

Impact of COVID-19 pandemic on acute appendicitis: A retrospective cohort study

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Ethics Committee Approval

The study was approved by Bursa City Hospital Ethics Committee (2022-14/11).

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

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Abstract

Background/Aim: The probability of infection, especially from hospitals, and fear of contracting a disease caused changes in the clinical courses of many emergency diseases during the pandemic period. This article aimed to compare the histopathological and laboratory investigation results of acute appendicitis cases in a state hospital working as a pandemic hospital before and during the COVID-19 pandemic.

Methods: Patients undergoing appendectomy between March 2019 and March 2021 in the General Surgery Department of our hospital were included in the study. The period between March 2019 and March 2020 and the period between March 2020 and March 2021 were considered as the period before the pandemic and the pandemic period, respectively. Patients in the period before the pandemic were classified as Group A and the ones in the pandemic period as Group B. The patients were randomly selected from the computer system. Data of all patients, including ages, genders, presentation times to the hospital after initiation of pain, laboratory values, and histopathological investigation results were analyzed retrospectively.

Results: A total of 400 patients, including 200 patients in the period before the pandemic and 200 patients during the pandemic period, were included in the study. The mean age of patients who participated in the study before the pandemic was 35.85 (12.40) years, and during the pandemic period was 35.13 (12.30) years ($P=0.558$). The mean leukocyte values in the period before the pandemic, 13.23 (4.32), and during the pandemic period, 14.67 (4.09), were statistically different ($P<0.001$). The mean neutrophil value in the period before the pandemic, 10.08 (4.39), was found to be statistically lower than during the pandemic period, 11.26 (4.41) ($P=0.007$). In the histopathological investigation, one hundred and sixty patients were evaluated to be complicated and 40 patients to be non-complicated in the period before the pandemic. One hundred and ninety-six patients were evaluated to be complicated and 4 patients to be non-complicated during the pandemic period.

Conclusion: The fear of transmission of the virus has caused patients to be admitted to hospitals late. Therefore, the number of complicated appendicitis has increased during the COVID-19 pandemic.

Keywords: appendicitis, COVID-19 pandemic, complicated appendicitis

Introduction

The first case of COVID-19 was explained to be seen in our country on the day the World Health Organization (WHO) announced that COVID-19 disease transited to the pandemic [1–4]. The probability of infection, especially from hospitals, and fear of contracting a disease caused changes in the clinical courses of many emergency diseases during the pandemic period. This article aimed to compare the histopathological and laboratory investigation results of acute appendicitis cases in a state hospital working as a pandemic hospital before and during the COVID-19 pandemic

Materials and methods

Patients undergoing appendectomy between March 2019 and March 2021 in the General Surgery Department of our hospital were included in the study. The period between March 2019 and March 2020 and the period between March 2020 and March 2021 were considered as the period before the pandemic and the pandemic period, respectively. Patients in the period before the pandemic were classified as Group A and the ones in the pandemic period as Group B. The patients were randomly selected from the computer system. Data of all patients, including ages, genders, presentation times to the hospital after initiation of pain, leukocyte counts before the surgery (normal range: 4000–10000 /mm³), neutrophil counts (normal range: 1400–6500 /mm³), lymphocyte counts (normal range: 1000–4000 /mm³), and neutrophil/lymphocyte ratios and postoperative histopathological investigation results were analyzed retrospectively.

In order to determine the number of patients to be included in the study, a pilot study was conducted on 8 patients in each group. As a result of the pilot study, the effect size for leukocyte measurements in groups was 0.28. As a result, it was decided to include at least 200 patients in each group for 80% power and 5% significance level, with an effect size of 0.28.

Ethics committee approval of the study was obtained from the Bursa City Hospital Ethics Committee with the following decision number: 2022-14/11.

Statistical analysis

The Shapiro-Wilk test was used to investigate whether or not the data were normally distributed. Descriptive statistics were indicated as the mean and standard deviation for the quantitative data and the frequency and percentage for the qualitative data. T-test was used for data distributed normally in comparing two independent groups. Pearson's Chi-square and Fisher's exact tests were used to analyze categorical data. Significance was determined to be as $\alpha=0.05$. Statistical analysis of the data was performed using IBM SPSS 28.0 (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp.) statistic package program.

Results

A total of 400 patients, including 200 patients in the period before the pandemic and 200 patients during the pandemic period, were included in the study. The mean age of patients who participated in the study before the pandemic was 35.85 (12.40) years, and the mean age of patients who

participated in the study during the pandemic period was 35.13 (12.30) years ($P=0.558$). Sixty-one (30.5%) of patients who participated in the study before the pandemic were females, 139 (69.5%) of them were males, and 65 (32.5%) of patients who participated in the study during the pandemic were females, and 135 (67.5%) of them were males ($P=0.667$) (Table 1).

Table 1: Characteristics of 2019 and 2020 appendectomies

Appendectomies	Group A (n=200)	Group B (n=200)	P-value
Female/ Male	61/139	65/135	0.667
Age	35.85 (12.40)	35.13 (12.30)	0.558

Laboratory data were summarized in Table 2. The mean leukocyte values in the period before the pandemic and during the pandemic period were determined to be 13.23 (4.32) and 14.67 (4.09), respectively ($P<0.001$). The mean neutrophil values in the period before the pandemic and during the pandemic period were found to be 10.08 (4.39) and 11.26 (4.41), respectively ($P=0.007$). The percentages of lymphocytes in the period before the pandemic and during the pandemic period were determined to be 17.19 (11.0) and 15.2 (8.53), respectively ($P=0.043$).

Table 2: Comparison of laboratory values

	Group A	Group B	P-value
Wbc	13.23 (4.32)	14.67 (4.09)	<0.001
Baso	0.07 (0.15)	0.08 (0.16)	0.526
Baso %	0.54 (0.82)	0.58 (1.04)	0.647
Lym	2.01 (1.12)	2.05 (0.93)	0.690
Lym %	17.19 (11)	15.2 (8.53)	0.043
Mono	0.96 (1.46)	1.19 (2.23)	0.226
Mono %	6.95 (7.75)	7.86 (12.42)	0.378
Eos	0.11 (0.12)	0.12 (0.15)	0.664
Eos %	1.0 (1.11)	0.87 (1.03)	0.218
Neu	10.08 (4.39)	11.26 (4.41)	0.007
Neu %	74.26 (13.82)	75.5 (14.94)	0.393
Neu Lym	6.58 (5.06)	7.26 (6.15)	0.223
Neu Lym %	6.60 (5.09)	7.28 (6.18)	0.234

In the histopathological investigation, one hundred and sixty patients were evaluated to be complicated and 40 patients to be non-complicated in the period before the pandemic. One hundred and ninety-six patients were evaluated to be complicated and four patients to be non-complicated during the pandemic period.

Histopathological investigation results of 14 patients in the period before the pandemic and 2 patients during the pandemic period were not evaluated to be acute appendicitis.

Discussion

A virus first identified and reported from Wuhan City, China, on December 29th, 2019, was considered to be a pandemic within approximately 1 year and caused a fall on hard times throughout the world [2].

In our country, the first case was announced by the Ministry of Health on March 10, 2020 [3]. With the spread of COVID-19 in Turkey, the hospitals used for the treatment of this disease were announced to be risky areas for infection. With the postponement of elective surgical cases in the state hospitals announced to be pandemic hospitals, a difficult period began for patients [4]. With the fear of risk for viral infection in emergency and elective surgeries, decreases in presenting numbers to state hospitals assigned specifically as pandemic hospitals and delays in presenting periods occurred. Our study observed that patients presented to the hospital on the first day at the earliest beginning from pain in the period before the pandemic and on the third day at the earliest beginning from pain during the pandemic period.

Acute appendicitis is one of the most commonly encountered emergency surgeries in the general surgery department. The incidence is approximately 7%, which is more commonly seen in males [5,6]. Our study, determined no statistically significant difference between the two groups regarding age and gender.

Treatment of acute appendicitis is frequently surgical [7]. Based on the surgeon's decision according to the condition of the patient, medical or surgical treatment can be performed.

Since airway interventions are performed in patients, operative theaters where surgeons spend most of their time are high-risk areas for the spread of respiratory tract infections. This condition caused more difficulty in surgical branches during the pandemic period. It was observed that medical treatment became prominent with the partial change of treatment algorithms in emergency cases in some hospitals, especially during the pandemic period [8–10]. In our hospital, surgical treatment was primarily preferred in cases considered to be acute appendicitis.

The COVID-19 pandemic caused healthcare professionals working in institutions such as hospitals with a high risk of infection to have a more difficult condition. Due to either curfew or possible infection probability in the hospital, delays occurred in the diagnosis of many diseases. During this period, some changes occurred in the course, morbidity, and management of acute appendicitis. Our study determined that the complicated appendicitis rate in Group B was statistically significantly higher than the ratio in Group A.

A hemogram in laboratory investigation almost always takes part as an important component of the diagnosis in patients suspected of acute appendicitis. Leukocyte count is one of the most commonly used laboratory parameters, and while it is generally elevated in acute appendicitis patients, it is not a specific marker [11,12].

Acute appendicitis and leukocytosis were found to be associated with each other in many studies [13,14]. Many studies are reporting that the neutrophil count elevates and the leukocyte count decreases; therefore, the elevated neutrophil/lymphocyte ratio has a higher sensitivity in the diagnosis and shows the severity of acute appendicitis [13,15]. It has been reported that as the degree of inflammation of the vermiform appendix became more serious, this ratio increased significantly [16]. A decrease in lymphocyte counts is expected in complicated appendicitis compared to non-complicated appendicitis conditions [11,17]. In our study, it has been observed that the increased ratio of complicated appendicitis in Group B was reflected in the laboratory values consistent with the literature, and leukocyte and neutrophil counts were found to be statistically higher, but the lymphocyte count to be statistically less compared to the Group A.

Despite physical examination, laboratory findings, and auxiliary radiological methods, negative appendectomies are performed and will continue to be performed. The rate of negative appendectomy in the literature ranges between 2% to 30% [18,19]. In our study, the rate of negative appendectomy in Group A was found to be statistically significantly higher compared to the rate of negative appendectomy in Group B. We attributed this condition to a decrease in non-essential patient visits to the hospital during the pandemic period.

Limitations

The study has a number of possible limitations. Our data contains only cases that refer to the Çekirge State Hospital. Consequently, the need for future studies with prospective and with more patient series is present.

Conclusion

The obscurities in the treatment of the COVID-19 pandemic and higher mortality rates caused anxiety in humans. The fear of virus transmission has caused patients to be admitted to the hospitals late. Therefore, the number of complicated appendicitis has increased during the COVID-19 pandemic.

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