JMSR
Journal of Medical and Surgical Research

Research Article

ISSN: 2351-8200

JMSR 2021 Vol. VII, n 3:879- 885

THE IMPACT OF THE COVID-19 PANDEMIC ON GASTRIC CANCER SURGERY: -A SINGLE CENTER STUDY-

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ABSTRACT

Introduction: Coronavirus disease 2019 (COVID-19) was declared to be a global pandemic by the World Health Organization on March 11, 2020. The impact on gastric cancer (GC) surgery is unknown. Various reports have shown data indicating that cancer patients with COVID-19 have high morbidity and mortality rates. The choice of surgical procedures and perioperative management of the patients with malignancy has become even more impor¬tant in the COVID-19 pandemic. In this study, we aimed to evaluate the effects of the COVID-19 pandemic on the preopartive, intraoperative, and postoperative findings of patients operated for gastric cancer in our clinic.**Materials and Methods:** We defined the 'COVID-19' period as occurring between 12-03-2020 and 31-08-2020. All the enrolled patients were divided into two groups, pre-COVID-19 group (Pre-CG; 64 cases) and COVID-19 group (CG; 39 cases). A total of 103 patients with gastric cancer were included in this study. Patient characteristics, preoperative, intraoperative, and postoperative clinicopathological findings were compared between groups. **Results:** The waiting times before admission increased in CG (Pre-CG [6.73±2.85] vs CG [20.61±5.16] ; p<0.001). After admission, the waiting time before surgery was longer in CG (Pre-CG [5.06±3.06] vs CG [6.89±3.32] ; p=0.006). No significant difference was detected between the groups in terms of operation time, surgical procedure, combine organ resection, intraoperative blood transfusion requirment (p values, respectively; p=0.108; p=0.951; p=0.204; p=0.597). Postoperative complications were oesophagojejunostomy leak (3/1) , atelectasis (2/2), duodenal leak (2/2), ileus (3/0), pleural effusion (2/2), and others (1/1), and there was no statistically significant difference between the two groups (p = 0.333). There was no significant difference between the two groups in terms of hospital stay (p = 0.086) and ICU stay (p = 0.989). **Conclusion:** In this study, it was seen that the COVID-19 pandemic did not affect morbidity and mortality in gastric cancer surgery, but it prolonged admission waiting and operation waiting times. Since there is very little data in the literature regarding the effect of COVID-19 on gastric cancer surgery, our study will guide future studies on this subject.

Keywords: COVID-19; Impact; Gastric cancer; Pandemics; Surgery.

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*****Published in 2021.*

doi: 10.46327/msrjg.1.000000000000----
doi url: https://doi.org/10.46327/msrjg

JMSR
Journal of Medical and Surgical Research
Research Article
ISSN: 2351-8200
JMSR 2021 Vol. VII, n 3:879- 885

INTRODUCTION

COVID-19 was first seen in China at the end of December 2019. COVID-19 is a novel type of coronavirus that is defined as SARS-CoV-2 [1]. Coronavirus disease (COVID-19) spread rapidly all over the world and was declared to be a global pandemic by the World Health Organization (WHO) on March 11, 2020. COVID-19 usually presents with respiratory symptoms such as fever, muscle pain, weakness, cough, and dyspnea. However, the number of patients suffering from gastrointestinal symptoms such as abdominal pain, diarrhea, nausea and vomiting is not few [2]. Gastric cancer (GC) surgery is not a front-line issue in the fight against the novel coronavirus, however, in such a special situation, patients with cancer are more likely to develop COVID-19. And in this case, in cancer patients can occur complications that require intensive care [3]. Surgery is the foundation of curative therapy for many malignancies. Delayed resection may lead to progression, resulting in clinically significant differences in complications, recurrence, and survival. Delayed treatment may also lead to the need for additional adjuvant or neoadjuvant therapy, additional imaging studies for restaging, and ultimately less efficient and less effective care. Furthermore, the psychological burden of delayed surgery is likely significant. Therefore, many changes and new algorithms have been proposed in the surgical strategy during the pandemic period. The American College of Surgeons (ACS) and the Society of Surgical Oncology (SSO) published guidelines for triage of nonemergent surgical procedures [4]. Turkey as well as in the whole world noncancer some elective surgeries are postponed. At the same time, open surgery has been given superiority by suggesting the high risk of COVID-19 transmission during laparoscopic surgery [5, 6]. There is only one study in the literature investigating the effect of the COVID-19 pandemic process on GC surgery [7]. The aim of this study is to investigate the effects of COVID-19 pandemic on GC surgery.

MATERIALS AND METHODS

This study was approved by the Ministry of Health, General Directorate of Health Services and Ethics Committee of Ankara University Medical Faculty (Decision number: İ10-640-20). The data of 103 patients, who underwent surgery for gastric cancer in the Surgical Oncology Clinic of Ankara University Medical Faculty in the period between August 2019 and August 2020, were retrospectively studied. According to the official statement of the Ministry of Health of Turkey description first case of coronavirus in Turkey was detected on March 11. Taking this into consideration, the patients were categorized into two groups: “pre-COVID-19” (Pre-CG; 64 cases; period from 01-08-2019 to 10-03-2020) and “COVID-19” (CG; 39 cases; period between 12-03-2020 and 31-08-2020). The operations were performed by 2 surgeons and same team. Polymerase chain reaction (PCR) test was performed for COVID-19 by taking combined nasal and throat swabs from all patients 24-48 hours before surgery in pandemic period. CORONEX-COVID-19 RT-qPCR diagnostic kit (made in Turkey/Ankara/Teknokent) was used for PCR test. The criteria for inclusion in the study were as follows: patients with a preoperative diagnosis of histologically proven gastric adenocarcinoma; there was no missing patient data. On the other hand, the exclusion criteria were as follows: patients diagnosed with other malignant tumors such as gastric lymphoma, neuroendocrine tumors, squamous cell carcinoma, stromal tumors in the preoperative or postoperative pathological examination; a history of other organ cancer; and missing data. Patient characteristics, preoperative, intraoperative and postoperative clinicopathological findings were compared between the two groups. Patient characteristics were included age, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) scores, comorbidity, tumor localization, neoadjuvant treatment status. The evaluation of preoperative clinicopathological findings included the analysis of admission waiting time (day), operation waiting time (day), AFP, CEA, CA 19-9, Hb and Clinical TNM staging. The following intraoperative findings were evaluated: operation method (laparoscopic or open), surgical procedure performed (total gastrectomy, disatl subtotal gastrectomy, diagnostic laparoscopy), combined organ resection, operation time (min.), requirment for blood transfusion. On the other hand, the following postperative findings were evaluated: 30-day postoperative complications, mortality, presence of postoperative fever, total hospital stay, intensive care unit (ICU) stay and postoperative blood transfusion requirment. Finally, all findings were compared between the two groups.

RESULTS

During the pandemic period, all gastric cancer surgeries in our clinic were performed under elective conditions. PCR test was performed for COVID-19 by taking combined nasal and throat swabs from all patients 24-48 hours before surgery. The operation of three patients was delayed due to PCR positivity

JMSR
Journal of Medical and Surgical Research
Research Article
ISSN: 2351-8200
JMSR 2021 Vol. VII, n 3:879- 885

and was performed at a later date. No PCR test positivity was found in any patient in the postoperative period.

One hundred three patients were operated for GC. Sixty four (62.1%) of 103 patients were operated before the pandemic (Pre-CG), and 39 (37.9%) during the pandemic period (CG). Sixty one (59.2%) of the patients were male, 42 (40.8%) were female and mean ± standard deviation and median (minimum-maximum) values of the patients' age were respectively 61.13 ± 13.04 and 62.00 (24.00-90.00). Tumor localization in pre-CG was antrum in 31 (48.4%) patients, corpus in 21 (32.8%) patients, and cardia in 12 (18.8%) patients. In CG, 18 (46.2%) patients had antrum, 10 (25.6%) patients had corpus and 11 (28.2%) patients had cardia tumors, and there was no statistically significant difference between the two groups (p = 0.494). Comparisons of patient characteristics are shown in **Table I**.

Table I. Comparison of patients characteristics.

Variables		Groups				
		Pre-CG (64 cases)		CG (39 cases)		
		n	%	n	%	p
Gender	**Male**	38	59.4	23	59.0	0.968[a]
	Female	26	40.6	16	41.0	
Age	**Mean±SD**	59.62±13.50		63.61±12.01		0.133[b]
Neoadjuvant treatment	**No**	51	79.7	33	84.6	0.532[a]
	Yes	13	20.3	6	15.4	
Comorbidities	**No**	38	59.4	21	53.8	0.582[a]
	Yes	26	40.6	18	46.2	
ASA	**1**	38	59.4	21	53.8	0.796[a]
	2	24	37.5	16	41.0	
	3	2	3.1	2	5.2	
Tumor Location	**Antrum**	31	48.4	18	46.2	0.494[a]
	Corpus	21	32.8	10	25.6	
	Cardia	12	18.8	11	28.2	
BMI	**Mean±SD**	24.86±4.24		24.62±4.41		0.736[c]

a, Ki-kare; b, Student-t; c, Mann Withney U; SD, standart deviation.

The waiting times before admission increased in CG (Pre-CG [6.73± 2.85] vs CG [20.61± 5.16]; p<0.001). After admission, the waiting time before surgery was longer in CG (Pre-CG [5.06± 3.06] vs CG [6.89± 3.32] ; p=0.006). The relationship of preoperative characteristics with the groups is summarized in **Table II**.

Tablo II. Comparison of preoperative clinicopathological findings.

Variables		Groups				
		Pre-CG (64 cases)		CG (39 cases)		
		n	%	n	%	p
Clinical TNM stage	**1**	9	14.1	3	7.7	0.243[a]
	2	41	64.1	22	56.4	
	3	14	21.8	14	35.9	
AFP	**Normal**	60	93.7	37	94.9	0.814[a]
	High	4	6.3	2	5.1	
CEA	**Normal**	32	50.0	22	56.4	0.527[a]
	High	32	50.0	17	43.6	
CA 19-9	**Normal**	60	93.7	29	74.3	0.005[a]
	High	4	6.3	10	25.7	
Operation waiting (day)	**Mean±SD**	5.06±3.06		6.89±3.32		0.006[c]
Hb	**Mean±SD**	11.98±2.08		11.57±2.05		0.328[b]
Admission waiting (day)	**Mean±SD**	6.73±2.85		20.61±5.16		<0.001[c]

a, Ki-kare; b, Student-t; c, Mann Withney U; SD, standart deviation.

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Research Article
ISSN: 2351-8200
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Although more laparoscopic operations were performed in the pre-covid period, there was no significant difference between the groups in terms of operation type (p=0.276). At the same time, no significant difference was detected between the groups in terms of operation time, surgical procedure, combine organ resection, intraoperative blood transfusion requirment (p values, respectively; p=0.108; p=0.951; p=0.204; p=0.597). Intraoperative findings are summarized in **Table III**.

Table III. Comparison of intraoperative clinicopathological findings.

Variables		Groups				
		Pre-CG (64 cases)		CG (39 cases)		
		n	%	n	%	p
Operation time	**Mean±SD**	118.98±42.56		126.41±47.18		0.108[b]
Surgical Procedure	**Subtotal gx**	36	56.3	21	53.8	0.951[a]
	Total gx	21	32.8	13	33.3	
	Diagnostic lap	6	9.3	5	12.9	
Operation type	**Open**	18	28.1	15	38.5	0.276[a]
	Laparoscopic	46	71.9	24	61.5	
Combine Organ Resection	**No**	58	90.6	32	82.1	0.204[a]
	Yes	6	9.4	7	17.9	
İntraoperative blood transfusion	**No**	55	85.9	32	82.1	0.597[a]
	Yes	9	14.1	7	17.9	

a, Ki-kare; b, Mann Wtihney U; SD: standart deviation; gx: gastrectomy; lap: laparoscopy.

Although the hospital stay was shorter in CG, there was no significant difference between the groups (Pre-CG [12.45 ± 7.36] vs CG [10.30 ± 5.78] ; p=0.086). There was no significant difference between the groups in terms of ICU stay (Pre-CG [2.00± 5.86] vs CG [1.69± 2.01] ; p=0.989). There was no significant difference between the groups in terms of postoperative mortality (p = 0.920). All mortalities were due to surgical complications, and COVID-19 was not detected in any of the patients with mortality. Post-operative complications were oesophagojejunostomy leak (3/1) , atelectasis (2/2), duodenal leak (2/2), ileus (3/0), pleural effusion (2/2), and others (1/1), and there was no statistically significant difference between the two groups (p = 0.333) (**Table IV**).

Table IV. Comparison of postoperative clinicopathological findings

Variables		Groups				
		Pre-CG (64 cases)		CG (39 cases)		
		n	%	n	%	p
Pathological TNM stage	**1**	10	15.6	3	7.7	0.385[a]
	2	27	42.2	14	35.9	
	3	21	32.8	16	41.0	
	4	6	9.3	5	12.8	
Complication	**No**	53	82.8	35	89.7	0.333[a]
	Yes	11	17.2	4	10.3	
Postop. mortality	**No**	61	95.3	37	94.9	0.920[a]
	Yes	3	4.7	2	5.1	
Postop. fever	**No**	53	82.8	31	79.5	0.673[a]
	Yes	11	17.2	8	20.5	
Postop. Blood Transfusion	**No**	57	89.1	31	79.5	0.181[a]
	Yes	7	10.9	8	20.5	
Hospital stay	**Mean±SD**	12.45±7.36		10.30±5.78		0.086[b]
ICU stay	**Mean±SD**	2.00±5.86		1.69±2.01		0.989[b]

a: Ki-kare; b: Mann Withney U; postop: postoperative; ICU: Intensive Care Unit.

STATISTICAL ANALYSIS

SPSS 25.0 software was used in the analysis of the data. For descriptive analysis, quantitative variables mean ± standard deviation and median (minimum-maximum), and qualitative variables were presented as number of patients (percentage). The mean distributions of the quantitative data were tested with the Shapiro-Wilk test and histogram curves. Both the Shapiro-Wilk test and histogram curves were used to see if the variables were normally distributed. In terms of the quantitative variable, the difference between the categories of the qualitative variable with two categories was examined using the Mann-

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Journal of Medical and Surgical Research
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ISSN: 2351-8200
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Whitney U test for those who provided normal distribution assumptions and those who did not provide the Student-t-test. The Chi-squared test was used to evaluate the relationship between two qualitative variables. The statistical significance level was accepted as 0.05.

DISCUSSION

Oncological patients are immunosuppressed both because of the disease itself and the side effects of chemotherapy and/or radiotherapy taken. This makes patients more susceptible to infections, and the prognosis of infections in these patients is worse and more destructive. Cancer patients are almost twice as likely to catch COVID-19 compared to the general population. The choice of surgical procedures and perioperative management of the patients with malignancy has become even more important in the COVID-19 pandemic. The impact of COVID-19 pandemic on gastric cancer (GC) surgery is unknown, particularly service provision, outpatient care, surgical strategy and the possible impact on surgeons. Despite the emergency due to the COVID-19 pandemic, patients affected by GC still need surgery.

During the pandemic period, many measures were taken to prevent the spread of the virus all over the world, and some changes were made in the working order of surgical clinics. Accordingly, some changes were made in the working order of our clinic. Double-bed wards were turned into a single-bed service, visitor reception was restricted, some surgeries such as ostomy closure and benign breast tumor surgeries were postponed, operations were performed with a limited number of staff to prevent unnecessary crowd. In this study, admission waiting time in CG was significantly longer than in Pre-CG ($p<0.001$). In our opinion, this may be due to the decrease in the number of beds and hospitalization and discharge procedures, as well as the patients avoiding the hospital for fear of contamination during the pandemic. There are few studies in the literature related to the increase in the number of patients diagnosed with advanced stage cancer and delayed cancer emergency admissions due to the fear of COVID-19 transmission [8].

After admission, the patients were hospitalized in a single bed room. In addition to the routine preoperative examinations of the patients, combined nasal and throat swabs were taken from all patients 24-48 hours before the operation and PCR test was performed. At the same time, after admission, the patient was observed for 2 days preoperatively for high fever and suspicious findings for COVID-19. During this observation period, patients with negative PCR tests and no suspicious findings for COVID-19 were operated. Factors such as preoperative examinations, a longer observation period (2 days), a decrease in the number of beds, and a slowdown in hospitalization and discharge procedures caused a prolonged operation waiting time in the CG ($p=0.006$). The operation of 3 patients was postponed due to the positivity of the preoperative PCR test and was performed at a later date. In the postoperative period, no PCR test positivity was found in our patients. In line with this study, Yu-xuan Li et al. reported that the admission waiting and operation waiting time was long in the pandemic group [7].

In the present study, no significant difference was found between the two groups in terms of intraoperative findings such as surgery time, operation type, surgical procedure performed, combined organ resection, and intraoperative blood transfusion. National Comprehensive Cancer Network (NCCN) guidelines recommend accurate clinical staging, perioperative therapy, and complete lymphadenectomy for patients with stage II to III GC [9]. The SSO COVID-19 guidelines recommend endoscopic resection of amenable cT1a lesions, primary resection of cT1b lesions, and neoadjuvant therapy for cT2 or higher lesions [10]. EMR or ESD could not be performed because the clinical stage of our patients was not suitable for endoscopic resection. Although the number of laparoscopic operations decreased during the pandemic period compared to the pre-covid period, no significant difference was found ($p=0.276$). In the first 2 months of the pandemic, considering the viral transmission risk of laparoscopy, open surgery was mostly performed in our clinic. In the following months, necessary precautions were taken and gastric cancer surgeries were performed by laparoscopic method. In contrast with this, in the study conducted in China, GC surgeries during the pandemic period were mostly performed by laparoscopic method [7]. Many studies have reported several advantages of laparoscopic surgery over conventional open surgery such as less postoperative pain, less blood loss, shorter hospital stays, and rapid normalization of bowel movements [11-13]. But there are few studies in the literature evaluating the viral transmission risk of laparoscopic surgery and its reliability during the pandemic period [5, 6]. The most important part of laparoscopic surgery is the creation of an artificial pneumoperitoneum. This causes the surgical team to be exposed to aerosol. At the same time, ultrasonic scalpel and energy devices widely used in laparoscopic surgery cause excessive surgical smoke. In some studies, active corynobacterium, papillomavirus and H. I. V. were

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ISSN: 2351-8200
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detected in surgical smoke [14-16]. Therefore, it cannot be excluded that there is no risk of SARS-CoV-2 infection in surgical smoke. Chun-I Li et al. reported that the smoke concentration after the use of electrical or ultrasonic devices for 10 minutes in laparoscopic surgery was significantly higher than traditional open surgery [17]. In the literature, studies from China generally recommend laparoscopic surgery in gastrointestinal cancer surgery during the pandemic period [18, 19]. Although there is no consensus in the literature regarding the use of laparoscopic surgery in the pandemic period considering all these factors, there are a number of recommendations to reduce the risk of viral transmission in minimally invasive surgery. Suggestions such as creating a pneumoperitoneum with low pressure, closing the taps before placing a port, attaching a CO2 filter to one of the ports to remove smoke when necessary, reducing the insertion and removal of instruments from the port, and emptying the abdominal air with a suction device and a CO2 filter from the port at the end of the operation can be listed [5]. We tried to follow these recommendations while performing laparoscopic surgery in our clinic.

Although it was not statistically significant, it was observed that the length of hospital stay was shorter during the pandemic period (p=0.086). This result can be explained by the efforts of patients to be discharged as soon as possible to reduce the risk of contracting the new coronavirus. In contrast with this, in the Chinese study, the duration of hospital stay was longer during the pandemic period [7]. There was no statistical difference in pathological TNM staging, complication, postoperative blood transfusion, mortality, postoperative fever between two groups. Postoperative complications were oesophagojejunostomy leak (3/1) , atelectasis (2/2), duodenal leak (2/2), ileus (3/0), pleural effusion (2/2), and others (1/1), and there was no statistically significant difference between the two groups (p=0.333). After surgery, in patients with fever of unknown cause, appropriate ward isolation measures were taken and postoperative blood routine, C-reactive protein, procalcitonin, chest CT, and new coronavirus PCR tests were done. As a result of these examinations, COVID-19 disease was not detected in patients in the postoperative period in our clinic.

LIMITATIONS

Since the pandemic process is not yet over, our study includes a short period of time. It is necessary to consider these factor when interpreting the results of this study.

CONCLUSION

In conclusion, this study is one of the few studies in the literature investigating the effect of COVID-19 on GC surgery. This series has seen the pandemic prolong the admission waiting and operation waiting. In this study, the effect of COVID-19 on the morbidity and mortality of GC surgery was not observed. Despite the full impact of COVID-19 on GC surgery is still unknown, this will only be evident in the long run. We believe that our study will add value to the literature as it is the second study investigating this issue and based on real data.

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ISSN: 2351-8200
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