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Effects of the COVID-19 pandemic on colorectal cancer surgery

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Ethics Committee Approval
The study was approved by the Research Ethics Committee of KTO Karatay University Faculty of Medicine (approval number: 2022/020, date: 22.12.2022).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: In accordance with the guidelines published during the COVID-19 pandemic, cancer operations, except for emergencies, were postponed. However, the effect of postponed surgical treatment on the outcomes of cancer cases has not yet been determined. Therefore, this study aimed to compare the clinical data and outcomes of patients who underwent surgery for colorectal cancer before and during the pandemic.

Methods: This retrospective cohort study was conducted in the Department of General Surgery. Patients who underwent surgery for colorectal cancer during the pre-pandemic period (February 1, 2019-December 31, 2019) and pandemic period (August 1, 2020-June 30, 2021) were included. The patients' demographic data, clinical and laboratory findings, clinical presentation, operation type, complications, and pathology results were retrospectively obtained by screening the patient files.

Results: The study included a total of 183 patients, 91 in the pre-pandemic period and 92 in the pandemic period. During the pandemic period, the length of hospital stay was significantly shorter, but the rate of readmission after discharge was significantly higher ($P<0.001$, $P=0.04$). There was no significant difference between the two periods in terms of disease stage. During the pandemic period, the number of cases that underwent emergency surgery was significantly higher. The rates of mortality and postoperative complication rates were also significantly higher ($P=0.04$, $P<0.001$).

Conclusion: The pandemic had serious effects on colorectal cancer cases. There was an increase in mortality and morbidity due to the increase in complicated cases.

Keywords: COVID-19, colorectal cancer, effect, pandemic, surgery

Introduction

Coronavirus disease 2019 (COVID-19), which first appeared in China in December 2019, started to show its effects in Turkey as of March 2020, similar to many other countries across the world. During this process, many guidelines were published on how, when, and on whom surgical procedures should be performed [1-4]. A postponement of surgical operations other than emergencies was recommended. It has been reported that surgical interventions in patients with a diagnosis of COVID-19 have increased morbidity and mortality rates [5]. In a meta-analysis, the postoperative mortality rate in patients with COVID-19 was reported to be 20% [6]. The most important recommendation commonly included in all the guidelines concerning colorectal cancer was to avoid surgery in COVID-19-positive patients. Other recommendations included immediate surgery in emergency cases, such as obstruction and perforation; postponement of elective cases; and preference of non-surgical treatments in stage II/III rectal and metastatic colorectal cancer [3,4,7].

It has been reported that among gastric, pancreatic, and colorectal malignancy cases with postponed surgical treatments during the pandemic, colorectal cancer was the malignancy in which the survival of patients was most affected [8]. A meta-analysis showed that a 12-week delay in colorectal cancer operations was associated with reduced survival [9]. Therefore, it is recommended that surgery should not be delayed for more than 6 to 12 weeks in patients with early stage colorectal cancer, who have completed neoadjuvant therapy. There are also centers reporting that, provided that the pandemic measures included in published guidelines were strictly followed, the surgical treatment of malignancy cases was continued as in previous periods, with no additional problems being encountered in the postoperative period [10,11].

Despite the above-mentioned recommendations and studies, there is only limited research addressing the course, staging, and follow-up of colorectal cancer cases during the pandemic period. One of these studies undertaken in Korea reported that the rate of patients who did not undergo tumor resection and received neoadjuvant therapy was significantly higher compared to the pre-pandemic years [12]. In addition, during the pandemic period, minimally invasive approaches, especially laparoscopy, were less frequently applied, and compared to previous periods, more patients required multiple organ resections rather than the resection of only the organ with the tumor. The most important conclusion drawn from that study is that resectability decreased during the pandemic period, which could possibly affect long-term oncological outcomes [12].

Some studies have shown an increase in the number of colon cancer cases that presented to the hospital due to obstruction and underwent emergency surgery during the pandemic period compared to previous years [13,14]. In these studies, more T4 cancer cases were diagnosed during the pandemic period than in previous periods [13]. In another study, it was reported that patients admitted to the hospital under emergency conditions presented with more complications, and the rate of bowel resection increased [15]. In a Dutch-based study, it was determined that with the suspension of national cancer screening programs during the pandemic, there was a decrease in the diagnosis of early-stage colorectal cancer, but no change was observed in those with advanced stage cancer [16].

A study conducted in the UK also discussed the postoperative period in colorectal cancer surgery performed during the pandemic period, and reported no significant difference was detected in the rate of postoperative complications, length of hospital stay, readmission after discharge, tumor staging, and lymph node dissection success compared to the pre-pandemic period [17]. Similarly, in a study from China, It was found that the incidence of surgical complications did not differ during the pandemic. The length of hospital stays and the frequency of laparoscopies, however, increased during this time, according to the authors [18].

This study aimed to compare the demographic, clinical, and postoperative characteristics of patients who underwent surgery for colorectal cancer during and before the pandemic, and thus, examine the effects of the COVID-19 pandemic on colorectal cancer surgery.

Materials and methods

Trial design

After receiving approval from the Ethics Committee of KTO Karatay University Faculty of Medicine (approval number: 2022/020, date: December 22, 2022) and written informed consent from each participant, this study was retrospectively carried out at the General Surgery Department of Health Sciences University Konya City Hospital. The study was conducted in accordance with the Declaration of Helsinki.

Participants and eligibility criteria

Colorectal cancer operations performed in our clinic were retrospectively screened from the patient files. In Turkey, the first COVID-19 case was reported on March 11, 2020 (19). Therefore, we evaluated colorectal cancer operations performed between August 1, 2020, and June 30, 2021, as the pandemic period and those performed during the previous year (February 1, 2019-December 31, 2019) as the pre-pandemic period.

In our center, during the pandemic, the polymerase chain reaction (PCR) test for COVID-19 was routinely performed in patients scheduled for surgery. During this period, no patients with COVID-19 were followed up in our hospital or clinic. All the patients included in the study consisted of those confirmed to have no COVID-19 infection by the PCR test or thoracic computed tomography. Patients with incomplete data were not included in the study.

Inclusion criteria: over age 18 and having undergone emergency or elective surgery for colorectal cancer during the specified periods.

Exclusion criteria: under age 18, having undergone surgery for indications other than colorectal cancer, having undergone surgery for colorectal cancer outside the specified dates, diagnosed with COVID-19, and missing data.

Outcomes

Demographic data, such as age and gender, as well as tumor localization and TNM classification were recorded for all patients. In addition, information involving surgical procedures performed, whether surgery was performed under emergency or elective conditions, length of hospital stay, postoperative

complications (Clavien-Dindo classification), preoperative and postoperative white blood cell (WBC) count and C-reactive protein (CRP) values, presence of readmission and re-intervention, and rate of laparoscopy use were also recorded. These data were compared between the two periods.

Statistical analysis

In this study, the Statistical Package for the Social Sciences version 21.0 (SPSS, Chicago, IL, USA) was used for the statistical analyses of the data. As descriptive statistics, mean, standard deviation, median, minimum, and maximum values were used for continuous variables and number and percentage values for discrete variables. The Mann-Whitney U and chi-square tests were conducted for comparisons between two independent groups. The results were evaluated at the 95% confidence interval and P <0.05 indicated statistical significance.

Results

The study included a total of 183 patients, of whom 91 (36 women and 55 men) underwent surgery during the pre-pandemic and 92 (35 women and 57 men) during the pandemic. The mean age of the patients was 63.1 years for the pre-pandemic period and 63.7 years for the pandemic period. The demographic data of the patients are shown in Table 1.

When the preoperative and postoperative WBC count and CRP values of the patients were compared, only the preoperative CRP value was found to be significantly higher during the pandemic period *(P*=0.003). While the mean preoperative CRP value was 17.5 mg/L before the pandemic, it was 45.3 mg/L during the pandemic period. No significant difference was detected in the remaining laboratory values (Table 1).

When compared to the pre-pandemic period (12.1 days), the mean length of hospital stays significantly dropped during the pandemic (5.1 days) (*P*<0.001). The rate of patients undergoing surgery for emergency reasons, such as obstruction, perforation, and bleeding was significantly higher during the pandemic period (n=49/92, 26.7%) compared to the pre-pandemic period (n=32/91, 17.4% [*P*=0.01]) (Table 1).

It was also shown that the rates of morbidity and mortality were much greater during the pandemic *(P*<0.001, *P*=0.04). Mortality was observed in 13 (7.1%) patients during the pandemic and only 5 (2.7%) patients during the pre-pandemic period. According to the evaluation of postoperative complications with the Clavien-Dindo classification, the complication rate was significantly higher during the pandemic compared to the pre-pandemic period (*P*<0.001). There was no discernible difference between the pre-pandemic period (eight [4.3%]) and the pandemic (seven [3.8%]) in terms of the number of patients who experienced Grade I and II complications, which are considered minor. However, grade III, IV, and V complications, classified as severe, occurred in 11 (6.01%) patients in the pre-pandemic period and 37 (20.2%) patients during the pandemic period, indicating a significant increase in the latter (*P*<0.001) (Table 1).

Despite the fact that the rate of ostomies increased during the epidemic, this was not statistically significant (n=25, 30.83% vs n=37, 40.2%). The percentage of patients who received neo-adjuvant chemotherapy did not significantly differ between the two time periods (n=20, 21.9% vs n=22, 23.4%) (Table 1).

Table 1: Details of the patients' demographic and clinical data

	Pre-pandemic (n=91) (%)	Pandemic (n=92) (%)	*P*-value
Age, years (mean)	63.1	63.7	0.74
Gender			0.83
Male	36 (39.5%)	35 (38%)	
Female	55 (60.4%)	57 (61.9%)	
Clinical presentation			
Elective	59 (64.8%)	43 (46.7%)	0.01
Emergency	32 (35,1%)	49 (53.2%)	0.01
Bleeding	10 (10.9%)	13 (14.1%)	0.52
Obstruction	22 (24.2%)	30 (32.6%)	0.20
Perforation	0	6 (6.5%)	0.056
Surgical procedure			
Open surgery	78 (83.3%)	71 (77.1%)	0.14
Laparoscopy	13 (16.6%)	21 (22.8%)	0.14
Preoperative laboratory values			
White blood cell count (10^3/mm^3)	8.3	9	0.20
C-reactive protein (mg/l)	17.5	45.3	0.003
Postoperative laboratory values			
White blood cell count (10^3/mm^3)	11.8	11.5	0.68
C-reactive protein (mg/l)	116	133	0.24
Length of hospital stay (day)	12.1	5.1	<0.001
Re-admission	7 (7.7%)	17 (18.5%)	0.04
Re-intervention	5 (5.5%)	16 (17.4%)	0.02
Stoma Rate	25 (30.83 %)	37 (40.2 %)	0.07
Neoadjuvant treatment	20 (21.9%)	22 (23.4 %)	0.75
Postoperative complication (Clavien-Dindo, %)			
No complication	72 (79.1 %)	48 (52.2 %)	<0.001
Grade I	0	5 (5.4 %)	0.10
Grade II	8 (8.8 %)	2 (2.2 %)	0.04
Grade IIIA	1 (1.1 %)	4 (4.3 %)	0.18
Grade IIIB	5 (5.5 %)	10 (10.9 %)	0.18
Grade IVA	0	5 (5.4 %)	0.57
Grade IVB	0	5 (5.4 %)	0.10
Grade V	5 (5.5 %)	13 (14.1 %)	0.04

The rate of readmission was significantly higher during the pandemic period (n=7, 3.8% vs n=17, 9.2%) (*P*=0.04*)*. The rate of surgical interventions in readmitted cases was also significantly higher during this period (n=5, 2.7% vs n=16, 8.7% [*P*=0.02]). Despite the fact that laparoscopy was used more frequently during the epidemic period, there was no statistically significant change (n=13, 7.1% vs n=21, 11.4%) (Table 1). Last but not least, there were no appreciable differences in cancer pathological staging and T (tumor), N (lymph node), and M (metastasis) staging between the pre-pandemic and pandemic periods (Table 2).

Table 2: TNM staging of the patients

	Pre-pandemic (n=91) (%)	Pandemic (n=92) (%)	*P*-value
T (Primary tumor)			
T1	1 (1.1%)	3 (3.3%)	0.14
T2	10 (10.1%)	14 (15.2%)	
T3	39 (42.8%)	41 (44.6%)	
T4	41 (45%)	34 (36.7%)	
N (Lymph nodes)			
N0	40 (43.4%)	49 (53.3%)	0.17
N1	31 (34.1%)	23 (25%)	
N2	11 (12.1%)	19 (20.6%)	
N3	9 (9.9%)	1 (1.1%)	
M (Metastases)			
M0	80 /%87.8%)	72 (78.3%)	0.08
M1	11 (12.1%)	20 (21.8%)	

Discussion

Regarding the demographic information of the patients in this study, there was no discernible variation between the pandemic and pre-pandemic periods (mean age and gender distribution). Of the laboratory values of the patients, only preoperative CRP was found to be significantly higher during the pandemic period. As stated in the literature and recommended in relevant guidelines, surgery was performed in only complicated and emergency colorectal cancer cases during the pandemic, which explains the significantly higher CRP value in this period.

There is no clear information in the literature concerning the length of the hospital stay of patients undergoing colorectal cancer surgery during the pandemic. Some studies reported that the length of hospital stay was prolonged, while others did not indicate any change [17,18]. In the current study, the length of the hospital stay was significantly shorter during the pandemic period. This may be related to the willingness of both patients and surgeons to reduce the risk of COVID-19 transmission.

In this study, the rate of patients who underwent surgery for emergency reasons was found to be significantly higher during the pandemic period compared to the previous year. In the literature, there are studies confirming this finding [13-15]. It is known that patients tended to delay their hospital visits due to the risk of contracting COVID-19. In addition, with the healthcare personnel being affected by the pandemic, the number of outpatient clinics and endoscopy units were reduced, resulting in increased patient density in these settings. This can explain the higher rate of patients diagnosed for emergency reasons during the pandemic period.

Morbidity and mortality significantly increased with the increase in emergency operations. Despite the fact that there was no discernible difference in the rates of Clavien-Dindo Grade I and II complications, which were resolved with medical treatment without any interventional procedure, the rates of Grade III, IV, and V complication significantly increased during the pandemic period. At the same time, the mortality rate, classified as Grade V, significantly increased during this period, indicating that the cases surgically treated during the pandemic period were more complicated, as also stated in many previous studies [13-15]. Due to the increase in surgical operations performed under emergency conditions, severe complications, and thus associated mortality rates also increased.

In the literature, in addition to studies showing progression in cancer staging during the pandemic due to patients' delayed hospital visits to reduce the risk of COVID-19 transmission and the inability of outpatient-endoscopy units in hospitals to work at full capacity, there are also those reporting no significant change in staging during the pandemic [12,13,16]. In the current study, the number of patients with metastatic colorectal cancer was higher, but the difference was not statistically significant. In other words, there was no significant difference in pathological or clinical staging between the pre-pandemic and pandemic periods.

Rates of readmission and re-intervention after discharge from the hospital significantly increased throughout the epidemic period. This may have been due to the more complicated nature and emergency conditions of cases that underwent surgery and patients being discharged earlier during the pandemic. This finding should be supported by further studies with larger series.

Some authors have reported that COVID-19 spreads through not only droplets and contact but also fecal-oral route and aerosols. An international guideline on COVID-19 recommended that laparoscopy should be avoided due to the risk of aerosol formation and viral transmission [20]. Therefore, it was stated that laparoscopic operations should not be preferred, and even if they need to be performed, there is a need for careful management of laparoscopic gases, especially their evacuation process [21-23]. However, other studies have suggested that laparoscopic approaches can be used since there is no clear evidence yet indicating an increased risk of COVID-19 [24,25]. In a study examining the presence of COVID-19 in peritoneal fluid, the COVID-19 virus could not be detected in samples [26]. It has been argued that although laparoscopy may involve some risks for the surgical team, it does provide faster recovery and discharge for the patient [27]. In brief, there is no clear consensus on whether laparoscopy should be performed under pandemic conditions [25]. In our study, there was a numerical increase in the frequency of laparoscopy use compared to the previous year, but this was not statistically significant. We consider that this contributed to the faster recovery and discharge of our patients.

According to some studies, the rate of ostomies rose considerably during the pandemic period [28,29]. On the other hand, several authors claimed that there was no discernible change [30]. Although the rate of ostomies increased in our study during the pandemic, there was no statistically significant rise in this rate. The reason for this may be that ostomy was preferred more than anastomosis in infective conditions for emergency reasons during the pandemic period.

Limitations

Our article's retrospective approach and limited sample size are its two main limitations.

Conclusion

It is clear that the pandemic has had serious effects on colorectal cancer surgery. Our findings do not support the hypothesis that patients presented to the hospital with a more advanced cancer stage, which is one of the most commonly addressed issues in the literature. There was a significant increase in the number of patients operated for emergency indications, such as obstruction, perforation, and bleeding, and this had a significant effect on morbidity and mortality in the postoperative period. We attributed the higher readmission and re-intervention rates in the pandemic to the shorter length of hospital stay during this period.

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