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# Association between Delay in Surgical Treatment and Perforation in Acute Appendicitis

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## Abstract

**Introduction:** Acute appendicitis is a prevalent emergency surgical pathology and without prompt intervention may lead to gangrene, perforation and death. Increased mortality and morbidity will increase the hospital stay and the costs. We aimed to see the association between surgical treatment and perforation.

**Patient and Method:** 130 patients who were undergone emergency appendectomy were included in the study. Patients were divided into three groups based on the time from symptom onset to the operation (Group 1, <24hours; Group 2, 24-36 hours; Group 3, >36 hours). Perforation rates, surgical site infections, operation time and hospital stay was compared.

**Result:** Hospital stay was shorter in Group 1 compared to Group 2 and 3 and were respectively 1.9 days, 3.4 days, 4.8 days. Surgical site infection was 5.4% for Group 1, 7.2% for Group 2, 10% for Group 3 ($p<0.02$). When the perforation rate was compared it was found 3% for group 1, 13% for Group 2, 31% for Group 3 and it was statistically significant ($p<0.001$).

**Conclusion:** Surgical site infections, hospital stay, perforation and complications associated with perforation were less in patients with acute appendicitis who were diagnosed and treated within 24 hours of symptom onset than patients who were diagnosed after 24 hours.

**Keywords:** Acute appendicistis; Appendectomy; Delay in surgery; Perforation rate

## Introduction

Appendicitis is the most common nonelective procedure performed by general surgeons [1]. It has generally been accepted that an appendectomy should be performed within a few hours of diagnosis and that a delay in the operation may lead to an increase in the morbidity [2-4]. Appendiceal rupture puts patients at risk for serious sequelae including peritonitis, sepsis and death. Increasing time between symptom onset and treatment may be a risk factor for a ruptured appendix, but little is known about how the risk changes with passing time. Most studies assessing the effect of time between symptom onset and treatment on risk of appendiceal rupture compare ruptured and nonruptured groups [3-5].

This study aimed to determine the changes in risk of rupture in patients with appendicitis with increasing time from symptom onset to treatment to help guide the swiftness of surgical intervention.

## Patient and Method

130 patients (female/male 34/96) between 16 and 65 ages who were undergone emergency appendectomy in a 12 months period in Keçiören Education Hospital General Surgery Clinic were included in the study. In this period 157 patients had appendectomy but 27 of these who didn't meet the inclusion criteria were excluded. All patients had classic (open) appendectomy. Patients were divided into three groups based on the onset of sypmtoms. Group 1, patients operated in 24 hours; Group 2, patients operated between 24-36 hours; Group 3, patients operated after 36 hours.

Patients who were undergone laparascopic appendectomy, interval appendectomy under 16 years old, older than 65 years, diabetes, malignant disease, immune supression and antibiotic usage were excluded.

Patients admitted to the emergency department were first evaluated by emergency resident. In case of suspected appendicitis they were evaluated by a general surgeon in the emergency ward. Clinical data, physical examination, laboratory and imaging studies were the mainstays of evaluation. Patients who were diagnosed acute appendicitis and patients who underwent clinical observation were included. Symptom onset and leukocyte counts operation start and end time were recorded. Hospital stay defined as arrival at hospital to discharge of patient. Perforation defined as opening the appendiceal lumen macroscopically. Surgical site infection

defined as presence of clinically or microbiological infection. All of the diagnoses and perforations were histopathologically confirmed. Perforation rates, surgical site infections and hospital stay was compared.

SPSS software was used for the statistical analysis. The x2 test and ANOVA were used to analyze the statistical difference between the 2 groups. A P value of less than 0.05 was considered significant.

## Results

A total of 130 appendicectomies were performed in patients aged 16 to 65 years in the 12-month period from September 2006 to 2007. The average age of these patients was 32.8 years (range 16–65 years). There were 96 men and 34 women in the study group. 33 (25.3%) of the 130 patients were Group 1, 67 (51.5%) of the 130 patients were Group 2 and 30 (23%) of the 130 patients were Group 3 (Table 1).

| | Group I (n= 33) | Group II (n= 67) | Group III (n=30) | P value |
|---|---|---|---|---|
| Gender (Female / Male) | 24/9 | 40/17 | 22/8 | >0.089 |
| Mean hospital stay (days) | 1.9 (1-3) | 3.4 (1-10) | 4.8 (2-14) | >0.086 |
| Operation times (minutes) | 35 (30-45) | 58 (40-65) | 69 (40-80) | <0.002 |
| Perforasyon rate | 3% (13/76) | 13% (11/132) | 31% | <0.001 |
| Surcical site infection rate | 5. 4% | 7.2% | 10% | <0.02 |

Group 1, patients operated in 24 hours; Group 2, patients operated between 24-36 hours; Group 3, patients operated after 36 hours

**Table 1:** Outcome of comparison between groups

Perforation rates were 3% (1 patient) for Group 1 , 13% (9 patients) for Group 2 and 31% for Group 3 (10 patients). When Group 1 and others (Group 2, 3) were compared it was statistically significant ($p<0.001$) but the difference between Group 2 and 3 was not statistically significant.

Hospital stay was shorter in Group 1 than Group 2 and 3, it was 1.9 days, 3.4 days, 4.8 days respectively ($p<0.038$). Surgical site infection rate was 5.4% for Group 1, 7.2% for Group 2 and 10% for Group 3 ($p<0.02$). Mean operation time was 35 minutes for Group 1, 58 minutes for Group 2 and 69 minutes for Group 3.

## Discussion

In this study, surgical site infections, hospital stay, perforation and complications associated with perforation were less in patients with acute appendicitis who were diagnosed and treated within 24 hours of symptom onset than patients who were diagnosed after 24 hours.

Acute appendicitis, the term we use today and the pathophysiological abnormality we understand in the 21st century, is attributed to Reginald H. Fitz [6]. He also recognized the vital importance of early diagnosis and immediate surgical intervention. Appendicitis may mimic other clinical conditions. Inflammatory and infectious disorders such as gastroenteritis and respiratory infections may cause lymphoid follicle hyperplasia, which results in luminal obstruction and appendiceal inflammation [7]. Acute appendicitis is typically done within hours of diagnosis to prevent the complications of gangrene and perforation. In uncertain cases, delay of surgery and repeated assessment are commonly practised to achieve a more precise diagnosis. All these factors may contribute to diagnostic or therapeutic delays in the management of acute appendicitis. Delay in treatment is regarded as the main cause of perforation and complications, but there are controversies as to whether preadmission or postadmission delay is more important [8-10]. Fortunately, death due to acute appendicitis is now rare (mortality rate, 0%- 2.4%) [9-14]. Nevertheless, failure to diagnose appendicitis early is still a leading cause of increased perforation and complications (complication rate, 3.4%-33%) [3,15,16].

One of the most prominent changes that marked the last few years has been the emphasis on the potential negative impact of prolonged work hours for residents [17,18]. The authors said that it can be helpful to delay in performing an appendectomy for acute appendicitis for 12 to 24 hours after the diagnosis, especially at night so that trainees, surgeons, and other personnel do not lose sleep an important consideration since the complication rates and results of immediate and late appendectomy are the same.

Surana, *et al.* [4] studied the effects of delaying an appendectomy for acute appendicitis. They found no statistical difference in the rate of complications between children who underwent appendectomies within 6 hours of diagnosis and those who underwent appendectomies between 6 and 18 hours of diagnosis (2.3% to 4.2%, respectively; P=0.28). A similar study by Yardeni, *et al.* [2] on the effects of delaying appendectomies by 6 to 24 hours in children showed no significant increase in the rate perforation, operative time, or complications when compared with children who underwent the appendectomies within 6 hours. Furthermore, some studies suggest that the rate of perforation is due to a delay in patient presentation rather than to a delay in treatment. [18,19]. In our study, the early and late groups had similar clinical outcomes. The group III, group II had more longer length of stay than the group I (4.8 days, 3.4 days, 1.95 days respectively).

Highest perforation rate was in Group 3 and the difference was statistically significant when compared to Group 1. Surgical site infection rate was alike and for Group 1, Group 2 and Group 3 it was 5.4%, 7.2%, 10% respectively ($p<0.02$).

Many retrospective studies do demonstrate a direct relationship between symptom duration and perforation rate, however, these studies do not prospective randomise. Our study was prospective, randomized [20]. We didn't try to find out the reasons for delay and the stage of the disease but the time on which the perforation makes a peak. This study's purpose was to determine the association between increasing time from symptom onset to treatment and risk of rupture in patients with appendicitis. We did not seek to determine the likelihood of an appendicitis diagnosis in patients presenting with abdominal pain, and these data are not applicable to patients without appendicitis. Although this approach limits the applicability of our findings to patients with appendicitis, it provides an important benchmark for physicians treating patients with appendicitis—information that is lacking. Time between symptom onset and treatment, a potentially modifiable factor, is associated with risk of ruptured appendicitis.

Bichell, *et al.* found out 0-2% perforation rate for every 12 hours on the first 36 hours, after 36 hours this rate increased to 5% for every 12 hours [21]. In our study for the first 24 hours perforation rate was 3%, after that it increased 10% for every 12 hours.

Maroju, *et al.* prehospital time was broken down into segments of 12 h to identify a cut off point beyond which the incidence of perforation increases significantly. Their found that 82% of the patients who had an acutely inflamed appendix presented within 36 h of the onset of their symptoms, and 82% of these patients presented in the first 24 h [22]. On the other hand 75.5% of advanced appendicitis patients presented at least 36 h after the onset of complaints, and 45% of these patients arrived 72 h after onset [2]. When the total delay in similar time intervals was analysed, it was found that at a delay of more than 36 h there was a significant increase in the incidence of advanced appendicitis. Colson, *et al.* found that patients who delayed presenting for more than 12 h after the onset of symptoms had a higher incidence of perforation [9,19]. In our study 77% of the patients were operated in the first 36 hours of symptom onset. Temple, *et al.* found out that 20% of the perforated appendices had a delay of less than 24 h from the onset of symptoms. While our results were like Colson, *et al.* they were contradictory to Temple, *et al.* [20].

Pediatric and geriatric populations are privileged age groups. These cases have sensitive nature regardless of the disease [23,24]. Therefore, we exclude these groups. However, we did not exclude adolescents. Perhaps this is the most serious shortcomings of our work.

In conclusion, morbidity caused by acute appendicitis increases with delay in treatment. Whatever the cause is, when the patients operated on the first 24 hours and others are compared morbidity and hospital stay increases significantly on the latter.

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