

## Interval Appendectomy Following Non-Operative Treatment for Acute Appendicitis in Children: Narrative Review Article

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**Abstract:** Acute appendicitis is one of the most common surgical emergencies in children. Traditionally, appendectomy has been regarded as the standard treatment; however, increasing evidence supports non-operative management (NOM) for selected cases of uncomplicated appendicitis and as an initial strategy for complicated appendicitis presenting with abscess or phlegmon. The role of interval appendectomy (IA), defined as the elective removal of the appendix weeks after successful NOM, remains controversial. Historically, IA was routinely recommended to prevent recurrent appendicitis and to exclude underlying pathology. More recent evidence has challenged this practice, highlighting relatively low recurrence rates after successful NOM, advances in imaging and follow-up protocols, and the morbidity and costs associated with additional surgery. This review examines the current evidence regarding IA in children following NOM for both complicated and uncomplicated acute appendicitis. The literature suggests that routine IA may not be necessary in all children after successful NOM. While certain subgroups, particularly those with appendicoliths, persistent symptoms, or recurrent disease, may benefit from interval appendectomy, a selective rather than routine approach appears increasingly justified. Shared decision-making involving children, parents, and clinicians is essential when balancing the risks of recurrence against the morbidity and costs of surgery.

**Keywords:** Acute Appendicitis, Interval Appendectomy, Delayed Appendectomy, Complicated Appendicitis, Uncomplicated Appendicitis, Children, Non-Operative Treatment.

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## INTRODUCTION

Acute appendicitis is the most common general surgical emergency that is seen in the pediatric population. It has an annual incidence of 90 cases per 100,000 population in most Western countries, with the peak age of incidence being in the 9 to 12-year-old age group, and it is slightly more common in male children. The clinical presentation is that of right lower abdominal pain, which is initially central, followed by radiation to the right lower abdomen. On abdominal examination, there may be guarding and rigidity over the right iliac fossa (Podany, 2017). The diagnosis of acute appendicitis in the pediatric population involves a clinical assessment of the patient, followed by blood investigations such as a full blood count to look for leukocytosis and inflammatory markers, including C-reactive protein (CRP), and a urine analysis. Imaging modalities, such as ultrasound and computerized tomography, are performed

if complications like perforation, abscess formation, and appendicular phlegmon are suspected (Morrow & Newman, 2007).

The management of acute appendicitis in the pediatric patient can be divided into non-operative treatment with antibiotics and appendectomy. Appendectomy can be performed as an open or a laparoscopic method (Rentea & St. Peter, 2017b). Non-operative treatment of acute, uncomplicated appendicitis is usually not followed by interval appendectomy, while patients who undergo non-operative treatment for complicated appendicitis may need to undergo an interval appendectomy. The timing of when to perform an interval appendectomy is an area of controversy, with the most common time being 8 to 12 weeks following the completion of non-operative treatment (Rentea & St. Peter, 2017a). The World Society of Emergency

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Surgeons (WSES), in their guidelines for the management of acute appendicitis in 2020, has recommended against routine interval appendectomy following completion of non-operative treatment of acute appendicitis in children, and interval appendectomy is recommended if there are symptoms of recurrence (Di Saverio *et al.*, 2020). The Society of Gastrointestinal and Endoscopic Surgeons (SAGES), in their guidelines for the diagnosis and management of acute appendicitis of 2024, has recommended interval appendectomy for pediatric patients who have undergone non-operative treatment, but this is a conditional recommendation based on the evidence provided (Kumar *et al.*, 2024). The Swedish National Guidelines for the diagnosis and management of acute appendicitis in adults and children of 2025 have recommended against performing an interval appendectomy as a routine following non-operative treatment for acute appendicitis (Salö *et al.*, 2025).

As there is uncertainty regarding the indication for performing an interval appendectomy following non-operative treatment of acute appendicitis, we have undertaken this review article to examine the role of interval appendectomy in pediatric patients following non-operative treatment of acute, uncomplicated, and complicated appendicitis. We performed a comprehensive literature review utilizing PUBMED, the Cochrane Database of Clinical Reviews, Semantic Scholar, and Google Scholar, focusing on clinical trials, observational studies, systematic reviews, and meta-analyses published between 1990 and 2026. The search employed the following keywords: “interval appendectomy,” “acute appendicitis,” “delayed appendectomy,” “complicated appendicitis,” “Uncomplicated appendicitis,” “non-operative treatment,” and “Children.” Articles not published in English, as well as case reports, commentaries, and letters to the editor, were excluded. This study included pediatric patients only.

## DISCUSSION

### Interval Appendectomy in Children Following Non-Operative Treatment of Complicated Appendicitis

Interval appendectomy is defined as performing an elective appendectomy following non-operative treatment for complicated appendicitis. It is usually performed after 8 to 12 weeks, following successful completion of non-operative treatment. An interval appendectomy is performed to prevent recurrent attacks of acute appendicitis (Fawcner-Corbett *et al.*, 2014). The role of interval appendectomy in the management of complicated appendicitis in children was assessed by Vane *et al.*, A total of 86 children with complicated appendicitis were included in this study, with 59 patients undergoing immediate appendectomy and 27 undergoing interval appendectomy. There were no differences in complications or length of hospital stay between the procedures (Vane & Fernandez, 2006). The effectiveness of early versus interval appendectomy for children with

complicated appendicitis was assessed in a nonrandomized controlled trial by Blakely *et al.*, A total of 131 children were divided into two groups: 64 children who underwent early appendectomy and 67 children who underwent interval appendectomy. Interval appendectomy was associated with reduced adverse event rates (30% vs 55%) and a shorter time away from normal activity (13.8 vs 19.4 days) (Blakely *et al.*, 2011). Schmidt *et al.*, retrospectively assessed the effects of hospital stay and complications between early and interval appendectomy in children with complicated appendicitis. A total of 254 patients were included in this study, with 232 undergoing early appendectomy and 22 undergoing interval appendectomies. Early appendectomy was associated with reduced hospital stay and reduced complications (Schmidt *et al.*, 2026).

A retrospective study on the safety and feasibility of interval appendectomy following non-operative treatment for complicated appendicitis was conducted by Suzuki *et al.*, A total of 42 patients were included in this study, with 34 patients undergoing interval appendectomy and 8 patients undergoing early appendectomy. The rate of post-operative complications was lower in the interval appendectomy group (9% vs 75%) (Suzuki *et al.*, 2023). Nazarey *et al.*, also conducted a retrospective study on 105 patients with complicated appendicitis who underwent non-operative treatment and interval appendectomy. The intra-abdominal abscess rate was 27%, and the recurrence rate before performing interval appendectomy was 11% (Nazarey *et al.*, 2014). Takahashi *et al.* looked at the experience of interval appendectomy following non-operative treatment of complicated appendicitis in children. A total of 43 patients with complicated appendicitis were included in this study, with 34 patients undergoing interval appendectomy. The interval appendectomy group was associated with a longer length of hospital stay, and the recurrence rate was 15% (Takahashi *et al.*, 2021). Zhang *et al.* looked at the intermediate-term evaluation of interval appendectomy in the pediatric population. A total of 471 patients were included in this study, with 377 undergoing emergency appendectomy and 96 undergoing non-operative treatment and interval appendectomy. Patients who underwent interval appendectomy were associated with reduced postoperative complications and adhesive intestinal obstruction (Zhang *et al.*, 2021).

A systematic review was conducted by Hall *et al.*, on the justification of performing an interval appendectomy following successful non-operative treatment of complicated appendicitis in children. A total of 3 studies with 127 cases were included in this study, and the incidence of complications following interval appendectomy was 3.4%, the recurrence rate following non-operative treatment was 20.5%, and the length of stay for interval appendectomy was 3 days (Hall *et al.*, 2011). A systematic review and meta-analysis of randomized controlled trials comparing early versus

interval appendectomy for children with complicated appendicitis was conducted by Duggan *et al.*, A total of 2 studies with 171 patients were included in this study, and emergency appendectomy was associated with reduced adverse events (OR-0.28,95%CI,0.1-0.77), and reduced unplanned admission (OR-0.08,95%CI,0.01-0.67) for complicated appendicitis with abscess formation, while there were no differences between emergency appendectomy and interval appendectomy for complicated appendicitis without abscess formation(Duggan *et al.*, 2016).

An open-label, randomized controlled trial on active observation versus interval appendectomy after successful non-operative treatment of complicated appendicitis in children (CHINA study) was conducted by Hall *et al.*, A total of 106 patients were randomized to 52 patients who underwent interval appendectomy and 54 patients who underwent active observation. The recurrence rate following active observation 12%(95%CI,5-23), and the complication rate following interval appendectomy was 6%(95%CI,1-17). This study showed that interval appendectomy need not be done as a routine(Hall *et al.*, 2017). A retrospective study was conducted by Puapong *et al.*, on the need for performing interval appendectomy in children following completion of non-operative treatment. A total of 72 patients were treated with non-operative treatment, and 11 patients underwent interval appendectomy. Out of the 61 patients who underwent non-operative treatment alone, the recurrence rate was 11%. This study showed that interval appendectomy need not be performed as a routine(Puapong *et al.*, 2007). Another study by Karaca *et al.*, who had managed children with complicated appendicitis with localized abscess with conservative treatment, also noted that the recurrence rates were low and interval appendectomy need not be performed as a routine(Rfan Karaca *et al.*, 2001).

A systematic review of the interval appendectomy practices for complicated appendicitis in children from the American Pediatric Surgical Association outcomes was conducted by Sulkowski *et al.*, A total of 46 studies with 6222 patients were included in this study. The incidence of recurrence was 2-50%, and the optimal timing for performing an interval appendectomy was undetermined. Still, it was suggested that performing it within 3 months of completion of non-operative treatment. The presence of appendicoliths was associated with a risk for recurrence, and the incidence of appendicular neoplasms is rare(Sulkowski *et al.*, 2026). Farr *et al.*, looked at the optimal timing for performing an interval appendectomy. A total of 500 patients were included in this study, with an average time of 12.7 weeks for performing an interval appendectomy. Operations performed before 12 weeks were associated with increased difficulty due to the presence of inflammation(Farr *et al.*, 2021).

The histological analysis of the appendix specimen that is removed following interval appendectomy after completion of non-operative treatment of complicated appendicitis in children was assessed by Otake *et al.*, A total of 48 children who had undergone interval appendectomy, and 24 out of the 48 appendix specimens showed features of infiltration of inflammatory cells, with foreign body reaction and fibrosis(Otake *et al.*, 2014). Pederiva *et al.*, also looked at the histopathology of the appendix in children who underwent interval appendectomy. A total of 42 patients have undergone non-operative treatment, and 33 have undergone an interval appendectomy. The 33 appendix specimens had features of inflammation, and 53% of the specimens had infiltration into the serosa, and 25% had signs of necrosis and hemorrhage. No malignant lesions were found on the specimen(Pederiva *et al.*, 2021). Fouad *et al.*, conducted a study on the pathological findings following interval appendectomy in children. A total of 149 patients were included in this study, and all of the specimens had features of inflammation, 17% had an appendicolith present, and there were no features of malignancy(Fouad *et al.*, 2020).

Laparoscopic interval appendectomy was performed following non-operative treatment for complicated appendicitis in children by Owen *et al.*, A total of 35 children had undergone an interval laparoscopic appendectomy following completion of conservative treatment. It was performed at a median interval of 93 days, and the mean duration of surgery was 55minutes. The length of hospital stay was one day, and there were no post-operative complications (Owen,2006). A single-center retrospective study on the safety and effectiveness of laparoscopic interval appendectomy after completion of non-operative treatment was conducted by Esposito *et al.*, A total of 71 patients were included in this study, and the mean operative time was 27 minutes; the length of hospital stay was 32 hours, and there were no complications from the procedure(Esposito, 2025).

Abiko *et al.*, performed elective laparoscopic interval appendectomy following non-operative treatment for acute appendicitis in children. A total of 120 patients had undergone interval laparoscopic appendectomy, and the mean interval for surgery was 48.5 days, and the mean operative time was 38 minutes. Same-day discharge was successful in 97.5% of cases, and complications were seen in 2.5% of cases(Ryoichi Abiko, 2026). Whyte *et al.*, also conducted a retrospective study on outpatient interval appendectomy after completion of non-operative treatment for complicated appendicitis. A total of 24 patients were included in this study, with 88% of the cases being able to be discharged on the same day. This study showed that outpatient interval appendectomy was feasible in children(Whyte *et al.*, 2008).

### Interval Appendectomy following Non-Operative Treatment of Acute Uncomplicated Appendicitis in Children

Following successful non-operative management (NOM) of acute uncomplicated appendicitis in children, routine interval appendectomy is generally not recommended. Contemporary pediatric evidence suggests that many children treated successfully with antibiotics remain free of recurrent appendicitis, making an interval appendectomy unnecessary in a substantial proportion of cases. Long-term follow-up studies have reported that although recurrence can occur, most patients avoid further episodes, thereby sparing them the risks, costs, and recovery associated with surgery. Consequently, current practice increasingly favors a selective rather than routine approach to interval appendectomy, with emphasis on shared decision-making between clinicians and families(Lipsett *et al.*, 2022).

The decision to perform an interval appendectomy should therefore be individualized based

on factors associated with recurrence or treatment failure. The most consistently reported risk factor is the presence of an appendicolith, which has been associated with a higher likelihood of recurrent appendicitis and failure of Non-Operative Management. Additional considerations include recurrent abdominal symptoms, radiological evidence of persistent appendiceal pathology, difficulty accessing emergency medical care, and significant parental anxiety regarding recurrence. However, interval appendectomy itself is not without risk. Potential complications include surgical-site infection, intra-abdominal abscess formation, adhesive bowel obstruction, anesthetic-related adverse events, postoperative pain, and increased healthcare costs. Given these operative risks and the relatively modest recurrence rate after successful Non-Operative Management, many authors conclude that routine interval appendectomy offers limited benefit for children with uncomplicated appendicitis and should be reserved for selected high-risk cases(Brucchi *et al.*, 2025; Faria *et al.*, 2026).

**Table 1**

| Study                                   | Study Type                                                                                                                                                  | Key Findings                                                                                                                                                                                                       | Implications for Interval Appendectomy                                                                                                                                                                                                                         |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hall <i>et al.</i> , 2011               | Systematic review of pediatric appendiceal mass/abscess management                                                                                          | Reported relatively low recurrence rates following successful Non-Operative Management and questioned the necessity of routine Interval Appendectomy in all children.                                              | Routine Interval Appendectomy may not be necessary for every child after successful Non-Operative Management; observation is a reasonable alternative in selected patients.                                                                                    |
| Blakely <i>et al.</i> , 2014            | Prospective randomized trial comparing early vs interval appendectomy in perforated appendicitis with abscess/phlegmon                                      | Early appendectomy reduced time away from normal activities and adverse events compared with delayed surgery.                                                                                                      | Supports early definitive surgery in selected complicated appendicitis cases and highlights limitations of a delayed Interval Appendectomy strategy.                                                                                                           |
| Hall <i>et al.</i> , 2017 (CHINA Study) | Multicenter randomized controlled trial comparing active observation versus interval appendectomy after successful non-operative treatment of appendix mass | Recurrence occurred in approximately 12% of children managed with observation. More than 75% of children avoided an operation altogether. Observation resulted in fewer hospital days and was more cost-effective. | Landmark evidence against routine Interval Appendectomy. Supports active observation as the preferred strategy after successful Non-Operative Management, reserving Interval Appendectomy for selected patients with recurrent symptoms or high-risk features. |
| Suzuki <i>et al.</i> , 2023             | Contemporary pediatric cohort evaluating outcomes after Non-Operative Management                                                                            | Demonstrated high success rates of Non-Operative Management with acceptable recurrence rates; identified patient factors influencing recurrence risk.                                                              | Interval Appendectomy should be individualized, particularly for children with appendicoliths or recurrent symptoms.                                                                                                                                           |
| Schmidt <i>et al.</i> , 2026            | Retrospective comparison of early versus interval appendectomy in children with complicated appendicitis                                                    | Early appendectomy was associated with shorter cumulative hospital stay, whereas Interval Appendectomy avoided operating in an acutely inflamed field but required a second hospitalization.                       | Interval Appendectomy remains useful in selected patients but may increase overall healthcare utilization; benefits must be balanced against recurrence risk and family preference.                                                                            |

| Study                          | Study Type                                                                                                                         | Key Findings                                                                                                                      | Implications for Interval Appendectomy                                                                                                                                                  |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sulkowski <i>et al.</i> , 2026 | Evaluation of elective Interval Appendectomy following successful Non-Operative Management in pediatric uncomplicated appendicitis | Focused on recurrence prediction and family decision-making; emphasized that not all children benefit from elective appendectomy. | Supports a risk-stratified approach in which Interval Appendectomy is reserved for patients at increased risk of recurrence or with significant family anxiety regarding future attacks |

Table showing the role of interval appendectomy following non-operative treatment of acute appendicitis in children.

## CONCLUSION

The role of interval appendectomy following successful non-operative treatment of acute appendicitis in children remains controversial. Historically considered standard practice, routine Interval appendectomy has been challenged by growing evidence demonstrating relatively low recurrence rates, limited risk of appendiceal neoplasms, and the morbidity and costs associated with additional surgery. Current literature suggests that most children treated successfully with non-operative strategies will not experience recurrence and therefore may not require routine appendectomy. Nevertheless, specific subgroups, including those with appendicoliths, persistent symptoms, recurrent disease, or radiological findings, may still benefit from elective surgery.

Contemporary practice is increasingly moving toward a selective, individualized approach rather than universal interval appendectomy. Shared decision-making that incorporates clinical risk factors, family preferences, quality-of-life considerations, and local expertise offers the most appropriate framework for management. Further prospective multicenter studies are required to establish definitive recommendations and optimize patient selection.

**Conflict of Interest:** There is no conflict of interest.

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