



## Post-Operative Antibiotics Duration in the Treatment of Acute Uncomplicated Appendicitis

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### Abstract

**Background:** Appendicectomy is presently the gold standard of treatment for acute appendicitis, although the duration and type of antibiotics administered remains variable in clinical practice. We hypothesized that a shortened course of antibiotics would not lead to adverse outcomes in patients who underwent surgery for uncomplicated appendicitis as compared to a longer course.

**Methods:** This is a retrospective analysis of 940 patients admitted to a tertiary urban hospital. We included adult patients who underwent appendicectomy for acute, uncomplicated appendicitis and who had medical records available from at least one follow-up outpatient visit. We excluded patients who were found to have perforated appendicitis intra operatively, as well as those who had other intra-abdominal infections that may have required treatment.

Patients were divided into two groups: those who received 24 h or less of antibiotics (intravenous and oral), and those who received more than this. Outcomes were then compared between the two groups. The primary outcome was rate of intra-abdominal collection, while secondary outcomes were rates of surgical site infection, re-admission to hospital for infectious issues and antibiotic complications.

**Results and Conclusion:** We found no statistically significant difference in the rate of intra-abdominal collection, or of any of the secondary outcomes between the two groups. Our data suggests that patients who have undergone appendicectomy for uncomplicated antibiotics should not receive a prolonged course of antibiotics as a routine unless other indications are present.

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### Introduction

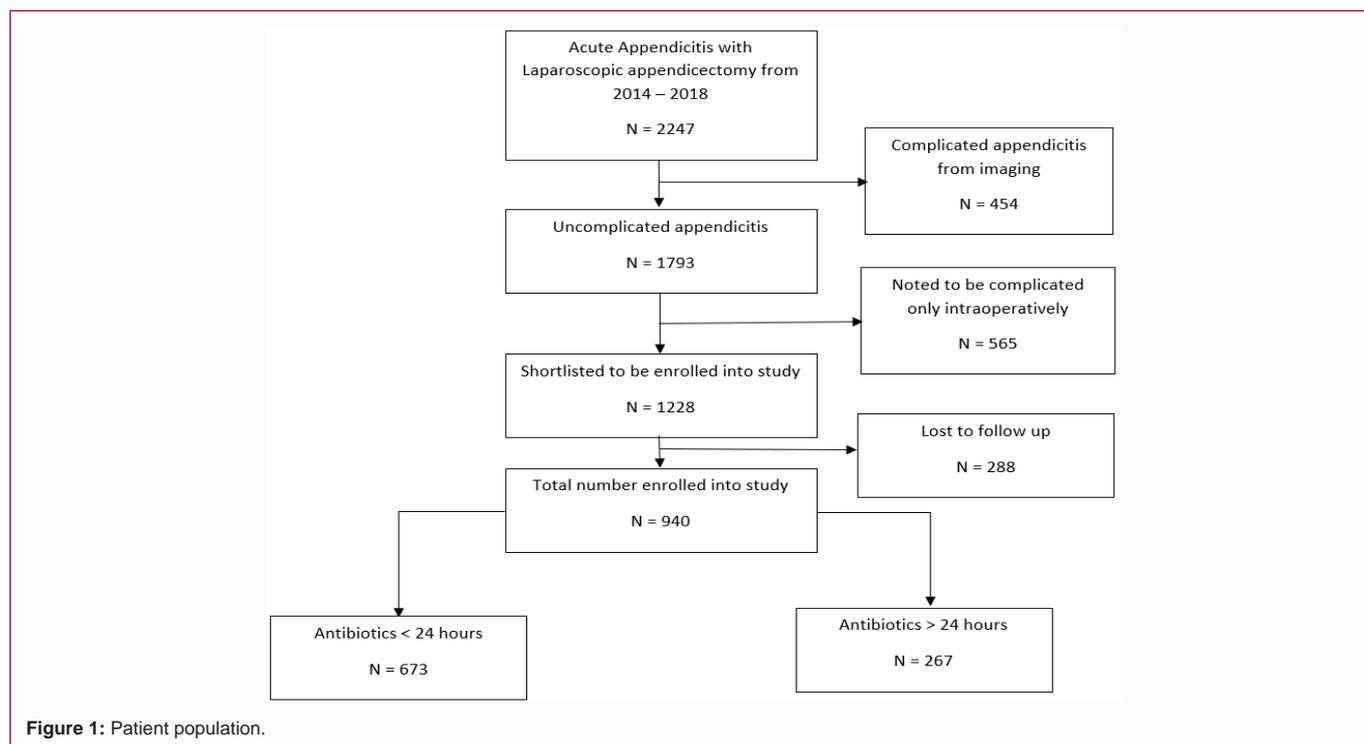
Acute appendicitis is one of the most common diseases faced by general surgeons today, with an estimated annual incidence of 10 per 100,000 populations (Figure 1). The gold standard treatment of appendicitis has traditionally been surgery, although recent studies have called this into question [1,2]. The laparoscopic approach has become widely accepted in many parts of the world [3,4], which has led to significant changes in the rate and complications encountered after surgery.

It is well known that laparoscopic surgery results in a lower wound infection rate than open, at the expense of an increased risk of intra-abdominal collections. The WSES Jerusalem guidelines [1] advise against prolonging the duration of postoperative antibiotics beyond three to five days even in cases of complicated appendicitis once adequate source control is achieved. Given that most (75% to 87%) patients have non-perforated appendicitis, we hypothesized that most patients who have undergone surgery do not need a prolonged course of antibiotics.

Tan Tock Seng Hospital (TTS) is a busy urban hospital in Singapore with one of the highest numbers of emergency admissions daily. We perform over 450 appendicectomies for adults yearly, and there has been a switch from the open to the laparoscopic approach over the past 15 years. The absence of an acute care team means this surgical load is evenly distributed throughout the department, and hence some differences in clinical practice (such as antibiotic choice and duration) were present. We therefore set out to compare the outcomes of patients receiving a shorter course (24 h or less) of antibiotics against those who received a longer course.

### Methodology

This is a retrospective study using available medical records for patients undergoing appendicectomy (both laparoscopic and open) for non-perforated appendicitis. This study was reviewed and approved by our institution's ethics board (the Domain Specific Review Board).



**Table 1: Demographics.**

	≤ 24 h antibiotics (n=673)	>24 h antibiotics (n=267)	p-value
Median Age in years (IQR)	33 (26 – 47)	37 (28 – 51.5)	0.004
Gender			
Female	327	122	0.423
Male	346	145	
ASA classification			
1 or 2	632	247	0.432
3 or 4	41	20	
Histology			
With perforation	24	18	0.034
Without perforation	649	249	

We searched our electronic medical records for all patients who had undergone appendicectomy between January 1<sup>st</sup>, 2014 and December 31<sup>st</sup>, 2018. These records were reviewed, and patients who were found to have perforated appendicitis or abscess formation intraoperatively were excluded. Out of a total of 2,247 appendicectomies performed, 1,228 patients’ records were screened and a further 288 patients who had defaulted their follow-up appointments were excluded as data on outcomes was not available.

### Variables and Outcomes

The remaining patients were then divided into two groups, one which received 24 h or less of antibiotics (n=673 patients) and those who received a longer course (n=267 patients). This cut off was based on the WSES Jerusalem guidelines [4]. For the purposes of this study, both intravenous and oral antibiotics were considered to be equivalent.

The primary outcome was the rate of development of intra-abdominal abscess, while secondary outcomes were superficial

surgical site infections, side effects from antibiotic usage and hospital re-admission rates for any related issues. Rates of intra-abdominal abscess, readmission rate and antibiotic complication rates were compared between the two groups using Fisher’s Exact Test while superficial surgical site infection rate was compared using the Chi-Squared Test. All statistical analysis was performed using IBM SPSS Statistics v26.

### Results

A total of 940 patients were analyzed, and they were divided into 2 groups those who received 24 h or less of antibiotics while the other group received a longer course than 24 h. The demographics of the patient cohort are shown in Table 1. As expected, the majority of the patients were young with a median age of 33 and 37 years in both groups. While a difference in age was observed between the groups, we feel this is unlikely to have any clinical significance particularly on patient outcomes.

While patients found to have perforation intra operatively were excluded from our study, a small number of patients were thought to have non perforated appendicitis whose histology returned as perforation. As Table 1 shows, a higher proportion of patients in the >24 h antibiotic group were found to have perforation compared to the <24 h group (7.2% vs. 3.7%). These patients were therefore excluded from the subsequent statistical analysis to avoid contamination of the results.

On comparing the outcomes, we found the rate of intra-abdominal abscess formation was higher in the longer antibiotic group, despite it not reaching statistical significance in our study. On univariate analysis, patients who received >24 h of antibiotics were found to be more likely to be readmitted (p=0.036) although this difference disappeared on multivariate analysis. There was no difference between the two groups in the other secondary outcomes studied (Table 2, 3).

**Table 2:** Outcomes.

Outcomes	Patients who had received 24 hours or less of postoperative antibiotic therapy (n=673)		Patients who received more than 24 hours of postoperative antibiotics (n=267)	
	Count	Percentage	Count	Percentage
Intra-abdominal abscess	6	0.89%	7	2.62%
Readmission for re-infection	4	0.59%	6	2.25%
Superficial Surgical Site Infection	12	1.78%	6	2.25%
Histology showing perforation	24	3.56%	18	6.74%
Side effects of antibiotics	Total: 1	0.14%	Total:2	0.74%
	- Diarrhoea: 1		- Diarrhoea: 1	0.37%
			- Oral thrush: 1	0.37%

**Table 3:** Primary outcomes.

	≤ 24 h antibiotics (n=673)	>24 h antibiotics (n=267)	p-value	OR (95% CI)
Intra-abdominal Abscess	6	7	0.059	2.993 (0.996 – 8.990)
Superficial surgical site infection	12	6	0.64	1.266 (0.470 – 3.409)
Hospital re-admission	4	6	0.036	3.845 (1.076 – 13.735)
Antibiotics complication	1	2	0.196	5.072 (0.458 – 56.167)

Our results therefore suggest that in patients without frank intraoperative evidence of perforation or gangrene, a longer course of post-operative antibiotics did not lead to a higher rate of complications and potentially could have contributed to additional morbidity.

### Discussion

Our results, while counter intuitive to historical surgical pedagogy, do fit with the findings of several previous groups [6,7]. This finding is significant because the World Health Organization [8] recently released a report advocating for the restriction of antibiotic use to rein in antibiotic resistance. Given that appendicitis is one of the most common diseases treated by general surgeons, it is crucial to restrict antibiotics to the patients who require it. This would help slow the proliferation of microbial resistance to antibiotics while also avoiding unnecessary complications from antibiotic use.

Like previous authors [6], we found a number of patients who had surgical notes indicating no perforation (hence included in our study) although their histological reports showed perforation. This could be from recording errors (the surgeon typing the note wrongly recorded or left out perforation) or from specimen handling during transfer to the pathologist. Regardless, clinical decision making on antibiotic duration would have been based on the recorded finding in most cases, and our initial data shows that these patients did not suffer from a higher rate of infective complications (though these patients were later excluded in the final analysis).

Interestingly, the results we had showed a trend towards a higher odds ratio of complications in patients given more than 24 h of antibiotics. None were statistically significant except for the rates of readmission i.e., patients who were given more antibiotics having a higher rate of readmissions. Some possible reasons for this include these patients being more ill and/or having baseline poorer comorbidities to begin with, which then predisposed them to a negative outcome (For example, patients on immunosuppression, history of diabetes etc), and developing complications in spite of being given more antibiotics.

Our study was retrospective and from a single institution, so care should be taken when generalizing to other settings. It is also possible

that other factors played a role in the managing clinician deciding to give a longer course of antibiotics, and this might not have been picked up. Even so, the lack of a difference in patient outcomes between both groups is reassuring and will hopefully lead to a change in future practice patterns. Given current evidence, it is difficult to envision prospective studies in this setting as it would not be ethical to give patients antibiotics when they have been shown to be unnecessary.

In summary, we advocate stopping antibiotics within 24 h post-surgery for patients who have uncomplicated appendicitis.

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