

# Treatment of acute appendicitis: Urgent surgery or emergent surgery?

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## ABSTRACT

**BACKGROUND:** The standard treatment of acute appendicitis, which is a rapidly progressive inflammatory disease, remains surgery. However, several studies have suggested antibiotics treatment for acute appendicitis, especially in centers where surgery at all hours is not possible. Therefore, in this study, we investigated the relationship between the preoperative waiting period and postoperative complications in patients who underwent interval surgery following conservative management during the same admission.

**METHODS:** All patients who were diagnosed with uncomplicated acute appendicitis between October 2014 and February 2015 and underwent surgery at a single center were included in this retrospective study. Patients were divided into two groups based on the waiting period between the diagnosis and the time of surgery: group A (emergency, waiting period <10 h) and group B (urgency, waiting period ≥10 h). The demographic features, preoperative waiting period, antibiotics use, pathological diagnosis, postoperative complications, length of hospital stay, and readmission were compared between the two groups.

**RESULTS:** This study comprised 160 patients, including 79 and 81 patients in groups A and B, respectively. The demographic features, comorbidities, and pathological diagnosis were comparable between the two groups. The average preoperative waiting period was significantly longer in group B than in group A. However, the mean length of hospital stay and the rate of postoperative complications, including infections at the surgical sites and intra-abdominal abscesses, were similar between the two groups.

**CONCLUSION:** Our analyses revealed that there were no disadvantages associated with a longer preoperative waiting period in patients diagnosed with uncomplicated appendicitis.

**Keywords:** Appendicitis; delayed appendectomy; medical therapy; uncomplicated appendicitis.

## INTRODUCTION

Acute appendicitis (AA) is the most common cause of acute abdomen,<sup>[1]</sup> for which standard therapy is surgery; the mortality rate of AA ranges between 0.07% and 0.7%.<sup>[2,3]</sup> The mechanism underlying AA includes abdominal wall necrosis following a decrease in blood and lymph flow after luminal obstruction, and the delayed diagnosis of AA leads to perforation. Although emergent surgical intervention is considered to prevent the progression of AA, the effects of emergent appendectomy on morbidity and mortality have been reported to have limited benefits based on accumulating evidence. In addition, recent reports regarding pediatric patients have indicated that surgical treatment can be safely postponed with

effective fluid and antibiotic therapy.<sup>[4-6]</sup> Therefore, the waiting period is considered to not contribute to increased morbidity in patients who have to wait for mandatory reasons.

We, therefore, investigated whether AA in adult patients was a surgical emergency requiring immediate intervention and assessed the relationship between preoperative waiting time and postoperative complications.

## MATERIALS AND METHODS

This retrospective study included all the patients who were diagnosed with uncomplicated AA between October 2014 and February 2015 at the study institution. Ethics approv-

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al was not required for this retrospectively designed study (analysing of pre-existing data). This study was conducted in accordance with the 1964 Helsinki Declaration. Informed consent was obtained from all subjects, and all methods were carried out in accordance with the relevant guidelines and regulations. While the inclusion criteria were as follows: (1) age between 18-65 years, (2) no additional comorbidity, (3) patients with final pathological diagnosis as AA, the exclusion criteria were as follows: (1) age, <18 years or >66 years; (2) patients undergoing additional surgical procedures concomitantly with appendectomy; (3) pregnancy; (4) requirement for intensive care; and (5) patients with incidental, interval, and negative appendectomies. Demographical data, comorbidities, the time interval between the diagnosis and surgery, operation time, length of hospital stay, antibiotics use, analgesic requirement, pathological diagnosis, and readmission status were included.

On the basis of our review of similar studies, the patients who fulfilled the inclusion and exclusion criteria were classified into the following two groups: group A comprising patients with a preoperative waiting time of <10 h (emergent appendectomy) and group B comprising patients with a preoperative waiting time of  $\geq 10$  h (urgent appendectomy). The patient characteristics were compared between the two groups. Antibiotic prophylaxis was performed with 1-g cefazolin sodium (Mustafa Nevzat, Istanbul, Turkey) within one h of the AA diagnosis in all patients.

The results were analyzed using SPSS version 21.0 (IBM, Armonk, NY, USA). Continuous variables were expressed as

means  $\pm$  standard deviation (SD) or medians (range) on the basis of data distribution, whereas categorical variables were presented as absolute values and percentages. Differences in continuous variables between the two groups were assessed using Student's t-test for normally distributed variables and the Mann-Whitney U test for non-normally distributed variables. Differences in categorical variables were assessed using Fisher's exact or chi-square tests. A P-value of less than 0.05 was considered to indicate statistical significance.

## RESULTS

A total of 160 patients diagnosed with AA between October 2014 and February 2015 and fulfilled the study criteria were included in the present study. Groups A and B included 79 and 81 patients, respectively, with F/M ratios of 23/56 and 27/54, respectively. The mean ages were  $31.9 \pm 11.5$  (range, 18–66) and  $30.8 \pm 8.8$  (range, 18–65) years in groups A and B, respectively ( $p=0.882$ ). No significant difference was noted in the comorbidity rates between the two groups ( $p=0.339$ ). In groups A and B, the mean preoperative waiting periods were  $4.4 \pm 2.0$  (range, 1–9) and  $15.1 \pm 4.3$  (range, 10–32) h ( $p<0.001$ ), and the mean operation times were  $50.3 \pm 16.2$  (range, 20–90) and  $54.0 \pm 12.6$  (range, 20–80) min ( $p=0.040$ ), respectively. The mean length of hospital stay was  $30.4 \pm 13.5$  (range, 8–96) h in group A and  $30.3 \pm 8.3$  (range, 11–48) h in group B ( $p=0.391$ ) (Table 1).

Wound infections were observed in three patients (3.8%) in group A and in five patients (6.17%) in group B, which did not significantly differ between the two groups ( $p=0.720$ ).

**Table 1.** Comparison of the surgical details between the two study groups

	Group A		Group B		p
	Mean $\pm$ SD	Min-Max	Mean $\pm$ SD	Min-Max	
Preoperative waiting period (h)	4.4 $\pm$ 2.0	1–9	15.1 $\pm$ 4.3	10–32	<0.001
Operation time (min)	50.3 $\pm$ 16.2	20–90	54.0 $\pm$ 12.6	20–80	0.040
Hospital stay (h)	30.4 $\pm$ 13.5	8–96	30.3 $\pm$ 8.3	11–48	0.391

SD: Standard deviation.

**Table 2.** Comparison of the postoperative features between the two study groups

	Group A		Group B		p
	n (79)	%	n (81)	%	
In-hospital SSIs	3	3.8	5	6.2	0.720
Intra-abdominal abscess	–	–	2	2.5	0.497
Antibiotic use	79	100	80	98.8	1.000
Narcotic analgesic requirement	7	8.9	9	11.1	0.343

SSI: Surgical site infection.

Furthermore, the intra-abdominal abscesses, which were observed only in two patients in group B, did not significantly differ between the two groups ( $p=0.497$ ). No significant differences were noted in the rates of antibiotic and analgesic use between the two groups ( $p=1.000$  and  $0.343$ , respectively) (Table 2).

According to the pathological assessment, 75 (94.9%), three (3.8%), and one (1.3%) patient in group A received the definitive diagnoses of AA, lymphoid hyperplasia, and mucinous neoplasia, respectively. In group B, 78 (96.3%) and three (3.7%) patients were definitively diagnosed with AA and lymphoid hyperplasia, respectively, based on the pathological assessment. No significant difference was noted in the distribution of the definitive diagnoses between the two groups ( $p=0.837$ ).

## DISCUSSION

Appendectomy is the most frequently performed emergency surgery by general surgeons.<sup>[7,8]</sup> Following diagnosis, patients are usually treated within a few hours for preventing the progression of inflammation. Studies have shown that AA can be treated without interval appendectomy, especially in patients with plastron appendicitis.<sup>[9–11]</sup> Antibiotic therapy has also been demonstrated to be successful without surgery in select cases of uncomplicated AA.<sup>[12,13]</sup>

The ideal timing for surgery in patients who require surgery remains a focus of debate. Certain studies have suggested that the outcomes are better with emergent appendectomy than with delayed appendectomy.<sup>[13–17]</sup> In contrast to these studies suggesting that delayed surgery for appendicitis is associated with increased rates of postoperative complications, such as surgical site infections, other studies have reported no significant differences in the complication rates between early and late appendectomies.<sup>[4,18,19]</sup> Moreover, some studies have shown that fatigue and the lack of sleep adversely affect the clinical performance and cognitive skills of the surgeons during immediate appendectomies performed at night or at the end of long shifts in the operating room, leading to an increase in complication rates.<sup>[20,21]</sup>

In the present study, we found that delaying the surgery for several reasons (fasting status of the patient and the order of urgency of waiting operations) following the diagnosis of AA in the emergency department was not associated with increased complication rates or increased length of hospital stay. One likely explanation for these findings is the initiation of treatment with antibiotics and fluid support in patients with a waiting period of more than 10 h, which may allow the control of inflammation. Accordingly, no significant differences were noted in the rates of postoperative surgical site infections or intra-abdominal abscesses between the patients treated with emergency surgery and patients treated with urgent surgery. However, Busch et al.<sup>[22]</sup> reported that an in-hospital delay of more than 12 h was associated with

increased rates of perforation and other complications. Furthermore, Teixeira et al.<sup>[13]</sup> reported that an in-hospital delay of more than six h led to an increased surgical site infection rate independently of other factors. Giraudo et al.<sup>[17]</sup> reported a significant increase in the complication rates between the delayed ( $\geq 24$  h) and early ( $< 24$  h) appendectomy groups. However, two other retrospective studies reported that no significant differences were noted in the complication rates between the early ( $< 12$  h) and late (12–24 h) groups.<sup>[5,23]</sup> A meta-analysis found that delays over 48 h were associated with increased wound infection rates.<sup>[24]</sup>

Patients with AA can wait for more than 10 h for surgery at our center, which is a high-volume trauma center with a 24-hour surgical team on duty. Patients with AA can be maintained with fluid resuscitation and intravenous antibiotic therapy, excluding patients with perforation, who are pregnant, and those exhibiting sepsis symptoms. No differences were noted in the patient outcomes, complications, and the length of hospital stay between the patients treated with emergency surgery and patients treated with urgent surgery. In conclusion, patients receiving antibiotic and fluid therapy, with the exclusion of high-risk patients, can be safely maintained for up to 24 h although AA requires surgery. These findings derived from retrospective data should be substantiated in prospective studies.

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**Conflict of Interest:** None declared.

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## ORİJİNAL ÇALIŞMA - ÖZET

### Akut apandisit tedavisinde acil cerrahi veya gecikmiş cerrahinin yeri

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**AMAÇ:** Akut apandisit, hızla ilerleyen bir iltihabi hastalık olup, standart tedavisi acil cerrahi girişimdir. Bununla birlikte, son zamanlarda bazı olgularda yarı elektif olarak apandektomi planlanabileceği konusunda görüşler belirtilmektedir. Bu çalışmamızdaki amacımız zorunlu nedenlere bağlı ameliyatın ertelendiği durumlarda ve komplike olmayan olgularda sıvı ve antibiyotik tedavisi altında güvenli olarak apandektomi uygulanabileceğini ortaya koymaktır.

**GEREÇ VE YÖNTEM:** Çalışmamız Ekim 2014–Şubat 2015 tarihleri arasında akut apandisit ön tanısı ile apandektomi yapılmış 160 olguyu içermektedir. Hastalar, ameliyat öncesi bekleme süresi 10 saat altı ve üstü olacak şekilde iki gruba ayrıldı ve patoloji sonuçları, komplikasyon oranları ve hastanede kalış sürelerine göre karşılaştırıldı.

**BULGULAR:** Çalışmaya 160 hasta alındı. Grup A'da 79, Grup B'de 81 hasta vardı. Hastaların demografik verileri, patoloji raporları ve komorbid durumları incelendiğinde istatistiksel anlamlı fark yoktu. Ortalama ameliyat öncesi bekleme süresi ve ameliyat süreleri karşılaştırıldığında gruplar arasında anlamlı fark saptandı. Hastaneden kalış süreleri, yara yeri enfeksiyonu ve karınıçi apse açısından her iki grup arasında anlamlı fark saptanmadı.

**TARTIŞMA:** Komplike olmayan akut apandisit tanısı alan hastaların, acil serviste ameliyat öncesi uygun medikal tedavi ve gözlem altında geçirdiği bekleme süresinin, komplikasyon ve hastanede yatış süresi üzerine olumsuz etkisi yoktur.

**Anahtar sözcükler:** Apandisit; gecikmiş apandektomi; komplike olmayan apandisit; medikal tedavi.

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