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Chapter 18

Endoscopic Retrograde Appendicitis Therapy for Acute Appendicitis: A Review

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Abstract

Acute appendicitis continues to be a prevalent surgical emergency globally, traditionally addressed through appendectomy or, more recently, conservative antibiotic treatment. In recent years, endoscopic retrograde appendicitis therapy (ERAT) has emerged as an innovative, minimally invasive technique that preserves the appendix. ERAT employs colonoscopic access to the appendiceal orifice, facilitating decompression, irrigation, removal of obstructive materials such as fecaliths, and stent placement when necessary. Evidence indicates that ERAT achieves high technical and clinical success rates, with reduced post-procedural pain, shorter recovery periods, and preservation of appendiceal function. Nonetheless, challenges such as recurrence risk, operator dependency, limited global availability, and the absence of standardized protocols remain. ERAT has the potential to transform the treatment paradigm for appendicitis, particularly for patients seeking non-surgical management or those at high surgical risk. This chapter examines the role of ERAT in managing acute appendicitis, encompassing its procedural techniques, indications, clinical outcomes, advantages, limitations, and future perspectives.

Keywords: Acute appendicitis, Uncomplicated appendicitis, Appendicolith, ERAT, EDAT, and Endoscopy.

Introduction

Acute appendicitis is a clinical condition marked by inflammation of the appendix and represents the most frequent cause of admission to general surgical wards. It predominantly affects young adults in their second and third decades of life. In most Western countries, the incidence of acute appendicitis is approximately 90 to 100 cases per 100,000 individuals. This condition can be categorized into simple acute appendicitis and complicated acute appendicitis (Bhangu, 2015). Diagnosis involves a thorough history and clinical examination, supplemented by blood tests for inflammatory markers, such as leukocytosis and elevated C-reactive protein (CRP), which together can aid in assessing risk for acute appendicitis. Imaging techniques, including ultrasound and computed tomography, are employed to enhance diagnostic accuracy, particularly in atypical case (Bom, 2021; Ching, 2025). The standard treatment for acute appendicitis is an appendectomy, which can be performed via open or laparoscopic methods. Although appendectomy is the gold standard, non-operative management with intravenous antibiotics may be considered for patients who are not suitable candidates for surgery (Moris, 2021; Long, 2025).

Endoscopic retrograde appendicitis therapy (ERAT) is a minimally invasive endoscopic procedure involving the intubation of the appendicular orifice via colonoscopy. The procedure begins with the flushing of the lumen, followed by the insertion of a stent. After confirming the placement fluoroscopically, debris and appendicolith are removed, and the lumen of the appendix is flushed again before inserting a stent to facilitate drainage. Conducted under sedation, ERAT demonstrates a technical and clinical success rate ranging from 90% to 100%, with a recurrence rate of 5% to 10%. The primary indications for ERAT are acute, uncomplicated appendicitis and chronic appendicitis. The traditional ERAT employs an image intensifier; however, variations such as endoscopic retrograde direct appendicitis therapy utilize a cholangioscope to visualize the appendix lumen, thereby eliminating the need for radiation. (Zhang, 2024; BouHaidar, 2016; Salati, 2025; Liu D. Z., 2024; Ullah, 2022).

This chapter examines the roles of endoscopic retrograde appendicitis therapy (ERAT) in the management of acute appendicitis, focusing on its indications and complications. A comprehensive literature review was performed utilizing PUBMED, the Cochrane Database of

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Systematic Reviews, Google Scholar, and Semantic Scholar. The search encompassed randomized controlled trials, non-randomized trials, observational and cohort studies, case reports, clinical reviews, systematic reviews, and meta-analyses published between 2010 and 2026. Keywords employed in the search included ”Acute appendicitis,” ”Uncomplicated appendicitis,” ”endoscopy,” ”ERAT,” ”EDAT,” and ”Appendicolith.” All articles were in English and were evaluated through manual cross-referencing of the literature. Commentaries were excluded from this review. The study included both adult and pediatric patients with acute appendicitis.

Discussion

Endoscopic Retrograde Appendicitis Therapy

Endoscopic retrograde appendicitis therapy (ERAT) was introduced by Liu et al. in 2012. This procedure involves the insertion of a colonoscope, identification of the appendiceal orifice, intubation, appendicular decompression, retrograde appendicography, stent drainage, and cleansing of the appendicular lumen. In this retrospective study, four patients were included, and ERAT was successful in all cases, with no complications or recurrence observed during the 19-month follow-up period (Liu, 2012). Liu et al. also conducted a multi-center retrospective study on ERAT for acute appendicitis. Of the forty patients with acute appendicitis, thirty-four underwent ERAT, resulting in a clinical success rate of 97% and a failure rate of 3%. At a median follow-up of 12 months, the recurrence rate was 6.2% (Liu B. R., 2015).

Ye et al. conducted a retrospective study on endoscopic retrograde appendicitis therapy (ERAT) for acute appendicitis, involving 22 patients. The success rate of ERAT was 95.5%, with a recurrence rate of 9.1% after a 33-month follow-up (Ye, 2018). Shen et al. compared ERAT with laparoscopic and open appendectomy for acute appendicitis management. Ninety-nine patients were divided into three groups: 33 underwent ERAT, 33 underwent laparoscopic appendectomy, and 33 underwent open appendectomy. The clinical success rates were 87.88% for ERAT, 96.97% for laparoscopic appendectomy, and 100% for open appendectomy. With a median follow-up of 22 months, no significant differences in adverse events were observed among the procedures. (Shen, 2022). Yang et al. compared ERAT with laparoscopic appendectomy for acute, uncomplicated appendicitis in a study of 422 patients, with 79 undergoing ERAT and 343 undergoing laparoscopic appendectomy. ERAT demonstrated a success rate of 92.1% and reduced postoperative pain, with no significant differences in adverse effects, hospital stay length, or procedure time (Yang, 2022). Ding et al. assessed the feasibility of ERAT for acute appendicitis management in a study of 210 patients, with 70 undergoing ERAT, 68 undergoing laparoscopic appendectomy, and 72 undergoing open appendectomy. ERAT was associated with a shorter operative time, and the recurrence rate at a 6-month follow-up was 2.86% (Ding, 2022).

Dhindsa et al. conducted a systematic review and meta-analysis on endoscopic retrograde appendicitis therapy (ERAT) for acute appendicitis. This study incorporated seven studies involving 298 patients, revealing a technical success rate of 99.36% (95% CI, 97.61-100) and a clinical success rate of 99.29% (95% CI, 97.48-100). The adverse event rate was 0.19% (95% CI, 0-1.55), and the recurrence rate was 6.01% (95% CI, 2.9-9.93). The findings indicated that ERAT is a safe and effective treatment for acute appendicitis (Dhindsa, 2022). Wang et al. also conducted a systematic review and meta-analysis on the efficacy of ERAT in acute uncomplicated appendicitis. This study included 12 studies with 970 patients, demonstrating that ERAT was associated with a shorter hospital stay (WMD 1.15, 95% CI 1.99-0.31) and a reduced rate of intestinal obstruction (OR=0.19, 95% CI, 0.05-0.79). The study concluded that ERAT led to shorter operative times and faster recovery (Wang, 2021). Xu et al. performed a systematic review and meta-analysis on the clinical efficacy and safety of ERAT for acute appendicitis. This analysis included 26 studies with 2236 patients, showing that the ERAT group experienced shorter hospital stays and operative times. Additionally, ERAT was linked to lower complication rates (RR 0.25, 95% CI, 0.18-0.35), although the recurrence rate was higher (2.10, 95% CI, 1.02-4.32). The study demonstrated that while ERAT is effective for managing acute appendicitis, it is associated with a higher recurrence rate (Xu, 2023).

A systematic review and meta-analysis by Pata et al. evaluated endoscopic retrograde appendicitis therapy (ERAT) versus appendectomy as contemporary approaches for managing acute appendicitis. This study incorporated six studies involving 575 patients, with 236 undergoing ERAT and 339 undergoing appendectomies. The analysis revealed no significant differences in the technical success rates between the two procedures (RR 0.97, 95% CI, 0.92-1.02). However, ERAT was associated with a shorter procedure time (MD 14.38, 95% CI, 20.87-8.59), reduced hospital stay duration (MD 1.19, 95% CI, 2.37-0.01), and decreased post-intervention abdominal pain (RR 0.21, 95% CI, 0.14-0.32) (Pata, 2023). Another systematic review and meta-analysis by Sarraf et al. focused on ERAT in cases of acute, uncomplicated appendicitis in adults. This study included eight studies with 326 patients, reporting a technical success rate of 98% (95% CI, 97-100), a clinical success rate of 99% (95% CI, 97-100), and an adverse event rate of 1.8% (95% CI, 4-3.2). The recurrence rate following ERAT was 6% (95% CI, 3-9) over a follow-up period of 17.7 months (Sarraf, 2023). Basukala et al. conducted a systematic review and meta-analysis comparing ERAT and laparoscopic appendectomy in acute appendicitis. This study included four studies with 470 patients, finding that ERAT was associated with a shorter operative time but a higher recurrence rate. No significant differences were observed in terms of hospital stay length and adverse events (Basukala, 2023).

Wang et al. conducted a systematic review and meta-analysis of randomized controlled trials to compare endoscopic retrograde appendicitis therapy (ERAT), appendectomy, and antibiotic treatment for acute uncomplicated appendicitis. This study included 23 studies with a total of 4,350 patients. The findings indicated that ERAT was associated with a reduced complication rate compared to antibiotic therapy (OR 0.20, 95% CI, 0.06-0.67) and a lower recurrence rate (OR 0.22, 95% CI, 0.08-0.57). Appendectomy demonstrated the lowest recurrence rate (OR 0.06, 95% CI, 0.03-0.11). No significant differences were observed in the length of hospital stay among the groups (Wang J. Y., 2025). Li et al. conducted a separate systematic review and meta-analysis focusing on the safety and efficacy of ERAT in children with acute uncomplicated appendicitis. This study incorporated ten studies involving 1,372 patients, with 660 children undergoing ERAT and 712 undergoing appendectomies. The results showed that ERAT was associated with a shorter hospital stay (WMD = 2.21, 95% CI, 1.73-2.69) and fewer complications (RR = 0.27, 95% CI, 0.18-0.39), while no significant difference was found in the recurrence rate (RR = 0.78, 95% CI, 0.51-1.19). The study concluded that ERAT is a feasible option for managing acute, uncomplicated appendicitis in children (Li, 2025).

Direct Vision Endoscopic Retrograde Appendicitis Therapy

This study examines a variant of endoscopic retrograde appendicitis therapy, utilizing either an appendoscope or a peroral digital single-operator cholangioscope for direct visualization of the appendicular lumen. Notably, this procedure eliminates the need for contrast agents and image intensifiers, making it suitable for patients for whom radiation exposure is contraindicated. Liu et al. conducted a retrospective study involving 125 patients, revealing that appendiscope-assisted endoscopic retrograde appendicitis therapy (ERAT) achieved a technical success rate of 98.5% and a clinical success rate of 100%. The recurrence rate was observed to be 4.8% at a 12-month follow-up (Liu P. W., 2025). Chen et al. compared endoscopic direct vision retrograde appendicitis therapy with laparoscopic appendectomy in cases of acute uncomplicated appendicitis. This retrospective study included 87 patients, with 41 undergoing endoscopic direct vision retrograde appendicitis therapy and 47 undergoing laparoscopic appendectomy. The findings indicated that endoscopic direct vision retrograde appendicitis therapy resulted in shorter operative times, reduced abdominal pain, quicker resumption of oral intake, and an average hospital stay of 3 days. The recurrence rate was 7.32% at a 13-month follow-up (Chen, 2026).

Pan et al. conducted a comparative study between direct visualization endoscopic retrograde appendicitis therapy and laparoscopic appendectomy for acute uncomplicated appendicitis. The study included 102 patients, with 34 undergoing direct vision endoscopic retrograde appendicitis therapy and 68 undergoing laparoscopic appendectomy. The technical and clinical success rates for the direct vision endoscopic retrograde appendicitis therapy were 97.06% and 94.12%, respectively. No significant differences were observed between the two procedures concerning adverse events and length of hospital stay. The recurrence rate for direct vision endoscopic retrograde appendicitis therapy was 2.94% (Pan, 2025).

Table 1: Success and recurrence rates of endoscopic retrograde appendicitis therapy (ERAT) for the treatment of acute appendicitis

Study	Study Type	Year	N=Numbers	Success Rate	Recurrence Rate
Liu et al	Multicenter retrospective study	2015	34	97%	6.2%
Dhindsa et al	Systematic review & meta-analysis	2022	298	Technical success rate-99.36%(95%CI,97.6-100) Clinical success rate-99.29%(95%CI,97.48-100)	6.01%(95%CI,2.9-9.93)
Shen et al	Retrospective study	2022	99	87.88%	9.09%
Yang et al	Retrospective study	2022	79	92.1%	7.9%
Sarraf et al	Systematic review & meta-analysis	2023	326	Technical success rate-98%(95%CI,97-100) Clinical success rate-99%(95%CI,97-100)	6%(95%CI,3-9)

Table showing the success rate and recurrence rate of endoscopic retrograde appendicitis therapy for acute appendicitis.

Conclusions

Endoscopic retrograde appendicitis therapy (ERAT) constitutes a notable advancement in the treatment of acute appendicitis, presenting a minimally invasive and organ-preserving alternative to conventional surgical methods. Current evidence indicates that ERAT achieves high success rates, facilitates quicker recovery, and results in fewer complications compared to traditional surgical approaches. Nonetheless, challenges such as recurrence, technical complexity, and limited global experience persist. Although ERAT has not yet supplanted appendectomy as the standard treatment, it offers a valuable option for selected patients. The future role of ERAT in clinical practice will be shaped by ongoing research and technological progress.

Declaration

Conflict of interest: There is no conflict of interest.

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