

An Overview on Conservative Management of Acute Appendicitis

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Abstract:

Traditionally, appendectomy has been the standard treatment for acute appendicitis. However, recent studies suggest that nonoperative management (NOM) with antibiotics can be effective for uncomplicated appendicitis, offering benefits such as shorter hospital stays and reduced surgical risks. This approach is particularly advantageous in settings where surgical resources are limited or in patients with significant surgical risks.

Keywords: Acute Appendicitis, management, antibiotics.

Introduction:

Conservative management of nonspecific right iliac fossa (RIF) pain, particularly when appendicitis is suspected but unconfirmed, involves close observation, supportive care, and symptom control in stable patients without signs of complications. It includes monitoring vital signs, inflammatory markers (e.g., WBC, CRP), and using imaging US follow up also CT if needed. Recent evidence supports conservative management of nonspecific RIF pain, highlighting that up to 30–50% of such cases do not progress to surgical pathology and resolve with observation alone. Many cases, especially in young females, resolve without surgery, helping avoid unnecessary appendectomy while safely identifying any evolving conditions. (1).

Treatment of appendicitis is essential in preventing further morbidity and mortality; a margin of error in over diagnosis is acceptable. Currently, the rate of negative appendectomies is approximately 20 percent (2).

Acute appendicitis is a common surgical emergency that traditionally warrants immediate surgical intervention via appendectomy. However, in recent years, there has been growing interest in conservative, non-operative management as an alternative approach. This thesis delves into the conservative treatment of acute appendicitis, including its principles, efficacy, patient selection criteria, outcomes, and future directions. (3)

Conservative treatment of appendicitis

Principles of Conservative Treatment

Conservative treatment of acute appendicitis involves managing the condition with antibiotics and supportive care without immediate surgical intervention. The primary goals of conservative management are to control the infection, alleviate symptoms, and promote resolution of inflammation without the need for appendectomy.(4)

Recent studies have highlighted the advantages of conservative management for acute appendicitis, particularly in cases classified as uncomplicated. Antibiotic therapy offers a non-invasive solution, reducing surgical risks such as wound infections, anesthesia complications, and post-operative pain. A landmark study published in *JAMA* revealed that approximately 70% of patients managed conservatively avoided surgery within a one-year follow-up, demonstrating the effectiveness of antibiotics in controlling inflammation. (5)

Research comparing conservative treatment with surgery has shown that while appendectomy remains the definitive treatment, antibiotic therapy can be a safe and effective alternative for selected patients. Meta-analyses have concluded that conservative treatment can avoid emergency surgery and its associated complications.(6)

One of the most significant benefits of conservative management is cost-effectiveness. Studies have shown that avoiding surgery reduces overall healthcare costs and decreases the burden on hospital resources, such as operating rooms and post-operative care units. Additionally, patients treated conservatively experience shorter hospital stays and faster recoveries, allowing them to return to their normal lives more quickly. This is especially beneficial for individuals with comorbidities, who may face higher surgical risks. (7, 8)

Moreover, advancements in diagnostic imaging, such as CT and MRI, have improved the ability to distinguish between complicated and uncomplicated appendicitis, facilitating the safe application of conservative management. The availability of broad-spectrum antibiotics has further strengthened this approach. While appendectomy has been the gold standard for decades, growing evidence suggests that conservative treatment may be the future for select patients. Long-term outcomes from multiple studies indicate that recurrence rates are manageable, especially when balanced against the risks of surgery. (9)

Key principles include:

1. Antibiotics: Administering antibiotics to target the bacterial infection causing appendicitis. Antibiotic regimens typically consist of broad-spectrum agents effective against common pathogens.

The primary bacteria implicated in appendicitis are part of the gut flora, with **Escherichia coli** and **Bacteroides fragilis** being the most common pathogens. These bacteria contribute to the infection and inflammation in appendicitis, along with other anaerobic bacteria like **Peptostreptococcus** and **Fusobacterium** species. (6)

In the conservative management of acute non-complicated appendicitis, antibiotic therapy is vital for effective treatment while minimizing the need for surgical intervention.

Recommended intravenous (IV) regimens include:

- A combination of **Ceftriaxone** - third generation semisynthetic cephalosporin - (1 g IV every 24 hours) and **Metronidazole** (500 mg IV every 8 hours) can be used, with Ceftriaxone covering common enteric gram-negative bacteria (total daily dose: 1 g) and Metronidazole targeting anaerobic organisms (total daily dose: 1.5 g).
- Alternatively, **Piperacillin-Tazobactam** - Extended-spectrum penicillin combined with a beta-lactamase inhibitor - at a dosage of (3.375 g IV every 6 hours), providing broad-spectrum coverage against both aerobic and anaerobic bacteria, making it suitable for polymicrobial infections often seen in appendicitis. The total daily dose for this regimen is calculated as $3.375 \text{ g} \times 4 \text{ doses} = 13.5 \text{ g}$.
- Similarly, **Ampicillin-Sulbactam** - broad-spectrum aminopenicillin and a beta-lactamase inhibitor - can also be used at a dosage of (1.5 - 3 g IV every 6 hours) not exceed 12 gm per day, offering similar broad-spectrum coverage against aerobic and anaerobic bacteria

Following the initial IV therapy, oral regimens may include:

- **Ciprofloxacin** - second generation fluoroquinolone - at a dosage of (500 mg orally twice daily), effective against gram-negative bacteria (total daily dose: 1 g), combined with **Metronidazole** at (500 mg orally every 8 hours) to target anaerobes (total daily dose: 1.5 g).
- Alternatively, **Amoxicillin-Clavulanate** -penicillins and beta-lactamase inhibitors - can be administered at (875 mg orally every 12 hours), offering broad-spectrum coverage against both aerobic and anaerobic bacteria.

When selecting antibiotics, it is essential to consider patient-specific factors such as allergies and local microbial resistance patterns. (7, 10)

2. Observation and Monitoring: Close observation and monitoring of patients to assess their response to antibiotics and any signs of worsening symptoms or complications. This may involve frequent clinical assessments, laboratory tests, and imaging studies to evaluate the appendix's condition and detect any complications, such as perforation or abscess formation. (2).

Key monitoring items include vital signs, abdominal pain levels, and signs of complications (e.g., increased tenderness, distension, fever). Laboratory tests like complete blood count (CBC) and inflammatory markers (CRP) should be assessed at baseline and repeated within 24 to 48 hours. Imaging studies may be warranted if symptoms do not improve **(10)**.

The follow-up period typically spans 24 to 72 hours post-treatment initiation. Expectations include stabilization of vital signs, decreased pain levels, and improved laboratory values. If progress is noted, patients transition to oral antibiotics and discharge with instructions for follow-up within a week. Continuous assessment is crucial to identify any deterioration and prevent complications **(11)**.

- 3. Pain Management:** Pain relief must be balanced with the need to monitor for potential complications such as perforation or abscess formation. Adequate pain relief to improve patient comfort and well-being. Pain management strategies may include the use of analgesic medications, such as nonsteroidal anti-inflammatory drugs (NSAIDs) like **ibuprofen** or **diclofenac** are commonly used to manage mild to moderate pain while reducing inflammation or opioids as **morphine** may be considered under close supervision, as well as non-pharmacological interventions, such as heat therapy or relaxation techniques. **(12)**
- 4. Dietary Support:** Advising patients to adhere to a clear liquid diet initially, followed by a gradual transition to solid foods as tolerated. Adequate hydration is essential to support the body's healing process and minimize the risk of complications such as dehydration. **(3)**
- 5. Selective Surgery:** Reserving surgical intervention for cases where conservative treatment fails to resolve the appendicitis or if complications develop. Surgical options may include open or laparoscopic appendectomy, depending on the patient's clinical condition and surgical considerations. **(2)**

Patient Selection Criteria

The selection of patients for conservative treatment of acute appendicitis requires careful consideration of various factors, including:

- 1. Clinical Presentation:** Patients with uncomplicated acute appendicitis, characterized by mild to moderate symptoms and absence of systemic signs of severe infection or complications such as perforation, abscess formation, or peritonitis are more likely to respond favorably to conservative treatment. **(10)**
- 2. Patient Preference:** Patient preferences, beliefs, and values play a significant role in decision-making regarding treatment options. Some patients may express a preference for conservative management over surgery due to concerns about surgical risks, recovery time, or other personal factors.
- 3. Surgical Risk:** Patients who are deemed high-risk candidates for surgery due to advanced age, significant comorbidities, or other factors may be considered for conservative treatment to avoid the potential complications associated with surgery.
- 4. Clinical Stability:** Patients who are hemodynamically stable and able to tolerate oral intake are generally better candidates for conservative management. **(13)**

Efficacy and Outcomes

Several studies have investigated the efficacy and outcomes of conservative treatment for acute appendicitis, with generally favorable results. Key findings include:

- 1. Success Rates:** Conservative treatment with antibiotics alone has been shown to achieve successful resolution of acute appendicitis in a significant proportion of patients, with reported success rates ranging from 60% to 90% in various studies.
- 2. Reduced Need for Surgery:** Conservative treatment can potentially obviate the need for surgery in a substantial number of patients, thereby avoiding the risks and complications associated with appendectomy.

3. Lower Rates of Surgical Complications: Patients treated conservatively may experience lower rates of surgical complications, such as wound infection, postoperative pain, and bowel obstruction, compared to those undergoing appendectomy. **(13)**

4. Shorter Hospital Stay: Conservative treatment is often associated with shorter hospital stays and faster recovery times compared to surgical intervention, allowing patients to return to normal activities sooner.

Challenges and Considerations

While conservative treatment of acute appendicitis offers several potential advantages, it is not without challenges and considerations:

1. Diagnostic Uncertainty: Distinguishing between uncomplicated and complicated appendicitis can be challenging based on clinical presentation alone. Accurate diagnosis is essential to ensure appropriate patient selection for conservative management. **(3)**

Underscoring the need for comprehensive evaluation, including clinical assessment, laboratory tests, and imaging studies, to guide appropriate treatment decisions. **(14)**

2. Risk of Recurrence: While conservative treatment can effectively resolve acute appendicitis in many cases, there is a risk of recurrence about 20% , necessitating close monitoring and follow-up of patients over time.

The main possible causes of recurrence after non-operative treatment for acute appendicitis include incomplete resolution of infection, formation of abscesses, chronic appendicitis, underlying anatomical issues, delayed surgical intervention, patient factors such as age and immune response, poor adherence to treatment, and misdiagnosis of the condition.**(15)**

To resolve issues related to the recurrence of acute appendicitis after non-operative treatment, it is essential to enhance diagnostic accuracy through imaging techniques, ensure comprehensive antibiotic therapy with appropriate regimens, and establish regular follow-up appointments for monitoring. Educating patients on treatment adherence and recognizing symptoms of recurrence is crucial. Personalized treatment plans based on individual patient factors can optimize outcomes, and a multidisciplinary approach involving various healthcare professionals can provide comprehensive care and management. **(16)**

Interval appendectomy, performed after initial non-operative treatment (NOT) of acute appendicitis, is considered in specific cases. While ,studies have shown that recurrences, when they occur, are typically milder and can often be treated with repeated conservative measures rather than immediate surgery. Patient factors, such as age, comorbidities, and severity of the initial episode, play a key role in determining the need for interval appendectomy. Individualized decision-making, along with ongoing monitoring and education, ensures effective long-term management without exposing patients to unnecessary surgical risks. **(17, 18)**

3. Selection Bias: Patient selection bias may influence the outcomes of studies comparing conservative and surgical treatments for acute appendicitis. Patients deemed suitable for conservative management may have different baseline characteristics and disease severity compared to those undergoing surgery, potentially confounding study results. **(2)**

4. Limited Long-Term Data: Long-term data on the outcomes of conservative treatment for acute appendicitis, including rates of recurrence, development of appendiceal tumors, and quality of life, are limited and require further investigation.

5. Patient Preferences and Shared Decision-Making: Engaging patients in shared decision-making and ensuring informed consent are critical aspects of conservative management, as treatment preferences and values may vary among individuals. **(13)**

Surgical treatment of appendicitis

Preoperative Preparation

Before an appendectomy, confirm the diagnosis through clinical evaluation and imaging studies. Intravenous fluids are given to manage dehydration, with close monitoring of vital signs. A single dose of antibiotics, usually a second-generation cephalosporin, is administered prior to incision. Obtaining informed consent after discussing the procedure and potential complications. Patients are typically advised to refrain from eating or drinking (nil per oral) prior to surgery to minimize aspiration risk during anesthesia. An anesthesia evaluation is also conducted to assess the patient's fitness for surgery. May need a Foley catheter, and any electrolyte deficiencies should be corrected before anesthesia. (19).

Open appendicectomy : Has been considered the standard treatment for acute appendicitis since the first appendicectomy was performed by McBurney in 1889 via an incision at McBurney point allowing direct visualization and ligation of appendix base and mesoappendix. (20)

Laparoscopic appendectomy: The laparoscopic approach is becoming the procedure of choice for acute appendicitis as it is a safe and feasible intervention to confirm the diagnosis beside the appendectomy .(21).

Standard procedure:

A. Position of the patient:

The patient is positioned supine in a 15° Trendelenburg position with a slight left rotation to clear the operative field. The surgeon stands on the left, the assistant on the right, and the monitor is on the patient's right. Pneumoperitoneum is achieved using techniques like the Veress needle or open Hasson method or a bladeless Opti-View port (22, 23).

B. Trocar placement

The first trocar, a 10 mm, is inserted at the umbilicus to prevent hernias, with intraperitoneal pressure set to 14 mmHg. A second 5 mm trocar is added suprapubically, and a third trocar is placed in the iliac fossa for better triangulation towards the appendix. Surgeons may adjust port placements based on the appendix's location, with the camera port often positioned at the umbilicus (24).

C. Identification and mobilization of the appendix

A diagnostic laparoscopy to confirm the diagnosis and check for other issues. Using a Babcock grasper to retract the cecum and expose the appendix, avoiding direct grasping an inflamed appendix. Dissection at the base of the appendix creates a window between the mesentery and the appendix, allowing for secure division of the mesoappendix using a harmonic scalpel or Ligasure.(25)

D. Transection techniques

Suture ligation, using free ties or pre-tied endoloops, is cost-effective but requires more skill and time. In contrast, stapling is quicker and easier but more expensive and necessitates a 12-mm port. (26).

E. Specimen retrieval

As care is needed to avoid contamination of the abdomen and port site wounds, the appendix is placed in an impermeable retrieval bag before removing it from the abdomen. Alternatively, if the appendix is not too large, it can be pulled into one of the larger ports and withdrawn with the whole port (22).

F. Irrigation and drainage

The purpose of irrigation is to remove all debris, purulent fluid collections, and blood from the surgical area. There is no advantage of irrigation in early appendicitis, without any pus, and there may be a risk of spreading contaminated fluid throughout the abdomen (27).

II. Contraindication of laparoscopic appendectomy

A. Absolute contraindication:

1. **Abdominal Wall Sepsis:** Risk of introducing infection into the peritoneal cavity.
2. **Severe Cardiac Diseases:** Conditions like decompensated cardiac disease and recent myocardial infarction can impair lung expansion and oxygenation.
3. **Appendicular Mucocele:** Encountering a mucinous tumor necessitates an atraumatic approach, indicating a need for conversion to open appendectomy. (22).

B. Relative contraindications

1. **Multiple Previous Abdominal Operations:** While multiple surgeries may complicate laparoscopy, one or two prior elective procedures can be managed with careful planning and technique. (22).
2. **Generalized Peritonitis:** Once considered a contraindication due to risks like malignant hypercapnia, laparoscopy is now deemed feasible and effective for appendicular and gastroduodenal perforations, with proper irrigation and antibiotic therapy. (27).
3. **Pregnancy:** Laparoscopic appendectomy can be safely performed during pregnancy, though visualization may be challenging in the third trimester due to the size of the uterus.
4. **Portal Hypertension:** This condition may increase the risk of bleeding and complications during dissection.
5. **Abdominal Aortic or Iliac Aneurysm:** High risk of vascular injury during trocar insertion.
6. **Abdominal Hernias:** While not a strong contraindication, careful management of intra-abdominal pressure is necessary to avoid disruption. (28).

Reference:

1. Gammeri, E., Catton, A., van Duren, B. H., Appleton, S. G., & van Boxel, G. I. (2016). Towards an evidence-based management of right iliac fossa pain in the over 50-year-old patient. *Annals of The Royal College of Surgeons of England*, 98(6), 408–411.
2. Cohn, S.M., & Rhee, P. (Eds.). (2019). *50 Landmark Papers Every Acute Care Surgeon Should Know* (1st ed.). CRC Press. <https://doi.org/10.1201/9780429316944>
3. Agathis, A. Z., Miller, M., & Divino, C. M. (2019). National trends in diagnostic imaging for appendicitis: a cross-sectional analysis using NSQIP. *The American Surgeon*, 85(6), 625–630.
4. Diaz, Jose J. MD, CPE, CNS, FACS, FCCM; Ceresoli, Marco MD; Herron, Thomas MD; Coccolini, Federico MD (2025). Current management of acute appendicitis in adults: What you need to know. *Journal of Trauma and Acute Care Surgery* 98(2):p 181-189, February 2025. | DOI: 10.1097/TA.0000000000004471
5. Salminen, P., Paajanen, H., Rautio, T., Nordström, P., Aarnio, M., Rantanen, T., ... & Jartti, A. (2015). Antibiotic therapy vs appendectomy for treatment of uncomplicated acute appendicitis: The APPAC randomized clinical trial. *JAMA*, 313(23), 2340–2348. <https://doi.org/10.1001/jama.2015.6154>
6. Sallinen, V., Akl, E. A., You, J. J., Agarwal, A., Shoucair, S., Vandvik, P. O., & Darzi, A. (2023). Meta-analysis of antibiotics versus appendectomy for non-perforated acute appendicitis. *The British Journal of Surgery*, 110(4), 441–450. <https://doi.org/10.1093/bjs/znad003>
7. Vons, C., Barry, C., Maitre, S., Pautrat, K., Leconte, M., Costaglioli, B., ... & Karoui, M. (2011). Amoxicillin plus clavulanic acid vs appendectomy for treatment of uncomplicated acute appendicitis: An open-label, noninferiority, randomized controlled trial. *The New England Journal of Medicine*, 364(25), 2375–2385. <https://doi.org/10.1056/NEJMoa1111457>
8. Hosokawa, Y., Moritani, M., Makuuchi, Y., & Nagakawa, Y. (2024). Indication of conservative treatment by antibiotics for uncomplicated and complicated acute appendicitis. *World Journal of Gastrointestinal Surgery*, 16(8), 2538–2545. <https://doi.org/10.4240/wjgs.v16.i8.2538>

9. Hansson, J., Körner, U., Khorram-Manesh, A., Solberg, Å., & Lundholm, K. (2012). Randomized clinical trial of antibiotic therapy versus appendectomy as primary treatment of acute appendicitis in unselected patients. *The Lancet Gastroenterology & Hepatology*, 12(1), 44–52. *Journal of British Surgery*, 96(5), 473–481
10. Di Saverio, S., Podda, M., De Simone, B., Ceresoli, M., Augustin, G., Gori, A., Boermeester, M., Sartelli, M., Coccolini, F., & Tarasconi, A. (2020). Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. *World Journal of Emergency Surgery*, 15, 1–42.
11. Minneci, P. C., Mahida, J. B., Lodwick, D. L., Sulkowski, J. P., Nacion, K. M., Cooper, J. N., ... & Deans, K. J. (2016). Effectiveness of patient choice in nonoperative vs surgical management of pediatric uncomplicated acute appendicitis. *JAMA surgery*, 151(5), 408–415.
12. Talan, D. A., & Di Saverio, S. (2021). Treatment of acute uncomplicated appendicitis. *New England Journal of Medicine*, 385(12), 1116–1123.
13. Şener, K., Çakır, A., Kılavuz, H., Altuğ, E., & Güven, R. (2023). Diagnostic value of systemic immune inflammation index in acute appendicitis. *Revista Da Associação Médica Brasileira*, 69, 291–296.
14. Bom, W. J., Scheijmans, J. C. G., Ubels, S., van Geloven, A. A. W., Gans, S. L., Tytgat, K. M. A. J., van Rossem, C. C., Koens, L., Stoker, J., Bemelman, W. A., Dijkgraaf, M. G. W., & Boermeester, M. A. (2022). Optimising diagnostics to discriminate complicated from uncomplicated appendicitis: a prospective cohort study protocol. *BMJ open*, 12(4), e054304. <https://doi.org/10.1136/bmjopen-2021-054304>
15. De Almeida Leite, R. M., Seo, D. J., Gomez-Eslava, B., Hossain, S., Lesegretain, A., de Souza, A. V., ... & Ricciardi, R. (2022). Nonoperative vs operative management of uncomplicated acute appendicitis: a systematic review and meta-analysis. *JAMA surgery*, 157(9), 828–834.
16. Bendib H. (2024). Is non-operative treatment of acute appendicitis possible: A narrative review. *African journal of emergency medicine : Revue africaine de la medecine d'urgence*, 14(2), 84–90. <https://doi.org/10.1016/j.afjem.2024.03.006>
17. Huang, L., Yin, Y., Yang, L., Wang, C., Li, Y., & Zhou, Z. (2017). Comparison of antibiotic therapy and appendectomy for acute uncomplicated appendicitis in children: a meta-analysis. *JAMA pediatrics*, 171(5), 426–434.
18. Suzuki, T., Matsumoto, A., Akao, T. *et al.* Interval appendectomy as a safe and feasible treatment approach after conservative treatment for appendicitis with abscess: a retrospective, single-center cohort study. *Updates Surg* 75, 2257–2265 (2023). <https://doi.org/10.1007/s13304-023-01679-1>
19. Hoxha, I., Duraj, B., Xharra, S., Avdaj, A., Beqiri, V., Grezda, K., Selmani, E., Avdiu, B., Cegllar, J., Marušić, D. and Osmani, A., 2022. Clinical decision-making for appendectomy in Kosovo: A conjoint analysis. *International Journal of Environmental Research and Public Health*, 19(21), p.14027.
20. Al-Shuwayman, A. A., Hamad Aldawsari, H. F., Mufreh Al-Shahri, S. B. S., Abdullah Al-Qarni, F. K., Bin Saeed, S. M., & Al-Harkan, M. S. (2023). Appendicitis: A medical serious condition - An updated review. *International Journal of Health Sciences*, 7(S1), 3624–3639.
21. Jaschinski T, Mosch CG, Eikermann M, Neugebauer EA and Sauerland S (2018): Laparoscopic versus open surgery for suspected appendicitis. *Cochrane Database of Systematic Reviews*, Nov 28; 11(11): CD001546.
22. Katkhouda N (2009): "Laparoscopic Surgery of the Appendix" *Mastery of Endoscopic and Laparoscopic Surgery 3rd Edition* edited by Soper, Nathaniel J, Swanstrom Lee L, Eubanks W Stephen and Leonard Michael E ,8(46):462-467.
23. Mason RJ, Moazzez A, Moroney JR and Katkhouda N (2012): Laparoscopic vs open appendectomy in obese patients: outcomes using the American College of Surgeons National Surgical quality improvement program database. *Journal of the American College of Surgeons*, 215(1), 88-99.
24. Farid, M., Baz, A., Riad, M. et al (2025). Using the endoscopic snare to facilitate two-port laparoscopic appendectomy. *Surg Endosc*. <https://doi.org/10.1007/s00464-025-11743-z>
25. Rosales A, Montorfano L, Rosenthal RJ. "Laparoscopic Appendectomy." In: Rosenthal R, Rosales A, Lo Menzo E, Dip F, editors. *Mental Conditioning to Perform Common Operations in General Surgery Training*. Cham: Springer; 2020. p. 147–151

26. Delibegović S and Mehmedovic Z (2018): The influence of the different forms of appendix base closure on patient outcome in laparoscopic appendectomy: a randomized trial. *Surgical Endoscopy*; 32(5): 2295-2299
27. Mannu GS, Sudul MK, Bettencourt-Silva JH, [Cumber](#) E, [Li](#) F et al., (2017): Closure methods of the appendix stump for complications during laparoscopic appendectomy. *Cochrane Database of Systematic Reviews*; Nov 13;11(11):CD006437.
28. Vaitheeswaran R (2015): Role of diagnostic laparoscopy in diagnosing chronic abdominal pain (Doctoral dissertation, Madurai Medical College, Madurai):1-138.