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Review Article

Endoscopic Retrograde Appendicitis Therapy for Acute Appendicitis: Narrative Review Article

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Abstract: Acute appendicitis remains one of the most common surgical emergencies worldwide, traditionally managed by appendectomy or, more recently, conservative antibiotic therapy. In recent years, endoscopic retrograde appendicitis therapy (ERAT) has emerged as a novel, minimally invasive, appendix-preserving technique. ERAT utilizes colonoscopy access to the appendiceal orifice, allowing for decompression, irrigation, removal of obstructive material such as fecaliths, and stent placement where necessary. Evidence suggests that ERAT achieves high technical and clinical success rates, with reduced post-procedural pain, shorter recovery times, and preservation of appendiceal function. However, challenges including recurrence risk, operator dependency, limited global availability, and lack of standardized protocols persist. ERAT has the potential to redefine the treatment paradigm for appendicitis, particularly in patients seeking non-surgical management or those with high surgical risk. This review explores the role of ERAT in the management of acute appendicitis, including its procedural techniques, indications, clinical outcomes, advantages, limitations, and future perspectives.

Keywords: Acute Appendicitis, Uncomplicated Appendicitis, Appendicolith, ERAT, EDAT, Endoscopy.

INTRODUCTION

Acute appendicitis is a clinical condition that is characterized by inflammation of the appendix, and it is the most common admission to the general surgical ward. It is most seen in young adults in the second and third decades of life. The incidence of acute appendicitis in most Western countries is about 90 to 100 cases per 100,000 population. Acute appendicitis can be classified as simple acute appendicitis or complicated acute appendicitis (Bhangu, 2015). The diagnosis of acute appendicitis involves history and clinical examination, followed by blood investigations in the form of inflammatory markers like leukocytosis and elevated C. Reactive protein (CRP), which, when combined, can give a risk prediction for acute appendicitis. Imaging modalities like ultrasound and computerized tomography are used to increase the accuracy of diagnosis of acute appendicitis in atypical presentations (Bom, 2021; Ching, 2025). The management of acute appendicitis involves performing an appendectomy, which can be performed as an open or laparoscopic method. Appendectomy is considered the gold standard for the treatment of acute appendicitis, but non-operative treatment with intravenous antibiotics can be considered for some patients who may not be fit to undergo surgery (Moris, 2021; Long, 2025).

Endoscopic retrograde appendicitis therapy (ERAT) is a minimally invasive endoscopic therapy where the appendicular orifice is intubated via a colonoscopy. After flushing the lumen, a stent is inserted. After fluoroscopic confirmation, removal of debris and appendicolith is performed, followed by flushing of the lumen of the appendix and insertion of a stent to allow drainage. This procedure is performed under sedation and is associated with a technical and clinical success rate of 90-100%. The recurrence rate following the procedure was 5% to 10%. The main indication for endoscopic retrograde appendicitis therapy (ERAT) is acute, uncomplicated appendicitis and chronic appendicitis. The classical endoscopic retrograde appendicitis therapy (ERAT) involves the use of an image intensifier, but variations of this therapy include endoscopic retrograde direct appendicitis therapy, which uses a cholangioscope to visualize the lumen of the appendix, and this does not involve the use

of radiation (Zhang, 2024; BouHaidar, 2016; Salati, 2025; Liu D. Z., 2024; Ullah, 2022).

In this review, we analyze the roles of endoscopic retrograde appendicitis therapy (ERAT) in managing acute appendicitis. We explore the indications and complications of endoscopic retrograde appendicitis therapy (ERAT) in the management of acute appendicitis. A comprehensive literature review was conducted using PUBMED, the Cochrane Database of Systematic Reviews, Google Scholar, and Semantic Scholar. The search targeted randomized controlled trials, non-randomized trials, observational and cohort studies, case reports, clinical reviews, systematic reviews, and meta-analyses published from 2010 to 2026. The keywords used in the search included "Acute appendicitis," "Uncomplicated appendicitis," "endoscopy," "ERAT," "EDAT," and "Appendicolith." All articles were in English and were assessed through manual cross-referencing of the literature. Commentaries were excluded from this review. The study encompassed both adult and pediatric patients with acute appendicitis.

DISCUSSION

Endoscopic Retrograde Appendicitis Therapy

Endoscopic retrograde appendicitis therapy was introduced by Liu *et al*., in 2012. This procedure included the insertion of a colonoscope, followed by the identification of the appendiceal orifice, followed by intubation, appendicular decompression, retrograde appendicography, stent drainage, and cleansing of the appendicular lumen. A total of 4 patients were included in this retrospective study, and endoscopic retrograde appendicitis therapy was successful in all cases. There were no complications and no recurrence during the 19-month follow-up (Liu, 2012). A multi-center retrospective study on endoscopic retrograde appendicitis therapy for acute appendicitis was conducted by Liu *et al*., Thirty-four out of forty patients with acute appendicitis underwent endoscopic retrograde appendicitis therapy (ERAT), and the clinical success rate was 97%, and the failure rate was at 3%. At a median follow-up of 12 months, the recurrence rate was at 6.2% (Liu B. R., 2015).

A retrospective study on endoscopic retrograde appendicitis therapy (ERAT) for acute appendicitis was conducted by Ye *et al*., A total of 22 patients were included in this study, and endoscopic retrograde appendicitis therapy (ERAT) was successful in 95.5% of patients. After a follow-up of 33 months, the recurrence rate was at 9.1% (Ye, 2018). Endoscopic retrograde appendicitis therapy (ERAT) was compared with laparoscopic appendectomy and open appendectomy for the management of acute appendicitis by Shen *et al.,* A total of 99 patients were divided into three groups: 33 who underwent ERAT, 33 who underwent laparoscopic appendectomy, and 33 who underwent open appendectomy. The clinical success rates for ERAT, laparoscopic appendectomy, and open appendectomy were 87.88%, 96.97%, and 100%, respectively. With a median follow-up of 22 months, there were no significant differences regarding adverse events between the procedures (Shen, 2022). Endoscopic retrograde appendicitis therapy (ERAT) was compared with laparoscopic appendectomy for acute, uncomplicated appendicitis by Yang *et al*., A total of 422 patients with acute, uncomplicated appendicitis were included in this study, with 79 patients undergoing ERAT and 343 patients undergoing laparoscopic appendectomy. ERAT was associated with a success rate of 92.1% and reduced postoperative pain, but there were no significant differences regarding the adverse effects, length of hospital stays, and procedure time (Yang, 2022). Ding *et al*., also assessed the feasibility of endoscopic retrograde appendicitis therapy (ERAT) for the management of acute appendicitis. Two hundred and ten patients were included in this study, with 70 patients undergoing ERAT, 68 patients undergoing laparoscopic appendectomy, and 72 undergoing open appendectomy. Endoscopic retrograde appendicitis therapy (ERAT) was associated with a shorter operative procedure time, and the recurrence rate at 6 months follow-up was at 2.86% (Ding, 2022).

A systematic review and meta-analysis of endoscopic retrograde appendicitis therapy (ERAT) for acute appendicitis was conducted by Dhindsa *et al*., Seven studies with 298 patients were included in this study, and the technical success rate was 99.36%(95%CI,97.61-100), and the clinical success rate was 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). This study showed that endoscopic retrograde appendicitis therapy (ERAT) was safe and effective for the management of acute appendicitis (Dhindsa, 2022). A systematic review and meta-analysis on the efficacy of endoscopic retrograde appendicitis therapy in acute uncomplicated appendicitis was conducted by Wang *et al*., A total of 12 studies with 970 patients were included in this study, and the length of hospital stay was shorter in the endoscopic retrograde appendicitis therapy (ERAT) (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). This study showed that ERAT was associated with a shorter operative time and faster recovery (Wang, 2021). A systematic review and meta-analysis on the clinical efficacy and safety of endoscopic retrograde appendicitis therapy for acute appendicitis was conducted by Xu *et al*., Twenty-six studies with 2236 patients were included in this study; the length of hospital stay and operative time were shorter in the ERAT group. ERAT was also associated with lower complication rates (RR0.25,95%CI,0.18-0.35), and the recurrence rate was, however, higher (2.10,95%CI,1.02-4.32). This study showed that ERAT was effective for the management of acute appendicitis, but it was associated with a higher recurrence rate (Xu, 2023).

A systematic review and meta-analysis comparing endoscopic retrograde appendicitis therapy and appendectomy for the modern approach in the management of acute appendicitis was conducted by Pata *et al*., A total of 6 studies with 575 patients were included in this study, with 236 undergoing ERAT and 339 undergoing appendectomies. There were no differences regarding the technical success rate between the procedures (RR0.97,95%CI,0.92-1.02). Endoscopic retrograde appendicitis therapy (ERAT) was associated with a shorter procedure time (MD14.38,95%CI,20.87-8.59), reduced length of hospital stays (MD1.19.95%CI,2.37-0.01), and lower post intervention abdominal pain (RR0.21,95%CI,0.14-0.32). This study did not show any differences regarding the technical success rate between the procedures (Pata, 2023). Another systematic review and meta-analysis were conducted by Sarraf *et al*., on endoscopic retrograde appendicitis therapy in acute uncomplicated appendicitis in adults. A total of 8 studies with 326 patients were included in this study, and the technical success rate was 98%(95%CI,97-100), the clinical success rate was 99%(95%CI,97-100), and the adverse event rate was 1.8%(95%CI,4-3.2). The recurrence rate following ERAT was 6%(95%CI,3-9) at a follow-up of 17.7 months (Sarraf, 2023). Basukala *et al*., conducted a systematic review and meta-analysis comparing endoscopic retrograde appendicitis therapy and laparoscopic appendectomy in acute appendicitis. 4 studies with 470 patients were included in this study, and ERAT was associated with a shorter operative time and higher recurrence rate. There were no differences regarding the length of hospital stay and adverse events (Basukala, 2023).

A systematic review and meta-analysis of randomized controlled trials comparing endoscopic retrograde appendicitis therapy, appendectomy, and antibiotic treatment for acute uncomplicated appendicitis was conducted by Wang *et al*., A total of 23 studies with 4350 patients were included in this study, and endoscopic retrograde appendicitis therapy(ERAT) was associated with a reduced complication rate compared to antibiotic therapy(OR0.20,95%CI,0.06-0.67).ERAT also showed a reduced recurrence rate compared to antibiotic therapy(OR 0.22,95%CI,0.08-0.57). Appendectomy was associated with the lowest recurrence rate (OR0.06,95%CI,0.03-0.11). There was no difference regarding the length of hospital stay between the groups (Wang J. Y., 2025). A systematic review and meta-analysis on the safety and efficacy of endoscopic retrograde appendicitis therapy in acute uncomplicated appendicitis in children was conducted by Li *et al*., Ten studies with 1372 patients were included in this study, with 660 children undergoing ERAT and 712 children undergoing appendectomy. Endoscopic retrograde appendicitis therapy (ERAT) was associated with a shorter hospital stay (WMD = 2.21, 95% CI, 1.73-2.69), fewer complications (RR = 0.27, 95% CI, 0.18-0.39), and no significant difference regarding the recurrence rate (RR = 0.78, 95% CI, 0.51-1.19). This study showed that ERAT was feasible in the management of acute uncomplicated appendicitis in children (Li, 2025).

Direct Vision Endoscopic Retrograde Appendicitis Therapy

This is a variant of endoscopic retrograde appendicitis therapy, where an appendoscope or a peroral digital single-operator cholangioscope is used for direct visualization of the appendicular lumen. This procedure does not require the use of contrast agents and image intensifier and can be performed in patients where radiation exposure is contraindicated (Feng, 2024)). A total of 125 patients were included in a retrospective study by Liu *et al*., and appendiscope-assisted endoscopic retrograde appendicitis therapy (ERAT) was associated with a technical success rate of 98.5% and a clinical success rate of 100%. The recurrence rate was 4.8% at 12 months of follow-up (Liu P. W., 2025). Endoscopic direct vision retrograde appendicitis therapy was compared with laparoscopic appendectomy in acute uncomplicated appendicitis by Chen *et al*., This retrospective study included 87 patients, with 41 undergoing endoscopic direct vision retrograde appendicitis therapy and 47 undergoing laparoscopic appendectomy. Endoscopic direct vision retrograde appendicitis therapy was associated with shorter operative time, reduced abdominal pain, faster resumption of oral intake, and a mean length of stay in the hospital of 3 days. The recurrence rate was 7.32% at 13 months of follow-up (Chen, 2026).

Direct visualization endoscopic retrograde appendicitis therapy was compared with laparoscopic appendectomy for acute uncomplicated appendicitis by Pan *et al*., A total of 102 patients were included in this study, with 34 patients undergoing direct vision endoscopic retrograde appendicitis therapy and 68 patients undergoing laparoscopic appendectomy. The technical success rate and clinical success rate for direct vision endoscopic retrograde appendicitis therapy were 97.06% and 94.12%, respectively. There was no difference between the procedures regarding adverse events and length of hospital stay. The recurrence rate for direct vision endoscopic retrograde appendicitis therapy was at 2.94% (Pan, 2025).

Table I

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

ERAT represents a significant advancement in the management of acute appendicitis, offering a minimally invasive, organ-preserving alternative to surgery. Current evidence demonstrates high success rates, faster recovery, and reduced complications compared to traditional approaches. However, recurrence, technical complexity, and limited global experience remain challenges. While ERAT cannot yet replace appendectomy as the standard of care, it provides a valuable option for selected patients. Ongoing research and technological advancements will determine its ultimate role in clinical practice.

Conflict of Interest: There is no conflict of interest.

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