SAR Journal of Medicine

Abbreviated Key Title: *SAR J Med*
Home page: https://sarpublication.com/journal/sarjm/home
DOI: https://doi.org/10.36346/sarjm.2026.v07i04.001

OPEN ACCESS

ISSN 2707-773X (P)
ISSN 2709-6920 (O)

Review Article

Management of Acute Uncomplicated Appendicitis in Pediatric Patients: Narrative Review Article

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Article History: | Received: 27.05.2026 | Accepted: 15.07.2026 | Published: 16.07.2026 |

Abstract: Acute appendicitis remains the most common surgical emergency in childhood and a leading cause of acute abdominal pain requiring operative intervention. Despite advances in diagnostic modalities and perioperative care, diagnosis in pediatric patients remains challenging because of age-dependent symptom variability, communication barriers, and overlap with other abdominal conditions. Delayed diagnosis may result in perforation, abscess formation, sepsis, and prolonged hospitalization. Conversely, overdiagnosis may lead to unnecessary appendectomies and increased healthcare costs. This management of acute uncomplicated appendicitis in children includes the non-operative treatment with antibiotics and the laparoscopic appendectomy in children. Laparoscopic appendectomy continues to represent the standard treatment for uncomplicated appendicitis; however, antibiotic-first approaches may be appropriate in selected patients. In this review, we will look at the role of non-operative treatment and laparoscopic appendectomy in the management of acute, uncomplicated appendicitis. We will also review 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, Complications.

INTRODUCTION

Acute appendicitis is a common acute abdominal emergency that is seen in children, and it is seen at a median ages of 9 to 12 years, with a slightly higher incidence in male patients. The incidence of acute appendicitis in children is 80 to 90 cases per 100,000 population. The clinical presentation included symptoms of central abdominal pain that localizes to the right iliac fossa, and it is associated with nausea, vomiting, and fever. On abdominal examination, there will be guarding and rigidity over the right iliac fossa. The laboratory investigations include a full blood count to detect the presence of leukocytosis and inflammatory markers, such as C-Reactive Protein (CRP), which may be elevated. Imaging modalities like ultrasound are the primary imaging modality of choice, as they are readily available and do not involve radiation exposure. Computerized tomography is performed if the ultrasound findings are equivocal or if complications like perforation and mass formation are suspected. The disadvantage of computerized tomography is the involvement of ionizing radiation(Podany, 2017; Rentea & St. Peter, 2017).

The management of acute appendicitis in children can be divided into non-operative treatment, which involves the use of antibiotics and analgesics, or appendectomy, which can be performed as an open or laparoscopic method. Non-operative treatment is a viable option for children with acute, uncomplicated appendicitis, but it is associated with a high recurrence rate. Laparoscopic appendectomy is now considered the gold standard for the management of acute appendicitis in children, as it is associated with a faster recovery, decreased analgesic usage, and faster oral intake. Open appendectomy is performed in cases where a laparoscopic appendectomy cannot be performed on the patient (Filho *et al*., 2024; Morrow & Newman, 2007; Rentea & St. Peter, 2017b). The World Society of Emergency Surgeons (WSES) has recommended in its guidelines for the management of acute appendicitis of 2020 that non-operative treatment can be offered for the management of acute, uncomplicated appendicitis in children in the absence of an appendicolith, while also advising on the risk of failure. They have also recommended that laparoscopic appendectomy be offered to children with acute appendicitis if the

expertise and equipment are available(Di Saverio *et al*., 2020).

This review aims to assess the management of acute uncomplicated appendicitis in children. We will look at the role of non-operative treatment in the management of acute uncomplicated appendicitis. We will also look at the role of laparoscopic appendectomy in the management of acute, uncomplicated appendicitis in children. We will also look at the role that appendicolith plays in non-operative treatment for acute, uncomplicated appendicitis in children. A comprehensive literature review was conducted using PubMed, the Cochrane Database of Clinical Reviews, and Google Scholar, targeting original articles, clinical trials, observational studies, cohort studies, review articles, systematic reviews, and meta-analyses from 1985 to 2026. The search employed the following keywords: "Non-operative treatment," "Acute Appendicitis," "Conservative treatment," "Laparoscopic appendectomy," "Appendectomy,"" Appendicolith", and "Complications." All articles were in English, with case reports and commentaries excluded. Studies involving only pediatric patients were included in this study.

DISCUSSION

Non-Operative Treatment of Acute Uncomplicated Appendicitis in Children

Non-operative treatment of acute, uncomplicated appendicitis in children involves the use of intravenous antibiotics and analgesics. The diagnosis of acute uncomplicated appendicitis is made by assessing the presence of leukocytosis and imaging modalities like ultrasound or computerized tomography, which will demonstrate an inflamed appendix, with no features of perforation. The success rate of non-operative treatment of acute uncomplicated appendicitis is 85% at one year follow-up(Gonzalez *et al*., 2016; Hall & Eaton, 2018; Nepomuceno & Pearson, 2021). The feasibility of non-operative treatment of acute uncomplicated appendicitis in children was assessed by Minneci *et al*., in this prospective non-randomized clinical trial, 77 patients were divided into 30 patients who underwent non-operative treatment and 47 patients who underwent appendectomy. Non-operative treatment was associated with a success rate of 93%, and fewer disability days and faster return to school(Minneci *et al*., 2014).

An open-label international multicenter non-inferiority randomized trial comparing appendectomy and antibiotics for acute uncomplicated appendicitis in children was conducted by St Peter *et al*., A total of 936 patients were randomized to 459 patients who underwent appendectomy and 477 who underwent antibiotic treatment. At 12 months follow-up, data were available from 846 patients, and antibiotic therapy was associated with a treatment failure rate of 33.8%, compared to 7.1% for appendectomy. This study showed that antibiotic therapy was inferior to appendectomy(St Peter *et al*.,2025). A multi-center, non-randomized, controlled interventional study comparing antibiotic therapy and appendectomy for acute uncomplicated appendicitis in children was conducted by Minneci *et al*., A total of 1068 patients were included in this study, with 370 patients undergoing non-operative treatment and 698 patients undergoing appendectomy. At a follow-up of 1 year, a total of 806 patients were included in the analysis, and the success rate for non-operative treatment was at 67.1%, and they had fewer disabilities(Minneci *et al*., 2020).

A systematic review and meta-analysis reevaluating non-operative treatment for acute uncomplicated appendicitis in children was conducted by Faria *et al*., A total of 7 studies with 1480 patients were included in this study, and 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 was lower in the non-operative treatment group at 1 year (RR 0.67,95%CI,0.60-0.75). This study showed that non-operative treatment of acute appendicitis in children was associated with a higher treatment failure rate(Faria *et al.,* 2026). Another systematic review and meta-analysis for non-operative treatment of acute appendicitis in children was conducted by Maita *et al*., A total of 21 studies were included in this review, and non-operative treatment had a success rate of 92% (95% CI,88;96) and a recurrence rate of 16%(95%CI,10;22) (Maita *et al*., 2020). A systematic review and meta-analysis comparing the short- and long-term outcome of non-operative treatment for acute appendicitis in children was conducted by Decker *et al*., A total of 14 studies were included in this review, with 5048 patients managed non-operatively. The 30-day failure rate was at 20%(95%CI,11-29%) and the one-year failure rate was at 32%(95%CI,25%-38%)(Decker *et al*., 2024).

A meta-analysis of randomized controlled trials on non-operative treatment of acute uncomplicated appendicitis in children was conducted by Brucchi *et al*., A total of 3 studies with 269 patients were included in this review. There were no differences regarding treatment efficacy between the procedures, and the length of hospital stay was longer in the non-operative treatment group(Brucchi *et al*., 2025). A meta-analysis comparing conservative treatment with appendectomy for acute uncomplicated appendicitis was conducted by Bi *et al.,* A total of 9 studies with 64,540 patients were included in this study, and the success rate of conservative treatment was 90%(OR0.122,95%CI;0.041-0.376) at 1 month, but the rate was lower at 1-year follow-up(Bi *et al*., 2019). Another meta-analysis comparing antibiotic therapy and appendectomy for acute uncomplicated appendicitis in children was conducted by Huang *et al*., A total of 5 studies with 404 patients were included in this study, and non-operative treatment was successful in 90.5% of cases, and the risk of treatment failure increased with the presence of appendicolith(Huang *et al*., 2017).

Table I

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.

Table 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 presence of an appendicolith that is detected on imaging is associated with a higher risk of failure of non-operative treatment of acute appendicitis in children. Appendicolith is often associated with a higher rate of inflammation and increased diameter of the appendix(Oktay *et al*., 2023). Mahida *et al*., conducted a prospective randomized trial on non-operative treatment of acute uncomplicated appendicitis in children with appendicolith, and the failure rate of non-operative treatment was 60% at 4.7 months of follow-up. This trial was discontinued due to safety concerns(Mahida *et al*., 2016). The presence of appendicolith in children with acute appendicitis was found to be associated with severe symptoms and signs, with a higher risk of complications like perforation, and hence is associated with failure of non-operative treatment of acute appendicitis(Wang *et al*., 2020). A retrospective study on pediatric appendicitis with appendicolith was conducted by Yoon *et al*., A total of 269 patients were included in this study, and patients with appendicolith were associated with prolonged symptoms of abdominal pain and a higher risk of perforation(Yoon *et al*., 2018). Similar studies by Gupta *et al*., and Diya *et al*., also concluded that the presence of appendicolith was associated with a higher risk of complications like perforation(Alaedeen *et al*., 2008; Gupta, 2025).

A systematic review and meta-analysis on conservative treatment of pediatric patients with appendicolith appendicitis versus non-appendicolith appendicitis was conducted by Soares *et al*., A total of 12 studies with 814 patients were included in this study, with 282 patients having an appendicolith and 532 not having an appendicolith. There were no differences in the initial success rate following conservative treatment for both groups, but on subgroup analysis, there was a lower success rate in the group that had appendicitis with appendicolith (OR-0.42,95%CI,0.21-0.84). The recurrence rate was higher in the group that had

appendicitis with appendicolith (OR-2.75,95%CI,1.05-7.20)(Soares, V, 2025).

Laparoscopic Appendectomy for Acute Uncomplicated Appendicitis in Children

Laparoscopic appendectomy was performed for children with acute, uncomplicated appendicitis, with the standard 3-port technique. Stringel *et al*., had conducted a retrospective study on 50 children with acute appendicitis who had undergone laparoscopic appendectomy, and though the length of operation was longer, the length of hospitalization and incidence of postoperative complications were equivalent to open appendectomy(Stringel,1997). A retrospective study on the outcomes of laparoscopic versus open appendectomy in children was conducted by Lee *et al*., A total of 7,650 patients were included in this study, with 3,551 patients undergoing laparoscopic appendectomy and 4,099 patients undergoing open appendectomy. There was a reduced rate of postoperative wound infection and abscess formation with laparoscopic appendectomy (Lee *et al.,* 2011). Fujishiro *et al*., had conducted a retrospective analysis of the Japanese National Surgical database comparing laparoscopic versus open appendectomy for acute appendicitis in children. A total of 3166 laparoscopic appendectomies were performed out of 4489 appendectomies. Postoperative complications were seen in 5.5% of cases, and the intra-abdominal abscess rate was 2.3%, respectively. The length of hospital stay was like that of an open appendectomy(Fujishiro *et al*., 2021).

The outcome of laparoscopic versus open appendectomy in childhood was assessed by a retrospective study on data from 21,541 children who had undergone an appendectomy from 2017-2109. A total of 18,799 children had undergone laparoscopic appendectomy, and 2390 had undergone open appendectomy. The overall complication rate was 2.1%, and the reoperation rate was 1.8%(Rolle *et al*., 2024). Childers et also looked at contemporary appendectomy for acute, uncomplicated appendicitis in children. A total of 9057 patients were obtained from the 2017 American College of Surgeons National Quality Improvement Program, and laparoscopic appendectomy was performed in 94.6% of cases. The complication rate was 2.1%, and the conversion rate was 1.1%(Childers *et al*., 2019).

A meta-analysis comparing laparoscopic versus open appendectomy for acute appendicitis in children was conducted by Aziz *et al*., A total of 23 studies with 6477 patients were included in this study. The wound infection rate was lower in the laparoscopic appendectomy group (1.5% vs 5% OR-0.45,95%CI,0.27-0.75), and postoperative ileus was also lower in the laparoscopic appendectomy group (1.3% vs 2.8% OR-0.5,95%CI,0.29-0.86). The intra-abdominal abscess rate was higher in the laparoscopic appendectomy group, but it was not statistically significant(Aziz *et al*., 2006). A systematic review and meta-analysis on the incidence of intra-abdominal abscess following laparoscopic appendectomy in children was conducted by Nataraja *et al*., A total of 66 studies with 22,060 patients were included in this study, comprising 9,600 patients who underwent laparoscopic appendectomy and 12,460 patients who underwent open appendectomy. There were no differences regarding the intra-abdominal abscess rates between laparoscopic and open appendectomy (2.9% vs2.7%), but the wound infection rate was higher in the open appendectomy group (3.7% vs 2.2%)(Ramesh, M. Nataraja, 2013).

CONCLUSION

Acute appendicitis remains the most common pediatric abdominal surgical emergency and continues to pose diagnostic and therapeutic challenges. Early recognition is essential to prevent perforation and other complications. Contemporary management relies on a combination of careful clinical assessment, laboratory investigations, and imaging modalities, like ultrasound and computerized tomography. Laparoscopic appendectomy remains the standard treatment for most children, while nonoperative management may be considered in carefully selected cases of uncomplicated appendicitis. The presence of an appendicolith is often associated with failure of non-operative treatment, and patients should be advised about this. Evidence-based care pathways, antibiotic stewardship, and minimally invasive surgical techniques have significantly improved outcomes.

Conflict of Interest: There is no conflict of interest.

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