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The effect of the COVID-19 pandemic on acute appendicitis cases

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Abstract

The COVID-19 outbreak has affected healthcare systems around the world, and has led to changes in the clinical and treatment approaches to all diseases. To reveal the reflection and negative effects of the psychological trauma associated with the COVID-19 pandemic among those with acute appendicitis. A retrospective analysis is made of the data of patients admitted to the emergency departments in our city (Trabzon, Turkey) and taken into operation. Comparative analysis of two patient groups diagnosed with acute appendicitis in our region was included in our study: In the COVID-19 pandemic period (Group 2); and on the same dates a year ago (Group 1). Groups 1 and 2 comprised 231 and 144 patients, respectively ($p<0.001$). There was no statistically significant difference in the type of anesthesia between the groups ($p=0.280$). There was no statistically significant difference between the groups in terms of median duration of surgery ($p=0.239$). There was a statistically significant difference in the pathological diagnoses of Groups 1 and 2 ($p<0.001$). Considering the pathological diagnoses, a significant difference was established in the duration of hospital stay of the cases, which was longer in patients diagnosed with perforated appendicitis ($p<0.001$). It is apparent that during the COVID-19 outbreak, hospitals are associated with increased transmission risk, causing people to delay their referral to the emergency department, and leading to an increase in irreversible complications and mortality rates.

Keywords: COVID-19 pandemic, emergency general surgery, appendicitis, acute appendicitis complications

1. Introduction

In December 2019, cases of pneumonia of unknown origin were identified in the city of Wuhan in the Hubei province of China. Chinese scientists revealed that the agent behind the pneumonia in these patients was “severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, known previously as 2019-nCoV)”. In February 2020, the disease was given the title Coronavirus Disease 2019 (COVID-19) in literature. The disease spread rapidly, and the World Health Organization (WHO) declared a pandemic on March 11, 2020, and COVID-19 spread rapidly, jeopardizing the health of the whole world, and especially healthcare workers (1). The health ministries of many countries decided to halt elective procedures to make room in hospitals and intensive care units for those infected with COVID-19, while delaying emergency procedures and interventions was not possible. It is known that those with somatic symptoms are associated with more frequent hospital admissions. According to literature, hospital admission is a significant safety-seeking behavior among patients with a fear of death, related to anxiety and panic disorders (2, 3). While hospital admissions play an important role in coping with a fear of death in those with Somatic Symptom Disorders, Panic Disorder and Anxiety Disorders, the fear of death from COVID-19 infection has led to hospitals being associated with a significantly increased risk of transmission, and consequently, as a trigger of fear. When it comes to the possibility of Coronavirus transmission, it can be said that symptoms that may indicate a serious health problem are often ignored, and patients with significant medical problems may exhibit avoidant behaviors related to hospital admissions to counter their fear of death. We believe that fears of COVID infection and death are likely to reduce the frequency of hospital admissions. Accordingly, the aim in the present study is to discuss the effect of the COVID-19 pandemic on patients with acute appendicitis (AA), as a cause of acute abdomen requiring general surgery, in the light of data garnered from the hospitals in our city.

2. Material and Methods

The present study included patients who were referred to general surgery consultation by emergency departments and diagnosed with AA during the COVID-19 pandemic in our city, as well as patients who were consulted for general surgery by the emergency department and diagnosed with AA in the same period one year ago.

The patients were divided into two groups. Group 1 included patients who presented from March 15, 2019 to May

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15, 2019; while Group 2 included patients who presented from March 15, 2020 to May 15, 2020, during the COVID-19 pandemic. The patients' age, gender, American Society of Anesthesiologists (ASA) score, type of anesthesia, duration of surgery, pathological diagnosis and duration of hospital stay were accessed retrospectively for Groups 1 and 2, and the differences between groups were investigated.

The data were analyzed using PASW Statistics (Version 18.0. Chicago: SPSS Inc.). The data were analyzed with descriptive statistics, and Chi-square and Mann-Whitney U tests. The statistical significance was set at $p < 0.05$.

3. Results

A retrospective analysis was made of 375 consecutive cases diagnosed with AA, including 231 (62%) female and 144 (38%) male patients with a median age of 26 (min 4–max 90) years. Groups 1 and 2 included 231 and 144 patients, respectively ($p < 0.001$, Table 1). There were 136 (59%) male and 95 (41%) female patients in Group 1, and 95 (66%) male and 49 (34%) female patients in Group 2, with no significant difference between the groups ($p = 0.169$, Table 1). There was no difference in the median age between the groups [26 (4–90) years, and 26.5 (5–82) years, respectively; $p = 0.531$, Table 1].

As can be seen in Table 1, there were 284 (75.5%) cases with an ASA score of 1, 78 (21%) with an ASA score of 2 and 13 (3.5%) cases with an ASA score 3. Table 1 reveals that the ASA scores were similar in Groups 1 and 2, and there was no statistically significant difference in the ASA scores of the two groups ($p = 0.827$). Among the operated patients, 329 (88%) were administered general anesthesia and 46 (12%) were administered spinal anesthesia. The number of patients administered general anesthesia was 206 (89%) in Group 1, compared to 123 (85%) in Group 2. The number of patients administered spinal anesthesia, in turn, was 25 (11%) and 21 (15%) in Groups 1 and 2, respectively. There was no statistically significant difference in the type of anesthesia between the groups ($p = 0.280$, Table 1).

The median duration of surgery was 50 (min 15–max 180) minutes for all cases. The median duration of surgery was 50 (min 15–max 180) minutes in Group 1, and 50 (min 30- max 150) minutes in Group 2, with no statistically significant difference between the groups ($p = 0.239$, Table 1).

Among all cases, the pathological result was reported to be acute appendicitis in 211 (56%), acute phlegmonous appendicitis in 93 (25%), acute perforated appendicitis in 40 (11%) and Non-Appendicitis (NA) in 31 (8%). The number of patients diagnosed with a pathology of acute appendicitis was 146 (63%) in Group 1 and 65 (45%) in Group 2. The number of patients diagnosed with a pathology of acute phlegmonous appendicitis was 51 (22%) and 42 (29%) in Groups 1 and 2, respectively. The number of patients diagnosed with a pathology of acute perforated appendicitis was 12 (5%) in Group 1 and 28 (19%) in Group 2. The number of patients diagnosed with NA was 22 (10%) in Group 1, and nine (7%) in Group 2. There was a statistically significant difference in the pathological diagnoses recorded in Groups 1 and 2 ($p < 0.001$, Table 1).

The median duration of hospital stay was similar in both groups, and no significant difference was established between the groups [2 (min 1–max 9), 2 (min 1–max 17), respectively; $p = 0.550$, Table 1].

Table 1. Demographics and perioperative findings of patients who underwent surgery

	Group 1	Group 2	Total	p value
Total number of patients	231	144	375	**p<0.001**
Gender, n (%)				
Male	136 (59)	95 (66)	231(62)	0.169
Female	95 (41)	49 (34)	144(38)	
Age, median (min-max), years	26 (4–90)	26.5 (5–82)	26 (4-90)	0.531
ASA*, n (%)				
• **A1**	175 (76)	109 (76)	284 (75.5)	
• **A2**	47 (20)	31 (21)	78 (21)	0.827
• **A3**	9 (4)	4 (3)	13 (3.5)	
Type of anesthesia, n (%)				
• **Spinal anesthesia**	25 (11)	21 (15)	46 (12%)	0.280
• **General anesthesia**	206 (89)	123 (85)	329 (88%)	
Duration of surgery (Min)				
• **Minimum**	15	30	15	
• **Maximum**	180	150	180	0.239
• **Median**	50	50	50	
Types of pathology n (%)				
• **Acute appendicitis**	146 (63)	65 (45)	211(56)	
• **Phlegmonous**	51 (22)	42 (29)	93 (25)	**p<0.001**
• **Perforated**	12 (5)	28 (19)	40 (11)	
• **NA****	22 (10)	9(7)	31 (8)	
Duration of hospital stay (days)				
• **Minimum**	1	1	1	
• **Maximum**	9	17	17	0.550
• **Median**	2	2	2	

*American Society of Anesthesiologists (ASA) classification; A1, A normal healthy patient; A2, A patient with mild systemic disease; A3, A patient with severe systemic disease that does not affect daily activities. **NA: Non-Appendicitis.

When the length of hospital stay was compared, the median duration was 2 (min 1–max 6) days for AA, 2 (min 1–max 9) days for phlegmonous appendicitis, 3 (min 1–max 17) days for perforated appendicitis and 2 (min 1–max 5) days for NA. Considering the pathological diagnoses, a significant difference was established in the duration of hospital stay of the cases, being longer in patients diagnosed with perforated appendicitis [3 (min 1–max 17) days; $p < 0.001$, Table 2].

Table 2. Duration of hospital stay according to pathological diagnosis

Duration of hospital stay	Minimum (days)	Maximum (days)	Median	p value
Acute appendicitis	1	6	2	p<0.001
Phlegmonous A	1	9	2	
Perforated A	1	17	3	
NA*	1	5	2	

*NA: Non-Appendicitis.

4. Discussion

The COVID-19 pandemic has come to affect the entire world, and continues to spread day by day. The virus and the pandemic conditions that have come to threaten our lives first emerged in March 2020 in our country, bringing about several changes that have transformed our entire lives. It is inevitable that this situation, in which vital routines are disrupted, people experience intense anxiety and significant restrictions are placed on their social lives, affecting also psychological health.

In these days, as the virus continues its spread in a second wave, the outbreak is seeming to cause great anxiety in those who have quarantined themselves at home, as well as those who have to go to work. New attitudes and behaviors are being observed, with many people tending to go out less or not to go out at all, increased frequencies of hand washing, and washing food when it enters the home.

This period can be perceived as an extraordinary situation in which many people experience intense anxiety, fear and stress, and there is a considerable likelihood that a picture will emerge in which psychological well-being is affected. Increased fears of contracting the virus can generate anxious moods and repetitive behaviors and a sense of inadequacy even in matters of hygiene. Adequate and controlled stress can benefit the person in any event, but too much can turn into a phobia. Obsessive-compulsive disorder can manifest in such symptoms such as excessive anxiety and anxiety disorder, or excessive cleaning in the belief that excessive contamination may occur, especially in those who are more negatively affected by the current situation. Typically, excessive anxiety is accompanied by disaster scenarios that trigger anxiety in the mind, and consequently such physical symptoms as palpitations, hyperventilation and sweating. This period, which it is believed will be better explained in mental health studies in the future, is believed to be characterized by increased anxiety, and obsessive, depressive, and phobic attitudes and behaviors.

Within this period, which has changed our habits at home, at work and on the street, and has led to the emergence of the several psychological attitudes mentioned above, a situation has arisen in which patient anxiety leads them to avoid going to healthcare institutions and getting help. In such situations, people delay accessing needed healthcare, ignore their symptoms, and avoid or fear attending hospitals due to the COVID-19 pandemic, leading to discontinuations of treatment for chronic diseases or hesitancy in going to the hospital and getting help, even in cases of pain.

The present study has sought answers to the following questions: Are patients delaying visits to emergency departments due to the COVID-19 pandemic? Does this cause us to encounter more complicated and difficult cases as surgeons? Have the mortality and morbidity levels associated with emergency surgical operations increased?

The COVID-19 pandemic caught us all off-guard, and has led us to a situation in which people worldwide are being adversely affected. This led to an increase in irreversible complications and mortality rates due people delaying referral to the emergency department. The diagnosis and treatment of conditions that would not be a threat to life and that would affect only quality of life if not treated urgently are postponed to a more appropriate time to reduce the hospital density. There have been several articles published emphasizing the effects of the COVID-19 pandemic on different surgical procedures performed under emergency conditions, and the precautions to be taken (4-6). However, there has yet been no study examining the extent to which delays in surgery affect human life in cases of AA, as the cause of acute abdomen requiring emergency surgery. In the present study, we discuss this issue through the cases of appendicitis, as the most common cause of acute abdomen.

AA is the most common cause of acute abdomen and surgical intervention in the world (7). It is more common in men than in women (8). The lifetime risk of developing AA has been reported to be 8.6% in men and 6.7% in women (9, 10). Although it develops most commonly between the ages of 10 and 19, it can occur in all age groups. In the present study, a retrospective analysis was made of 375 consecutive cases operated with a diagnosis of AA. The patients included 231 (61.6%) female and 144 (38.4%) male patients, with a median age of 26.0 (min 4–max 90) years. The findings of the present study were consistent with those literature in general and in terms of between-group comparisons (Table 1).

The reason for referral to the emergency department was predominantly abdominal pain, starting in the epigastrium or near the navel, following a loss of appetite and nausea, and localized towards the right lower quadrant in the following hours. In approximately 60% of patients, the localization of the pain shifts towards the right lower quadrant eight hours after the onset of symptoms. Vomiting typically occurs after the pain. In acute appendicitis, a physical examination reveals sensitivity, defense and rebound tenderness in the right lower quadrant, depending on the time of admission. Typical presentations of appendicitis may not develop in the elderly and in children. In general, mild leukocytosis of 10,000 to 18,000/mm^3 is identified in non-complicated appendicitis cases, and moderate polymorphonuclear dominance may sometimes be seen. A physical examination is essential in cases

of acute appendicitis. In radiological examinations, the sensitivity of ultrasonography is between 78% and 96%, and the specificity is between 85% and 98% (11). Although computed tomography is just as accurate as ultrasonography, or even more so, in establishing diagnosis, it has a harmful effect on patients and it is expensive in practice, but may be used when it is difficult to establish a diagnosis, and for the exclusion of differential diagnoses.

In cases of delays in referral to hospital, delays in diagnosis, and accordingly, delays in intervention, simple appendicitis may become complicated, resulting in abscesses and perforations. Delays in admission to surgery increases morbidity and mortality, with the mortality rate in particular due to appendicitis being < 0.07–0.7%. There were no mortalities in the present study (12).

The present study revealed a significant decrease in cases who presented to the emergency department and who were diagnosed with AA during the pandemic, as expected (231 vs. 144 patients, $p < 0.001$, Table 1).

There was no difference in the ASA scores of the groups (Table 1). When the type of anesthesia was examined, no significant difference was established between the groups. However, as in all operations performed during the pandemic, there was an increase in preference for spinal anesthesia, as a means of reducing the risk of transmission (Group 1, 11%; Group 2, 15%, Table 1). The absence of any significant difference in the present study resulted from our inexperience in the transmission routes of the virus and our preference for general anesthesia, in the thought that surgery would be challenging due to the potentially complicated patients.

Although the number of complicated patients seems high, there was no difference in the duration of surgery between the groups [50 minutes (min 15–max 180), 50 minutes (min 30–max 150) respectively; $p = 0.239$, Table 1], which we attribute to the experience and harmonized working of the surgical team.

In the present study, the NA rate was 8% (31 patients), compared to 2–40% in literature (13, 14). When the groups were compared, the number of patients diagnosed with NA was 22 (10%) in Group 1 and nine (6%) in Group 2. There was a statistically significant difference in the pathological diagnosis between Groups 1 Group 2 ($p < 0.001$, Table 1), which made it difficult to establish a diagnosis due to delayed admission. This complicated the cases, resulting in a decrease in the number of negative laparotomies. There is a reciprocal relationship between perforation rate and negative appendectomy, the perforation rate being 3.6% in young men, but higher in children and the elderly (15).

When age distribution was examined in the histopathological diagnosis subgroups, no statistically significant difference was noted between the groups ($p = 0.062$). The number of patients diagnosed with a pathology of acute phlegmonous appendicitis was 51 (22%) and 42 (29%) in Groups 1 and 2, respectively. The number of patients diagnosed with a pathology of acute perforated appendicitis was 12 (5%) in Group 1, and 28 (19%) in Group 2 ($p < 0.001$, Table 1). We believe that patients presented to the emergency department late, and so the appendicitis had sufficient time to become complicated. Accordingly, an increase in morbidity rates occurred.

The median duration of hospital stay was longer in complicated patients, being 2 (min 1–max 6) days for acute appendicitis, 2 (min 1–max 9) days for phlegmonous appendicitis, 3 (min 1–max 17) days for perforated appendicitis, and 2 (min 1–max 5) days for lymphoid hyperplasia. There was a significant difference in the median duration of hospital stay ($p < 0.001$, Table 2). Increased durations of hospital stays are detrimental to the national economy, and delay the return of patients to socioeconomic life.

Wound infections are the most common morbidity in complicated appendicitis. Unnecessary surgeries, perforation rates and hospital stay for patients without acute appendicitis can be reduced through the use of auxiliary diagnostic methods (16), including laparoscopy, scoring systems, ultrasonography, computed tomography and magnetic resonance (17). Today, the need for appendectomy in both complicated and uncomplicated appendicitis is a topic of frequent discussion, with medical treatment attracting more attention, with a growing level of support (18, 19). Appendectomy, however, preserves its value for final diagnosis, especially in the middle- and advanced-age groups, since primary and secondary tumors may be detected incidentally in appendectomy specimens (20).

The conservative follow-up of cases with AA during the COVID-19 pandemic may be applied with the surgeon's decision, considering the general condition of the patient. It should be remembered that a laparoscopic appendectomy will probably shorten the duration of hospital stay (21). On the other hand, whether the surgical procedure to be performed during the pandemic should be performed through laparoscopic or conventional methods remains controversial. While the contact of the surgical team with the fluid and tissues of the patient increases with conventional methods, the risk of viral contamination through the aerosol effect of the gas used in laparoscopic surgeries or surgical smoke should be taken into account. Percutaneous drainage should be performed in patients with peri-appendicular abscesses. Patients with evidence of perforation can be managed with percutaneous drainage or operation, depending on the patient's condition. Patients who do not respond to non-surgical treatment should undergo immediate surgery (22).

This period has witnessed an increase in irreversible complications and mortality rates due to people delaying their referral to the emergency department. Until vaccination studies have been completed, we, as healthcare professionals, will continue to make sacrifices for the maintenance of the physical,

psychological and social well-being of society.

Conflict of interest

None to declare.

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None to declare.

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