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Original Research Article

Effects of Management of Appendicitis with Antibiotics versus Appendectomy in Early Management in Uncomplicated Appendicitis

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Abstract: *Uncomplicated acute appendicitis has traditionally been managed surgically, but recent studies suggest that non-operative management with antibiotics may offer a viable alternative. Evaluating the comparative outcomes of both approaches is crucial for optimizing patient care and resource utilization, especially in resource-constrained settings.* ***Objective:*** *To compare the outcomes of early management of uncomplicated appendicitis with intravenous and oral antibiotics versus laparoscopic appendectomy.* ***Methods:*** *This quasi-experimental study was conducted in the Department of General Surgery at Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro. The sample size was completed in five months from November 2024 to March 2025. A total of 196 patients diagnosed with uncomplicated acute appendicitis were enrolled using consecutive non-probability sampling and equally divided into two groups. Group A (n=98) received intravenous ertapenem (1 g/day) for three days, followed by oral levofloxacin (500 mg once daily) and metronidazole (500 mg thrice daily) for seven days. Group B (n=98) underwent laparoscopic appendectomy. Baseline pain scores were recorded using the Visual Analog Scale (VAS). Patients were reassessed on days 1, 2, and 7 post-intervention for treatment failure, complications, and pain severity. Data were analyzed using SPSS version 25, with chi-square and Mann-Whitney U tests applied where appropriate. A p-value of <0.05 was considered statistically significant.* ***Results:*** *The median age (IQR) of patients was 37 (15) years in Group A and 36 (12) years in Group B. There was no significant difference in hospital stay between the groups (p = 0.239). Treatment failure occurred in 32 patients (32.7%) in the antibiotic group compared to 6 patients (6.1%) in the surgical group (p<0.001). No statistically significant differences were observed between the two groups in terms of postoperative complications (p = 0.172) or VAS pain scores at follow-up (p > 0.05).* ***Conclusion:*** *Laparoscopic appendectomy demonstrated a significantly lower rate of treatment failure compared to antibiotic therapy in patients with uncomplicated acute appendicitis. However, both interventions showed comparable outcomes in terms of hospital stay duration, pain severity, and complication rates. Surgical management remains the more definitive treatment, although antibiotics may be considered in selected cases.*

Keywords: Appendectomy, Antibiotic Therapy, Laparoscopy, Treatment Outcome, Uncomplicated Appendicitis

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Introduction

The most frequent acute intra-abdominal emergency is appendicitis, which can manifest as anything from asymptomatic and self-resolving to severe infection and mortality. The diagnosis must rely on clinical symptoms and signs, or clinical grading systems, because no investigation is entirely accurate. As a result, it is often misdiagnosed. The mechanism in many cases is thought to be fecal blockage of the appendiceal lumen. Several factors interact to determine how quickly appendicitis progresses if treatment is not received.

Since McBurney's 1889 report, appendectomy has been the standard treatment for acute appendicitis. Since the 19th century, it has been widely believed that, without surgery, the condition frequently progresses from uncomplicated to perforated appendicitis (3). The advent of laparoscopic surgery and the low threshold for surgical intervention have raised the risk of unnecessary surgery-related morbidity and high negative appendectomy rates (4). Individuals who have early, uncomplicated appendicitis may benefit from non-operative management with supportive care and antibiotics; most cases resolve after this treatment. Antibiotic treatment was commonly considered a temporary solution before surgery in patients with suspected appendicitis who did not exhibit any overt signs of appendicectomy, such as perforation or peritonitis (5). However, there was no evidence to support regular administration of antibiotics for individuals with uncomplicated acute appendicitis because of intrinsic faults in the quality and design of individual investigations (6).

Recent reports of lower morbidity linked to antibiotic treatment compared to surgery for uncomplicated acute appendicitis have called into question this long-standing practice (7). Diagnostic techniques like computed tomography and ultrasound have made it possible to identify the limited number of people who arrive with complex appendicitis (8). Additionally, epidemiological data indicate that the incidence of perforated appendicitis has remained comparable across all age groups, despite the growing trend of surgical investigation for suspected appendicitis over time (9). However, further research is necessary to determine how to treat the vast majority of patients with simple appendicitis (10).

In recent years, systematic reviews and meta-analyses of the literature, including a Cochrane review that contrasted antibiotic treatment with appendicectomy, have summarized the data as either inconclusive or in favor of antibiotic treatment. This could result from reducing the evidence to a summary of both randomized and non-randomized studies, or from incorporating trials with poor methodology or those that had been withdrawn after publication. Therefore, to bridge the gap in the literature, the current study aimed to compare the outcomes of early management of uncomplicated appendicitis with antibiotics versus appendectomy. The study results will guide a better approach for managing patients with uncomplicated appendicitis, aiming to reduce the risk of complications and decrease the need for unnecessary surgical intervention. This, in turn, will help reduce the cost of treatment and hospitalization, as well as improve patient satisfaction.

Methodology

This quasi-experimental study was conducted at the Department of General Surgery, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, following ethical approval from the institutional review committee. The sample size was completed in 5 months, from November 2024 to March 2025. A total of 196 patients diagnosed with uncomplicated acute appendicitis were enrolled using a non-probability consecutive sampling technique. The sample size was calculated based on an expected prevalence of 48.1%, with a 95% confidence level and a 7% margin of error.

Eligible participants included adult patients between 18 and 60 years of age of either gender with imaging-confirmed uncomplicated acute appendicitis. Diagnosis was based on computed tomography (CT) criteria, including an appendiceal diameter greater than 6 mm with wall thickening, along with at least one of the following findings: abnormal contrast enhancement of the appendiceal wall, peri-appendiceal edema due to inflammation, or localized fluid collections. Patients were excluded if they presented with complicated appendicitis characterized by walled-off abscesses, diffuse peritonitis, septic shock, recurrent appendicitis, suspected neoplasms, significant free air or free fluid, or severe phlegmon on imaging, especially where extensive procedures such as ileocolectomy were anticipated.

Informed written consent was obtained from all participants. At enrollment, a standardized data collection form was used to record demographic characteristics, clinical presentation, and physical examination findings. Diagnosis was confirmed in all cases through abdominal CT. Baseline pain intensity was measured using the Visual Analog Scale (VAS), with scores ranging from 0 (no pain) to 10 (worst possible pain), categorized as mild (1–3), moderate (4–6), or severe (7–9).

Patients were randomized into two groups (n=98 each) using an odd-even allocation method. Group A received conservative management with antibiotics, while Group B underwent laparoscopic appendectomy. The antibiotic regimen included intravenous ertapenem sodium 1 g once daily for three days, initiated in the emergency department. Patients were reassessed by the on-call surgeon within 12 to 24 hours of admission to evaluate clinical progression. If signs of peritonitis, appendiceal rupture, or clinical deterioration were noted, surgical intervention was undertaken. Following intravenous therapy, oral levofloxacin 500 mg once daily and metronidazole 500 mg three times daily were administered for an additional seven days.

Patients in Group B underwent standard laparoscopic appendectomy using a three-port technique. Prophylactic antibiotics, including cefuroxime 1.5 g and metronidazole 500 mg, were administered 30 minutes prior to incision. Postoperative antibiotics were not continued unless clinically indicated by infection. All surgeries were performed by consultant surgeons. Histopathological confirmation of appendicitis was based on the presence of transmural neutrophilic infiltration within the muscularis layer of the appendix. A histologically normal appendix was considered treatment failure in the surgical group. In the antibiotic group, treatment failure was defined as any case that ultimately required appendectomy or anesthesia for additional appendicitis-related procedures.

Patients were followed up clinically at 24 hours (Day 1), 48 hours (Day 2), and Day 7 post-intervention. Outcomes were recorded in the study proforma. The primary outcome was treatment failure, as defined above. Secondary outcomes included hospital stay duration, VAS pain score at different time intervals, and postoperative or post-treatment complications such as incisional pain, persistent abdominal discomfort, diarrhoea, intraabdominal abscess, and perforation.

Data were analysed using SPSS version 25.0. The Shapiro-Wilk test confirmed non-normal distribution of continuous variables; therefore, quantitative data were presented as medians with interquartile ranges (IQR). Categorical variables were expressed as frequencies and percentages. Between-group comparisons for categorical variables such as treatment failure and complication rates were performed using the Chi-square test. Comparisons of continuous variables, including VAS pain scores and hospital stay duration, were analyzed using the Mann-Whitney U test. A p-value ≤ 0.05 was considered statistically significant.

Results

A total of 60 patients participated in the study, divided into Group A (bupivacaine) and Group B (bupivacaine with steroids). Group A had 30 patients A total of 196 patients were enrolled. In the antibiotic group, the median (IQR) age of the patients was 37 (15) years, while in the appendectomy group, it was 36 (12) years. The antibiotic and appendectomy groups had median (IQR) hospital stays of 3 (1) and 3 (1) days, respectively, and the difference between the two groups was not statistically significant (Z = -1.176, p = 0.239). The median (IQR) VAS pain score was 8 (1) for antibiotic group and 8 (1) for appendectomy group at baseline (Z=0.000, P=1.000); 5 (1) for antibiotics and 5 (1) for appendectomy group after 24 hours of intervention (Z=-1.265, p=0.206); 2 (1) for antibiotics and 2 (2) for appendectomy group after 48 hours of intervention (Z=-1.389, p=0.165); and 0 (0) for both groups after 7 days (Z=0.000, p=1.000) (Table-1).

Concerning gender, there were 54 (55.1%) males and 44 (44.9%) females in Group A and 59 (60.2%) males and 39 (39.8%) females in Group B (Figure 1).

In Group A, there were 26 (26.5%) patients in the 18- to 30-year age group, 49 (50%) patients in the 31- to 45-year age group, and 23 (23.5%) patients in the 46- to 60-year age group. In Group B, there were 28 (28.6%) patients in the 18- to 30-year age group, 54 (55.1%) patients in the 31- to 45-year age group, and 16 (16.3%) patients in the 46- to 60-year age group (Figure 2).

In terms of treatment failure, 32 (32.7%) patients experienced treatment failure in Group A, compared to 6 (6.1%) in Group B ($\chi 2 = 22.068$, $p < 0.001$). In terms of complications, the results showed that in Group A, no complications were seen in 92 (93.9%) patients, persistent abdominal pain was seen in 0 (0%) patient, diarrhea occurred in 4 (4.1%) patients, intra-abdominal abscess was formed in 1 (1%) patient and perforation occurred in 1 (1%) patient. In Group B, no complications were observed in 95 (97%) patients, while 1 (1%) patient reported persistent or incisional abdominal pain, and an intra-abdominal abscess formed in 2 (2%) patients ($\chi^2 = 6.381$, $p = 0.172$) (Table 2).

Table 1: Median (IQR) of the demographic and clinical variables (n=196)

Variable	Group A (Antibiotic) n = 98	Group B (Appendectomy) n = 98	Z value	p value
Age (in years)	37 (15)	36 (12)	–	–
Duration of hospital stay (in days)	3 (1)	3 (1)	-1.176	0.239
VAS pain score at baseline	8 (1)	8 (1)	0.000	1.000
VAS pain score 24 hours after intervention	5 (1)	5 (1)	-1.265	0.206
VAS pain score 48 hours after intervention	2 (1)	2 (2)	-1.389	0.165
VAS pain score at 7th day	0 (0)	0 (0)	0.000	1.000

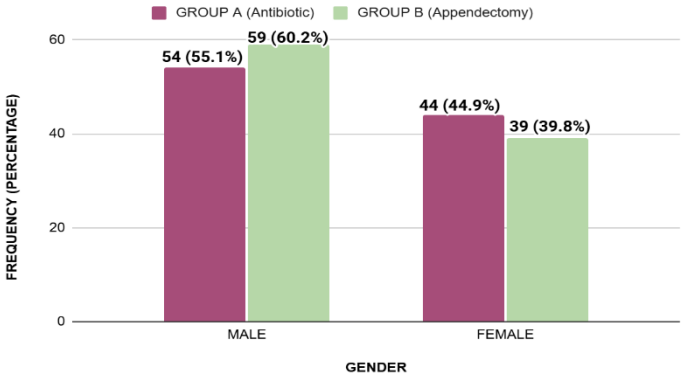

Figure 1: Gender distribution of patients in both groups (n=196)

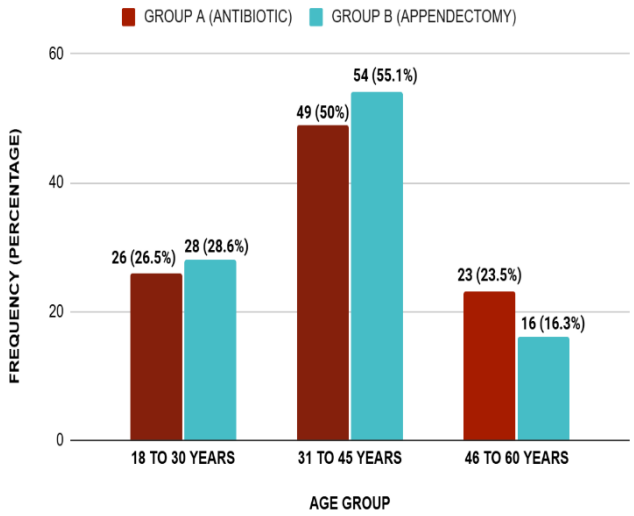

Figure 2: Distribution of patients concerning age group (n=196)

Table 2: Comparison of both groups in terms of treatment failure and complications (n=196)

Variables	Group A (Antibiotic) n = 98	Group B (Appendectomy) n = 98	χ^2 value	p value
Treatment failure				
Yes	32 (32.7%)	6 (6.1%)	22.068	<0.001
No	66 (67.3%)	92 (93.9%)		
Complications				
None	92 (93.9%)	95 (97%)	6.381	0.172
Incisional/persistent abdominal pain	0 (0%)	1 (1%)		
Diarrhea	4 (4.1%)	0 (0%)		
Intraabdominal abscess	1 (1%)	2 (2%)		
Perforation	1 (1%)	0 (0%)		

Discussion

The current study's findings revealed that in patients with uncomplicated acute appendicitis, laparoscopic appendectomy was significantly associated with a lower rate of treatment failure compared to antibiotics, i.e., 6.1% versus 32.7% ($p < 0.001$). However, there were no significant differences between the two treatment modalities in terms of duration of hospitalization, pain severity, or complications.

The cause of acute appendicitis is still unknown, and many surgeons now use imaging tests to support clinical diagnoses before surgery (12). Imaging does have significant ramifications, though, especially when it comes to younger patients' exposure to radiation from CT scans (13). An appendectomy carries a high risk of morbidity and death as well. Determining if appendectomy is still the best course of action for treating acute appendicitis is crucial (15). Recently, several authors have suggested using antibiotics as a conservative treatment for acute

appendicitis (16). Due to the risk of recurrent appendicitis and the potential for an undetected cancer, some authors recommend interval appendectomy; nonetheless, there seems to be an increasing tendency toward the use of antibiotics alone and the complete avoidance of surgery (17). To rule out a missing malignant lesion, the patient may undergo further radiologic or endoscopic testing. Given this developing discussion, it is important to keep in mind that other intra-abdominal inflammatory diseases are treated conservatively and that the current approach to treating acute appendicitis is primarily based on traditional practice rather than research (19). But in reality, treating appendicitis with antibiotics is tricky. It depends on several variables (e.g., children versus adults, simple versus complex appendicitis, time between appendectomy and ultimate treatment, and alternative therapeutic options including percutaneous drainage) (20). Therefore, to address the gap in the existing literature regarding the effectiveness of antibiotics, the current study was conducted to compare the outcomes of managing uncomplicated acute appendicitis with antibiotics versus appendectomy.

In terms of treatment failure, our study results revealed that antibiotics were associated with a 32.7% treatment failure rate, compared to laparoscopic appendectomy, which had a significantly lower treatment failure rate of 6.1% ($p < 0.001$). St Peter et al. revealed that treatment failure occurred in 34% of the patients who received antibiotic therapy compared to 8% patients who underwent appendectomy (12). Rocha et al. revealed that up to 20% of patients who received medical care had treatment failure and had to undergo surgical intervention, whereas appendectomy failed in 10% of the patients (13). Iresjo et al. in a study revealed that antibiotics prevented surgical intervention in 50% to 72% of patients with acute appendicitis. (15) Poprom et al. in a meta-analysis revealed that the treatment success rate of antibiotics was lower compared to the surgical intervention for acute appendicitis (16). Fitzmaurice et al. in a meta-analysis revealed that despite raising important issues and showing how antibiotics might be used as a stopgap measure before surgery, none of the studies included in their review provided sufficient evidence to support their conclusions that antibiotics could be used as a final treatment for acute appendicitis (1). These results corroborate those of our study, which found that in patients with simple appendicitis, appendectomy—especially laparoscopic appendectomy—was linked to a higher success rate than antibiotics. However, conclusions were constrained by the significant degree of variability among the studies included in the meta-analysis, especially regarding the criterion of treatment success. De Almeida Leite et al. found no significant difference in the success rate between operative and non-operative management of acute appendicitis (14). Similarly, our study found no advantage of antibiotics over appendectomy.

In terms of complications, our study results showed that although antibiotics were associated with higher rates of complications, particularly diarrhea, there was no significant difference between laparoscopic appendectomy and antibiotics in patients with uncomplicated appendicitis. According to de Almeida Leite et al., there was no discernible change in the operative and non-operative management of appendicitis in terms of major and minor complications (14). St Peter et al. revealed that the antibiotic group was associated with significantly higher adverse effects of mild to moderate intensity compared to the appendectomy group (relative risk 4.3, $p<0.0001$) (12). On the contrary, Poprom et al. revealed that appendectomy was associated with higher rates of complications (16). Different studies have yielded varying results regarding complications related to appendectomy versus antibiotics. However, the differences between our study findings and those conducted previously can be attributed to the type of complications assessed, appendectomy performed via the open route, and the duration over which they were evaluated.

We found no statistically significant difference between the two methods in terms of hospital stay duration. According to Liu et al., the length of hospital stay did not differ significantly between the two groups (4). In a similar vein, Varadhan et al. found no discernible difference in the length of hospital stay between the groups receiving antibiotics and those undergoing appendectomy (18). These findings support our study findings. However, de Almeida Leite revealed that the duration of hospital stay was significantly longer in the non-medical management of appendicitis compared to operative management (14). This difference may be due to the severity of the infection and the type of antibiotic used. Although antibiotics appear to have a potential role in treating acute appendicitis, the authors acknowledge that there is currently insufficient data to alter practice.

The study had certain limitations. The results of this study cannot be generalized because it was a single-center study with a small sample size. Secondly, the patients were not assessed over a longer term during which further complications might have arisen. Thirdly, comparison of antibiotics with open appendectomy was not done, so it cannot be commented on whether antibiotics are associated with better outcomes than appendectomy. Lastly, the recurrence of appendicitis in the antibiotic group was not assessed.

Conclusion

The current study concluded that, in patients with uncomplicated appendicitis, laparoscopic appendectomy was superior to antibiotics in terms of treatment failure rates. At the same time, both modalities were equal in terms of complications and duration of hospital stay. To lower future risk and morbidity related to appendicitis, it is suggested that all patients with uncomplicated appendicitis have laparoscopic appendectomy, given the high success rate and no potential for recurrent appendicitis. In certain cases of simple appendicitis, nonoperative treatment with antibiotics may be adequate. If primary antibiotic treatment is to be regularly provided as first-line therapy, patients must get the proper counseling. Future studies should be conducted on a larger sample size to validate the current study's results.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-LUMHS-084-24)

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The authors declared the absence of a conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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