acute appendicitis in children encompasses two primary approaches: non-operative treatment, which includes the administration of antibiotics and analgesics, and appendectomy, which may be conducted via open or laparoscopic techniques. Non-operative treatment is a feasible option for children with acute, uncomplicated appendicitis; however, it is associated with a significant recurrence rate. Laparoscopic appendectomy is currently regarded as the gold standard for managing acute appendicitis in children due to its association with expedited recovery, reduced analgesic requirements, and quicker resumption of oral intake. Open appendectomy is reserved for cases where laparoscopic appendectomy is not feasible (Filho et al., 2024; Morrow & Newman, 2007; Rentea & St. Peter, 2017b). According to the 2020 guidelines by the World Society of Emergency Surgeons (WSES), non-operative treatment may be considered for managing acute, uncomplicated appendicitis in children, provided there is no appendicolith, while acknowledging the potential risk of treatment failure. Furthermore, the guidelines recommend offering laparoscopic appendectomy to children with acute appendicitis, contingent upon the availability of appropriate expertise and equipment (Di Saverio et al., 2020).

This review seeks to evaluate the management strategies for acute uncomplicated appendicitis in pediatric patients. Specifically, it examines the efficacy of non-operative treatment and the role of laparoscopic appendectomy in managing this condition. Additionally,

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the influence of appendicolith on non-operative treatment outcomes is considered. A comprehensive literature review was conducted utilizing PubMed, the Cochrane Database of Clinical Reviews, and Google Scholar. The review focused on original articles, clinical trials, observational studies, cohort studies, review articles, systematic reviews, and meta-analyses published between 1985 and 2026. The search incorporated the following keywords: "Non-operative treatment," "Acute Appendicitis," "Conservative treatment," "Laparoscopic appendectomy," "Appendectomy," "Appendicolith," and "Complications." Only articles in English were considered, with case reports and commentaries excluded. The study exclusively included research involving pediatric patients.

Discussion

Non-Operative Treatment of Acute Uncomplicated Appendicitis in Children

Non-operative management of acute, uncomplicated appendicitis in children entails the administration of intravenous antibiotics and analgesics. The diagnosis of this condition is established through the evaluation of leukocytosis and imaging techniques such as ultrasound or computed tomography, which reveal an inflamed appendix without signs of perforation. The success rate of non-operative management is 85% at a one-year follow-up (Gonzalez et al., 2016; Hall & Eaton, 2018; Nepomuceno & Pearson, 2021). Minneci et al. assessed the feasibility of this approach in children. In their prospective non-randomized clinical trial, 77 patients were divided into two groups: 30 patients received non-operative treatment, while 47 underwent appendectomy. The non-operative approach demonstrated a 93% success rate, with fewer disability days and a quicker return to school (Minneci et al., 2014).

An open-label, international, multicenter, non-inferiority randomized trial conducted by St Peter et al. compared appendectomy with antibiotic treatment for acute uncomplicated appendicitis in children. The study randomized 936 patients, with 459 undergoing appendectomies and 477 receiving antibiotic treatment. At the 12-month follow-up, data from 846 patients were analyzed, revealing a treatment failure rate of 33.8% for antibiotic therapy, compared to 7.1% for appendectomy, indicating the inferiority of antibiotic therapy (St Peter et al.,2025). Additionally, Minneci et al. conducted a multicenter, non-randomized, controlled interventional study comparing the same treatments. This study included 1,068 patients, with 370 receiving non-operative treatment and 698 undergoing appendectomies. At the one-year follow-up, 806 patients were analyzed, showing a success rate of 67.1% for non-operative treatment, which was associated with fewer disabilities (Minneci et al., 2020).

A systematic review and meta-analysis conducted by Faria et al. reevaluated non-operative treatment for acute, uncomplicated appendicitis in children. This study incorporated seven studies with a total of 1480 patients. The findings indicated that the treatment failure rate was higher in the non-operative treatment group (RR 4.97, 95% CI, 3.57-6.91), and the treatment success rate at one year was lower (RR 0.67, 95% CI, 0.60-0.75). The study concluded that non-operative treatment of acute appendicitis in children is associated with a higher treatment failure rate (Faria et al., 2026). Another systematic review and meta-analysis by Maita et al. examined non-operative treatment of acute appendicitis in children, including 21 studies. The success rate for non-operative treatment was 92% (95% CI, 88-96), with a recurrence rate of 16% (95% CI, 10-22) (Maita et al., 2020). Decker et al. conducted a systematic review and meta-analysis comparing the short- and long-term outcomes of non-operative treatment for acute appendicitis in children. This review included 14 studies with 5048 patients managed non-operatively. The 30-day failure rate was 20% (95% CI, 11-29%), and the one-year failure rate was 32% (95% CI, 25-38%) (Decker et al., 2024).

Brucchi et al. conducted a meta-analysis of randomized controlled trials examining non-operative treatment for acute uncomplicated appendicitis in children. This review incorporated three studies encompassing 269 patients. The analysis revealed no significant differences in treatment efficacy between the procedures; however, the duration of hospital stay was extended in the non-operative treatment group (Brucchi et al., 2025). Bi et al. performed a meta-analysis comparing conservative treatment with appendectomy for acute uncomplicated appendicitis, including nine studies with a total of 64,540 patients. The success rate of conservative treatment was 90% (OR 0.122, 95% CI; 0.041-0.376) at one month, although this rate declined at the one-year follow-up(Bi et al., 2019). Huang et al. conducted another meta-analysis comparing antibiotic therapy with appendectomy for acute, uncomplicated appendicitis in children. This study included five studies with 404 patients, demonstrating a 90.5% success rate for non-operative treatment. However, the risk of treatment failure increased in the presence of appendicolith (Huang et al., 2017).

Table 1 showing the studies and outcomes for non-operative treatment for acute appendicitis in children.

Appendicolith As a Risk Factor for Failure of Non-operative Treatment of Acute Appendicitis

The detection of an appendicolith on imaging is correlated with an increased risk of failure in non-operative treatment of acute appendicitis in pediatric patients. An appendicolith is frequently linked to elevated inflammation rates and an enlarged appendix diameter (Oktay et al., 2023). Mahida et al. conducted a prospective randomized trial examining non-operative treatment for acute uncomplicated appendicitis in children with appendicolith, revealing a 60% failure rate at 4.7 months of follow-up. This trial was terminated due to safety concerns (Mahida et al., 2016). The presence of an appendicolith in children with acute appendicitis is associated with severe symptoms and signs, as well as an elevated risk of complications such as perforation, thereby contributing to the failure of non-operative treatment(Wang et al., 2020). Yoon et al. conducted a retrospective study on pediatric appendicitis with appendicolith, involving 269 patients, which demonstrated that patients with appendicolith experienced prolonged abdominal pain and a heightened risk of perforation (Yoon et al., 2018). Similar studies by Gupta et al. and Diya et al. also concluded that the presence of an appendicolith is associated with an increased risk of complications, including perforation (Alaedeen et al., 2008; Gupta, 2025).

Soares et al. conducted a systematic review and meta-analysis comparing conservative treatment outcomes in pediatric patients with appendicolith appendicitis to those with non-appendicolith appendicitis. The study incorporated 12 studies, encompassing a total of 814 patients, of whom 282 had an appendicolith, and 532 did not. The initial success rates of conservative treatment did not differ significantly between the two groups. However, subgroup analysis revealed a lower success rate in patients with appendicolith appendicitis (OR 0.42, 95% CI, 0.21-0.84). Additionally, the recurrence rate was higher in the appendicolith group (OR 2.75, 95% CI, 1.05-7.20) (Soares, V, 2025).

Table 1: The studies and outcomes for non-operative treatment for acute appendicitis in children

Study	Study Design & Population	Primary Findings	Outcomes
Huang et al.,2017	Meta-analysis of 5 pediatric studies (n=404) comparing antibiotics vs appendectomy for uncomplicated appendicitis.	Initial success rate 90.5%; complication rates include surgery. The presence of an appendicolith increased the risk of failure.	Non-Operative Management appeared feasible and effective in selected children but required further Randomized Controlled Trials.
Bi et al,2019	Meta-analysis of pediatric studies evaluating Non-Operative Management for uncomplicated appendicitis.	Demonstrated high initial success and acceptable safety, but recurrence remained a concern; evidence quality was limited by observational studies.	Supported Non-Operative Management as a potential option in carefully selected patients but emphasized the need for higher-quality evidence.
Maita et al.,2020	Systematic review and meta-analysis of 21 studies on non-perforated appendicitis in children.	Symptoms resolved in 92% of children; 16% subsequently underwent appendectomy after discharge. No significant difference in complications or Length of Stay compared with surgery.	Non-Operative Management is considered safe and effective, although robust randomized trials were lacking.
Minneci et al,2020	Prospective multicenter non-randomized comparative study; 1,068 children aged 7–17 years.	67.1% avoided appendectomy at 1 year. Non-operative management was associated with fewer disability days (6.6 vs. 10.9 days).	Most children treated non-operatively avoided surgery, with quicker return to normal activities.
Decker et al.,2024	Cost-effectiveness analysis based on a large multicenter pediatric cohort (>1,000 patients).	Non-Operative Management was cost-saving and associated with less pain and fewer missed school days during the first year.	Non-operative management may provide economic and patient-centered advantages when appropriately selected.
St Peters et al.,2025	International multicenter randomized non-inferiority trial; 936 children aged 5–16 years.	Treatment failure for 1 year: 34% NOM vs 7% surgery. Non-inferiority not demonstrated.	Antibiotic treatment was inferior to appendectomy for uncomplicated appendicitis in children.
Brucchi et al,2025	Meta-analysis of 3 pediatric Randomized Controlled Trials (269 patients).	Similar complication rates and 1-year efficacy; lower success in the antibiotic group overall. Children without appendicolith had outcomes comparable to surgery.	Non-Operative Management is safe and feasible, particularly in patients without appendicolith.

Laparoscopic Appendectomy for Acute Uncomplicated Appendicitis in Children

Laparoscopic appendectomy was employed for children with acute, uncomplicated appendicitis using the standard three-port technique. Stringel et al. conducted a retrospective study involving 50 children with acute appendicitis who underwent laparoscopic appendectomy. Although the duration of the operation was longer, the length of hospitalization and the incidence of postoperative complications were comparable to those of open appendectomy (Stringel,1997). Lee et al. conducted a retrospective study comparing the outcomes of laparoscopic versus open appendectomy in children. This study included a total of 7,650 patients, with 3,551 undergoing laparoscopic appendectomy and 4,099 undergoing open appendectomy. The study found a reduced rate of postoperative wound infection and abscess formation associated with laparoscopic appendectomy (Lee et al., 2011). Fujishiro et al. performed a retrospective analysis using the Japanese National Surgical Database to compare laparoscopic and open appendectomy for acute appendicitis in children. Out of 4,489 appendectomies, 3,166 were laparoscopic. Postoperative complications occurred in 5.5% of cases, and the intra-abdominal abscess rate was 2.3%. The length of hospital stay was similar to that of open appendectomy (Fujishiro et al., 2021).

The outcomes of laparoscopic versus open appendectomy in children were evaluated through a retrospective study involving data from 21,541 pediatric patients who underwent appendectomy between 2017 and 2019. Of these, 18,799 children underwent laparoscopic appendectomy, while 2,390 underwent open appendectomy. The overall complication rate was 2.1%, and the reoperation rate was 1.8%(Rolle et al., 2024). Additionally, Childers et al. examined contemporary appendectomy for acute, uncomplicated appendicitis in children. Data from 9,057 patients were sourced from the 2017 American College of Surgeons National Quality Improvement Program, with laparoscopic appendectomy performed in 94.6% of cases. The complication rate was 2.1%, and the conversion rate was 1.1% (Childers et al., 2019).

Aziz et al. conducted a meta-analysis comparing laparoscopic and open appendectomy for acute appendicitis in children, incorporating 23 studies with a total of 6,477 patients. The findings indicated a lower wound infection rate in the laparoscopic appendectomy group (1.5% compared to 5%, OR 0.45, 95% CI 0.27-0.75) and a reduced incidence of postoperative ileus (1.3% compared to 2.8%, OR 0.5, 95% CI 0.29-0.86). Although the intra-abdominal abscess rate was higher in the laparoscopic group, this difference was not statistically significant(Aziz et al., 2006). Additionally, Nataraja et al. conducted a systematic review and meta-analysis on the incidence of intra-abdominal abscess following laparoscopic appendectomy in children. This study included 66 studies with 22,060 patients, comprising 9,600 who underwent laparoscopic appendectomy and 12,460 who underwent open appendectomy. The analysis revealed no significant differences in intra-abdominal abscess rates between the two groups (2.9% vs. 2.7%); however, the wound infection rate was higher in the open appendectomy group (3.7% vs. 2.2%) (Ramesh, M. Nataraja, 2013).

Conclusion

Acute appendicitis is the most prevalent pediatric abdominal surgical emergency, presenting ongoing diagnostic and therapeutic challenges. Prompt identification is crucial to avert perforation and other complications. Current management strategies integrate thorough clinical evaluation, laboratory tests, and imaging techniques, such as ultrasound and computerized tomography. Laparoscopic appendectomy is the standard treatment for most pediatric patients, although nonoperative management may be appropriate for carefully selected cases of uncomplicated appendicitis. The presence of an appendicolith is frequently linked to the failure of nonoperative treatment, and patients should be informed of this risk. The implementation of evidence-based care pathways, antibiotic stewardship, and minimally invasive surgical techniques has markedly enhanced patient outcomes.

Article Information

Conflict of Interest Disclosure: No potential conflict of interest was declared by the authors.

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