

Washington University Emergency Medicine Journal Club
Non-operative Management of Pediatric Appendicitis

Vignette

You are working in the ED in rural Missouri and receive sign out on a ten year old male presenting with apparent uncomplicated appendicitis. The patient presented with increasing right lower quadrant pain for the past 36 hours, nausea, and anorexia. He did not have a fever and was able to walk into the emergency department. His vital signs are as follows: BP 110/60, HR 85, RR 12, Sat 98% on room air, T 36.5. Your colleague believes that the patient has appendicitis without peritonitis on exam (RLQ pain on palpation, but no guarding or rebound tenderness). Your colleague had already consulted the general surgeon on call who agreed with the physical exam findings, but insisted on an abdominal/pelvis CT (with IV and oral contrast).

The CT revealed acute appendicitis with an appendiceal diameter of 1 cm without phlegmon, abscess, or fecalith. After you receive sign out on this patient, you prepare to transfer him to a children's hospital as there are no pediatric surgeons at your hospital. However, the family would prefer to be treated at the local hospital, as the nearest children's hospital is quite far away and it would be a hardship on the family to receive treatment there. Furthermore, the family asks if surgery is truly necessary as a family member recently died due to complications of a surgery. You consider the question, and begin to search the literature to see if there is any evidence that non-operative management of appendicitis in children (with antibiotics) is safe and effective.

PICO Question**Population:** Children with uncomplicated appendicitis**Intervention:** Non-operative management with antibiotics**Comparison:** Appendectomy**Outcome:** Complications (wound infection, perforated appendix); recurrent appendicitis; resolution of symptoms; need for appendectomy despite initial non-operative management.**Search Strategy**

PubMed was searched using the strategy: (nonoperative OR non-operative) AND (appendicitis) AND (children), resulting in 66 citations. The "10 years" publication date filter was applied, reducing the total to 46 results (<http://tinyurl.com/mlrljws>). The titles and abstracts of these 46 articles were reviewed to assess for relevant studies involving children with *uncomplicated* appendicitis, and 4 relevant articles were selected.

Article 1: [Minneci PC, Sulkowski JP, Nacion KM, Mahida JB, Cooper JN, Moss RL, Deans KJ. Feasibility of a nonoperative management strategy for uncomplicated acute appendicitis in children. J Am Coll Surg. 2014 Aug;219\(2\):272-9. \[Answer Key\]\(#\).](#)

Article 2: [Armstrong J, Merritt N, Jones S, Scott L, Bütter A. Non-operative management of early, acute appendicitis in children: is it safe and effective? J Pediatr Surg. 2014 May;49\(5\):782-5. \[Answer Key\]\(#\).](#)

Article 3: [Svensson JF, Patkova B, Almström M, Naji H, Hall NJ, Eaton S, Pierro A, Wester T. Nonoperative Treatment With Antibiotics Versus Surgery for Acute Nonperforated Appendicitis in Children: A Pilot Randomized Controlled Trial. Ann Surg. 2014 Jul 28. \[Answer Key\]\(#\).](#)

Article 4: [Abeş M, Petik B, Kazil S. Nonoperative treatment of acute appendicitis in children. J Pediatr Surg. 2007 Aug;42\(8\):1439-42. \[Answer Key\]\(#\).](#)

Bottom Line

Appendicitis remains a common diagnosis, with an annual incidence of approximately 250,000 in the US; the highest incidence occurs in pediatric patients between the ages of 10 and 19 years ([Addis 1990](#)). A total of over 216,00 children required urgent appendectomy in the US between 2006 and 2008 ([Masoomi 2012](#)). While the overall complication rate from surgical appendectomy is low (~2.5%), surgery can be associated with significant time out of school for children and time off work for parents. Non-operative management of pediatric appendicitis therefore offers the theoretical advantage of reducing these often ignored societal costs. While studies in adults have demonstrated better pain control, fewer complications, and shorter duration of sick leave with non-operative management ([Mason 2012](#)), the evidence is less well-defined in the pediatric population.

We identified a handful of small studies of varying methodological quality for our review. A single randomized controlled trial from Sweden was identified that enrolled 50 children with non-perforated appendicitis found that 2 children out of 24 randomized to non-operative treatment required appendectomy within 3 months; an additional 7 children underwent appendectomy within one year, for an overall 62% rate of avoidance of appendectomy ([Svensson 2014](#)). There were no major complications in either group, and the length of stay for the initial hospital admission was shorter in the operative group (median 34.5 hours vs. 51.5 hours, $p = 0.0004$). The authors reasonably conclude that “nonoperative treatment is feasible and safe.”

Unfortunately, this randomized controlled trial did not evaluate the effect of non-operative management on other important outcomes to parents and children, such as time of work for the parent or time to return to school and normal activities for the child. These outcomes were addressed in a prospective nonrandomized trial from Columbus, Ohio ([Minneci 2014](#)). Children with uncomplicated appendicitis with symptoms lasting less than 48 hours were eligible for enrollment. The decision

to proceed with surgery or non-operative management was made by the families of eligible patients after counseling using a standardized, scripted presenting process by 1 of 3 trained physicians in order to minimize [selection bias](#). A total of 77 children were enrolled, 30 of whom underwent non-operative management with the remainder undergoing laparoscopic appendectomy. Three children initially managed non-operatively required appendectomy within 30 days of enrollment, for a 30-day success rate of 90% (95% CI 79-100%). Patients in this group had longer initial hospital stays (median 38 vs. 20 hours), but fewer days to return to normal activity (median 3 vs. 16.5), fewer days of missed school (median 3 vs. 5). While quality of life questionnaire scores were slightly higher for the non-operative group, overall parental satisfaction scores were the same for both groups, and were quite high.

Two additional retrospective studies of lesser methodological quality were identified. A case series of 24 patients treated by a single pediatric surgeon in Ontario ([Armstrong 2014](#)), 3 out of 12 patients initially managed non-operatively required appendectomy within the follow-up period (median of 6.5 months follow-up). One patient in the non-operative group developed a post-operative infection compared to two in the operative group; none of these required further surgery or led to long-term complications. A final case series from Turkey in which 16 patients with appendicitis treated non-operatively was reviewed ([Abes 2007](#)). One patient failed initial non-operative management and required appendectomy after one day of antibiotics, while 2 additional patients developed recurrent appendicitis within one year and required appendectomy. The overall 1-year success rate was therefore 81% (95% CI 57-93.4%). No major complications were reported.

The data, while limited, suggest that non-operative management of pediatric appendicitis with antibiotics is safe and does not result in significant morbidity. It also appears that non-operative management results in less time out of school and a shorter time to return to normal activities, and most likely would lead to less time off work for the parents. It therefore seems reasonable to offer an initial attempt at non-operative management to the parents of select children with uncomplicated acute appendicitis. The final decision will depend on many factors, including the comfort-level of the parents, child, and surgeon, as well as the potential affect of the decision on child and parental activities.