

# Evaluating The Effectiveness Of Antibiotic Therapy In Treating Acute Appendicitis

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## Abstract

**Introduction:** Antibiotic treatment of unselected patients with acute appendicitis is safe and effective. However, it is unknown to what extent early provision of antibiotic treatment may represent overtreatment due to spontaneous healing of appendix inflammation.

**Objective:** This study aims to anticipate the efficacy of antibiotic therapy in treating critical appendicitis.

**Methods:** This retrospective analysis includes patients with acute appendicitis treated in the Department of Surgery, in various hospitals in Cumilla. The study took place between January 2022 and June 2023. Patients were classified into two groups, the antibiotic group and the control group based on computed tomography (CT) findings on the first visit, and the treatment course was subsequently compared.

**Results:** In this study involving 252 participants diagnosed with acute appendicitis, there were two groups: the antibiotic group (n = 138) and the control group (n = 114). The study found that the appendectomy rate during the first hospital stay was 28% for the antibiotic group and 53% for the control group, showing a significant difference (P < .004). Life table analysis revealed that there was a time-dependent variation in the need for appendectomy during the follow-up period (P < .03). The use of antibiotics led to a 72% to 50% reduction in the need for surgical exploration and appendectomy compared to 47% to 37% in the control group over the follow-up period of 5 to 72 days.

**Conclusion:** Early antibiotic treatment is more effective than the traditional "wait and see" approach to prevent the need for surgical exploration and appendectomy.

**Keywords:** Appendicitis, Laparoscopy, Early antibiotic, Traditional treatment, Acute Appendicitis

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## I. Introduction

The use of antibiotics as a conservative treatment for acute appendicitis has become increasingly common in recent years [1-5]. However, some in the surgical community are still uncertain about its effectiveness compared to traditional in-hospital monitoring and surgical procedures [6, 7]. Studies, including both observational and randomized ones, have shown that providing appropriate antibiotic treatment to all patients with acute appendicitis could potentially reduce the need for surgery by around 50% within 6 to 8 years of follow-up [1, 2, 8]. It has been indicated that antibiotics have shown positive results in treating both uncomplicated (mostly phlegmonous) and complicated (gangrenous, perforated) appendicitis by preventing or delaying the need for surgery. This suggests that emergency late-night surgeries may not be necessary for medical reasons to avoid suboptimal surgical conditions [9, 10]. However, it is still uncertain whether antibiotics may be an over-treatment for patients with early and mild onset of appendicitis, as it is not clear to what extent infection initially triggers and drives appendix inflammation [11]. If this is the case, antibiotics may only be beneficial in a later stage of progression. Therefore, from an evidence-based perspective, it is still unknown whether antibiotic treatment for early, mild appendicitis is effective in addition to traditional in-hospital observation, before a decision is made regarding surgery or discharge without surgery [12]. This study aims to find an alternative way to treat appendicitis by using antibiotics. The written consent and ethical clearance were completed beforehand.

## II. Objective

- *General objective:* The objective of this study is to find an alternative treatment for acute appendicitis other than traditional treatment.
- *Specific objective:* This study aims to assess the efficacy of the use of antibiotics in treating acute appendices.

## III. Methodology

A total of 268 patients, who visited different hospitals in Cumilla for the treatment of acute appendicitis, from January 2022 to June 2023 were selected for this randomized controlled study. Among these 268 patients,

3 patients were excluded from this study due to incomplete follow-up and 13 were excluded due to adverse effects of antibiotic therapy. The study patients were of 18 to 60 years old.

- **Inclusion criteria:** Patients aged more than 18 years, with leucocyte blood count <13,000/mL, and CRP <60 mg/L were included. Patients with acute appendicitis were included only.
- **Exclusion criteria:** Patients more than 60 years old, with adverse reactions to antibiotics were excluded. Also, patient who came with 2<sup>nd</sup> or third time treatment for the appendicitis were excluded.

The patients were divided into two groups, the antibiotic group (n = 138) and the control group (n = 114). All the data were collected from the hospitals. The attending physicians made surgical decisions based on disease history, clinical status, biochemical tests, and computed tomography (CT), as well as gynecological examination when deemed necessary. The follow-up sessions were completed by in-person meetings and phone calls. Group comparisons were performed using a two-sided analysis of variance. The overall frequency of the primary medical event (appendectomy) was statistically compared using chi-square analysis when patients were discharged from the hospital and by lifetable analysis until December 2023. P value > 0.005 was counted as a significant value. Ethical clearance was ensured by the hospital authorities before the study. Well-informed written consent papers were signed by the patients.

#### IV. Result

Figure-1 shows the study patient inclusion criteria. Inflammatory blood markers (CRP, white blood cells), body temperature, liver and kidney function tests, and serum electrolyte levels were similar between patients treated with antibiotics and those in the control group at the beginning of the study. The results of multiple regression analysis suggested that CRP and leucocytes were the key factors. The total length of hospital stay was nearly the same in both the antibiotics group and the control group ( $2 \pm 1.2$  days; mean  $\pm$  SD) [Table-1]. When Appendixes were examined microscopically using the Swedish standard criteria, the rate of complicated appendicitis (gangrenous, perforated) was found to be similar for all patients included in the study (14.5% vs. 12.2%) [Table-2].

Figure-1: Patients selection

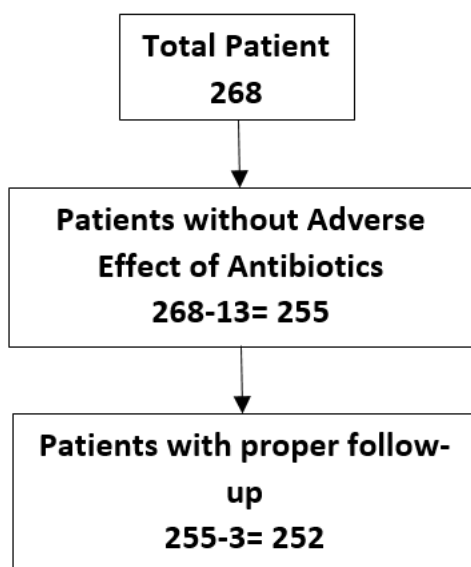


Table-1: Characteristics of study patients

	Variables	Antibiotics group N= 138	Control group N=114
Clinical characteristics	Sex (male/female) (%)	100/100	90/110
	Age (years)	48 $\pm$ 8	46 $\pm$ 11
	Body temperature (C)	37.9 $\pm$ 0.1	36.9 $\pm$ 0.08
	C-reactive protein (mg/L)	26 $\pm$ 2	24 $\pm$ 2
	WBC (Leukocytes)/mL	10716 $\pm$ 240	11189 $\pm$ 460
Liver function tests	Serum bilirubin (mmol/L)	21 $\pm$ 10	11 $\pm$ 1
	Alkaline phosphatase (mkat/L)	1.13 $\pm$ 0.05	1.40 $\pm$ 0.09
	Aspartate aminotransferase (mkat/L)	0.48 $\pm$ 0.04	0.38 $\pm$ 0.02
	Alanine aminotransferase (mkat/L)	0.61 $\pm$ 0.09	0.42 $\pm$ 0.06
	Serum creatinine (mmol/L)	72 $\pm$ 2	73 $\pm$ 2

Serum electrolytes	Na (mmol/L)	139 ± 0.3	139 ± 0.3
	K (mmol/L)	4 ± 0.05	4 ± 0.05
Abdominal status	Vomiting (%)	39	54
	Local tenderness (%)	97	100
	Clinical signs of peritonitis (%)	0	0
	CT investigation (%)	42	36
	Ultrasound (%)	6	4
	Operation at first hospital stay (n)	38 (28%)	60 (53%), P < .004
	Hospital stay (d)	2.2 ± 1.1 (SD)	2.0 ± 1.2 (SD)

Table-2: Histopathological classification of resected appendices

Appendix histopathology	Antibiotics group	Control group	P value
Percent of operated patients	N= 38	N= 60	
Gangrenous and/or perforated (%)	52.6 %	23.3 %	< .07
Phlegmonous (%)	47.4 %	60.0 %	
Normal appendix (%)	0 %	16.7 %	
Percent of included patients	N= 138	N= 114	
Gangrenous and/or perforated (%)	14.5 %	12.2 %	
Phlegmonous (%)	13.0 %	31.6 %	< .05
Normal appendix (%)	0 %	8.8 %	< .05
Recovered without operation (%)	72.4 %	47.4 %	< .01

## V. Discussion

Appendectomy, the surgical removal of the appendix for acute appendicitis, is one of the most common surgical procedures globally. The approximate mortality rate for this procedure is around 0.1%, with significant long-term complications ranging from 2% to 3% [24]. Serious complications following surgical appendectomy are still significant concerns and may lead to lifelong issues such as abdominal hernias, conditions resulting in intestinal blockages requiring additional surgeries, and in some cases, intestinal strangulation leading to the removal of parts of the intestine [24, 25]. The potential differences in risks for effects on fertility in females undergoing antibiotic treatment versus surgical appendectomy have been debated, but a recent review did not find evidence to support such events [24, 26]. It has been observed that a considerable number of patients are highly willing to try antibiotic treatment as a first option, before resorting to definitive appendectomy, when provided with evidence-based information from published reports. This preference for antibiotics over surgery has been noted by others as well [27]. This has sparked an important debate among surgeons as to whether antibiotic treatment can be a feasible and relevant first-line therapy for patients who prefer conservative alternatives to immediate surgical exploration [28]. This is particularly relevant in light of the increased demand for healthcare resources due to widespread Covid infections, as noted by the American College of Surgeons [29]. Previous reports have indicated that antibiotic treatment for acute appendicitis is safe and associated with significantly fewer complications compared to immediate surgical interventions, particularly those involving open surgery [1, 2]. However, the use of antibiotics for patients with early and uncomplicated appendicitis with mild symptoms may lead to overtreatment if a high frequency of spontaneous healing occurs [20, 22]. Therefore, previous positive results on antibiotics versus acute surgery should also be evaluated in comparison to in-hospital observation only, before deciding whether to proceed with appendectomy or non-operative management, followed by safe discharge from the hospital.

The results of an investigation on highly selected patients with a low risk for advanced appendicitis showed that there was a reduced frequency of initial and subsequent operations in the study patients compared to the control group [38]. These findings are consistent with earlier studies on unselected patients with acute appendicitis [1, 2]. These results are important and confirm the hypothesis that administering appropriate antibiotics is statistically superior to traditional in-hospital "wait and see procedures," which are also characterized by regression and spontaneous healing [20]. This supports the idea that infection is not the primary trigger and driver of progressive appendix inflammation [11]. An important observation is that the early provision of antibiotics may reduce "false positive appendicitis" (by 9%-17%) in patients with early onset of assumed acute appendicitis, which can significantly improve the optimal surgical treatment of acute appendicitis if confirmed in larger patient populations (P < .07; Table II). This conclusion is based on the fact that diagnostic precision by imaging is usually not above 90% specificity in acute hospital services [30]. Additionally, it is important to consider and account for the long-term radiation risks of CT scans, as well as kidney impairments from radio-contrasts. Therefore, early antibiotic treatment of insidious acute appendicitis may reduce well-recognized problems with unnecessary abdominal explorations, which may represent around 10% to 15% of patients targeted for appendectomy in publications despite diagnostic criteria [25]. Although higher specificities may be communicated in the literature, these may be dependent on laparoscopy as a preoperative diagnostic procedure.

The studies on antibiotic treatment for acute appendicitis have typically focused on patients with "confirmed uncomplicated appendicitis" based on imaging [12, 16, 31, 32]. However, previous research suggests that antibiotics have significant effects on both complicated (gangrenous, perforated) and uncomplicated (mainly phlegmonous) appendicitis in both randomized and nonrandomized studies [1, 2]. The study hospitals' accurate diagnoses of acute appendicitis in unselected patients are close to 90% specificity, and applying CT scans or ultrasound to all patients would not significantly improve this under most clinical circumstances [13, 30, 33], as also inferred in our study where 2 patients with suspected appendicitis had normal appendixes. The potential role of antibiotics as a first-line therapy is supported by randomized, population-based, and observational studies with similar short and long-term follow-up results [1, 2, 31, 32, 34-36]. Therefore, this topic has been considered relevant for the further development of clinical medicine in surgical institutions worldwide. Several randomized studies have been published, with attempts to evaluate whether out-hospital oral antibiotics alone could be a potential treatment compared to a combination of initial intravenous therapy followed by out-hospital oral therapy. It appears unlikely that frequent recurrences of previous appendicitis will reoccur at significant rates beyond 8 to 10 years of follow-up, according to life-table analyses in previous investigations [37, 8]. Therefore, in our study, we chose to focus on highly selected patients with a low probability risk for rapid progression to severe appendicitis, defined according to our statistical criteria of phlegmonous appendicitis. These patients are frequently considered for active "non-operative management," at least in most European countries [13].

## VI. Limitations

The study's multicenter design may result in data loss, and different patient demographics could yield varied outcomes.

## VII. Conclusion And Recommendation

The previous findings on antibiotic treatment for acute appendicitis have indicated that both initial and long-term outcomes are generally positive and sometimes even very good [1, 2, 8]. These results were obtained in single medical facilities that handle a high number of acute cases (24 hours/7 days a week). Interestingly, even when decisions about whether patients need an appendectomy were based on individual assessments by physicians with varying levels of experience, the results remained promising. Treating acute appendicitis with antibiotics early on might lead to a reduced need for emergency appendectomies in the long run, possibly decreasing to about 50% of all patients [8]. The current findings support the idea that performing "nighttime" acute appendectomies is unnecessary when antibiotics are used and could even be unjustified in order to minimize surgical risks.

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### Conflicts of interest

No conflicts of interest were found

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