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Comparison of outcomes of the patients with acute cholecystitis treated in the COVID-19 pandemic and pre-pandemic period

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SUMMARY

OBJECTIVE: The coronavirus disease 2019 (COVID-19) pandemic has affected the health care system in an unpredictable way. In this study, we aimed to analyze the effects of the pandemic process on the disease severity on admission, management strategies, and outcomes of patients.

METHODS: The medical records of the patients who applied to the emergency department and consulted to the general surgery clinic from March 2020 until January 2021 were retrospectively reviewed as the pandemic period. For the control group, patients' medical records in the same time interval of 2019 were evaluated as the pre-pandemic period.

RESULTS: A total of 88 patients in the pre-pandemic period and 89 patients in the pandemic period were treated for acute cholecystitis. There was no statistically significant difference between the two groups in terms of the treatment strategies and length of hospital stay between the two periods (p=0.087 and p=0.587, respectively).

CONCLUSIONS: In the pandemic period, it is thought that postponing and bridging treatments may replace surgery for reducing the risk of contamination of both patients and health care workers.

KEYWORDS: Acute cholecystitis. SARS-CoV-2. COVID-19. Cholecystostomy.

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19) pandemic, has affected globally the health care system in an unpredictable way[1]. First COVID-19 case recorded in Turkey on March 10, 2020. Thereafter, the World Health Organization (WHO) declared the COVID-19 outbreak as a global pandemic on March 11[2]. While the adaptation processes in the health care systems and social life are being presented worldwide, studies for the standardization of approaches have rapidly started to take place in the literature[3].

Although elective surgical procedures, except cancer cases, were largely cancelled or delayed to preserve hospital resources and mitigate disease transmission, there are not enough data yet on how this approach affected the emergency surgical cases and interventions in the pandemic period[4]. In this period, as recommended for some surgical emergencies, nonoperative, medical, interventional radiological or endoscopic interventions for the treatment of acute cholecystitis cases have been suggested by the scientific communities in the early stages of the pandemic[5,6]. As with all hospital admissions, excluding COVID-19 cases, there was a decrease in the emergency department admissions. Although this can be explained as

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a decrease in the number of unnecessary emergency department visits, it is also thought that individuals may hesitate to apply to the hospital and, therefore, delays in real emergencies may occur[7]. This situation has raised concerns regarding the risk of surgical emergencies becoming more complicated at presentation[8]. Due to the rapid progress in the pandemic period, the health care services continued in practice without completely eliminating the contradictions by the devotion of the health care workers. Therefore, in our study, we aimed to analyze the effects of the pandemic process on the disease severity on admission, management strategies, and outcomes of patients with acute cholecystitis by comparing with the cases treated in the previous year.

METHODS

Ethical approvals were obtained from both the Ethics Committee of Gulhane Training and Research Hospital (approval no: 2020-449) and Ministry of Health Sciences Committee. The medical records of the patients who applied to the emergency department and consulted to the general surgery clinic from March 11, 2020, until December 31, 2020, were retrospectively reviewed as the pandemic period. For the control group, patients' medical records in the same time interval of 2019 were evaluated in the same way as the pre-pandemic period. Patients younger than 18 years, positive COVID-19 test within 7 days before or 7 days after the admission, or reoperated due to the previous complication were excluded from the study.

Demographic characteristics of the patients; laboratory tests, including C-reactive protein (CRP) levels and leukocyte counts; previous history of endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous cholecystostomy; American Society of Anesthesiologists (ASA) scores; treatment strategies; operation time in those who had surgery; intraoperative complications; length of hospital stay; Clavien-Dindo Classification[9] for surgical complications; and 30-day rehospitalization rate were examined. Tokyo Guidelines 2018/2013 severity grading was used to assess the severity of the acute cholecystitis[10]. Besides, the Parkland Grading Scale for Cholecystitis was used to stratify gallbladder disease severity during cholecystectomy[11].

All data were presented as median with interquartile range (IQR) or frequency (%). The chi-square test was used for categorical variables and the Mann-Whitney U test for continuous variables. A value of $p<0.05$ was considered statistically significant. The statistical analysis was performed using the RStudio statistical software (version 1.0.136; RStudio Inc., Boston, MA, USA).

RESULTS

Notably, 88 patients in the pre-pandemic period and 89 patients in the pandemic period were hospitalized and treated for acute cholecystitis. No statistically significant difference was found in the comparison of the two groups in terms of demographic characteristics. Median leukocyte values of the patients at admission were $13.5\pm4.9\times10^9$/L in the pre-pandemic period and $13.9\pm6.1\times10^9$/L in the pandemic period. No statistically significant difference was found between the groups with regard to leukocyte and CRP values at admission ($p=0.668$ and $p=0.571$; respectively) (Table 1).

According to the Tokyo Guidelines 2018/2013 severity grading for acute cholecystitis classification, 59.1% of the patients were grade I, 36.4% grade II, and 4.5% grade III in the pre-pandemic period. During the pandemic period, these rates were 47.2, 47.2, and 5.6%, respectively. In the comparison of the two groups, no statistically significant difference found in severity grading ($p=0.284$). Laparoscopic or open technique cholecystectomy was performed to 20.5% of the patients in the pre-pandemic period; this rate was 15.7% in the pandemic period. However, the rate of patients undergoing percutaneous cholecystostomy was 17% in the pre-pandemic period and 28.1% in the pandemic period, which means no statistically significant difference between the two groups in terms of the treatment strategies ($p=0.087$) (Table 1).

Patients undergoing urgent cholecystectomy were also evaluated separately. However, we did not find significant differences in demographic features such as age ($p=0.896$), gender ($p=0.530$), ASA score ($p=0.680$), severity grading ($p=0.475$), previous ERCP history ($p=0.685$), type of surgery ($p=1.000$), Parkland grading scale ($p=1.000$), CRP ($p=0.442$), and leukocyte ($p=0.180$) between the patients who underwent surgical treatment in the pre-pandemic period and the pandemic period. Two patients had intraoperative complications as the common bile duct injury during the pandemic period. Besides, there was no significant difference in the length of hospital stay and 30-day rehospitalization rate between the two periods ($p=0.587$ and $p=0.295$, respectively) (Table 2).

DISCUSSION

After WHO declared COVID-19 a pandemic in early March 2020, many scientific publications regarding the approaches to both elective and emergency surgical cases in general surgery practice have been published at national and international levels globally[12]. In the recent study, we aimed to analyze the

Table 1. Comparison of the outcomes between the pre-pandemic and pandemic periods.

Outcomes	Pre-pandemic period (n=88)	Pandemic period (n=89)	p-value
Age (year)	57.5 (IQR, 48–72)	54.0 (IQR, 47–66)	0.132
Sex, n (%)			
Female	43 (48.9)	37 (41.6)	0.330
Male	45 (51.1)	52 (58.4)	
Laboratory tests			
Leucocyte (×10^9/L)	13.5 (IQR, 10–18)	13.9 (IQR, 10–18)	0.668
C-reactive protein (mg/L)	114 (IQR, 33–199)	131 (IQR, 16–232)	0.571
TG18/TG13 severity grading, n (%)			
Grade I	52 (59.1)	42 (47.2)	0.284
Grade II	32 (36.4)	42 (47.2)	
Grade III	4 (4.5)	5 (5.6)	
Treatment strategies, n (%)			
Medical treatment	49 (55.7)	49 (55.1)	0.087
Percutaneous cholecystostomy	15 (17.0)	25 (28.1)	
ERCP	6 (6.8)	1 (1.1)	
Cholecystectomy	18 (20.5)	14 (15.7)	

IQR: interquartile range; TG18/TG13: Tokyo Guidelines 2018/2013 severity grading for acute cholecystitis; ERCP: endoscopic retrograde cholangiopancreatography.

effects of the pandemic on the volume, disease severity, management strategies, and outcomes of patients.

Acute cholecystitis has an important place in general surgery practice. Although it has surgical, medical, and interventional treatment options, laparoscopic cholecystectomy is now considered a standard treatment in optimal conditions with its increasing scientific studies in recent years. However, due to some factors such as comorbidities, age, and hospital admission time; open cholecystectomy, percutaneous or tube cholecystostomy, and medical treatment strategies can be considered an option[13]. We applied these treatment strategies in our clinic in both pre-pandemic and pandemic period groups in a similar way.

It is a well-known fact that nonsurgical strategies such as medical treatment or percutaneous cholecystostomy have a lower success rate and increase recurrence of the disease in the treatment of acute cholecystitis[14]. For this reason, it increases the popularity of the surgical treatment strategies, especially the laparoscopic approach[15]. In our study, no significant difference was found in treatment strategies and surgical technique between the pre-pandemic and pandemic periods.

In the COVID-19 pandemic period, as a disease severity laboratory test for many inflammatory diseases such as acute cholecystitis and acute appendicitis, acute-phase reactants including leukocyte and CRP are expected to increase because of possible delayed hospital admissions of patients[16]. Also, in the COVID-19 disease, it is known that the laboratory findings of leukopenia and high CRP are seen, but in this situation for the differential diagnosis, the clinical presentation of the patient is much more important[17]. In our study, no significant difference was observed in leukocyte and CRP values between the pre-pandemic and pandemic periods. In addition, we did not find a significant difference in these laboratory markers between patients operated in the pre-pandemic and those operated in the pandemic period.

Tokyo Guidelines 2018/2013 severity grading scale is a grading system using local and systemic signs of inflammation and imaging findings in acute cholecystitis. In this scale, acute cholecystitis is classified into grade I (mild), grade II (moderate), and grade III (severe)[18]. When we separated our patients according to this scale that determines the treatment strategies, we did not find a significant difference between the periods in the surgical and nonsurgical patients. Parkland grading scale is a scale ranging from grades I to V, which is revealed by intraoperative evaluation of adhesions from the gallbladder and evaluation of other inflammatory findings[19]. This scale is used to evaluate the difficulty of laparoscopic cholecystectomy and

Table 2. Comparison of patients undergoing urgent cholecystectomy between the pre-pandemic and pandemic periods.

Outcomes	Pre-pandemic period (n=18)	Pandemic period (n=14)	p-value
Age (year)	53.0 (IQR, 46–63)	55.0 (IQR, 42–63)	0.896
Sex, n (%)			
Female	7 (38.9)	7 (50.09)	0.530
Male	11 (61.1)	7 (50.0)	
Laboratory tests			
Leucocyte ($\times 10^9$/L)	14.3 (IQR, 10–19)	12.4 (IQR, 7–18)	0.180
C-reactive protein (mg/L)	55 (IQR, 25–152)	17 (IQR, 2–188)	0.442
ASA score, n (%)			
ASA 1	1 (5.6)	1 (7.1)	0.680
ASA 2	16 (88.9)	11 (78.6)	
ASA 3	1 (5.6)	2 (14.3)	
TG18/TG13 severity grading, n (%)			
Grade I	11 (61.1)	7 (50.0)	0.475
Grade II	7 (38.9)	6 (42.9)	
Grade III	0	1 (7.1)	
Previous ERCP history, n (%)	5 (38.5)	5 (50.0)	0.685
Type of surgery, n (%)			
Open cholecystectomy	3 (16.7)	2 (14.3)	1.000
Laparoscopic cholecystectomy	15 (83.3)	12 (85.7)	
Parkland grading scale, n (%)			
Grades 1–2	11 (61.1)	8 (57.1)	1.000
Grades 3–5	7 (38.9)	6 (42.9)	
Intraoperative complication, n (%)	0	2 (14.3)	0.183
Operation time (minute)	75 (IQR, 59–103)	59 (IQR, 55–100)	0.338
Length of hospital stay (day)	5 (IQR, 4–8)	5 (IQR, 4–8)	0.587
30-day rehospitalization, n (%)	1 (5.6)	3 (21.4)	0.295

IQR: interquartile range; ASA: American Society of Anesthesiologist; TG18/TG13: Tokyo Guidelines 2018/2013 severity grading for acute cholecystitis; ERCP: endoscopic retrograde cholangiopancreatography.

possible complications such as converting the open technique[19]. When we divided this scale into two subgroups as grades I–II and grades III–IV–V, we showed that there was no significant difference between the two periods.

Percutaneous cholecystostomy is a treatment strategy that can be used in patients with acute cholecystitis, especially in patients with high ASA scores, and can also be used as a bridge to elective treatment. Despite its low morbidity and mortality rates, it includes risks such as hemorrhage, liver abscess, and recurrence of symptoms[20,21]. Especially during the pandemic period, it may be thought that the risk of suffering from morbid and mortal complications of COVID-19 disease for elderly people has increased, and the tendency to this treatment strategy may have increased in order to mitigate disease transmission[22]. However, our study did not show an increased tendency in terms of percutaneous cholecystostomy.

Laparoscopic and open technique cholecystectomy is one of the surgical treatment strategies for acute cholecystitis. Converting to the open technique may be considered after intraoperative Parkland grading scale evaluation[23]. Although the preference of laparoscopy during the pandemic period is questioned in recent studies[24], no significant difference was found with the pre-pandemic period in our study.

To reduce the increased risk of contamination during the pandemic period, there is a general recommendation to shorten the length of hospital stay[4,25]. Researches showed that there is a tendency in this direction[25]. However, in our study, it was showed that hospitalization periods were similar in the two periods.

CONCLUSIONS

In the pandemic period, it is thought that more complicated acute cholecystitis cases may be seen due to the increased burden of the health care system and late admission to the hospital. Additionally, in this period, it is thought that postponing and bridging treatments such as medical treatment and percutaneous drainage may replace surgical interventions in order to reduce the risk of contamination of both patients and health care workers. In our study, there was no statistically significant difference between the groups in terms of the disease severity on admission and patients' outcomes. However, prospective randomized studies and reviews with larger population are needed on this subject.

AUTHORS' CONTRIBUTIONS

EL: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **MZB:** Data curation, Investigation, Methodology, Resources, Software, Writing – original draft, Writing – review & editing. **YSP:** Data curation, Methodology, Resources, Writing – review & editing.

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