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Endoscopic Retrograde Appendicitis Therapy: A Narrative Review of Current Evidence and Challenges for European Implementation

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Lasse Rehné Jensen [1], Luit Penninga [1, 2]

1. Department of Gastrointestinal Surgery, Aalborg University Hospital, Aalborg, DNK 2. Department of Clinical Medicine, Aalborg University Hospital, Aalborg, DNK

Corresponding author: Lasse Rehné Jensen, lasserehne@gmail.com

Abstract

Endoscopic retrograde appendicitis therapy (ERAT) is a minimally invasive, appendix-preserving approach to acute uncomplicated appendicitis. This narrative review critically evaluates the ERAT technique, patient selection, clinical outcomes, and challenges associated with potential implementation in European healthcare systems. Published randomised trials, observational studies, systematic reviews, and meta-analyses were reviewed alongside relevant international guidelines and literature on surgical outcomes and endoscopic capacity. ERAT has demonstrated technical success rates exceeding 95% in selected patients; however, technical feasibility does not necessarily translate into durable clinical success. Reported recurrence rates include 14.5% over three years in a randomised trial and 24% at one year in a comparative observational study. A recent meta-analysis found lower treatment success (odds ratio (OR) 0.15, 95% confidence interval (CI) 0.04-0.57) and higher recurrence (OR 7.68, 95% CI 2.32-25.46) after ERAT compared with laparoscopic appendectomy. Furthermore, preservation of the appendix precludes routine histopathological examination, raising concerns about potentially undetected appendiceal neoplasms. The available evidence is heterogeneous, predominantly originates from specialised Asian centres, and provides limited information on long-term outcomes and applicability to European healthcare systems. Implementation would require specialised endoscopic expertise, equipment, and procedural capacity. ERAT should therefore currently be regarded as an investigational treatment rather than an established alternative to laparoscopic appendectomy. Further prospective multicentre studies are needed to evaluate long-term recurrence-free survival, subsequent appendectomy, oncological safety, cost-effectiveness, and feasibility across different healthcare settings.

Categories: General Surgery
Keywords: acute appendicitis, endoscopic retrograde appendicitis therapy, endoscopic therapy, laparoscopic appendectomy, non-operative management, therapeutic endoscopy

Introduction And Background

Acute appendicitis is a common cause of emergency abdominal surgery, with a lifetime risk of approximately 7-8% [1]. Its aetiology is multifactorial and remains incompletely understood. Luminal obstruction, potentially caused by appendicoliths or lymphoid hyperplasia, has traditionally been considered an important mechanism, although appendicitis may also develop without demonstrable obstruction [1]. Appendicitis is commonly classified as uncomplicated or complicated, the latter including perforation, abscess formation, and/or peritonitis.

Appendectomy remains the standard treatment and is now predominantly performed laparoscopically; the transition from open to laparoscopic appendectomy has reduced postoperative complications [2,3]. In recent decades, however, non-operative treatment strategies have gained increasing attention. Randomised trials have demonstrated that antibiotic treatment may be an alternative to appendectomy in selected patients, although treatment failure and subsequent appendectomy remain important considerations [4,5]. Recent international guidelines recommend an individualised treatment approach incorporating patient preferences, including consideration of antibiotic treatment for uncomplicated appendicitis [6].

Interest in appendix-preserving treatment has also been supported by increasing recognition of the appendix's potential role in mucosal immunity and regulation of the gut microbiota [7,8]. However, preservation of the appendix has not been demonstrated to provide superior long-term clinical outcomes.

Against this background, endoscopic retrograde appendicitis therapy (ERAT) has been introduced as an appendix-preserving treatment based on endoscopic cannulation, decompression, and drainage of the appendiceal lumen. Endoscopic direct appendicitis therapy (EDAT) represents a related approach that enables direct intraluminal visualisation. Despite encouraging reports of technical feasibility, ERAT remains investigational, is not currently recommended by international guidelines, and its long-term clinical effectiveness and diagnostic safety remain uncertain.

Although several systematic reviews and meta-analyses have evaluated the clinical outcomes of ERAT, important questions remain regarding patient selection, recurrence, procedural safety, and implementation outside specialised Asian centres. This narrative review critically evaluates the technique, patient selection, clinical outcomes, and limitations of ERAT, with particular emphasis on its potential role and implementation challenges within European healthcare systems.

Review

Methods

This narrative review was conducted using PubMed and Google Scholar to identify relevant English-language biomedical literature. The literature search was conducted between May 1 and July 31, 2026, using the search terms “endoscopic retrograde appendicitis therapy,” “ERAT,” “endoscopic appendicitis treatment,” and “endoscopic direct appendicitis therapy.” Randomised controlled trials, observational studies, systematic reviews, and meta-analyses addressing the technique, patient selection, clinical outcomes, and safety of ERAT were considered. Additional literature searches were performed to identify relevant international and European guidelines and studies addressing appendicitis management, surgical outcomes, endoscopic training, and healthcare implementation. Publications were selected based on their relevance to the objectives of this review, and reference lists of relevant articles were screened to identify additional studies. As this was a narrative review, no formal systematic screening, risk-of-bias assessment, or quantitative evidence synthesis was performed. Findings from systematic reviews and meta-analyses were interpreted with consideration of potential overlap in their underlying primary studies.

Origin and rationale of ERAT

ERAT was first performed in China in 2009 by Liu et al., inspired by the principles of endoscopic retrograde cholangiopancreatography (ERCP). The first scientific report was published in 2012, introducing ERAT as a minimally invasive, appendix-preserving approach to acute appendicitis [9]. Since its introduction, ERAT has been adopted predominantly in China. According to a review published in 2024, more than 10,000 ERAT procedures had reportedly been performed across over 150 Chinese hospitals by the end of 2022 [10]. However, these figures were not derived from a comprehensive national registry, and published clinical experience outside Asia remains limited [10-12].

The rationale for ERAT is based on the hypothesis that appendiceal luminal obstruction and increased intraluminal pressure contribute to the development of acute appendicitis. Endoscopic decompression, irrigation, and removal of obstructing material may therefore facilitate resolution of inflammation while preserving the appendix [10-12]. However, acute appendicitis has a multifactorial aetiology, and luminal obstruction is not present in all cases. Consequently, decompression alone may not address the underlying mechanisms in every patient or prevent subsequent recurrence.

Despite its increasing use in selected centres, the indications for ERAT remain inconsistently defined, and the procedure is not currently recommended in international appendicitis guidelines [6]. Its predominantly Chinese adoption may reflect differences in clinical expertise, procedural availability, and local treatment preferences, although the reasons for its limited uptake elsewhere have not been systematically investigated. The available evidence therefore requires critical evaluation before broader implementation can be considered.

Technique and procedural considerations

ERAT is performed by advancing a colonoscope to the caecum, identifying the appendiceal orifice, and selectively cannulating the appendix using a guidewire and catheter, typically under fluoroscopic guidance (Figure *1*). Appendicography with water-soluble contrast is performed to assess the appendiceal lumen, including potential obstruction, stenosis, or filling defects. Following successful cannulation, decompression by aspiration and irrigation is performed to facilitate drainage of purulent material and removal of intraluminal debris. Appendicoliths that cannot be cleared by irrigation may be extracted using a retrieval basket or balloon catheter [9,10,12,13].

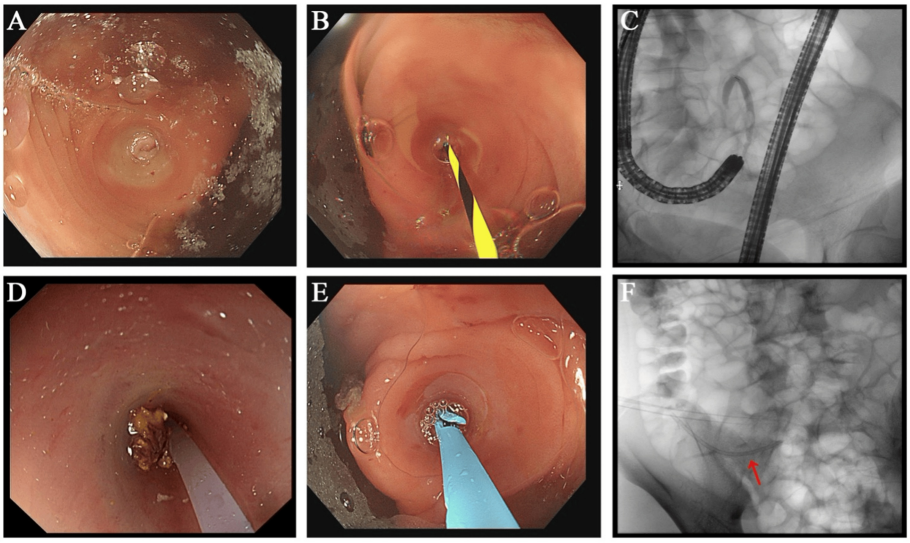


FIGURE 1: Endoscopic retrograde appendicitis therapy (ERAT).

(A) Identification and visualisation of the appendiceal orifice. (B) Guidewire-assisted cannulation of the appendix. (C) Appendicography. (D) Irrigation with removal of pus and a fecalith. (E, F) Placement of an appendiceal stent.

Figure reproduced with permission from Liu et al. and based on an illustration from Reference [10].

Careful guidewire manipulation and controlled irrigation are important procedural considerations, as instrumentation of an inflamed appendix carries a risk of perforation. Excessive force during cannulation, contrast injection, or appendicolith extraction should be avoided. However, standardised procedural safety protocols, including optimal irrigation pressure and volume, have not been established [9,10,12].

Temporary appendiceal stenting may be performed in selected patients with luminal stenosis or persistent obstruction to maintain drainage. Plastic stents, typically 7-8.5 Fr in diameter, are used (Figure *1*). In the multicentre randomised trial by Liu et al., stent position was assessed by abdominal radiography after two to four weeks, followed by endoscopic removal if the stent remained in place [13]. Other reports describe earlier removal or spontaneous passage, indicating variation in stent management [9,10,12]. Consequently, stent placement may necessitate additional imaging and a second colonoscopy, while stent migration represents a potential complication.

Adequate bowel preparation is required to visualise and access the appendiceal orifice. Published approaches include low-pressure rectal enemas, oral polyethylene glycol-based preparation, and rapid intracolonic cleansing [9,10,12]. However, preparation protocols vary, and the optimal strategy in patients presenting with acute appendicitis has not been established. Bowel preparation requirements may therefore influence the timing and feasibility of ERAT within an emergency treatment pathway.

Patient selection and contraindications

Patient selection is essential for the safe and effective use of ERAT, although eligibility criteria vary considerably between studies. Most clinical studies have focused on haemodynamically stable patients with acute uncomplicated appendicitis, generally established through clinical assessment and imaging [10-13]. However, CT cannot reliably exclude all cases of complicated appendicitis, as several radiological features have limited sensitivity for detecting perforation. Imaging findings should therefore be interpreted alongside the patient's clinical condition [14].

The randomised trial by Liu et al. included adults with suspected acute uncomplicated appendicitis, an Alvarado score of 5-10, and CT findings consistent with appendicitis. Patients with complicated appendicitis, inflammatory bowel disease, pregnancy, or selected comorbid conditions were excluded [13]. Although no internationally accepted contraindications specific to ERAT have been established, haemodynamic instability, generalised peritonitis, suspected perforation, and intra-abdominal abscess generally preclude its use in the populations studied [9-13].

The presence of an appendicolith warrants particular consideration. Although appendicoliths are associated with increased treatment failure following antibiotic therapy, their removal represents a potential therapeutic mechanism of ERAT. Appendicoliths have therefore not been uniformly excluded from ERAT studies [13]. Nevertheless, whether ERAT provides a clinically meaningful advantage in this subgroup

remains uncertain.

An important diagnostic limitation of ERAT is the absence of routine histopathological examination of the appendix, potentially leaving underlying appendiceal neoplasms undetected. In a large retrospective study of patients undergoing appendectomy, appendiceal neoplasms were identified in approximately 0.53% of a national sample, with increasing incidence among older patients [15]. However, these findings cannot be directly extrapolated to the selected population of patients with uncomplicated appendicitis undergoing ERAT. Although the risk of occult neoplasia should be considered during patient selection, evidence-based surveillance protocols specifically following ERAT have not been established.

Evidence regarding ERAT in children, pregnant patients, and patients with substantial comorbidity remains limited, and findings from highly selected adult populations should not be extrapolated to these groups without caution [9-13,16].

Evidence and clinical outcomes

The available evidence on ERAT includes randomised trials, retrospective cohorts, and several systematic reviews and meta-analyses, predominantly from Chinese centres [10,11,16,17]. However, differences in study design, outcome definitions, and follow-up duration, together with potential overlap between the primary studies included in published meta-analyses, complicate interpretation of the overall evidence. Key clinical studies evaluating ERAT, including comparative studies and investigations of long-term outcomes, are summarised in Tables *1*-*2*.

Study	Design and setting	Patients	Comparator	Technical/clinical success	Complications and hospital stay	Recurrence/subsequent appendectomy	Follow-up
Liu et al., 2022 [13]	Multicentre RCT; China	110 (55 ERAT; 55 appendectomy)	Appendectomy	Technical success: 94.5% vs. 100%	No postprocedural complications reported after ERAT. Hospital stay: 3 vs. 5 days	Eight recurrences after ERAT (14.5% of allocated patients); four underwent repeat ERAT	36 months
Li et al., 2023 [18]	Multicentre retrospective, propensity-score matched cohort; China	466 (233 ERAT; 233 antibiotics)	Antibiotics	Initial treatment success: 97.9% vs. 95.3%	Hospital stay: 2 vs. 5 days; complication rates NR	Recurrence: 9.9% vs. 24.7%; subsequent appendectomy NR	12 months
Zhan et al., 2025 [19]	Multicentre retrospective cohort; 9 hospitals, China	692 (188 V-ERAT; 504 antibiotics)	Antibiotics	Technical success: 96.3%; initial treatment success: 93.6% vs. 90.5%	Overall adverse events: no significant difference (p = 0.064); hospital stay: 3 vs. 4 days	Recurrence: HR 0.14 (95% CI 0.07-0.29); appendectomy during initial admission: 4.3% vs. 9.5%	Variable; exact duration NR
Liu et al., 2025 [20]	Multicentre retrospective, propensity-score matched cohort; China; appendicolith-positive patients	210 (105 ERAT; 105 LA)	Laparoscopic appendectomy	ERAT technical success: 91.4%; treatment success at 1 year: 85.7% vs. 100%	Overall adverse events: 21.0% vs. 17.1%; perforation: 2.9% vs. 0%; hospital stay: 3 vs. 4 days	Six ERAT recurrences; subsequent appendectomy not separately quantified	12 months
Cai et al., 2025 [21]	Retrospective comparative cohort; China	170 (136 EDAT; 34 ERAT)	EDAT vs. ERAT	Procedural success: 99.3% vs. 82.4%	Two perforations requiring appendectomy reported; EDAT associated with shorter hospital stay	Cumulative recurrence at 1 year: 10% vs. 24%; two ERAT failures underwent appendectomy	12 months; incomplete follow-up
Zhang et al., 2026 [22]	Multicentre retrospective cohort; 3 hospitals, China	435 ERAT patients	None	Technical success: 100%; clinical success: 92.4%	Abdominal pain: 8.8%; fever: 3.5%; hospital stay: 1 day (IQR 1-2)	Overall recurrence: 16.1% (70/435); subsequent appendectomy in 45/70 patients with recurrence (64.3%)	Median 37 months (IQR 24-48)

TABLE 1: Summary of primary clinical studies evaluating endoscopic retrograde appendicitis therapy.

Technical success, clinical success, complications, and recurrence were defined differently across studies. Recurrence estimates should be interpreted in relation to follow-up duration and the populations studied. Comparative outcomes are presented in the order of the treatment groups specified in each study.

CI, confidence interval; EDAT, endoscopic direct appendicitis therapy; ERAT, endoscopic retrograde appendicitis therapy; HR, hazard ratio; IQR, interquartile range; LA, laparoscopic appendectomy; NR, not reported; RCT, randomised controlled trial; V-ERAT, visual endoscopic retrograde appendicitis therapy

Study	Design	Included studies/patients	Comparisons	Main findings	Principal limitations
Dhindsa et al., 2022 [23]	Systematic review and meta-analysis	7 studies; 298 patients	Predominantly single-arm ERAT studies	Pooled technical success: 99.4%; clinical success: 99.3%; adverse events: 0.2%; recurrence: 6.0%	Small studies, limited comparative evidence and heterogeneous follow-up
Sarraf et al., 2023 [24]	Systematic review and meta-analysis	8 studies; 326 patients	Single-arm ERAT evidence	Pooled technical success: 98%; clinical success: 99%; adverse events: 1.8%; perforation: 1.5%; recurrence: 6%	Small samples, variable follow-up and limited generalisability
Pata et al., 2023 [25]	Systematic review and meta-analysis	6 comparative studies	ERAT vs. appendectomy or antibiotics	ERAT vs. appendectomy: recurrence at 1 year RR 11.28 (95% CI 2.61-48.73); hospital stay MD -1.19 days (95% CI -2.37 to -0.01). ERAT vs. antibiotics: recurrence RR 1.07 (95% CI 0.08-14.87)	Imprecision, heterogeneous study designs and limited long-term comparative evidence
Li et al., 2025 [26]	Systematic review and meta-analysis	8 studies; 2,005 patients	ERAT vs. laparoscopic appendectomy or antibiotics	Reported lower treatment success and higher recurrence versus appendectomy; no statistically significant differences in treatment success or recurrence versus antibiotics	Inconsistencies in comparator classification undermine confidence in the reported pooled estimates

TABLE 2: Summary of systematic reviews and meta-analyses evaluating endoscopic retrograde appendicitis therapy.

The included systematic reviews and meta-analyses contain overlapping primary studies and should not be interpreted as representing independent patient populations. Differences in study design, outcome definitions, and follow-up duration limit direct comparisons between pooled estimates.

CI, confidence interval; ERAT, endoscopic retrograde appendicitis therapy; MD, mean difference; RR, risk ratio

Technical success

ERAT has demonstrated high technical feasibility in published studies, although definitions of technical success vary. In a retrospective multicentre cohort of 435 patients, Zhang et al. reported a technical success rate of 100%, whereas clinical success was achieved in 92.4% [22]. Importantly, successful appendiceal cannulation and completion of the endoscopic procedure do not necessarily indicate resolution of appendicitis or durable treatment success. Furthermore, these results originate from experienced Chinese centres and may not be generalisable to settings with limited ERAT experience.

Complications

ERAT is associated with a risk of procedure-related complications, particularly appendiceal perforation during guidewire manipulation, appendicolith extraction, or stent placement. In a meta-analysis including 298 patients, Dhindsa et al. reported a pooled adverse event rate of 0.19% (95% CI 0-1.55%), with three documented perforations [23]. A subsequent meta-analysis of 326 patients reported a pooled adverse event rate of 1.8% (95% CI 0.4-3.2%) and a perforation rate of 1.5% (95% CI 0.02-2.8%), corresponding to four reported perforations [24]. Of these, one required emergency appendectomy, while the remaining cases were managed without immediate surgical intervention [24].

These estimates should be interpreted cautiously because of the small study populations, overlapping primary studies, and predominantly single-centre experience. Furthermore, the reported complication rates reflect selected patients treated in experienced centres and may not be generalisable to routine emergency practice. Although perforation appears uncommon, its potential consequences are clinically important when evaluating ERAT as an alternative to established treatments.

Recurrence

Recurrence remains an important concern following ERAT. In the prospective multicentre randomised trial by Liu et al., recurrent appendicitis was reported in eight of 55 patients (14.5%) allocated to ERAT during three years of follow-up [13]. However, three patients experienced initial technical failure, highlighting the distinction between procedural failure and subsequent recurrence.

In a retrospective multicentre cohort of 435 patients, Zhang et al. reported an overall recurrence rate of

16.1% during a median follow-up of 37 months, with a cumulative recurrence rate of 13% at one year [22]. Recurrence was defined as imaging-confirmed appendicitis following initial clinical resolution. In multivariable analysis, older age, previous appendicitis, higher Alvarado score, appendicoliths, limited operator experience, longer procedure time, and distorted appendiceal anatomy were independently associated with increased odds of recurrence. Stent placement was associated with lower odds of recurrence, although the observational design precludes conclusions regarding a causal protective effect [22].

In a smaller retrospective study comparing ERAT with EDAT, Cai et al. reported a one-year cumulative recurrence rate of 24% in the conventional ERAT group, which included only 34 patients [21]. However, the small sample size, incomplete follow-up, and non-randomised design limit the interpretation of this estimate.

Collectively, these studies indicate that recurrence remains clinically relevant following ERAT, although reported rates vary according to study design, patient population, outcome definitions, and follow-up duration. The identification of patients at increased risk of recurrence requires further validation.

Comparison with antibiotics and surgery

Antibiotic therapy is an established non-operative treatment option for selected patients with uncomplicated acute appendicitis, although initial treatment failure and subsequent recurrence remain important considerations. In the APPAC trial, 72.7% of patients allocated to antibiotic therapy avoided appendectomy during the first year [27]. At five years, the cumulative appendectomy rate was 39.1%, while the histologically confirmed recurrence rate was 32.4% [28,29]. At 10 years, the corresponding rates were 44.3% and 37.8%, respectively [29]. The cumulative complication rate was lower following antibiotic therapy than appendectomy (8.5% vs. 27.4%, $p < 0.001$), although the trial used open rather than laparoscopic appendectomy [29].

The presence of an appendicolith is particularly relevant when considering non-operative treatment. In the CODA trial, 41% of antibiotic-treated patients with an appendicolith underwent appendectomy within 90 days, compared with 25% of those without an appendicolith [30]. ERAT offers the theoretical advantage of mechanically removing appendicoliths, but their presence has also been associated with recurrence following ERAT [22]. In a retrospective multicentre study of 210 propensity score-matched patients with uncomplicated appendicitis and appendicoliths, Liu et al. reported lower one-year treatment success following ERAT than laparoscopic appendectomy (85.7% vs. 100%). Although ERAT was associated with shorter procedure times and lower treatment costs, hospital stay and overall adverse event rates did not differ significantly between groups [20]. These findings do not establish a clinical advantage of ERAT in patients with appendicoliths.

Direct comparisons between ERAT and antibiotic therapy remain limited. In a retrospective propensity score-matched study, Li et al. reported lower one-year recurrence following ERAT than antibiotic therapy (9.9% vs. 24.7%), while treatment success did not differ significantly between groups (97.9% vs. 95.3%) [18]. Similarly, a multicentre retrospective study by Zhan et al. comparing visual ERAT with antibiotic therapy reported comparable treatment success (93.6% vs. 90.5%) but a lower risk of recurrence following visual ERAT (HR 0.14, 95% CI 0.07-0.29) [19]. However, these observational findings are susceptible to residual confounding, and differences in patient selection, treatment protocols, and follow-up complicate interpretation. Furthermore, ERAT frequently involves concomitant antibiotic administration, making it difficult to isolate the additional therapeutic benefit of endoscopic intervention.

Systematic reviews and meta-analyses have reported potential short-term advantages of ERAT over appendectomy, including shorter hospital stays and less post-intervention pain [16,25]. However, these findings must be balanced against the risk of recurrence and subsequent intervention. In a meta-analysis including 2,005 patients, ERAT was reported to be associated with lower treatment success (OR 0.15, 95% CI 0.04-0.57) and higher recurrence (OR 7.68, 95% CI 2.32-25.46) compared with laparoscopic appendectomy [26]. These findings should be interpreted cautiously because the meta-analysis combined randomised and observational studies, included both adult and paediatric populations, and showed inconsistencies in the classification of treatment comparators.

Overall, ERAT remains an investigational appendix-preserving treatment. Although observational comparisons suggest potential advantages over antibiotic therapy, these findings do not establish a causal benefit. Further prospective comparative studies are needed to determine whether ERAT offers meaningful improvements in durable treatment success, recurrence, subsequent appendectomy, complications, and patient-reported outcomes.

Endoscopic direct appendicitis therapy

EDAT has been introduced as a modification of ERAT, allowing direct intraluminal visualisation of the appendix using a cholangioscope without fluoroscopic guidance (Figure *2*). In a retrospective comparative study of 170 patients, Cai et al. reported higher procedural success with EDAT than ERAT (99.3% vs. 82.4%) and lower cumulative recurrence rates at one year (10% vs. 24%) [21]. However, the ERAT group comprised

only 34 patients, follow-up was incomplete, and the study did not provide a clearly standardised definition of recurrence. Furthermore, treatment allocation was non-randomised, and propensity score matching accounted only for age and sex. These preliminary findings therefore require confirmation in larger prospective comparative studies.

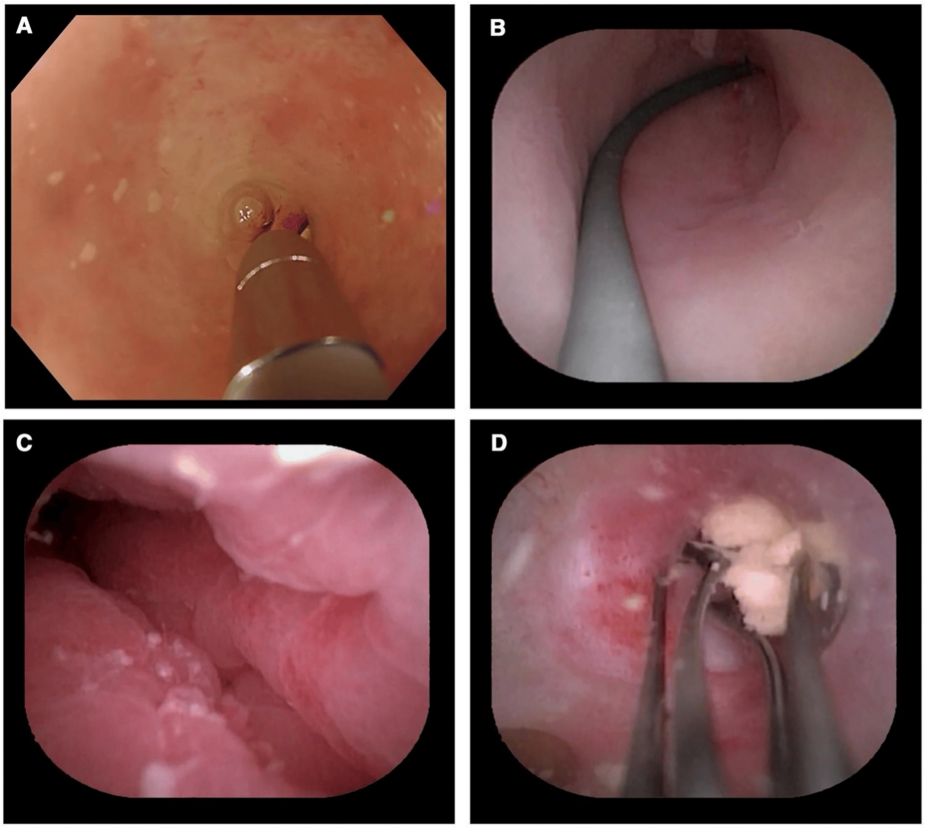


FIGURE 2: Endoscopic direct appendicitis therapy (EDAT) using a cholangioscope.

(A) Cannulation of the appendix with a cholangioscope. (B) Tip of the appendix. (C) Inspection of the inner appendiceal wall. (D) Fecalith removed with a basket.

Figure reproduced with permission from Liu et al. and based on an illustration from Reference [10].

Limitations of the evidence

The current evidence supporting ERAT has several important limitations. Most studies originate from Chinese centres, raising concerns about generalisability to other healthcare systems and patient populations [10-12,16-22,25,26]. Although randomised trials have been published, the evidence remains limited by variable methodological quality, heterogeneous study populations, and the predominance of observational data. Furthermore, several systematic reviews and meta-analyses include overlapping primary studies, meaning that their pooled sample sizes should not be interpreted as representing independent patient populations [16,17,23-26,31].

Definitions of technical success, clinical success, complications, and recurrence vary between studies, complicating direct comparisons. Patient selection and operator experience may influence reported outcomes, particularly as many studies originate from specialised centres. Follow-up duration also varies, and subsequent appendectomy and other additional interventions are not consistently reported. Consequently, high technical success rates and favourable short-term outcomes do not necessarily indicate durable clinical effectiveness.

An additional limitation concerns the absence of routine histopathological examination following ERAT, which may delay the diagnosis of occult appendiceal neoplasms. Although the risk appears relatively low in carefully selected patients with uncomplicated appendicitis, the long-term diagnostic safety of ERAT remains uncertain. No evidence-based surveillance protocol has been established specifically following ERAT. Follow-up assessment may therefore need to be individualised according to patient age, imaging findings, and persistent or recurrent symptoms, although the effectiveness of such an approach remains

unvalidated. These limitations highlight the need for prospective comparative studies with standardised outcome definitions, adequate follow-up, and clinically relevant endpoints.

Implementation in European clinical practice

Implementation of ERAT in European healthcare systems requires consideration of both clinical effectiveness and organisational feasibility. Laparoscopic appendectomy is a well-established treatment for acute appendicitis and remains the standard surgical approach in international guidelines [6]. Swedish national guidelines similarly recommend laparoscopic appendectomy as first-line surgical treatment for uncomplicated and complicated appendicitis, with specific exceptions for appendiceal abscess or phlegmon [32]. Contemporary European outcomes provide an important benchmark. In a German multicentre study including 31,988 adults across 68 hospitals, 97% of appendectomies were performed laparoscopically. Among patients undergoing laparoscopic appendectomy, postoperative surgical complications occurred in 3.0%, in-hospital mortality was 0.1%, and mean hospital stay was 4.2 days [33]. However, these outcomes cannot be directly compared with ERAT studies because of differences in patient populations, outcome definitions, and study design.

Beyond demonstrating technical feasibility, ERAT must provide clinically meaningful advantages over established treatments. Although observational studies have reported shorter hospital stays and lower treatment costs following ERAT than laparoscopic appendectomy, these findings predominantly originate from Chinese centres and may not be transferable to European healthcare systems [20,25]. ERAT requires access to urgent colonoscopy, appropriately trained endoscopists, specialised equipment, sedation or anaesthesia, and typically fluoroscopic guidance. Bowel preparation may delay treatment, while appendiceal stenting can necessitate additional imaging and repeat colonoscopy for removal. These requirements must be considered alongside the risks of perforation, recurrent appendicitis, subsequent appendectomy, and undetected appendiceal neoplasms. The potential costs of disposable cholangioscopes used for EDAT represent an additional consideration, and comparative cost-effectiveness data remain insufficient.

The feasibility of providing ERAT within existing European emergency care pathways is uncertain. Acute appendicitis is a common emergency condition, with an estimated age-standardised incidence of 266.5 per 100,000 population in Europe in 2019 [34]. Advanced therapeutic endoscopy requires specialised training, and procedural experience and training opportunities vary across European centres [35]. Introducing ERAT would therefore require dedicated training, supervised procedural experience, and multidisciplinary collaboration between surgeons, gastroenterologists, and radiologists. Simulation-based training and proctored procedures may be appropriate components of an initial implementation strategy, although validated ERAT-specific training and competency requirements have not been established. Potential effects on surgical training and workforce allocation should be considered as organisational factors rather than independent arguments against a treatment that may ultimately benefit patients.

Given the limited clinical experience outside Asia, initial European evaluation of ERAT should preferably take place within prospective clinical studies at centres with appropriate endoscopic expertise and immediate surgical backup. Such studies should prioritise durable clinical outcomes rather than technical success alone, including long-term recurrence-free survival, subsequent appendectomy, procedure-related complications, patient-reported outcomes, and the potential for missed appendiceal neoplasms. Comparative cost-effectiveness and the feasibility of delivering ERAT within established emergency pathways should also be assessed before broader implementation is considered.

Conclusions

ERAT represents a minimally invasive, appendix-preserving treatment option for selected patients with acute uncomplicated appendicitis. However, its role within established treatment pathways remains uncertain, particularly in European healthcare systems. Despite high reported technical success rates, concerns regarding recurrence, subsequent appendectomy, procedure-related complications, and undetected appendiceal neoplasms remain important.

Broader implementation would require consideration of patient selection, endoscopic expertise and availability, procedural capacity, and resource utilisation. At present, ERAT should be regarded as an investigational treatment rather than an established alternative to laparoscopic appendectomy or antibiotic therapy. Further prospective multicentre comparative studies are needed to evaluate long-term clinical effectiveness, patient safety, cost-effectiveness, and feasibility across different healthcare settings.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Lasse Rehné Jensen, Luit Penninga

Drafting of the manuscript: Lasse Rehné Jensen

Critical review of the manuscript for important intellectual content: Luit Penninga

Supervision: Luit Penninga

Disclosures

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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