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An evaluation of the efficacy and safety of conservative versus surgical treatment of acute appendicitis in children: a review of clinical reports and discussion

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ABSTRACT

Introduction: Appendectomy has traditionally been the standard treatment for acute appendicitis [AA]. However, new studies show the appendix is a necessary organ and an integral part of the body; together with advances in diagnostic imaging and pharmacological therapy, these findings encourage further exploration of non-surgical treatments. **Methods:** A literature review was conducted in the MEDLINE (PubMed) database covering the years January 2016 - July 2026. The analysis included 10 studies, all of which included patients under 18. **Results:** The initial clinical efficacy of NOM (up to 30 days) is high, ranging from 90% to 97%. However, in long-term follow-up (≥ 1 year), efficacy drops to 56–82% due to recurrences. The main predictor of nonoperative management [NOM] failure is the presence of an appendicolith, which increases the risk of treatment failure more than tenfold and constitutes an absolute contraindication to this method. Factors that negatively affect the success of NOM also include severe baseline pain and relying only on ultrasound for diagnosis. Both strategies demonstrate equivalent, high clinical safety. From an economic perspective, the annual costs of both methods are equivalent because of recurrence-related hospitalizations. With successful NOM, patients have a higher quality of life (median PedsQL: 92.4 vs. 87.0) and return to full activity faster. **Conclusions:** NOM is a safe and sufficient treatment option for children with uncomplicated acute appendicitis. Improved outcomes depend on precise patient selection using high-detail imaging to exclude a fecal stone.

Keywords: acute appendicitis, appendectomy, uncomplicated acute appendicitis, pediatric appendicitis, nonoperative management, conservative management, antibiotic therapy.

1. INTRODUCTION

Acute appendicitis is placed at a lifetime risk of about 7-9% (Addiss et al., 1990). Appendectomy, an operation which for many years was the leading way to cure AA, is one of the most common emergency operations in children (Hamill et al., 2014). The frequency of complications directly related to the surgical procedure or anesthesia is estimated at over 10% within 30 days of an appendectomy (Holloway et al., 2026). Furthermore, the rate of negative appendectomies, that is, resection of a histologically normal appendix, ranges from 4.3% to 6.3% in children, even though most hospitals can use high-quality imaging techniques (Hall et al., 2021a).

Modern clinical immunology describes the appendix not simply as a vestigial organ, but as a highly specialized structure that is part of the intestinal-associated lymphatic system [GALT], which serves as a rich reservoir of the physiological intestinal microbiome essential for the recolonization of the large intestine following episodes of dysbiosis, as well as a rich source of B and T lymphocytes (Bollinger et al., 2007).

A shift in the perception of the appendix as a non-vital organ, along with pharmacological and instrumental advances, enabled the study of the possibility of NOM with targeted antibiotic therapy (Salminen et al., 2015).

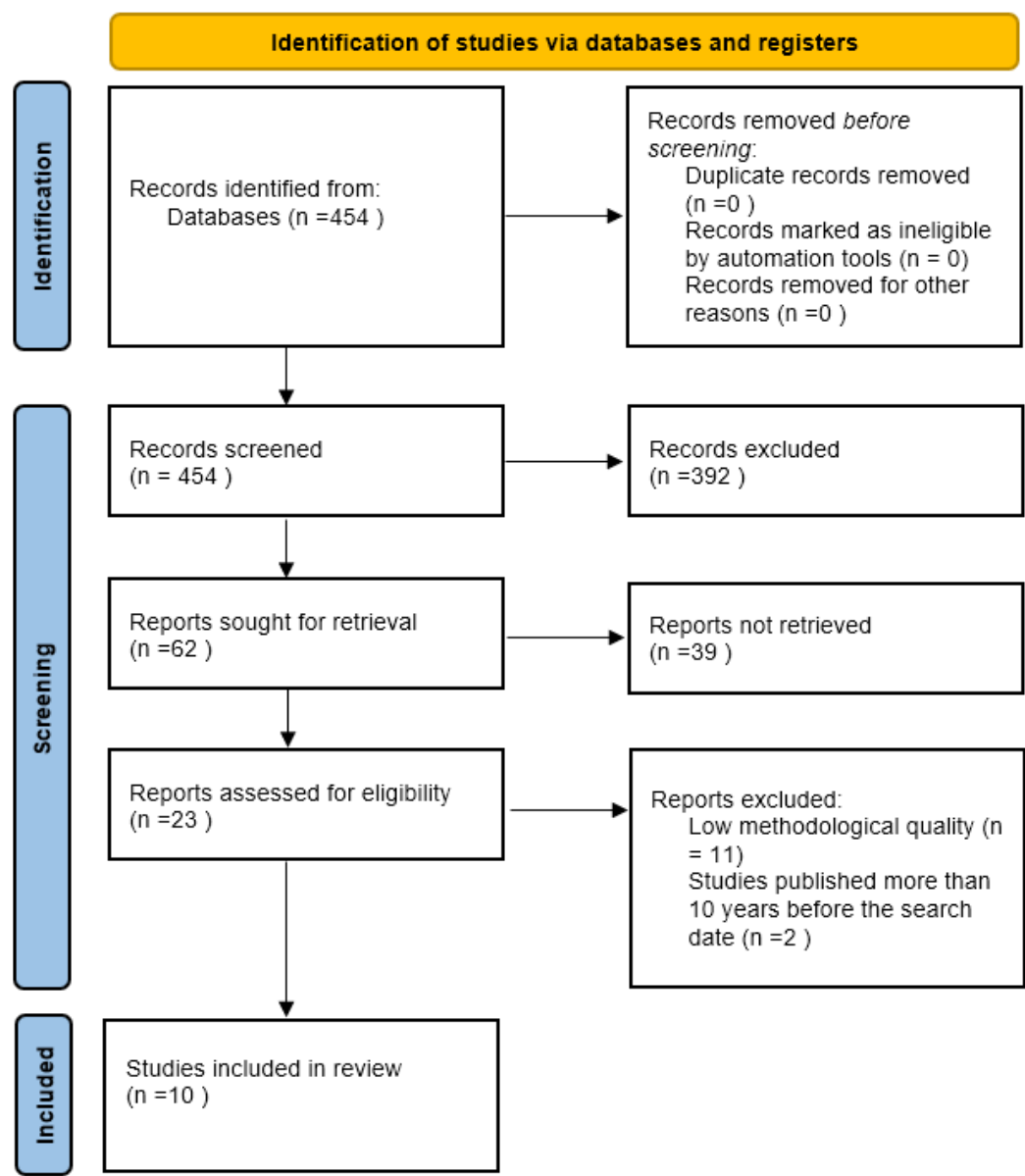


Figure 1. PRISMA Chart

2. REVIEW METHODS

Inclusion criteria for studies were: they were published within the last 10 years (January 2016- July 2026), full-text articles were available, and the studies involved children with uncomplicated appendicitis. Children were defined as being less than 18 years of age. Articles were found by using Boolean operators (AND and OR) and the following keywords: appendicitis, acute appendicitis, pediatric, children, adolescents, nonoperative, nonoperative management, antibiotic therapy, conservative management, appendectomy, and surgery. Articles of insufficient methodological quality were excluded. A flow diagram of study selection is presented in Figure 1.

3. RESULTS AND DISCUSSION

Comparative Study of Short- and Long-Term Efficacy

An analysis of the latest clinical reports indicates that nonoperative management with antibiotic therapy in children with uncomplicated acute appendicitis [UCAA] is defined by high initial effectiveness that, however, decreases significantly as the follow-up period lengthens. In the short term (up to 30 days from the start of therapy), the clinical success rate, represented as the resolution of symptoms and dismissal from the hospital without the need for surgical intervention, ranges from 90% to 97% (Hall et al., 2021a). A meta-analysis by Huang demonstrates that primary antibiotic therapy healed 90.5% (152) of pediatric patients with appendicitis (Huang et al., 2017). However, 9.5% failed the treatment and had an early appendectomy within 48 hours or recurred within the first month (Maita et al., 2020).

Over time, however, the stability of the therapeutic effect of conservative treatment deteriorates due to recurrences of appendicitis. In a meta-analysis (Decker et al., 2024) that included data published after the COVID-19 pandemic, the cumulative failure rate of NOM over one year or longer was as high as 32% (29% when the analysis was limited exclusively to randomized trials). These results are consistent with a long-term meta-analysis (Bi et al., 2019), which estimated the one-year effectiveness of conservative treatment at 75.6%. This means that one in three or one in four children initially treated with antibiotics ultimately undergoes appendectomy within 12 months of their first hospitalization.

An important point of reference is the results of the British CONTRACT study (a pilot study and feasibility assessment of a multicenter RCT), which demonstrated a significantly lower initial response rate to NOM of 70% (19 out of 27 patients responded to initial treatment) and a high relapse rate of as much as 37% within 6 months among children successfully discharged. The low efficacy of conservative treatment in the CONTRACT study was attributable to the pragmatic design of the inclusion criteria, which were based mainly on clinical assessment and lacked mandatory diagnostic confirmation using high-detail imaging techniques (Hall et al., 2021a). Consequently, histopathological features of perforation were found in 30% of the children who ultimately underwent appendectomy, which proves that the NOM group included patients with complicated appendicitis, in whom antibiotic therapy could not possibly have led to long-term success (Hall et al., 2021a). Some of the study data are presented in Table 1.

Table 1. Summary of short- and long-term efficacy, recurrence rates, and outcomes across included pediatric NOM studies

Study / Meta-analysis	Number of patients undergoing NOM	Definition of therapeutic success	Short-term efficacy (30 days)	Long-term efficacy (≥ 1 year)	Percentage of relapses after discharge
(Decker <i>et al.</i> , 2024)	5048	No need for surgery within the given time frame	80% (95% CI: 71–89%)	68% (95% CI: 62–75%)	N/A
(Maita <i>et al.</i> , 2020)	5,727	Resolution of symptoms and no appendectomy during early hospitalization	92% (95% CI: 88–96%)	N/A	16% (95% CI: 10–22%)
(Bi <i>et al.</i> , 2019)	2,687	No recurrence and no early surgery	90% (group)	56% (75.6% after excluding Bachur <i>et al.</i>)	N/A
(Huang <i>et al.</i> ,	168	No complications or	90.5%	N/A	26.8%

2017)		recurrences within 1 month			
(Minnecei <i>et al.</i> , 2022)	370	No appendectomy within 12 months	85.7%	66.2%	19.5%
(Hall <i>et al.</i> , 2021a)	29	No appendectomy during the first hospitalization	70%	41% (at 6 months of follow-up)	37% (7 out of 19 discharged)

Predictive Factors for Treatment Failure and Criteria for Eligibility for Conservative Treatment

Identifying clinical and radiological risk factors helps reduce the failure rate of conservative treatment and lowers the risk of unnecessarily exposing children to ineffective pharmacotherapy. The literature identifies many variables with strong prognostic value (Minnecei et al., 2022; Rincon Mora, 2026).

Presence of an appendicolith

The presence of a fecalith (appendicolith) is the most significant negative predictor of NOM success in children. A meta-analysis by Huang demonstrated that the presence of a fecalith increases the risk of antibiotic treatment failure more than tenfold (RR = 10.43; 95% CI: 1.46–74.26), whereas in patients without a fecal stone, this risk was significantly lower (RR = 7.87; 95% CI: 1.80–34.33) (Huang et al., 2017). This association is confirmed, with drastically worse outcomes in children with fecal stones (OR for NOM success: 0.073; 95% CI: 0.013–0.400) (Bi et al., 2019). In contrast, in the group without fecal stones, the effectiveness of NOM did not differ significantly from that of early appendectomy (OR: 0.159; 95% CI: 0.015–1.699). These data explain why the prospective study (Mahida et al., 2016), which enrolled only children with fecal stones, had to be discontinued due to a 60% failure rate. The presence of a fecal stone is therefore considered an absolute contraindication for NOM according to current guidelines.

Imaging Modalities and Biomarkers

The choice of imaging modality has a strong, indirect impact on treatment efficacy. The use of ultrasound (US) alone was associated with more than a twofold increase in the risk of NOM failure in the hospital compared to computed tomography (RR = 2.4; 95% CI: 1.0–5.8) (Minnecei et al., 2022). This suggests that the limited sensitivity of ultrasound for detecting small fecal stones or microscopic perforations leads to misclassification of patients (Hall et al., 2021a). To reduce ionizing radiation, the current standard of care recommends non-contrast MRI when there is suspicion or when specific clinical and laboratory tests are met, namely the neutrophil-lymphocyte ratio, the systemic inflammation index, and the appendix diameter threshold (Xu & Zhang, 2026). The CRP level on the day of NOM completion was also associated with the risk of recurrence (Alkhelaiwy et al., 2026).

Clinical Safety, Complications, and Safety of Pharmacotherapy

One of the key issues in the discussion of NOM in children is the comparison of the safety profiles of the two methods. No fatalities were reported in the studies included in the analysis, suggesting that overall safety does not differ substantially between conservative and surgical treatment (Decker et al., 2024). Overall, the series report the rate of post-operative major complications, namely the development of a grade III or higher complication according to the Clavien-Dindo classification, to be only 1% (95% CI: 0–1%) after early appendectomy (Decker et al., 2024). In classical appendectomy series, the post-discharge complication rate ranged from 20.5 to 24.4% in long-term follow-up, versus 2.8 to 6.5% after NOM (Xu & Zhang, 2026). Modern pediatric surgery, which is now based strictly on laparoscopic access, is characterized by very low invasiveness; nevertheless, post-operative complications still occur in 5% to 15% of children. Complications in both groups are mainly surgical site infections, intra-abdominal abscesses, and adhesions leading to post-appendectomy bowel obstructions (Hall et al., 2021a).

In the context of conservative management, there is concern about the risk of disease progression to complicated appendicitis (e.g., perforation) during a trial of NOM. Clinical evidence, however, indicates that delaying appendectomy in cases of NOM failure does not worsen treatment outcomes or increase the technical difficulty of the surgery itself. The progression of appendicitis in children shows no simple temporal relationship. Uncomplicated appendicitis rarely progresses to a complicated form solely due to a delay of a dozen or so hours in surgery, which supports the biological concept of two distinct forms of this disease (Hall et al., 2021a).

Pharmacological Aspects of Conservative Management

For NOM, the standard of care for a child in the hospital receiving intravenous (IV) antibiotics is 24 hours or more, then switched to oral once the child is tolerating a regular diet and is afebrile. This approach is supported by the American Pediatric Surgical Association (APSA) and the Dallas criteria for APPM. Most centers now use a single- or dual-regimen broad-spectrum antibiotic instead of the previously recommended 3-agent regimen (Lee et al., 2010).

Common complications of NOM pharmacotherapy are of two main types: allergic reactions, such as skin eruptions. The second type is gastrointestinal and can occur when the antibiotic is changed from intravenous to oral preparation. Most are tolerable if the patient can take the oral preparation within a few hours of meals and remains afebrile (Hall et al., 2021a).

Resource use and costs

The introduction of NOM as an alternative to appendectomy significantly affects the cost structure borne by the healthcare system (Hall et al., 2021a).

Length of Stay (LOS)

Performing appendectomy early reduces the length of hospitalization by about half a day (Hall et al., 2021a). Meta-analyses of randomized controlled trials in adult populations also show that early surgery reduces length of hospitalization by a factor of $RR = 1.48$ (de Almeida Leite et al., 2022). This is because NOM protocols require a minimum of 24–48 hours of observation and intravenous medication administration in a hospital ward setting. In the CONTRACT study, the median time from randomization to discharge was 61 hours in cases of successful NOM, but increased to 116 hours when surgery was required due to an early lack of response to treatment (Hall et al., 2021b). However, when long-term follow-up (6–12 months) is considered, the total length of hospital stay in both groups becomes similar due to readmissions among patients in the NOM group who experience disease recurrence (Hall et al., 2021a).

Financial Analysis and Cost Drivers

The economic section of the CONTRACT study (based on a detailed micro-cost model) demonstrated that the main cost drivers in the treatment of appendicitis are the hospital stay (cost per bed-day) and the costs of the surgical procedure itself (operating room, anesthesia). In some studies, the initial cost of NOM is significantly lower than the cost of appendectomy; in particular, the initial cost exceeded \$1,000 per patient (Mudri et al., 2017). However, considering the rate of recurrence and the need for conservative treatment for the second time and subsequent appendectomy in about 30% of children, the overall costs are similar for both treatments. This means that, from the payer's perspective, NOM ceases to be a cost-saving strategy if patient selection is not optimized to eliminate risk factors for recurrence, such as fecal stones (Mudri et al., 2017).

The Patient's Perspective, Decision-Making, and Quality of Life

Modern health technology assessment highlights the importance of incorporating patient and caregiver perspectives. Acute appendicitis in children is an emergency and a highly stressful event, which may limit parents' ability to make decisions.

Shared Decision-Making and the Role of Patient Activation Tool (PAT)

Minneci investigated the impact of the PAT, an interactive tablet-based system, on the quality of decisions made by caregivers of children with UCAA (Minneci et al., 2019). The study found that:

- The introduction of a structured consultation (both standard and PAT-supported) resulted in a very high sense of decision-making efficacy among parents (median of 100 points in both groups).
- The percentage of families choosing NOM did not differ significantly (31.6% in the PAT group vs. 41.2% in the control group).
- Studies show that parents can effectively understand the risks and benefits of both treatment options in the emergency department and actively participate in decision-making.

Days of disability and quality of life

The choice of treatment affects a family's daily life. The information we have shows that nonoperative management has some benefits when the treatment works well in the long run:

- Number of days of disability: When looking at cases for one year after treatment, children treated with NOM had fewer days when they had to limit their activity because of their condition. On average, children treated with NOM missed three days of activities. The children who had surgery to remove their appendix also missed three days of activities on average but with a statistically meaningful shift in the distribution of results in favor of NOM (Minnecci et al., 2019).
- Quality-of-life [QoL]: One month after the children went home from the hospital, their parents were asked to fill out a survey. Parents of children who got NOM said they were doing better than parents of children who had surgery. Children who got NOM scored a median of 92.4 on the quality-of-life scores at 30-day follow-up, and the kids who had surgery scored about 87.0. This difference is also large enough to matter ($P=0.01$). Also, parents of children who received NOM returned to work faster, and the children stopped taking pain medicine sooner (Minnecci et al., 2019).

4. CONCLUSION

Conservative management with antibiotic therapy in children with uncomplicated acute appendicitis is characterized by a high initial efficacy of 90–97%, which, however, decreases significantly in long-term follow-up. A key requirement for improving this approach is rigorous patient selection based on high-level imaging (particularly MRI or CT), as relying exclusively on ultrasound more than doubles the risk of treatment failure due to missed microperforations or the presence of an appendicolith, which is an absolute contraindication for NOM. Both clinical methods have equivalent safety, and any delay in surgery if the disease progresses does not worsen treatment outcomes. Although NOM does not generate annual savings for the healthcare system due to the costs of hospitalization associated with relapses, in cases of persistent success with pharmacotherapy, it provides patients with a higher quality of life, fewer days of disability, and a faster return to work for parents.

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Conceptualization: Daniel Glinka.

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All authors have read and agreed with the published version of the manuscript.

Informed consent

Not applicable.

Ethical approval

Not applicable. This article does not contain any studies with human participants or animals performed by any of the authors.

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Conflict of interest

The authors declare that they have no conflicts of interest, competing financial interest or personal relationship that could have influenced the work reported in this paper.

Data and materials availability

All data associated with this study will be available based on the reasonable request to the corresponding author.

REFERENCES

1. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol.* 1990;132(5):910-925. doi: 10.1093/oxfordjournals.aje.a115734
2. Alkhelaiwy O, Bamanan O, Aldossary M, Alqusaibi B. Interval Appendectomy in Adults and Pediatric Complex Appendicitis. *IntechOpen* 2026. doi: 10.5772/intechopen.1014498
3. Bi LW, Yan BL, Yang QY, Cui HL. Comparison of conservative treatment with appendectomy for acute uncomplicated pediatric appendicitis: a meta-analysis. *J Comp Eff Res.* 2019;8(10):767-780. doi:10.2217/cer-2019-0036
4. Bollinger R, Barbas AS, Bush EL, Lin SS, Parker W. Biofilms in the large bowel suggest an apparent function of the human vermiform appendix. *J Theor Biol.* 2007;249(4):826-831. doi:10.1016/j.jtbi.2007.08.032
5. de Almeida Leite RM, Seo DJ, Gomez-Eslava B, Hossain S, Lesegretain A, de Souza AV, Bay CP, Zilberstein B, Marchi E, Machado RB, Barchi LC, Ricciardi R. Nonoperative vs Operative Management of Uncomplicated Acute Appendicitis: A Systematic Review and Meta-analysis. *JAMA Surg* 2022;157(9):828-834. doi: 10.1001/jamasurg.2022.2937
6. Decker E, Ndzi A, Kenny S, Harwood R. Systematic review and meta-analysis to compare the short- and long-term outcomes of non-operative management with early operative management of simple appendicitis in children after the COVID-19 pandemic. *J Pediatr Surg* 2024;59(6):1050-1057. doi: 10.1016/j.jpedsurg.2023.12.021
7. Hall NJ, Eaton S, Sherratt FC, Reading I, Walker E, Chorozoglou M, Beattie RM, Hutchings N, Burls A, Young B, Cook JA. CONservative TReatment of Appendicitis in Children: A Randomized Controlled Feasibility Trial (CONTRACT). *Arch Dis Child* 2021b;106(8):764-773. doi: 10.1136/archdischild-2020-320746
8. Hall NJ, Sherratt FC, Eaton S, Reading I, Wood W, Chorozoglou M, Beattie RM, Hutchings N, Burls A, Young B, Cook JA, Wilmott A, Woodhouse N, Walker E, Offiah I, Drewett M, Thomas G, Jones B, Davies C, Ross AR, van't Hoff W, Brackley K, Khorana J, Lawson C, Knight M, Powell JE, Lee AC, Wood R. Conservative treatment for uncomplicated appendicitis in children: the CONTRACT feasibility study, including a feasibility RCT. *Health Technol Assess* 2021a; 25(10):1-192. doi: 10.3310/hta25100
9. Hamill JK, Liley A, Hill AG. Historical aspects of appendicitis. *ANZ J Surg* 2014;84(5):307-310. doi: 10.1111/ans.12425
10. Holloway M, Hime O, Harris CJ. Disease severity and postoperative complications after appendectomy. *Semin Pediatr Surg* 2026;151668. doi: 10.1016/j.sempedsurg.2026.151668
11. Huang L, Yin Y, Yang L, Wang C, Li Y, Zhou Z. Comparison of Antibiotic Therapy and Appendectomy for Acute Uncomplicated Appendicitis in Children: A Meta-analysis. *JAMA Pediatr.* 2017;171(5):426-434. doi:10.1001/jamapediatrics.2017.0057
12. Lee SL, Islam S, Cassidy LD, Abdullah F, Arca MJ. Antibiotics and appendicitis in the pediatric population: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee systematic review. *J Pediatr Surg* 2010;45(11):2181-2185. doi: 10.1016/j.jpedsurg.2010.06.038
13. Mahida JB, Lodwick DL, Nacion KM, Sulkowski JP, Leonhart KL, Cooper JN, Ambeba EJ, Deans KJ, Minneci PC. High failure rate of nonoperative management of acute appendicitis with an appendicolith in children. *J Pediatr Surg* 2016;51(6):908-911. doi: 10.1016/j.jpedsurg.2016.02.056
14. Maita S, Andersson B, Svensson JF, Wester T. Nonoperative treatment for nonperforated appendicitis in children: a systematic review and meta-analysis. *Pediatr Surg Int.* 2020;36(3):261-269. doi:10.1007/s00383-019-04610-1
15. Minneci PC, Cooper JN, Leonhart K, Gil LA, Rader S, Diefenbach KA, Deans KJ. Effects of a Patient Activation Tool on Decision Making Between Surgery and Nonoperative Management for Pediatric Appendicitis: A Randomized Clinical Trial. *JAMA Netw Open* 2019;2(6):e195009. doi: 10.1001/jamanetworkopen.2019.5009
16. Minneci PC, Hade EM, Gil LA, Cooper JN, Deans KJ, Afazi A, Ambeba EJ, Bence C, Berry WR, Boomer LA, Chen SY, Choudhry MS, Downard CD, Ehrhardt A, Fischer AC, Fox SJ, Hirschl RB, Hu YH, Kabre R, Kelleher DC, Kohler JE, Leys CM, Mak GZ, Minneci PC, Port E, Saito JM, Sato TT, St Peter SD, Tsao K, Weiss RG, Rader S. Demographic and Clinical Characteristics Associated With the Failure of Nonoperative Management of Uncomplicated Appendicitis in Children: Secondary Analysis of a Nonrandomized Clinical Trial. *JAMA Netw Open* 2022;5(5):e229712. doi: 10.1001/jamanetworkopen.2022.9712
17. Mudri M, Coriolano K, Bütter A. Cost analysis of nonoperative management of acute appendicitis in children. *J Pediatr Surg.* 2017;52(5):791-794. doi:10.1016/j.jpedsurg.2017.01.050
18. Rincon Mora SA. Current Management of Uncomplicated Acute Appendicitis: A Narrative Review of Nonoperative and

- Surgical Strategies. Cureus. 2026;18(3):e106086. doi:10.7759/cureus.106086
19. Salminen P, Paajanen H, Rautio T, Nordström P, Aarnio M, Rantanen T, Tuominen R, Hurme S, Virtanen J, Mecklin JP, Sand J, Jartti A, Rinta-Kiikka I, Grönroos JM. Antibiotic Therapy vs Appendectomy for Treatment of Uncomplicated Acute Appendicitis: The APPAC Randomized Clinical Trial. JAMA 2015;313(23):2340-2348. doi: 10.1001/jama.2015.6154
20. Xu J, Zhang T. Preoperative differentiation of acute appendicitis using NLR, SII, and maximum appendiceal diameter: a retrospective single-center diagnostic study. Front Surg 2026;13:1795204. doi: 10.3389/fsurg.2026.1795204.