

The impact of the COVID-19 pandemic on emergency general surgery: a retrospective study

Ismail Alper Tarim^I, Murat Derebey^{II}, Gökhan Selçuk Özbacı^{III}, Oğuzhan Özşay^{IV}, Mahmut Arif Yüksek^V, Sercan Büyükkakıncak^{VI}, Recep Bircan^{VII}, Bahadır Bülent Güngör^{VIII}, Mahmut Başoğlu^{IX}

Ondokuz Mayıs University Medical Faculty, Samsun, Turkey

^IPhD. Assistant Professor, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0002-6203-2644](https://orcid.org/0000-0002-6203-2644)

^{II}PhD. General Surgeon, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0002-0654-846X](https://orcid.org/0000-0002-0654-846X)

^{III}PhD. Associate Professor, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0003-0768-8306](https://orcid.org/0000-0003-0768-8306)

^{IV}PhD. Assistant Professor, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0001-6291-2652](https://orcid.org/0000-0001-6291-2652)

^VMD. Doctoral Student and General Surgery Resident, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0002-8323-7390](https://orcid.org/0000-0002-8323-7390)

^{VI}PhD. General Surgeon, Department of General Surgery, Trabzon Kanuni Eğitim ve Araştırma Hastanesi, Trabzon, Turkey.

[ID https://orcid.org/0000-0002-1262-9936](https://orcid.org/0000-0002-1262-9936)

^{VII}MD. Doctoral Student and General Surgery Resident, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0002-6842-6003](https://orcid.org/0000-0002-6842-6003)

^{VIII}PhD. Professor, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0002-1086-4254](https://orcid.org/0000-0002-1086-4254)

^{IX}PhD. Professor, Department of General Surgery, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey.

[ID https://orcid.org/0000-0003-3283-4483](https://orcid.org/0000-0003-3283-4483)

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ABSTRACT

BACKGROUND: The COVID-19 pandemic has affected healthcare systems worldwide. The effect of the pandemic on emergency general surgery patients remains unknown.

OBJECTIVE: To reveal the effects of the COVID-19 pandemic on mortality and morbidity among emergency general surgery cases.

DESIGN AND SETTING: Data on patients who were admitted to the emergency department of a tertiary hospital in Samsun, Turkey, and had consultations at the general surgery clinic were analyzed retrospectively.

METHODS: Our study included comparative analysis on two groups of patients who received emergency general surgery consultations in our hospital: during the COVID-19 pandemic period (Group 2); and on the same dates one year previously (Group 1).

RESULTS: There were 195 patients in Group 1 and 132 in Group 2 ($P < 0.001$). While 113 (58%) of the patients in Group 1 were women, only 58 (44%) were women in Group 2 ($P = 0.013$). Considering all types of diagnosis, there was no significant difference between the two groups ($P = 0.261$). The rates of abscess and delayed abdominal emergency diseases were higher in Group 2: one case (0.5%) versus ten cases (8%); $P < 0.001$. The morbidity rate was higher in Group 2 than in Group 1: three cases (1.5%) versus nine cases (7%); $P = 0.016$.

CONCLUSIONS: The COVID-19 pandemic has decreased the number of unnecessary nonemergency admissions to the emergency department, but has not delayed patients' urgent consultations. The pandemic has led surgeons to deal with more complicated cases and greater numbers of complications.

INTRODUCTION

The disease caused by the new coronavirus started in Wuhan, China, and has spread all over the world. It was named Coronavirus Disease 2019 (COVID-19) by the World Health Organization on February 11, 2020.¹

The COVID-19 pandemic has endangered health worldwide and has also threatened healthcare professionals. Elective interventions have been postponed around the world because of the COVID-19 pandemic, in order to make empty beds in the hospitals and intensive care units available for people suffering from the COVID-19 disease. However, it is not possible to delay emergency patients and emergency interventions.

Emergency cases are probably the most dangerous situation for healthcare workers, since it is unclear whether patients admitted to the emergency department carry COVID-19. People do not want to leave their homes and go to hospitals, for fear of the COVID-19 pandemic. This raises a number of questions: Are people coming late for admission to the emergency department because of the COVID-19 pandemic, even if they are sick? Does this lead surgeons to encounter more complicated and more difficult cases? Have the mortality and morbidity rates relating to emergency surgery performed during the COVID-19 pandemic period increased?

OBJECTIVE

Our aim in this study was to investigate the effects of the COVID-19 pandemic on emergency general surgery cases, through the characteristics of our clinical data.

METHODS

All the procedures performed in this study that involved human participants were conducted in accordance with the ethical standards of our institution's research ethics committee and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was conducted with approval from our hospital's ethics committee (approval number: 2020/366; approval date: June 15, 2020).

Our study included retrospective analysis on patients who received emergency general surgery consultation in our hospital during the COVID-19 pandemic period and on the same dates one year previously. The patients were divided into two groups. Group 1 included patients who were seen one year before the pandemic episode, between March 15, 2019, and May 15, 2019. Group 2 included patients who were seen between March 15, 2020 and May 15, 2020, i.e. during the COVID-19 pandemic period.

The patients' demographics, general findings (age and gender, etc.) and emergency diagnoses, and the results from those who underwent surgery (type of surgery, length of stay and complications, etc.) were recorded separately for Group 1 and Group 2. Differences between the groups were investigated.

The data were analyzed using the SPSS tools, version 18 (SPSS Inc., Chicago, IL, United States). We used descriptive statistics, chi-square tests and Mann-Whitney U tests to analyze the data. Statistical significance was accepted at $P < 0.05$.

RESULTS

There were 195 patients in Group 1 and 132 patients in Group 2 ($P < 0.001$; **Table 1**). While 82 patients (42%) in Group 1 were male and 113 (58%) were female, these proportions changed to 74 men (56%) and 58 women (44%) in Group 2. There was a significant difference between the groups in this regard ($P = 0.013$; **Table 1**). There was no difference in median age between the groups (53 years versus 50 years, respectively; $P = 0.177$).

There were no significant difference between the groups in terms of the following clinical characteristics: chronic diseases (diabetes mellitus, hypertension, coronary artery disease, etc., $P = 0.104$), time elapsed from the beginning of complaints to admission to the emergency department ($P = 0.933$), proportion of trauma patients ($P = 0.608$), rate of hospitalization with refusal of treatment ($P = 0.283$) and length of hospital stay ($P = 0.430$) (**Table 1**). In Group 2, four patients (3%) with a COVID-19 diagnosis or suspicion of this had consultations regarding emergency surgery.

The diagnoses of patients who had consultations regarding general surgery and the results from patients who underwent surgery are also shown in **Table 1**. In both groups, non-specific abdominal pain was diagnosed most frequently: 33 cases (17%) in Group 1 versus 31 cases (23.5%) in Group 2. When all types of diagnosis

were considered, there was no significant difference between the two groups ($P = 0.261$).

While the rate of emergency general surgery (EGS) was 40 cases (30%) in Group 2, it was 41 cases (21%) in Group 1 ($P = 0.079$; **Table 1**). Although there was no statistical difference in this regard, the patients in Group 2 had a higher rate of surgery. The most common type of surgery in both groups was appendectomy: 18 cases (9%) versus 19 cases (14%), respectively. There was no difference in the variety of operations between the groups ($P = 0.441$; **Table 1**). The rates of abscesses and delayed abdominal emergency diseases were significantly higher in Group 2: one case (0.5%) versus ten cases (8%), respectively; $P < 0.001$. The mortality rates were similar between the groups, but the morbidity rate was significantly higher in Group 2 than in Group 1: three cases (1.5%) versus nine cases (7%); $P = 0.016$ (**Table 1**).

DISCUSSION

The COVID-19 pandemic has brought an ongoing situation that has spread around the world and is affecting people negatively. It has been reported globally that the pandemic has stressed health-care systems and threatens the ability to provide patients with full and adequate care.²

We conducted this study in the light of changes to patients' tendencies for admission to the emergency department. Many articles have been published emphasizing the effects of the COVID-19 pandemic on many surgical procedures that would be performed either under elective or under emergency conditions and the precautions that should be taken.²⁻⁸ However, during the COVID-19 pandemic period, when most elective surgeries were not being performed, no study has yet been conducted on how emergency applications are affected and how the pandemic has affected the morbidity and mortality of emergency surgeries. In this study, we wanted to discuss this.

When we evaluated the results from our own clinic, we found that the rate of consultation for general surgery for patients who had been admitted to the emergency department decreased significantly, as was predicted (132 patients versus 195 patients; $P < 0.001$; **Table 1**). Patients may have been afraid of acquiring COVID-19 and, hence, the number of admissions to the emergency department decreased. Moreover, the number of emergency consultations for general surgery likewise decreased.

The finding in **Table 1** to which attention is drawn is that the gender of the patients in Group 2 was significantly male. Women accounted for 58% (113) in Group 1, but only 44% (58) in Group 2 ($P = 0.013$). This result brings two things to mind: either women were afraid of the pandemic and did not come to the emergency room; or, in the pre-pandemic period, women kept the emergency services unnecessarily busy.

As seen in **Table 1**, there was no difference regarding the duration of complaints and the time of emergency admission ($P = 0.933$).

This makes us think that when people had real intractable pain, they sought admission to the emergency department irrespective of the pandemic. Considering the fact that more men were admitted to the emergency department during the pandemic period, this strengthens the idea that women had sought admission to the

emergency department in the pre-pandemic period even though they did not have any emergency disease.

Although it was thought that people would not accept hospitalization during the COVID-19 pandemic period because they were afraid of this disease, there was no difference between the

Table 1. Demographics, general findings, diagnoses and results from patients who underwent surgery

	Group 1 (2019) [n (%)]	Group 2 (2020) [n (%)]	P
Total number of patients	195	132	< 0.001
Sex			
Male	82 (42)	74 (56)	0.013
Female	113 (58)	58 (44)	
Median age (with interquartile range), in years	53 (39)	50 (40)	0.177
Additional diseases*			
Yes	105 (53.8)	59 (44.7)	0.104
No	90 (46.2)	73 (55.3)	
Time between the onset of complaints and admission to the emergency room**			
Time period < 24 hours	91 (46.9)	61 (46.2)	0.933
Time period ≥ 24 hours and < 48 hours	36 (18.6)	23 (17.4)	
Time period ≥ 48 hours	67 (34.5)	48 (36.4)	
Traumatized			
Yes	16 (8.2)	13 (9.8)	0.608
No	179 (91.8)	119 (90.2)	
COVID-19-positive or suspected case	-	4 (3)	0.014
Refusal to accept hospitalization or treatment	20 (10.3)	9 (6.8)	0.283
Length of stay in the hospital, [median (with interquartile range)], in days	4.50 (7)	6.00 (8)	0.430
Patient diagnoses			
Nonspecific abdominal pain	33 (17)	31 (23.5)	
Acute appendicitis	21 (11)	21 (16)	
Acute hepatobiliary infections***	27 (14)	14 (11)	
Acute mesenteric ischemia	5 (2.5)	3 (2)	0.261
GIS perforations	7 (3.5)	3 (2)	
Intestinal obstructions	25 (13)	8 (6)	
GIS bleeding	6 (3)	2 (1.5)	
Other diagnoses	71 (36)	50 (38)	
Emergency general surgery	41 (21)	40 (30)	0.079
Types of surgery			
Appendectomy	18 (9)	19 (14)	
Colon or small bowel resection	4 (2)	10 (8)	
Hartman procedure	1 (0.5)	1 (0.8)	
Bridectomy	1 (0.5)	1 (0.8)	
Stoma creation	2 (1)	1 (0.8)	0.441
Primary repair for GIS perforation	3 (1.5)	1 (0.8)	
Total gastrectomy	1 (0.5)	1 (0.8)	
Herniography	6 (3)	2 (1.5)	
Diagnostic laparotomy	1 (0.5)	2 (1.5)	
Others	4 (2)	2 (1.5)	
Abscessed or delayed cases	1 (0.5)	10 (8)	< 0.001
Mortality	6 (3.1)	4 (3.0)	0.625
Morbidity	3 (1.5)	9 (7)	0.016

*Diabetes mellitus, hypertension, coronary artery disease, chronic kidney failure etc.; **The time between the onset of the patient's complaints and his presentation to the emergency room; ***Acute cholecystitis, acute pancreatitis, acute cholangitis etc.; GIS = gastrointestinal system.

two groups in our results ($P = 0.283$; **Table 1**). Again, only four patients (3%) in Group 2 were COVID-19-positive or were suspected cases. This very low rate suggested that the healthcare workers dealing with the emergency patients did not need to be overly anxious about COVID-19.

Lima et al. suggested that, among patients admitted to the emergency department with acute abdomen, if they undergo abdominal computed tomography (CT), chest CT should be added even if there is no respiratory complaint.⁹ We therefore requested chest CT for all our patients who would undergo emergency surgery. However, the low number of COVID-19-positive or suspected cases among our patients showed that it was wrong for us to perform chest CT on all patients. Consequently, in our opinion, it is unnecessary to have chest CT for all patients.

The diagnoses among the patients who had consultations for general surgery were similar in Group 1 and Group 2 ($P = 0.261$; **Table 1**). Nonspecific abdominal pain was diagnosed most frequently in both groups: Group 1, 33 cases (17%); Group 2, 31 cases (23.5%) (**Table 1**). There was no significant difference between the rates of patients undergoing emergency surgery, but the operation rate among the patients in Group 2 was higher than among those in Group 1: Group 1, 41 cases (21%); Group 2, 40 cases (30%); $P = 0.079$ (**Table 1**).

Fewer patients were admitted to the emergency department during the COVID-19 pandemic, but a higher proportion then underwent surgery. This result supports the idea that some of the patients admitted to the emergency department before the pandemic were not really emergencies.

During the pandemic, many things have changed regarding the approach to emergency general surgery patients. Suggestions such as applying laparotomy instead of laparoscopy and treating acute appendicitis with antibiotic therapy instead of surgery if no perforation is presented were added to the algorithms.^{10,11} Our appendectomy rates did not decrease during the pandemic period (Group 2), as seen in **Table 1**, because the new directive to treat acute appendicitis with antibiotics was implemented only after the period studied here. Because we will change our algorithm from now on, our appendectomy rate will decrease.

The rates of intra-abdominal abscesses and delayed emergency surgical cases were found to be significantly higher in Group 2: one case (0.5%) versus ten cases (8%), respectively; $P < 0.001$. Considering that there was no difference between the two groups in terms of the time between the onset of patients' complaints and their admission to the hospital, delays in making diagnoses may have been due to the time-consuming evaluations that physicians and surgeons undertook in the initial period of the pandemic. Di Saverio et al. suggested that all emergency general surgery patients should be tested for COVID-19, but that the testing process should not delay emergency surgery.¹²

Through having thoracic tomography performed on all our patients who would undergo emergency surgery, we may have lost time for these patients and may have consequently encountered cases that were more complicated. We performed various examinations, especially thoracic computed tomography scans, to ascertain whether any of our patients undergoing emergency surgery had COVID-19. This was a self-protection reflex to guard against this disease, but the time loss in making the diagnosis may have led to greater complications among these cases. Given that many surrounding hospitals have been serving as pandemic hospitals, patients in these hospitals have not been undergoing operations. Cases requiring urgent surgical intervention are directed to tertiary-level hospitals like ours. This may therefore have caused delays in operations for these patients.

While the mortality rate seen among cases of emergency laparotomy is 14-20% in the literature,¹³ our mortality rates were lower and our two groups had similar rates: Group 1, six cases (3.1%); Group 2, four cases (3%) (**Table 1**). However, our morbidity rates were significantly higher during the pandemic period. This may have related to delayed diagnoses or delayed operations: three cases (1.5%) versus seven cases (7%) ($P = 0.016$).

During the COVID-19 pandemic, one of our patients died due to this disease. Also during the pandemic period, one surgeon and one nurse working in our clinic were diagnosed with COVID-19 and were treated in our hospital. COVID-19 poses a great risk to healthcare professionals, given that it is a disease that has not yet been fully identified and for which no cure is yet available. This inevitably worries all healthcare professionals, including surgeons. In particular, it may cause delays in making diagnoses and treating emergency surgical patients among whom it is not certain whether they might have COVID-19.

Our study has some shortcomings. We were unable to add the durations of the operations into our study data because these were not recorded. If they had been recorded, some differences between the groups might have been seen. Again, it should be kept in mind that we may have encountered more complicated cases because our hospital is a tertiary-level hospital.

The strength of our study is that it was the first to investigate the effects of the COVID-19 pandemic on emergency general surgery.

CONCLUSION

The COVID-19 pandemic has had the result of decreasing the number of unnecessary nonemergency admissions to our emergency department, but it has not delayed urgent consultations for emergency cases. In our opinion, the processes of making diagnoses and undertaking emergency surgery on patients have been negatively affected by the COVID-19 pandemic period. The pandemic has led surgeons to deal with more complicated cases and greater numbers of complications.

REFERENCES

- World Health Organization (WHO). Naming the coronavirus disease (COVID-19) and the virus that causes it. 2020. Available from: [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-\(covid-2019\)-and-the-virus-that-causes-it](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it). Accessed in 2020 (Sep 18).
- Di Saverio S, Pata F, Gallo G, et al. Coronavirus pandemic and colorectal surgery: practical advice based on the Italian experience. *Colorectal Dis.* 2020;22(6):625-34. PMID: 32233064; <https://doi.org/10.1111/codi.15056>.
- De Simone B, Chouillard E, Di Saverio S, et al. Emergency surgery during the COVID-19 pandemic: what you need to know for practice. *Ann R Coll Surg Engl.* 2020;102(5):323-32. PMID: 32352836; <https://doi.org/10.1308/rcsann.2020.0097>.
- Coimbra R, Edwards S, Kurihara H, et al. European Society of Trauma and Emergency Surgery (ESTES) recommendations for trauma and emergency surgery preparation during times of COVID-19 infection. *Eur J Trauma Emerg Surg.* 2020;46(3):505-10. PMID: 32303798; <https://doi.org/10.1016/j.surg.2020.03.012>.
- Guerci C, Maffioli A, Bondurri AA, Ferrario L, Lazzarin F, Danelli P. COVID-19: How can a department of general surgery survive in a pandemic? *Surgery.* 2020;167(6):909-11. PMID: 32299626; <https://doi.org/10.1016/j.surg.2020.03.012>.
- Al-Balas M, Al-Balas HI, Al-Balas H. Surgery during the COVID-19 pandemic: A comprehensive overview and perioperative care. *Am J Surg.* 2020;219(6):903-06. PMID: 32334800; <https://doi.org/10.1016/j.amjsurg.2020.04.018>.
- Coccolini F, Perrone G, Chiarugi M, et al. Surgery in COVID-19 patients: operational directives. *World J Emerg Surg.* 2020;15(1):25. PMID: 32264898; <https://doi.org/10.1186/s13017-020-00307-2>.
- Hussain A, Mahawar K, El-Hasani S. The Impact of COVID-19 Pandemic on Obesity and Bariatric Surgery. *Obes Surg.* 2020;30(8):3222-3. PMID: 32388706; <https://doi.org/10.1007/s11695-020-04637-7>.
- Lima DS, Ribeiro MAF Jr, Gallo G, Di Saverio S. Role of chest CT in patients with acute abdomen during the COVID-19 era. *Br J Surg.* 2020;107(7):e196. PMID: 32386064; <https://doi.org/10.1002/bjs.11664>.
- Di Saverio S, Khan M, Pata F, et al. Laparoscopy at all costs? Not now during COVID-19 outbreak and not for acute care surgery and emergency colorectal surgery: A practical algorithm from a hub tertiary teaching hospital in Northern Lombardy, Italy. *J Trauma Acute Care Surg.* 2020;88(6):715-18. PMID: 32282750; <https://doi.org/10.1097/TA.0000000000002727>.
- Pata F, Khan M, Iovino D, Di Saverio S. Laparotomy represents the safest option during COVID-19 outbreak: Authors' response to: The COVID-19 pandemic should not take us back to the pre-laparoscopic era; Emergency laparoscopic surgery during COVID-19: what can we do and how to do it safely. *J Trauma Acute Care Surg.* 2020. Published online ahead of print. PMID: 32427770; <https://doi.org/10.1097/TA.0000000000002791>.
- Di Saverio S, Pata F, Khan M, Ietto G, Zani E, Carcano G. Convert to open: the new paradigm for surgery during COVID-19? *Br J Surg.* 2020;107(7):e194. PMID: 32367551; <https://doi.org/10.1002/bjs.11662>.
- Havens JM, Neiman PU, Campbell BL, et al. The Future of Emergency General Surgery. *Ann Surg.* 2019;270(2):221-2. PMID: 30614879; <https://doi.org/10.1097/SLA.0000000000003183>.

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Address for corresponding:

Ismail Alper Tarim

Department of General Surgery, Ondokuz Mayıs University Medical Faculty
Ondokuz Mayıs Üniversitesi Tıp Fakültesi, Genel cerrahi bölümü, Kurupelit
yerleşkesi, Posta kodu: 55270, Körfez, Atakum, Samsun, Türkiye
Tel. (+90) 5058583443

E-mail: ismailalpert@gmail.com

