



Comparing Conservative Treatment With Antibiotics and Appendectomy for Acute Appendicitis in Adult: A Comprehensive Systematic Review

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ABSTRACT

Background: Acute appendicitis is the most common reason for an emergency abdominal surgery, with a lifetime appendectomy risk of 12% for males and 23% for females. Although conservative (i.e., nonoperative) treatment of acute uncomplicated appendicitis with antibiotics has yet to be routinely recommended over appendectomy.

Methods: This systematic review focused on full-text English literature published between 2014 and 2024 using the PRISMA 2020 guidelines. Editorials and review pieces published in the same journal as the submission without a DOI were not accepted. **Result:** Five publications were found to be directly related to our ongoing systematic examination after a rigorous three-level screening approach. Subsequently, a comprehensive analysis of the complete text was conducted, and additional scrutiny was given to these articles. **Conclusion:** For patients who do not have a strong desire for emergency surgery or refuse emergency surgery, a conservative treatment that mainly entails anti-infection may be temporary.

Keyword: Acute appendicitis, appendectomy, antibiotics, nonoperative.

INTRODUCTION

Appendicitis is the most common acute intra-abdominal emergency, and the presentation varies from subclinical and self-resolving to overwhelming sepsis and death. As no investigation is accurate, the diagnosis has to rely on clinical symptoms and signs or clinical scoring systems and, as a result, frequently misdiagnosed. Blockage of the appendiceal lumen by faecolith is assumed to be the mechanism in many cases. If appendicitis is untreated, the progression of the disease depends on the interplay of several factors. Progression from intramural inflammation through the luminal obstruction to gangrene and perforation is not inevitable. Inflammation follows a variable pattern which may be aborted or delayed by host defenses at any time. Children less than 3 years of age have an 80% perforation rate because of delay in diagnosis and host defenses, including the omentum, are not fully developed. Appendicitis has a more rapid course in the elderly because of atherosclerosis, gangrene, and perforation are common. The perforation rate of 25% in patients with a history of pain of less than 24 h is not much lower than the 35% rate of perforation in patients with a history of over 48 h. These may indicate that uncomplicated and

complicated appendicitis are distinct diseases. An alternative outcome is that the appendix becomes surrounded by a mass of omentum which walls the inflammatory process and prevents inflammation from spreading to the abdominal cavity (appendix mass), yet the resolution of the condition is delayed.^{1,2}

Acute appendicitis with the incidence of approximate 1/1000 person-years, which affect 8 million annually, is the most common reason for emergency abdominal surgery. The etiology of acute appendicitis is generally fecal residue or lymphoid tissue proliferation blocking the appendiceal lumen, resulting in high pressure in the lumen and damage to the integrity of the mucosa. Acute appendicitis is classified as either uncomplicated or complicated acute appendicitis. Though the definition of them varies among studies, generally the uncomplicated acute appendicitis may absence of perforation, abscess or peritonitis and may or may not include non-perforated gangrenous or a fecalith.^{3,4}

For many years, appendectomy has been recommended for acute uncomplicated appendicitis. Complication after appendectomy, such as wound infection, intestinal adhesions, incisional hernias and so on, are between 2% and 23%. Laparoscopic appendectomy is

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preferred to an open approach with a lower incidence of complications. However, open appendectomy is still used if the appendix has burst or if access is difficult.³

Appendectomy has been the standard treatment for acute appendicitis for over a century. More than 300 000 appendectomies are performed annually in the United States.¹ Although appendectomy is generally well tolerated, it is a major surgical intervention and can be associated with postoperative morbidity. Since the time Fitz described the relationship between the appendix and pelvic abscess and McBurney demonstrated reduced morbidity from pelvic infections attributable to appendectomy, it has been thought that acute appendicitis invariably progresses to perforation. This line of thinking underlies the belief that emergency appendectomy is required when a diagnosis of appendicitis is made. Fitz's and McBurney's publications predated the availability of antibiotics by 40 years. In the absence of antibiotics, appendectomy saved lives by reducing the risk of uncontrolled pelvic infection when appendicitis was present.^{5,6}

During the 1950s, an initial non-operative approach for acute appendicitis was attempted, but it was not generally accepted at the time. Appendicitis complicated by appendicular abscess/phlegmon may

be managed with antibiotics and non-operative strategies with reduced complication rates compared to surgery, like other acute inflammatory intestinal conditions – i.e. diverticulitis and enterocolitis. In this sense, antibiotic therapy may be associated with reduced costs of treatment, avoiding operation and its consequent complications. However, the use of antibiotics alone as primary therapy for uncomplicated acute appendicitis is still being assessed, and studies have shown conflicting results so far.^{7,8}

METHODS

Protocol

The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 standards were scrupulously followed by the work's author. The purpose of this was to make sure the study satisfied all the requirements. The chosen technique was carefully designed to ensure the accuracy and dependability of the investigation's findings.

Criteria for Eligibility

This study does a thorough evaluation of the last 10 years' worth of literature on comparing conservative treatment with antibiotics and appendectomy for acute appendicitis in adult. This study intends to improve and provide light on comparing conservative treatment with antibiotics and appendectomy

for acute appendicitis in adult through a thorough examination of data. The primary goal of this paper is to highlight the significance of the noteworthy topics that have been identified across the literature.

To ensure the quality of the included information in this study, strict inclusion and exclusion criteria are applied. To be eligible for inclusion, papers must have been published in the English language between 2014 and 2024. Editorials, submissions without a DOI, previously published reviews, and duplicate journal entries are some of the exclusion criteria.

Search Strategy

The keywords used for this research is “comparing conservative treatment with antibiotics and appendectomy for acute appendicitis in adult”. The Boolean MeSH keywords inputted on databases for this research are:
(((“Appendicitis”[MeSH Terms] OR (“Acute appendicitis”[All Fields] AND “Management”[All Fields]) OR (“Teraphy”[MeSH Terms] OR (“Surgery”[All Fields] AND “Surgical”[All Fields]) AND (“Appendectomy”[MeSH Terms] OR “Nonoperative”[All Fields] OR “Operative”[All Fields] OR “Antibiotic”[MeSH Subheading] OR “Treatment”[All Fields] OR “Conservative”[All Fields]))))

Data retrieval

The writers thoroughly evaluated the abstract and title of each manuscript before beginning this systematic review in order to assess each one's significance. Just articles that met the inclusion criteria and aligned with the article's objectives were selected for further examination. Ultimately, a definitive result was obtained from a consistent pattern found over several analyses. Only full-text, English-language submissions were acceptable. Content that satisfied all pre-established inclusion criteria and directly related to the study's subject matter was included after the most stringent screening procedure. Studies that failed to satisfy these requirements were frequently ignored, and their conclusions were not taken into consideration. A thorough analysis was conducted on a plethora of information discovered throughout the research process, including titles, authors, publication dates, locations, study methodologies, and parameters.

Quality Assessment and Data Synthesis

The research that was reported in the titles and abstracts of each article was independently assessed by the authors in order to determine which papers needed additional investigation. Going over each document that satisfied the pre-established requirements to be included in the review was the following stage. The selection of an article for inclusion in the review was based on the evaluation procedure's results. By accelerating the selection of articles for further evaluation, this criterion was able to accomplish the goal of facilitating a thorough analysis of previous research and the factors that qualified them for the review.

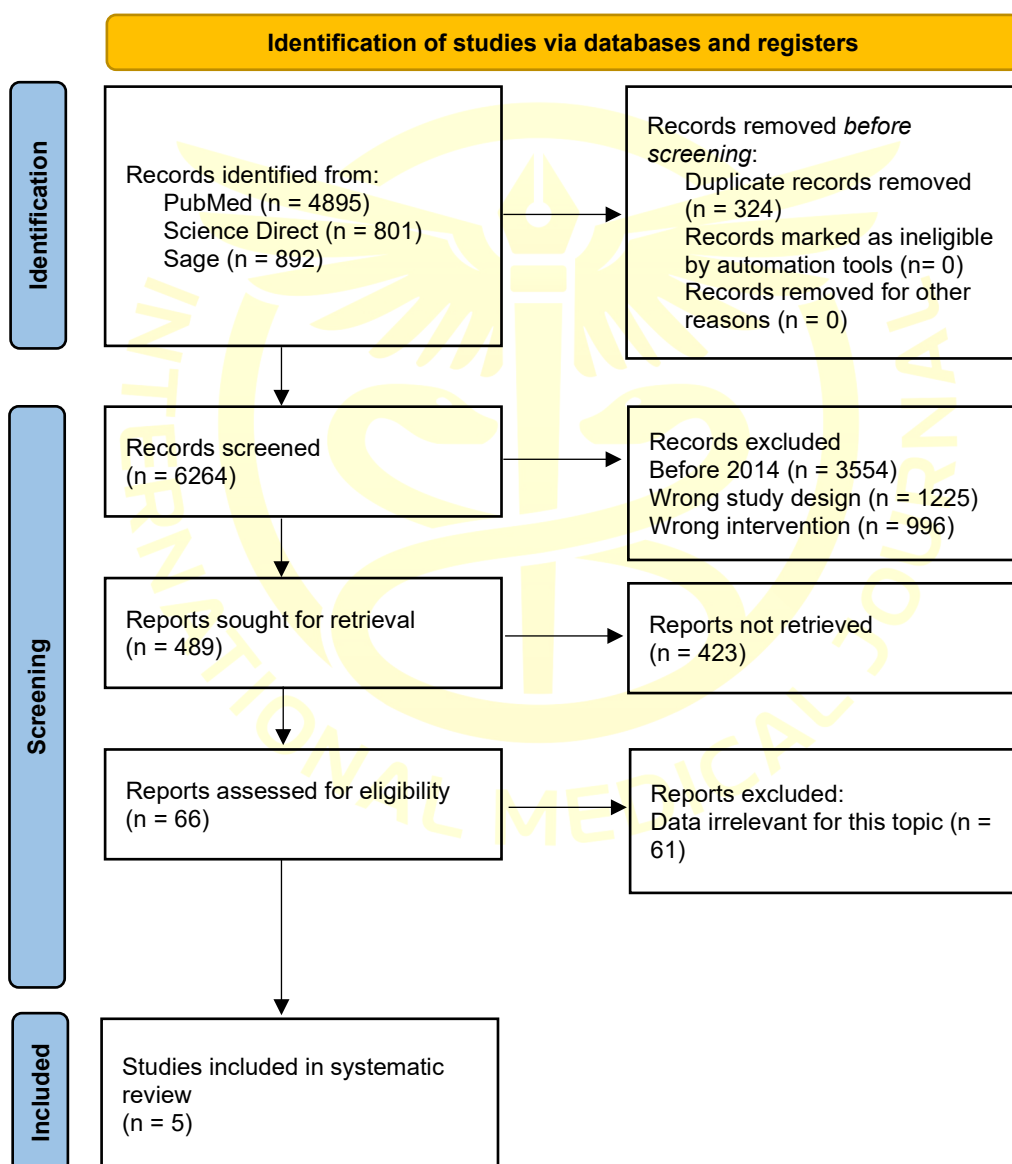


Figure 1. Article search flow chart

RESULT

Using reputable resources like Science Direct, PubMed, and SagePub, our research team first gathered over 6525 publications. A thorough three-level screening strategy was used to identify only five papers as directly relevant to our ongoing systematic evaluation. Next, a thorough study of the entire text and further examination of these articles were selected. Table 1 compiles the literature that was analyzed for this analysis in order to make it easier to view.

Table 1. The literature included in this study

Author	Origin	Method	Sample	Result
Ramadan, S et al., 2024⁹	Sweden	This retrospective study included patients with conservatively treated acute appendicitis at Skåne University Hospital, Sweden during 2012-2019. Information on patient demographics at index admission and follow-up data were retrieved from medical charts and	379	In total, 379 patients with conservatively treated acute appendicitis were identified, of which 78 (20.6%) had recurrence. All patients were followed-up for a minimum of 41 months after the first diagnosis of acute appendicitis unless appendectomy after successful conservative treatment or death occurred during follow-up. The median time to recurrence was 6.5 (1–17.8) months. After multivariable logistic regression analysis, external appendix diameter >10 mm [OR 2.4 (CI 1.37–4.21), $p = .002$] and intra-abdominal abscess [OR 2.05 (CI 1.18–3.56), $p = .011$] on computed tomography were significant independent risk factors for

		radiologic images.		recurrent appendicitis. Appendicolith was not associated with an increased risk of recurrence.
Ozdemir, K et al., 2023¹⁰	Turkey	The data of 92 patients who were diagnosed with plastron appendicitis in university hospital between 2015 and 2021 were analyzed retrospectively.	92	Interval appendectomy resulted in a lower rate of conversion to open surgery compared to primary surgery, shorter operative time, and lower complication rates. Surgical procedures were found to be superior in detecting neoplasms compared to conservative treatment. After conservative treatment, one of three patients was retreated with the diagnosis of acute appendicitis.
Akbar, HF et al., 2022¹¹	Qatar	This was a single hospital based retrospective, cross-sectional study from Jan 2015 to May 2020. Patients with clinical and radiological features of uncomplicated acute appendicitis with Alvarado's score >6 were	182	One hundred eighty-two cases of uncomplicated acute appendicitis were included and managed conservatively, of which 52.2% were males while 47.8% were females. The median age of the patients was 26 years. Conservative treatment was successful in 26.2% of the patients, with a recurrence of 5.5% in the six-month follow-up period. The mean number of days of hospital stay was three days in patients treated with conservative or surgical treatment.

		included in the study.		
Emamghissi, HJ yet al., 2021¹²	UK	A prospective, cohort study at 97 sites in the UK and Republic of Ireland included adult patients with a clinical or radiological diagnosis of appendicitis that either had surgery or non-operative management.	3420	A total of 3420 patients were recorded: 1402 (41 per cent) had initial antibiotic management and 2018 (59 per cent) had appendicectomy. At 90-day follow-up, antibiotics were successful in 80 per cent (1116) of cases. After propensity score matching (2444 patients), fewer overall complications (OR 0.36 (95 per cent c.i. 0.26 to 0.50)) and a shorter median LOS (2.5 <i>versus</i> 3 days, $P < 0.001$) were noted in the antibiotic management group. Accounting for interval appendicectomy rates, the mean total cost was €1034 lower per patient managed without surgery.
Lotfallah, A et al., 2021¹³	Germany	All patients presenting to our centre with AA between March and July 2020 were included. Six-month follow-up data were collected retrospectively using	57	Fifty-seven patients (n=57) were admitted with AA, 45.6% (n=26) managed conservatively compared to 54.4% (n=31) treated surgically. Higher complication rates were observed amongst the conservatively managed group, although not found to be statistically significant (16% vs 35%; $p=0.131$). There was no significant difference in length of hospital stay

		electronic records.		observed between the two groups (surgical: median, 2; interquartile range, 2-3 vs conservative: median, 3; interquartile range, 2-4). White cell count (WCC) and Alvarado score were higher on admission in the surgical group with statistical significance (p=0.012 and p=0.028, respectively).
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Ramadan, S et al (2024)⁹ showed abscess formation and appendix distension of >10 mm to be potential risk factors for recurrent acute appendicitis after initial successful conservative treatment. Identifying patients with a higher risk of recurrent appendicitis would rationalize the decision to perform appendectomy, instead of NOM.

Ozdemir, K et al (2023)¹⁰ showed performing routine interval appendectomy in plastron appendicitis because there are higher frequency of attacks after conservative treatment, the risk of missing tumors during conservative treatment, and the high rates of complication and conversion to open surgery in the primary surgery group. However, more studies with higher number of sample are needed on this subject.

Akbar, HF et al (2022)¹¹ showed there was a clear indication in favor of the operative management of uncomplicated acute appendicitis. Conservative management is no doubt gaining ground, and a lot of centers are inclined towards non-operative management; therefore, further randomized controlled trials and meta-analyses should be carried out on the matter for a more conclusive verdict.

Emamghissi, HJ yet al (2021)¹² showed there was no standardized antibiotic protocol and the decision to

proceed with surgery was at the clinician's discretion. There is inherent bias when implementing any novel management, and it is challenging to capture changes that result from a different consultant taking over the patient's care, therefore there is the possibility of residual confounding. A large proportion of patients in the antibiotic group were diagnosed clinically, meaning that a presumed diagnosis of appendicitis was given to some patients. This could be a confounder for how many patients had truly unsuccessful non-operative management, particularly those with normal appendix histology. CT was not used universally as in previous RCTs. This is a strength as resource constraints in the National Health Service would probably prevent universal CT scanning if non-operative management were adopted in the future. However, this may have contributed to the 6 per cent negative appendicectomy rate in the group managed non-operatively.

Lotfallah, A et al (2021)¹³ showed the use of conservative management to treat AA compared to appendicectomy remains an area of dispute. However, with careful selection criteria, conservative management of AA can be both safe and effective. As the pressures of the COVID-19 pandemic begin to ease following the implementation of successful vaccination rollout nationally, it is important for UK-

based centres to share their experience of managing AA. Whilst AA remains a clinical diagnosis, we have recommended a stratification pathway to facilitate safe patient selection for conservative management of AA. This will be relevant in situations where non-surgical management is being considered or preferred, as was the case during the initial phase of the pandemic.

DISCUSSION

Acute appendicitis is a common abdominal emergency that requires prompt diagnosis and treatment. For over a century, open appendectomy was the only standard treatment for appendicitis. However, recent studies have challenged the necessity of surgery in uncomplicated cases of appendicitis, and nonoperative management (NOM) with antibiotics alone has emerged as a promising alternative. Although appendectomy has long been considered the gold standard operative management (OM) for acute appendicitis, there is growing interest in NOM with antibiotics in both adults and children.^{14,15}

Appendicitis may present in many forms and with variable complications, rendering optimal treatment challenging. Although surgery has historically been the standard treatment regardless of presentation, multiple studies have

suggested that nonoperative options may be used in both complicated and uncomplicated appendicitis. Appendectomy is generally well tolerated, yet because it is a surgical intervention, there are substantial intraoperative and postoperative risks, such as infection, scars, and delayed recovery.^{16,17}

New scoring models and enhanced imaging in computed tomography permit accurate diagnosis of appendicitis and its manifestations in most patients. For uncomplicated appendicitis, there has been an effort to consider nonoperative management. Antibiotic-only treatment may be an attractive option to patients, as it may be associated with avoidance of surgical scars, reduction of postoperative pain, and faster recovery. It may also provide potential benefits to health care systems by reducing the burden on operating rooms, sparing the use of personal protective gear, and reducing overall costs. At this time, a nonoperative approach for uncomplicated appendicitis with antibiotic treatment is regarded as a safe alternative in select patients.¹⁶

While nonoperative management may offer certain advantages over appendectomy, such as decreased morbidity and shorter recovery time, there are concerns regarding the efficacy and safety of this approach. For instance,

nonoperative management may be associated with a higher rate of recurrent appendicitis and an increase in the duration of hospital stay. Thus, it is important to evaluate the efficacy and safety of nonoperative management compared to appendectomy in uncomplicated cases of appendicitis.¹⁴

Appendectomy has long been the standard treatment for appendicitis, even though successful use of antibiotic therapy as an alternative was reported more than 60 years ago. Although there have been several randomized trials of antibiotics for appendicitis in adults, exclusion of important subgroups (in particular, patients with an appendicolith, who may be at an increased risk for complications), small sample sizes, and questions about applicability to the general population have limited the use of this treatment. As recently as 2014, more than 95% of U.S. patients with appendicitis underwent appendectomy. However, with the pandemic of coronavirus disease 2019 (Covid-19), health systems and professional societies such as the American College of Surgeons have suggested reconsideration of many aspects of care delivery, including the role of antibiotics in the treatment of appendicitis.¹⁸

Searching for the first case of nonoperative treatment of AA, it could be suggested that it is as old as

man itself. The first report of a suspected spontaneous resolution of AA was published in 1910 by Smith and Wood Jones. They described the case of a young Nubian woman where the appendix was found attached with a thick adhesive band to the left pelvic wall suggesting that she had survived appendiceal rupture with abscess formation. The bizarre aspect of the report is that at the time of diagnosis, she was an uneviscerated mummy from the Byzantine era. In 1930 Bailey proposed his non-operative treatment algorithm and in 1959 Coldrey described for the first time a large series of 471 patients treated non-operatively with intravenous antibiotics. The recurrence rate was 48/470 (10.2%) with 1 death, 9 patients requiring abscess drainage, and 48 cases requiring a subsequent appendectomy. Another series from China reported 500 patients with the clinical diagnosis of AA. Of these, 425 had conservative treatment with Chinese traditional medicine and antibiotics were given to some. 7 recurrences have been reported. Conservative treatment has also been reported from doctors in service aboard of the U.S. Navy and the Soviet fishing fleet ships¹⁹

Numerous studies have established laparoscopic appendectomy as the current gold standard treatment for appendicitis as it explicates better results than open appendectomy due to substantial developments in laparoscopic

techniques and instruments. According to a meta-analysis of 33 prospective randomised controlled trials that included more than 3500 patients, laparoscopic appendectomy in adults was associated with a statistically significant reduction in the incidence of length of hospitalisation, post-operative complications, and recovery time.²⁰

Antibiotic therapy was frequently recommended as a bridge before surgery in patients with suspected appendicitis with no apparent causes for appendicectomy, such as evidence of perforation or peritonitis. However, due to inherent pitfalls in the quality and design of individual trials, the routine use of antibiotics in patients with uncomplicated acute appendicitis was not adequately supported. Given that other intra-abdominal inflammatory diseases, including colonic diverticulitis, are frequently treated non-operatively, the significance of antibiotic therapy in acute uncomplicated appendicitis may have been underestimated solely based on tradition rather than evidence. It is possible to identify a minor proportion of cases with complex appendicitis owing to the availability of diagnostic modalities, including computed tomography (CT) and ultrasound (US). Furthermore, epidemiological research indicates that, despite a rising tendency in surgical exploration for suspected appendicitis over the years, the

incidence of perforated appendicitis has remained consistent across all age groups.²⁰

In a 2016 guideline, the World Society of Emergency Surgery concluded that antibiotic therapy can be successful in selected patients with uncomplicated appendicitis who wish to avoid surgery (level of evidence 1; grade of recommendation, A). A 2014 survey of Irish surgeons found that about one fifth routinely treat appendicitis nonoperatively. However, little clinical guidance exists for practitioners in terms of how nonoperative treatment is administered so they can best select and inform patients, and provide care to achieve similar efficacy and safety as established in published trials.²¹

Since Fitz et al. described the relationship between the appendix and pelvic abscess in 1886, which result in high mortality, appendectomy became the preferred treatment for AA. In the absence of antibiotics, appendectomy can reduce the risk of uncontrolled pelvic infection to save lives. Bailey et al. described the conservative management of appendicitis in 1930, including resting and fasting followed by delayed elective appendectomy. Though appendectomy was the mainstay treatment, antibiotics were available. Coldrey E reported using antibiotic therapy to treat 471 AA in 1956 with low mortality (0.2%), and only 14.4% patients had recurrence.

Eriksson S reported no different efficacy between antibiotics and appendectomy in a randomized.²²

CONCLUSION

In conclusion, for adult patients with acute appendicitis (AA), conservative treatment has a high efficiency, although still slightly lower than that of appendectomy, but its incidence of complications is significantly lower than that of emergency surgery. Therefore, for patients who do not have a strong desire for emergency surgery or refuse emergency surgery, a conservative treatment that mainly entails anti-infection may be temporary. Nevertheless, it is necessary to emphasize the risk of recurrence and converting to operation in conservative treatment, and the rate of reoperation is higher than that of emergency operation.

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