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The effects of COVID-19 pandemic on surgical site infections after abdominal surgery

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Abstract

Surgical site infections are one of the most important factors that increase morbidity and length of stay, especially after abdominal surgical procedures. With the COVID-19 pandemic, serious isolation and contact measures have been taken in hospital clinics in Turkey and all over the world. The aim of this study is to compare the rate of surgical site infection in patients who underwent abdominal surgery between March 15, 2020 and May 31, 2020 in Gazi University Faculty of Medicine, General Surgery Clinic, and patients who underwent abdominal surgery between the same dates a year ago. The features were examined with the SSI between the two periods. A statistically significant difference was found between the patients who were operated on before and during the pandemic in terms of smoking status (p=0.020), urgency of surgery (p=0.001) and chemotherapy receiving status (p=0.002). A statistically significant difference was not recorded between patients with and without surgical site infection in terms of the season in which the operation was performed, the surgery over the previous incision, the type of operation, the urgency of the operation and the presence of a drain.

The precautions taken due to the COVID-19 pandemic do not change the risk of developing SSI after abdominal surgery. In preventing the risk of SSI, the factors related to the wound and the patient, which have been defined before, are at the forefront.

Keywords: Covid-19, pandemic, surgical site infections

Introduction

Surgical site infections (SSIs) are defined as infections seen in the surgical site in the postoperative period. All types of infections are included in this definition and are classified as superficial incisional, deep incisional and organ/space infections [1]. Infections occurring within 30-90 days following the surgery are considered SSI. It ranks third (14-16%) among nosocomial infections and first (38%) among post-surgical infections [2]. While the frequency of SSI may vary between centers according to the size of the hospital, the characteristics of the patients admitted, and the surgical techniques applied, the immune and nutritional status of the patient, accompanying chronic diseases, the condition of the wound and the presence of microorganisms in the environment also play a critical role in the development of SSI [3]. SSI causes patients to stay in the hospital longer, in addition to antibiotic usege, increase in treatment costs and loss of workforce [4,5].

The 2019 novel coronavirus (2019-nCoV) was identified in December 2019 in Wuhan, China's Hubei province. In January 2020, severe acute respiratory syndrome coronavirus 2 (SARS-

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CoV-2) was detected. In February 2020, the official name of the virus-borne disease was determined by the World Health Organization as COVID-19 [6]. According to the data of the World Health Organization on June 30, 2020, approximately 10 million people have been detected with the virus, over 500 thousand deaths have occurred, and the virus still continues to spread [7].

Measures have been announced to prevent the epidemic in Turkey and all over the world. Surgical interventions other than non-emergency and cancer patients were suspended between 15 March 2020 and 1 June 2020 in Turkey. Personal protective equipment began to be used in operating rooms, more attention was paid to personal hygiene, patient visits were prohibited, and contact with patients was reduced. A significant decrease was observed in the operations performed in surgical clinics and the number of patients in the clinics [8].

The goal of this study is to investigate the way this extraordinary situation experienced during the pandemic period affected the rate of surgical site infection in patients who underwent abdominal surgery in our clinic.

Material and Methods

Patients who underwent abdominal surgery between March 15, 2020 and May 31, 2020 in Gazi University Faculty of Medicine, General Surgery Clinic, and patients who underwent abdominal surgery between the same dates a year ago were retrospectively analyzed from the database of our hospital. This study was conducted by the approval of Ethics Committee of Gazi University Faculty of Medicine (approval no. 07.08.2020-488). The patients who were operated during the pre-pandemic period were named as Season 1, and the patients who were operated during the pandemic period were named as Season 2.

Demographic characteristics such as age and gender of the patients, type of operation, diabetes mellitus, hypertension, heart disease, kidney failure, lung disease, rheumatological diseases, liver disease, and diseases causing comorbidities as such were recorded. Immunosuppressive conditions such as organ transplantation, malignancy, chemotherapy history were recorded. The indications for the operation, the emergency-elective state of the operation, the type of operation, the duration of the operation, the amount of intraoperative transfusion were questioned.

Statistical Analysis

The data of the study were analyzed with the SPSS 23.0 (Statistics Package for Social Sciences) program. Statistical categorical variables in descriptors can measure numbers, percentages; continuous variables are shown as mean ± standard deviation or median (interquartile range) (IQR). The distribution of continuous variables was evaluated using visual (histogram and analysis graphics) and analytical method (Kolmogorov-Smirnov/Shapiro-Wilk test). Variables in continuous variables were analyzed using Student's t test or Mann-Whitney U test. Categorical variables were analyzed using Chi-square tests (Pearson, Yates's Chi-squared and Fisher Exact tests). In the univariate analysis, variables with a p value of <0.05 were included in the logistic regression model. By applying the obtained logistic regression analysis, the effective risk on the surgical site infection status of the operated patient was tried to be determined. P<0.05 was accepted to the service statistically.

Table 1. Clinical and demographic characteristics of the patients who underwent surgery in the pre-pandemic and pandemic periods

	Season 1 (n=190)	Season 2 (n=123)	p
Median age (IQR)	57(47-65)	60(50-69)	**0.030**[a]
Gender (%)			
Female	122(59.8)	82(40.2)	0.656**
Male	68(62.4)	41(37.6)	
Smoking Status (%)			
Never Used	136(61.3)	86(38.7)	
Actively Using	45(71.4)	18(28.6)	**0.002****
Quit	9(32.1)	19(67.9)	
DM (%)			
No	158(61.7)	98(38.3)	0.529*
Yes	32(56.1)	25(43.9)	
Prolonged Surgical Presence (%)			
No	183(60.8)	118(39.2)	>0.999***
Yes	7(58.3)	5(41.7)	
Surgery over Previous Incision (%)			
No	165(63.0)	97(37.0)	0.087*
Yes	25(49.0)	26(51.0)	
Intraoperative Transfusion (%)			
No	182(60.5)	119(39.5)	0.770***
Yes	8(66.7)	4(33.3)	
Type of Surgery (%)			
Laparoscopic	7(70.0)	3(30.0)	0.745***
Open	183(60.4)	120(39.6)	
Urgency of Operation (%)			
Emergency	4(22.2)	14(77.8)	**0.001***
Elective	186(63.1)	109(36.9)	
Wound Class (%)			
Clean	99(58.9)	69(41.1)	
Clean- Contaminated	90(62.9)	53(37.1)	0.735**
Contaminated	1(50.0)	1(50.0)	
Chemotherapy Status (%)			
No	156(65.5)	82(34.5)	
Yes	34(45.3)	41(54.7)	**0.002****
Status of Receiving			
Immunosuppressive Therapy (%)			
No	182(59.9)	122(40.1)	0.094***
Yes	8(88.9)	1(11.1)	
Drain (%)			
No	30(61.2)	19(38.8)	>0.999*
Yes	160(60.6)	104(39.4)	
ASA Score (%)			
1	16(80.0)	4(20.0)	
2	106(57.3)	79(42.7)	0.212**
3	65(62.5)	39(37.5)	
4	3(75.0)	1(25.0)	

[a]Mann Whitney U Test * Yates's Chi-squared Test ** Pearson Chi-square Test *** Fisher's Exact Test

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Results

The mean age of 313 patients included in the study was 52±13.0. Of the patients, 109 (34.8%) were male and 204 (65.2%) were female.

Among the patients who underwent surgery in the pre-pandemic and pandemic periods, there were no statistically significant differences in gender, the presence of diabetes mellitus, the presence of prolonged surgery, surgery over the previous incision, intraoperative transfusion status, operation type, wound class, immunosuppressive treatment status, the presence of a drain, or ASA score. (p>0.05). The median age of patients who underwent surgery in the post-pandemic period was found to be significantly higher 57 (47-65) vs. 60 (50-69); (p=0.030). A statistically significant difference was found between the patients who were operated before and during the pandemic in terms of smoking status (p=0.020), urgency of surgery (p=0.001) and chemotherapy receiving status (p=0.002).

Table 2. Comparison of surgical site infections according to some characteristics of the patients

	No SSI Number (%)	SSI Number (%)	p
Gender (%)			
Female	191(%93.6)	13(%6.4))	0.083*
Male	95(%87.2)	14(%12.8)	
Smoking Status (n=313)			
Never Used	210(%94.6)	12(%5.4)	**0.006****
Actively Using	53(%84.1)	10(%15.9)	
Quit	23(%82.1)	5(%17.9)	
DM (n=313)			
No	234(%91.4)	22(%8.6)	>0.999***
Yes	52(%91.2)	5(%8.8)	
HT (n=313)			
No	215(%93.1)	16(%6.9)	0.117*
Yes	71(%86.6)	11(%13.4)	
COPD (n=313)			
No	266(%91.1)	26(%8.9)	>0.999***
Yes	20(%95.2)	1(4.8)	
Cardiac Disease			
No	254(%92.0)	22(%8.0)	0.343***
Yes	32(%86.5)	5(%13.5)	
Rheumatological Disease (n=313)			
No	276(%91.1)	27(%8.9)	>0.999***
Yes	10(%100.0)	0(%0.0)	
Kidney Failure (n=313)			
No	284(%91.6)	26(%8.4)	0.238***
Yes	2(%66.7)	1(%33.3)	
Peripheral Vascular Disease (n=313)			
No	284(91.3)	27(%8.7)	>0.999***
Yes	2(%100)	0(%0.0)	
Chemotherapy Status (n=313)			
No	216(%90.8)	22(%9.2)	0.647*
Yes	70(%93.3)	5(%6.7)	
Status of Receiving Immunosuppressive Therapy (n=313)			
No	277(%91.1)	27(%8.9)	>0.999***
Yes	9(%100.0)	0(%0.0)	

* Yates's Chi-squared Test ** Pearson Chi-square Test *** Fisher's Exact Test

Statistically significant difference was not recorded between patients with and without surgical site infection in terms of gender, concomitant diabetes mellitus, hypertension, COPD, presence of cardiac disease, renal failure, and chemotherapy. A statistically significant difference was found between patients with and without surgical site infection in terms of smoking status (p=0.006) (Table 2).

Statistically significant difference was not recorded between patients with and without surgical site infection in terms of the season in which the operation was performed, the surgery over the previous incision, the type of operation, the urgency of the operation and the presence of a drain. A statistically significant difference was found between patients with and without surgical site infection in terms of intraoperative transfusion status (p=0.006) and wound class (p<0.001) (Table 3).

Table 3. Comparison of surgical site infections according to some operational characteristics of the patients

	No SSI Number (%)	SSI Number (%)	p
Season of Operation (n=313)			
Season 1	172(%90.5)	18(%9.5)	0.647*
Season 2	114(%92.7)	9(%7.3)	
Prolonged Surgical Presence (n=313)			
No	277(%92.0)	24(%8.0)	0.075***
Yes	9(%75.0)	3(%25.0)	
Surgery over previous incision (n=313)			
No	243(%92.7)	19(%7.3)	0.059***
Yes	43(%84.3)	8(%15.7)	
Intraoperative transfusion status (n=313)			
No	279(%92.7)	22(%7.3)	**0.002*****
Yes	7(%58.3)	5(%41.7)	
Type of Surgery (n=313)			
Laparoscopic	9(%90.0)	1(%10.0)	0.600***
Open	277(%91.4)	26(%8.6)	
Urgency of Operation (n=313)			
Emergency	15(%83.3)	3(%16.7)	0.195***
Elective	271(%91.9)	24(%8.1)	
Wound Class (n=313)			
Clean	164(%97.6)	4(%2.4)	**<0.001****
Clean- Contaminated	121(%84.6)	22(%15.4)	
Contaminated	1(%50.0)	1(%50.0)	
Drain Presence (n=313)			
No	47(%95.9)	2(%4.1)	0.278***
Yes	239(%90.5)	25(%9.5)	
ASA Class (n=313)			
1	20(%100.0)	0(%0.0)	0.060**
2	173(%93.5)	12(%6.5)	
3	90(%86.5)	14(%13.5)	
4	3(%75.0)	1(%25.0)	

* Yates's Chi-squared Test ** Pearson Chi-square Test *** Fisher's Exact Test

The median age of patients without surgical site infection is 58 (47-66) and the median age of patients with surgical site infection is 63 (53-71). There was a statistically significant difference in age between patients with and without surgical site infection (p=0.039). The mean blood hemoglobin level of patients without surgical site infection was 12.8 (±1.9) and the mean blood hemoglobin level of patients with surgical site infection was 12.7 (±1.9). There was no statistically significant difference in blood hemoglobin levels between patients with and without surgical site infection (p=0.771). The median blood albumin level of patients without surgical site infection was 4.2 (3.8-4.5) and the median value of blood albumin level of patients with surgical site infection was 3.9 (3.1-4.2). A statistically significant difference was recorded in blood albumin levels between patients with and without surgical site infection (p=0.002) (Table 4).

Table 4. Comparison of surgical site infections according to some characteristics of the patients

	No SSI	SSI	p
Age(year) Median (IQR)	58 (47-66)	63 (53-71)	**0.039***
Hemoglobin(g/dL)[a] Mean (±Sd[b])	12.8 (±1.9)	12.7 (±1.9)	0.771**
Albumin(g/dL)[a] Median (IQR)	4.2 (3.8-4.5)	3.9 (3.1-4.2)	**0.002***

* Mann Whitney U Test, ** Student's t Test [a]Grams per decilitre, [b]Standard deviation

In the multivariate logistic regression analysis, age, gender, smoking status and blood albumin levels of the patients did not have a statistically significant effect on the risk of surgical site infection. A 6.8-fold increase in the risk of surgical site infection in those who discovered intraoperative transfusion compared to those who did not (95% CI: 1.5-30.9, p=0.014). In terms of wound class, those in the clean-contaminated class were 5.4 times (95% CI:1.7-17.3, p=0.005) compared to those in the clean wound class, and 38.5 times (95% CI: 1.8-820.9, p) in the contaminated wound class compared to those in the clean wound class. =0.019) was found to increase the risk of surgical site infection (Table 5).

Table 5. Evaluation of risk factors on surgical site infection by multivariate regression analysis

	OR	%95 CI	p
Age	1.017	0.979-1.056	0.393
Gender			
Female	1.000	0.258-1.506	0.294
Male	0.624		
Smoking Status			
Never Used	1.000		
Actively Using	2.171	0.793-5.948	0.132
Quit	2.796	0.810-9.650	0.104
Status of Receiving Intraoperative Transfusion			
No	1.000	**1.476-30.885**	**0.014**
Yes	**6.752**		
Wound Class			
Clean	1.000		
Clean- Contaminated	**5.353**	**1.652-17.342**	**0.005**
Contaminated	**38.488**	**1.805-820.879**	**0.019**
Albumin	0.933	0.539-1.617	0.805

OR: Odds Ratio; CI: Confidence Interval

Discussion

With the COVID-19 pandemic, there have been changes in perioperative infection prevention protocols. Institutional policies have standardized protocols such stringent hand hygiene, the use of gloves, the use of personal protective equipment, and the disinfection of the surroundings [9-11]. In addition, serious quarantine measures were taken and patient visits - including us - were restricted in many countries [12]. It was thought that these measures would reduce the risk of SSI.

The impact of the coronavirus 2019 (COVID-19) pandemic on the rate of surgical site infections is still controversial. Studies with different patient populations from different countries continue to take place in the literature. Humphrey var et al. evaluated a total of 20297 patients who underwent total joint arthroplasty and found no difference in superficial SSI rates between the pre-COVID-19 pandemic and the COVID-19 pandemic cohort group [13]. Unterfrauner et al. in their study, which included 5791 orthopedic surgery patients, they reported that COVID-19 pandemic measures did not affect the risk of SSI [14]. Similarly, in the study of Baldwin et al. in 556 hand trauma patients, they found that the precautions taken did not change the risk of SSI in patients who were operated on due to hand trauma [15]. Liu et al. found no change in periocular surgical site infection in their patient group consisting of 680 patients [16]. On the contrary, Hassa et al. for their study, which included 1486 patients, they stated that the use of N95 during orthopedic surgical procedures reduced the risk of SSI [17]. Chacón-Quesada et al. in their study comparing 2657 neurosurgery patients, found that the rates of SSI decreased after the COVID-19 pandemic. They argued that the reason for this was the implementation of stringent hygiene measures established after the onset of the COVID-19 epidemic [18].

Different results are reported in a limited number of studies on the effects of COVID-19 pandemic measures on the rate of SSI after abdominal surgery. For example, Antonello et al. in their study evaluating SSI after cesarean section, stated that they found a 49% decrease in SSI rates and that this could be due to increased personal protective equipment [19]. Similarly, Losurdo et al. in their study with 541 patients, stated that the measures taken during the COVID-19 pandemic provided a significant reduction in both superficial and deep SSI rates. However, in their studies, 50.8% of their population was breast and thyroid surgeries, 37.9% were digestive surgeries and 11.3% were hepatopancreatobiliary surgeries [20]. Similar to this study, Pantvaidya et al. in their study, which included 3123 patients who underwent major oncologic surgery, found a 23% reduction in SSI with the COVID-19 pandemic measures. The predominant portion of the cohort of their studies consisted of breast and head and neck cancer surgeries [21]. Anjum et al. in their study, which included 126 patients who underwent emergency laparotomy, found that the use of personal protective equipment reduced the risk of SSI [22]. Ishibashi et al. reported that the rates of superficial SSI decreased during the COVID-19 pandemic, in which they evaluated 113 patients who underwent surgical resection for gastrointestinal malignancies. They found that this situation was correlated with the increase in the use of alcohol-based hand disinfectants [23]. However, Smith et al. reported that the precautions taken with the COVID-19 pandemic did not affect the risk of CAE in their study, which included 2231 colorectal surgery and 1192 hysterectomy patients, which is one of the most comprehensive studies on this subject [24].

In our study, it was observed that the measures applied due to the COVID-Pandemic had no effect on SSI (p:0.647). This is the case in Unterfrauner et al, and Smith et al. As Ark stated, it may be due to the view that clinics with low SSI rates will not benefit from additional measures taken due to COVID-19 [14,24]. Although the rate of SSI observed in our study was similar to the rates of reported SSI, the small number of patients and its retrospective nature constitute the limitation of this study [20,24,25].

In our study, the effects of different risk factors on SSI were also examined. Clean-contaminated and contaminated surgery types increase the risk of SSI compared to clean surgery types. In addition, intraoperative blood transfusion has been shown to increase the risk of SSI. This situation supports our classical knowledge [26-29].

Conclusion

The precautions taken due to the COVID-19 Pandemic do not change the risk of developing SSI after abdominal surgery. In preventing the risk of SSI, the factors related to the wound and the patient, which have been defined before, are at the forefront.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
This study was conducted by the approval of Ethics Committee of Gazi University Faculty of Medicine (approval no. 07.08.2020-488).

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