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The effect of Covid-19 pandemic on gastric cancer surgery

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Ethics Committee Approval
The study was conducted after approval was granted by Bursa city hospital clinical research ethics committee (Date: September 08, 2021, and No: 2021.16/3-08.09.21).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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No conflict of interest was declared by the authors.

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Abstract

Background/Aim: The global spread of the COVID-19 pandemic has led to difficulties in the prevention of other diseases and especially in the maintenance of cancer treatment, along with the attempts to control the pandemic. The present study aims to investigate the clinical, oncological, and financial effects of COVID-19 on patients undergoing radical gastric cancer surgery.

Methods: This retrospective cohort study included 46 patients and the clinical, epidemiological, radiological, and laboratory data of these patients were analyzed. Inclusion criteria were patients who were diagnosed with gastric cancer, who underwent radical surgical resection in pre-COVID-19 and during COVID-19 periods. Appropriate surgical options were used by taking precautions against viral transmission.

Results: Of the study patients, 56.5% were males, the median age was 69 (42–83) years, and the median length of stay was 9 (7–34) days. The rate of thoracic computed tomography (CT) taken was statistically significantly higher in during-COVID-19 period (P=0.008). The length of the surgery was statistically significantly longer and the estimated blood loss (cc) was lower in during-COVID-19 period (P<0.001, P=0.043, respectively). From a financial point of view, the cost was statistically significantly higher during-COVID-19 period (P=0.038).

Conclusion: The use of thoracic CT in the surgical management of gastric cancer patients was increased, the surgery was prolonged, and the estimated blood loss was reduced along with the pandemic. In addition, the cost of patient treatment increased due to increasing amount of the routine examination and surgical materials used.

Keywords: Gastric cancer, Surgery, COVID-19

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Introduction

Gastric cancer is one of the most common cancer types worldwide [1]. The global spread of the COVID-19 pandemic has led to difficulties in the prevention of other diseases and especially in the maintenance of cancer treatment, along with the attempts to control the pandemic. In this regard, health authorities have changed their strategies around the world and COVID-19 has resulted in the postponement or delay of oncological treatments, as in gastric cancer. To ensure that gastric cancer patients are minimally affected by the current situation, traditional treatment approaches has to be left to adapt to the new circumstances brought into our lives by the COVID-19 pandemic [2].

As gastric cancer is a tumor with well-known immunosuppression and cachexia, it is obvious that COVID-19 is likely to be more mortal in these patients than in the normal population [3]. The extent to which the COVID-19 pandemic has affected gastric cancer surgery is yet to be clarified. The potential effects of the COVID-19 pandemic on healthcare service delivery, outpatient follow-up, surgical strategy, and healthcare workers are not clear [4].

The present study aims to investigate the clinical, oncological, and financial effects of COVID-19 on patients undergoing radical gastric cancer surgery, before and from the onset of the COVID-19 pandemic to the present.

Materials and methods

Study design

Our hospital's surgical oncology clinic was and still is a tertiary cancer center before and during the COVID-19 pandemic. In addition, a part of our hospital and some intensive care units serve as the admission and treatment center for COVID-19 in our region. In our country, the first COVID-19 case was detected on March 1, 2020, followed by a rapid spread, resulting in health measures as well as changes in oncological patient management according to systemic facts. It is possible to state that there have been three major waves of COVID-19 in our country since the pandemic. Within those periods, the health authority adopted the relevant course of action based on short-interval assessments of the status to ensure that cancer therapy services would not be disrupted.

Our study defined the time from August 2019 to February 2020 as the pre-COVID-19 period, and the time from March 2020 to August 2021 as the COVID-19 period. The cases undergoing radical gastric cancer surgery in both periods were compared for demographic characteristics, main characteristics, clinicopathological characteristics, and health economics. The sub-items of the financial burden of COVID-19 on the surgical period-related health economics in these patients were also evaluated.

Financial calculations were calculated in Turkish lira and USD dollars according to the exchange rate at the time of surgery. The time to surgery was defined as the time from the finalization of the pathology to the day of the surgical intervention. Complications were evaluated according to the Clavien-Dindo classification system [5], using a grading of 1 to 5. Preoperative mouth and nose swabs were collected from gastric cancer patients undergoing surgery in the COVID-19 period and the patients were found to be COVID-19-free.

The study included 46 patients who were operated by two surgical oncologists. The clinical, epidemiological, radiological, and laboratory data of these patients were retrospectively retrieved from the hospital information management system. Inclusion criteria were patients who were diagnosed with gastric cancer, who underwent radical surgical resection, and who hadfully accessible records. Patients who had emergency surgery and who had palliative surgery instead of radical surgery were excluded. Additionally, appropriate surgical options (laparoscopic/open surgery etc.) were used by taking precautions against viral transmission during Covid-19 period.

Ethical statement

The study was conducted after approval was granted by Bursa city hospital clinical research ethics committee (Date: September 08, 2021, and No: 2021.16/3-08.09.21). All phases of the study were carried out under the principles established in the Declaration of Helsinki (World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", amended in October 2013, www.wma.net).

Statistical analysis

The SPSS version 26.0 was used for statistical analysis. The assumption of data normality for all quantitative variables was verified by the Shapiro-Wilk test. For the normally distributed variables, the data were expressed as mean (standard deviation). The non-normally distributed measurement data, in turn, were expressed as median and interquartile range. The count data were expressed using frequency and percentage (%). The Student's t-test was used to compare the means for normally distributed variables and the Mann-Whitney U test for non-normally distributed variables. The count data were statistically analyzed using Pearson's Chi-square test or Fisher's exact probability method. A *P*-value less than 0.05 was considered significant.

Results

Of the study patients, 56.5% were males, the median age was 69 (42–83) years, and the median length of stay was 9 (7–34) days. The rate of the patients receiving neoadjuvant chemotherapy was 21.7%. Early gastric cancer was detected in 21.7%. Laparoscopic surgery was performed in 50% of the patients. The mean length of surgery was 239 minutes. Complications were identified in 36.9% (n = 46) of the patients. The mean intraoperative blood loss was 220 cc. Additional organ resection was performed in 13% of the patients.

Within the scope of the study, one patient (3.3%) who was perioperatively infected by COVID-19 virus during COVID-19 period, needed intubation upon pulmonary involvement and was discharged after 14 days of hospitalization with anti-COVID-19 and supportive therapies. None of the patients died due to COVID-19.

The comparison of pre-COVID-19 and COVID-19 periods revealed no statistically significant difference in age, sex, length of hospital stay, time from diagnosis to surgery, tumor localization, T-stage, TNM stage, rates of early gastric cancer detection, and rates of neoadjuvant therapy ($P>0.05$, Table 1). The rate of thoracic Computed Tomography (CT) was

statistically significantly higher during COVID-19 period than in the pre-COVID-19 period (P=0.008, Table 1).

Table 1: Comparison of demographic and clinical features of Pre-Covid-19 and Covid-19 periods

	Pre-Covid-19 n=16	Covid-19 n=30	*P*-value
Age median(min-max)	75(42-82)	66(44-83)	0.362
Gender n(%)			
F	6(37.5)	14(46.7)	0.550
M	10(62.5)	16(53.3)	
Length of stay (day)	10(7-26)	9(7-34)	0.889
Time to surgery(day)			
Neoadjuvant (SD)	105.6 (3)	118.2 (67)	0.639
Non-neoadjuvant	31(11-165)	24(6-225)	0.874
Tumor site			
Cardia	2(12.5)	4(13.3)	0.666
Corpus	6(37.5)	15(50)	
Antrum	8(50)	11(36.7)	
T stage**			
1	4(25)	6(20)	0.331
2	0(0)	3(10)	
3	9(56.3)	11(36.7)	
4	3(18.8)	10(33.3)	
TNM Stage**			
1	3(18.8)	7(23.3)	0.276
2	8(50)	8(926.7)	
3	5(31.3)	15(50)	
Early Gastric Cancer (T1NxM0)*	4(25)	6(20)	0.712
Neoadjuvanttreatment	3(18.8)	7(23.3)	0.720
Number of Thorax CT	1(0-2)	2(1-5)	0.008

**According to NCCN guidelines, *According to Japanese guidelines, SD: standard deviation

The comparison of pre-COVID-19 and COVID-19 periods revealed no statistically significant difference in the type of the intervention, type of gastrectomy, additional organ resection (and splenectomy), degree of the complications (Clavien&Dindo Classification), tumor size (cm), number of total lymph nodes, number of metastatic lymph nodes, the closest surgical margin (mm), and perioperative mortality rates (P>0.05, Table 2). The rates of conversion to open surgery could not be statistically analyzed due to the inappropriate number of cases. The length of the surgery was statistically significantly longer and the estimated blood loss (cc) was lower during COVID-19 period than in the pre-COVID-19 period (P<0.001, P=0.043, respectively, Table 2).

Table 2: Comparison of postoperative clinical and oncopathological features of Pre-Covid-19 and Covid-19 periods

	Pre-Covid-19 n=16	Covid-19 n=30	*P*-value
Type of the intervention			
Laparoscopic	9(56.3)	15(50)	0.686
Open	7(43.8)	15(50)	
Type of the gastrectomy			
Total	7(43.8)	(20)66.7	0.133
Subtotal	9(56.3)	10(33.3)	
Length of the surgery	220(140-410)	348(220-525)	0.001
Conversion to open surgery	1 (6.25%)	0 (0%)	*
Estimated blood loss (cc)	280 (90-430)	190 (50-230)	0.043
Additional organ resection	2(12.5)	4(13.3)	0.936
Splenectomy	1(6.3)	2(6.7)	0.957
Complications**			
1-2	5(62.5)	4(50)	0.614
3-4	3(37.5)	4(50)	
Tumor diameter (cm)	4(0.5-10)	4(0.5-11)	0.870
Number of total lymph nodes (SD)	26 (9.8)	23 (10.5)	0.482
Number of metastatic lymph nodes	2(0-25)	2(0-17)	0.972
The closest surgical board (mm)	20(2-90)	25(2-50)	0.508
Perioperative mortality	1(6.3%)	2(6.7%)	0.957

*Statistical analysis could not be performed due to insufficient numbers**According to Clavien&Dindo Classification, SD: standard deviation

From a financial point of view, the cost was statistically significantly higher during COVID-19 period, both in Turkish Lira and USD (P<0.001, P=0.038, respectively, Table 3). The analysis of the cost sub-items revealed that drugs and treatment services, surgical material costs, radiological examinations and interventions, and laboratory services costs were statistically significantly more during COVID-19 period (Table 3).

Table 3: Distribution of invoice expenses in US dollars ($)

Invoice items	Pre-Covid-19 n=16	Covid-19 n=30	*P*-value
Medicines and treatment services	732 (336-1116)	1098 (659-2112)	0.018
Surgical material costs	594(256-877)	909 (475-1714)	0.038
Surgery Packages	461 (194-653)	565 (420-1070)	0.215
Hospitality expenses	199 (91-302)	301 (187-350)	0.173
Radiological examinations and interventions	120 (54-182)	198 (113-365)	0.14
Blood product transfusions	40 (17-60)	53 (38-69)	0.648
Laboratory services	39 (16-52)	66 (36-117)	0.029
Pathological examinations	28 (12-43)	46 (27-54)	0.525
Total cost	2217(1021-3399)	3236(1955-6305)	0.038

Discussion

Patients undergoing major surgery may die when faced with serious respiratory tract infections. Liang et al. [3] stated that gastric cancer patients would die if infected with COVID-19. Our study had one patient who contracted COVID-19 during gastric cancer surgery. Despite the need for intubation, intensive care, and close follow-up, this patient did not die.

The Eastern literature indicates that the time to gastric cancer progression is approximately 36–44 months [6]. For most patients, a wait time of a few months does not have a significant impact on the prognosis [7]. Our study observed that the non-neoadjuvant CT group had a similar time to surgery in the pre-COVID-19 and during COVID-19 periods, which was approximately 3 months. Ma et al.[8] showed that a waiting time of six months in early gastric cancer and three months in locally advanced cancer did not affect the prognosis. Lui et al. [9] concluded that the time to surgery did not impact overall survival or disease-free survival, but a time to surgery over six weeks improved the pathological complete response. However, Moraiset al. [10] reported a higher short-term mortality rate in the patient group with mostly gastrointestinal cancer cases.

Studies in the literature have suggested postponing the surgical treatment of gastric cancer and initiating the patient on chemotherapy during such delay [9,11,12]. On the other hand, Aznab [13] stated that conventional cancer chemotherapies could be administered by taking preventive health measures. It is known that chemotherapy, like surgical interventions, has an immunosuppressive effect [14]. However, chemotherapy cannot be used at all in older adult patients, making surgery the only curative treatment option [15]. Our study established similar waiting times and neoadjuvant therapy rates in both study groups, suggesting that the COVID-19 pandemic has not delayed the surgical treatment of gastric cancer and not increased the tendency to neoadjuvant therapy. We believe that this may be due to the patient's and the physician's concerns about tumor progression. In fact, stress has increased in oncological patients during the pandemic [16]. The increased stress might have triggered the psychological idea of "being closer to recover from the disease via surgery" in our society. In addition, the strict management of our center's surgical oncology clinic, intensive care units, and operating rooms under the pandemic restrictions might have contributed to the prioritization of surgery by giving confidence to the physician and the patient. Furthermore, the recent increase in vaccination and a better understanding of the transmission of the virus and characteristics of the disease might have created an environment of self-confidence and brought surgeons closer to their old clinical behaviors.

The retrospective study by Li et al. [17] examining the effects of the COVID-19 pandemic on gastric cancer treatment reported that the COVID-19 cost per patient was higher, which was attributed to the prolonged hospital stay. Our study also established increased cost per patient during COVID-19 period. However, this was not due to the prolonged hospital stay. Because the length of stay was similar in both groups of our study. The subgroup cost analysis showed that laboratory and radiological examinations were more common during COVID-19 period. It further revealed that more surgical materials were used during COVID-19 period. The increased cost observed in our study might be because the surgeons wanted to perform more examinations and used more surgical materials, due to the sensitive clinical approach of surgeons, and perhaps due to the pandemic, during COVID-19 period.

Li et al. [17] found that the time of surgery and estimated blood loss were the same before and after the pandemic. Our study observed prolonged surgeries and lower amounts of blood loss in the COVID-19 group. Along with the pandemic, it is seen that social distancing principles and strict hygienic behaviors have made our surgical interventions slower, more careful, and less bleeding while prolonging the surgery. From surgeons to nurses, all of the health professions, need to protect themselves against COVID-19 virus transmission. So, we think it is the reason of longer surgical time and lower amount of blood loss during surgery.

The main organ involvement in COVID-19 that causes mortality is the lungs, for which thoracic CT is used primarily in diagnosis. It is an expected result that this examination is used more in the COVID-19 group in our study. However, compared to the early days of the pandemic, we observed that the use of thoracic CT in our center has been increasingly reserved for patients with severe respiratory problems and low saturation. We also observe that this behavior has been affected by the decisions and recommendations of the scientific advisory board of the Ministry of Health.

Limitations

First of all, this is the first study that described the effect of this outbreak on gastric cancer in our region. This highlights the importance of the study. Despite that, since the outbreak of COVID-19 did not occur so long ago, the number of participants was relatively low. Although the surgical team was the same in this study, we couldn't evaluate the periodic effects of the outbreak on the healthcare team according to the fluctuations. Prospective studies may contribute to understand changes in fluctuations.

Conclusion

According to our study, the use of thoracic CT in the surgical management of gastric cancer patients was increased, the surgery was prolonged, and the estimated blood loss was reduced along with the pandemic. In addition, the cost of patient treatment was increased due to the examinations and surgical materials used. Future studies will clarify these issues.

Considering the effects of the COVID-19 pandemic on cancer surgery in the short term experienced, precautions should be taken and healthcare professionals should be prepared for possible situations in the light of scientific research on its long-term effects. In addition, given the fluctuating course of the pandemic, we believe that individualized treatment options should be considered more according to the treatment period (time, place, and patient's condition).

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