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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

The Adverse Effects of the COVID-19 Pandemic on General Surgical Residents' Surgical Practices: Real-Life Data with Numbers

COVID-19 Pandemisinin Genel Cerrahi Asistanlarının Cerrahi Uygulamaları Üzerindeki Olumsuz Etkileri: Sayılarla Gerçek Hayat Verileri

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ABSTRACT

Aim: The COVID-19 pandemic has had a negative impact on medical education and training worldwide. In this study, we investigated the effects of the COVID-19 pandemic on general surgical residency training.

Material and Method: The work locations, rates of infection with SARS-CoV-2, and the numbers of endoscopic and surgical procedures during the 9 months before the pandemic (June 2019-December 2019 and January-February 2020) and during the 9 months of the pandemic (April 2020-December 2020) were compared for general surgical residents. Furthermore, residents were asked three questions regarding the impact of the pandemic on their surgical training.

Results: A total of 14 residents, with a median age of 29.5 years (range: 27-34) and a median duration of training of 42 months (range: 24-60), were included in .Residents with less than 42 months of training experience (junior residents) showed a significant decrease in the duration of work in the general surgery ward and outpatient clinic compared to the pre-pandemic period (p=0.014 and p=0.034, respectively). There was also a decrease in the number of surgeries performed under the supervision of general surgery specialists (39.5 vs 22; p=0.027) Senior residents also had a significant decrease in the duration of work in the operating room compared to the pre-pandemic period ([median 3.75 (range: 3-6) vs. 3.0 (range: 2-6); p=0.024]), and there was a statistically significant decrease in the numbers of surgeries performed under the supervision of education staff (associate professor, professor, chief resident) and general surgery specialists (p=0.017, p=0.035, and p=0.012, respectively). All junior residents (100%) and 87.5% of senior residents expressed that their general surgical education was inadequate during the pandemic.

Conclusion: During the pandemic, both junior and senior residents experienced a significant decrease in the numbers of endoscopic and surgical procedures and surgeries performed under supervision.

Keywords: General surgical resident training, COVID-19 pandemic, extension of residency training duration

ÖZ

Amaç: COVID-19 pandemisi, dünya genelinde tıp eğitimini olumsuz etkiledi. Bu çalışmada, COVID-19 pandemisinin genel cerrahi asistanlık eğitimine etkilerini inceledik.

Gereç ve Yötem: Genel cerrahi asistanları için pandemi öncesi (Haziran 2019-Aralık 2019 ve Ocak-Şubat 2020) 9 ay ile pandemi dönemi (Nisan 2020-Aralık 2020) arasında çalışma yerleri, SARS-CoV-2 enfeksiyon yakalanma oranları, endoskopik ve cerrahi işlemlerinin sayıları karşılaştırıldı. Ayrıca, asistanlara pandeminin cerrahi eğitimlerine etkisi hakkında üç soru soruldu.

Sonuç: Toplamda 14 asistan, yaş ortalaması 29.5 yıl (aralık: 27-34) ve eğitim süresi ortalaması 42 ay (aralık: 24-60) olanlar çalışmaya dahil edildi. Eğitim deneyimi 42 ayın altında olan asistanlar (junior asistanlar), genel cerrahi servisinde ve poliklinikte çalışma süresinde pandemi öncesi döneme göre önemli bir azalma gösterdiler (sırasıyla p=0.014 ve p=0.034). Ayrıca, genel cerrahi uzmanlarının gözetiminde yapılan ameliyat sayısında bir azalma oldu (39.5'e karşı 22; p=0.027). Kıdemli asistanlar da pandemi öncesi döneme göre ameliyathane çalışma süresinde önemli bir azalma yaşadı ([ortalama 3.75 (aralık: 3-6) karşısında 3.0 (aralık: 2-6); p=0.024]), ve eğitim kadrosu (doçent, profesör, şef asistan) ve genel cerrahi uzmanlarının gözetiminde yapılan ameliyat sayısında istatistiksel olarak anlamlı bir azalma oldu (sırasıyla p=0.017, p=0.035 ve p=0.012). Tüm junior asistanlar (%100) ve kıdemli asistanların %87.5'i pandemi sırasında genel cerrahi eğitiminin yetersiz olduğunu ifade ettiler..

Sonuç: Pandemi döneminde hem junior hem de kıdemli asistanlar endoskopik ve cerrahi işlemlerin sayısında ve gözetim altında yapılan ameliyat sayısında önemli bir azalma yaşadılar.

Anahtar Kelimeler: Genel cerrahi asistan eğitimi, COVID-19 pandemisi, asistanlık eğitiminin süresinin uzatılması

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INTRODUCTION

Covid -19 pandemic has placed a significant burden on the healthcare system both globally and in our country. Since the beginning of the pandemic, there has been a continuous opening of pandemic clinics, wards, and new intensive care units (ICUs). In our country, the initial priority of the Ministry of Health was to prevent the spread of this contagious pandemic, and to reduce the number of affected individuals, elective outpatient clinic visits were reduced, and elective surgical procedures were temporarily banned. As the pandemic progressed, controlled outpatient clinic and surgical procedures, especially cancer surgeries, were resumed.

Due to the increased demand on healthcare systems, residents in all hospitals, including training and research hospitals, were assigned to pandemic-related outpatient clinics, wards, and ICUs. The decrease in outpatient clinic visits and surgical procedures due to closures and the assignment of surgical residents to non-clinical pandemic-related areas may have adversely affected the surgical training of residents, especially in the first 9 months when the pandemic was particularly intense. Research has been conducted worldwide to determine whether education, particularly in surgical specialties, has been disrupted and what can be done to prevent it. Studies have shown that surgical residents have experienced disruptions in both their theoretical education and the number of practical surgical cases, indicating a decrease in their training opportunities (1,2).

In this study, we investigated the impact of the COVID-19 pandemic on general surgical residents by comparing their assignments outside the general surgery clinic, rates of infection with SARS-CoV-2, and the numbers of endoscopic and surgical procedures during the 9 months before the pandemic and the first 9 months of the pandemic.

MATERIAL AND METHOD

Permission was received from the Ministry of Health of the Republic of Turkey and the clinical research ethics committee of Dışkapı Yıldırım Beyazıt Training and Research Hospital (Decision No: 135/13).

This retrospective study included residents currently undergoing training in the Department of General Surgery at .....Hospital, affiliated with the University of Health Sciences. Residents who had at least 9 months of surgical training before the COVID-19 pandemic were included in the study. Six residents with less than 9 months of general surgical training before the pandemic and 2 residents who served as chief residents during the pandemic, accompanying all surgeries, were excluded from the study. A total of 14 residents were included in the study.

Demographic data of the included residents, such as age and gender, were recorded, along with the duration of their residency training. The areas where they worked within the general surgery clinic (operating room, ward, outpatient clinic, wound care unit, ICU), the endoscopic procedures they performed (upper gastrointestinal endoscopy, colonoscopy, percutaneous endoscopic gastrostomy), and their respective numbers were documented. Additionally, minor surgical procedures, laparoscopic procedures (hemorrhoid surgery, anal fissure/fistula surgery, pilonidal sinus surgery, local excision of lipoma/sebaceous cyst, lymphadenopathy (LAP) excision, breast biopsy, laparoscopic procedures [cholecystectomy, inguinal hernia repair, transabdominal preperitoneal repair/total extraperitoneal repair (TAPP/TEP), colon surgery], major surgical procedures (total gastrectomy, colon surgery, hernia surgery [abdominal, inguinal], mastectomy, total thyroidectomy, liver surgery [hepatectomy, cystectomy]), and laparotomy procedures were individually recorded for each resident. The nature of these procedures, whether they were performed laparoscopically, open, on an emergency or elective basis, and the numbers of emergency surgical procedures (appendectomy, acute abdominal laparotomy, Fournier's/abscess surgery, irreducible hernia) and trauma surgeries (liver laceration, colon perforation, splenectomy) were documented. During these surgeries, the responsible member of the surgical team (educator, chief resident, specialist) was also recorded.

For each resident, the procedures mentioned above were recorded over the course of the first 9 months of the pandemic (April 2020-December 2020). The month of March 2020 was excluded from the study due to it being the initial month of the pandemic in our hospital, routine work continuing until March 19, 2020, and unclear working conditions and assignments. The main comparison was made between the numbers of surgical procedures during the 9-month period before the pandemic and the first 9 months of the pandemic. The impact of the pandemic on the numbers of laparoscopic procedures and emergency surgical procedures was analyzed.

Additionally, the locations where the residents worked during the first 9 months of the pandemic (COVID-19 outpatient clinics, wards, ICUs) and the duration of their assignments were recorded. Information on whether they were infected with SARS-CoV-2 during this period, the timing of infection, the positivity of real-time polymerase chain reaction (RT-PCR) tests if they were infected, and whether they were assigned to COVID-19-related units within the Department of General Surgery or were infected in social life was documented.

At the end of the study, residents were asked three questions: "Do you think your general surgical training was insufficient during the pandemic?", "Did working in COVID-19-related clinics outside the general surgery department contribute to your knowledge of pandemic management?", and "If you believe that the pandemic negatively affected your general surgical training, are you considering extending your residency training duration?"

Statistical Analysis

IBM SPSS version 22.0 (IBM Corporation, Armonk, NY, USA) was used for data analysis in our study. Continuous variables were expressed as mean ± standard deviation and/or median (min-max), while categorical data were presented as counts and percentages. Normality analyses of continuous variables were conducted using the Kolmogorov-Smirnov goodness-of-fit test. Since the data did not follow a normal distribution, comparisons between pre-pandemic and pandemic periods were performed using the Wilcoxon Signed-Rank Test. The Chi-Square Test was used for comparing categorical data. A statistical significance level of $p < 0.05$ was considered. Residents were divided into two groups, junior and senior, based on their median duration of residency, and comparisons were made accordingly.

RESULTS

The median age of the residents included in the study (n=14) was 29.5 years (range: 27-34), and the median duration of their training was 42 months (range: 24-60). Out of these residents, 12 were male (87.5%), and 2 were female (12.5%). There was no significant difference in gender between junior (less than 42 months of training) and senior (42 months or more of training) residents. However, a higher proportion of senior residents were 30 years and older compared to junior residents (75% vs. 16.7%; p=0.031).

Among the 6 junior residents, 4 of them had duties in the COVID-19 service, while none of the 8 senior residents had worked in the COVID-19 service (p=0.024). All senior residents had served in COVID-19 ICUs for a period of 1-3 months, while 66.7% of junior residents had served in COVID-19 ICUs for 1-2 months, and none of them had been infected with SARS-CoV-2. Among the senior residents who were infected with SARS-CoV-2, one was infected in the 2nd month, one in the 3rd month, and one in the 6th month (**Table 1**).

When comparing the locations, durations, rates of participation in surgeries under the supervision of supervisors and the numbers of endoscopic procedures and surgeries performed by junior residents before and during the pandemic, the following findings were observed:

Table 1. Comparison of Demographic Characteristics, Work in Pandemic-Related Units, and Rates of Infection with SARS-CoV-2 among General Surgical Residents

Features	Senior Assistants (N=6,%)	Junior Assistants (N=8,%)	p
Age			0.031
< 30 years old	5 (83.3)	2 (25.0)	
≥ 30 years old	1 (16.7)	6 (75.0)	
Gender			0.825
Female	1 (16.7)	1 (12.5)	
Male	5 (83.3)	7 (87.5)	
COVID-19 pandemic polyclinic work duration			0.213
0 month	5 (83.3)	8 (100.0)	
1 month	1 (16.7)	0 (0.0)	
COVID-19 pandemic service work duration			0.024
0 month	2 (33.3)	8 (100.0)	
1 month	3 (50.0)	0 (0.0)	
2 months	1 (16.7)	0 (0.0)	
COVID-19 pandemic intensive care unit work duration			0.164
0 month	2 (33.3)	0 (0.0)	
1 month	1 (16.7)	5 (62.5)	
1.5 months	1 (16.7)	0 (0.0)	
2 months	2 (33.3)	2 (25.0)	
3 months	0 (0.0)	1 (12.5)	
COVID-19 infecton status during the pandemic			0.091
No	6 (100.0)	5 (62.5)	
Yes	0 (0.0)	3 (37.5)	
Time of COVID-19 infection during the pandemic			0.413
2. months	0 (0.0)	1 (12.5)	
3 .months	0 (0.0)	1 (12.5)	
6 .months	0 (0.0)	1 (12.5)	
Location of COVID-19 infection during the pandemic			0.626
Service	1 (16.7)	1 (12.5)	
ICU	0 (0.0)	1 (12.5)	
general surgery	0 (0.0)	1 (12.5)	

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; ICU: Intensive Care Unit

During the pandemic period, there was a significant decrease in the duration of work in the general surgery ward and outpatient clinic compared to the pre-pandemic period (p=0.014 and p=0.034, respectively).

The number of surgeries performed under the supervision of supervisors decreased in all categories during the pandemic. However, a statistically significant decrease was observed only in the number of surgeries performed under the supervision of general surgery specialists (39.5 vs. 22; p=0.027).

There was a significant decrease in the numbers of pilonidal sinus and elective hernia surgeries among the endoscopic procedures and surgical interventions during the pandemic. Specifically, the median number of pilonidal sinus procedures before the pandemic was 13.5 (7-21), but no such procedures were performed during the pandemic (p=0.028). Additionally, the number of elective hernia surgeries decreased from 27.5 to 7.5 (p=0.026).

There was a statistically significant increase in the numbers of breast biopsies, laparoscopic appendectomies, and acute abdominal surgeries (p=0.046, p=0.041, and p=0.027, respectively) among the surgical procedures and interventions.

These findings indicate that the pandemic had a significant impact on the work experiences of junior surgical residents, with notable changes in the types and numbers of surgeries and procedures performed during the pandemic period. (**Table 2**)

Table 2. Comparison of the Working Locations, Durations, Rates of Participation in Surgeries with Supervisors, and the Numbers of Endoscopic and Surgical Procedures Performed by Junior Residents Before and During the Pandemic in the General Surgery Clinic

Features	before the pandemic [Median (25-75)]	pandemic era [Median (25-75)]	p
Working area (months)			
Operating room	2 (1-3)	2.5 (1-3)	0.276
general surgery service	3 (3-3)	2 (2-2)	0.014
general surgery polyclinic	3 (2-3)	2 (1-2)	0.034
wound clinic	1 (1-2)	1 (0-2)	0.157
Number of surgeries performed under supervision of a supervisor			
Faculty member (Ass. Prof, Prof.)	18.5 (9-27)	13.0 (8-22)	0.345
Chief assistant	14 (0-20)	10.5 (7-18)	0.753
General surgery specialist	39.5 (33-44)	22 (17-25)	0.027
Number of Endoscopic Procedures			
Upper GI Endoscopy	0 (0-0)	0 (0-0)	-
Colonoscopy	0 (0-0)	0 (0-0)	-
Per. Endo. gastrostomy	0 (0-0)	0 (0-0)	-
Minor Surgical Procedures			
Hemorrhoidectomy	3 (2-6)	1 (0-6)	0.171
pilonidal sinus	13.5 (7-21)	0 (0-1)	0.028
sebaceous cyst excision	1 (0-3)	1 (0-6)	0.752
breast biopsy	1 (0-3)	12.5 (2-16)	0.046
Lap. Surgical Procedures (n)			
laparoscopic cholecystectomy	1.5 (0-8)	0 (0-0)	0.109
laparoscopic hernia repair	0 (0-0)	0 (0-0)	-
laparoscopic appendectomy	0.5 (0-3)	7.5 (3-9)	0.041
laparoscopic colon	0 (0-0)	0 (0-0)	-
Surgical Procedures (n)			
appendectomy	13 (2-23)	5.5 (4-12)	0.109
Acute abdomen surgery	0 (0-2)	3.5 (1-12)	0.027
Large Abscess drainage	0 (0-2)	1 (0-3)	0.059
Urgent hernia repair	1.5 (0-5)	1 (0-3)	0.461
Total gastrectomy	0 (0-0)	0 (0-0)	-
colon surgery	0 (0-0)	0 (0-0)	-
elective hernia surgery	27.5 (22-38)	7.5 (3-16)	0.026
mastectomy	0 (0-1)	0.5 (0-2)	0.180
Thyroid surgery	0 (0-2)	0 (0-3)	0.655
diagnostic laparotomy	0 (0-0)	0 (0-0)	-
Liver laceration	0 (0-0)	0 (0-1)	0.317
Colon perforation	0 (0-0)	0 (0-0)	-
– Splenectomy	0 (0-0)	0 (0-0)	-

GIS: Gastrointestinal system

When comparing the working durations, rates of participation in surgeries with senior/resident instructors, and the numbers of surgeries and procedures performed by senior residents before and during the pandemic in the general surgery clinic, the following findings were observed:

During the pandemic period, there was a significant decrease in the duration of work in the operating room compared to the pre-pandemic period ([median 3.75 (3-6) vs. 3.0 (2-6); p=0.024]).

A statistically significant decrease was observed in the numbers of surgeries performed under the supervision in all categories (p=0.017, p=0.035, and p=0.012, respectively).

Among the surgical procedures and interventions, there was a significant decrease in the numbers of pilonidal sinus surgeries, laparoscopic cholecystectomies, laparoscopic hernia repairs, open hernia repairs, and thyroid surgeries during the pandemic (p=0.034, p=0.012, p=0.012, p=0.011, and p=0.035, respectively).

On the other hand, there was a statistically significant increase in the numbers of percutaneous endoscopic gastrostomies, splenectomies, sebaceous cyst excisions, and breast biopsies performed during the pandemic (p=0.049, p=0.034, p=0.026, and p=0.012, respectively) (**Table 3**).

Thirteen of the residents (92.9%) believed that their general surgery training was inadequate, with only 9 of them (64.3%) indicating that they might extend their training period for this reason. All of the junior residents (100%) believed that their general surgery training had been inadequate during the pandemic, while 87.5% of senior residents shared this belief. Among those considering extending their residency training, 83.3% were junior residents, and 50% were senior residents. Additionally, 83.3% of junior residents and 87.5% of senior residents stated that working in COVID-19-related clinics outside the general surgery clinic had contributed to their knowledge about pandemic management (**Table 4**).

DISCUSSION:

Our study encompasses the deployment of general surgery residents in COVID-19-related units, the number of infections with COVID-19, and the personal thoughts of residents regarding the impact of the COVID-19 pandemic on their surgical training. Additionally, it provides real-life numbers of emergency/elective surgeries, laparoscopic/open surgeries, endoscopic procedures, and the types and numbers of surgical procedures conducted in our general surgery clinic before the pandemic and during the first 9 months of the pandemic. All junior research assistants in our clinic were assigned to COVID-19 polyclinics and services,

while all senior residents were assigned to COVID-19 intensive care units (ICUs). The residents' infections with SARS-CoV-2 were more related to their social lives than their work in COVID-19 units. A decrease in the number of surgeries performed under the supervision of academic staff and in various surgical interventions and procedures was observed.

The COVID-19 pandemic has had a global impact on medical education and residency training (3). General surgery residents may have been more severely affected due to a decrease in the number of surgical cases and limitations in their training. The main reasons for this in our country include the prohibition of elective surgeries and the closure of the general surgery outpatient clinics during the first 3 months of the pandemic, followed by a reduction in the number of outpatient clinic patients and the restriction of surgical procedures to oncological surgeries. Furthermore, another significant factor is the assignment of all general surgery residents to COVID-19-related units for a period of 3 to 6 months during our research period.

In the study by Wise et al. (4), 37% of residents reported that surgical procedures were disrupted during this period due to a lack of personal protective equipment. However, our hospital did not encounter such a problem since the beginning of the pandemic.

Dedeilla et al.'s review (5) examined the challenges in internal and surgical education during the COVID-19 pandemic and analyzed 1288 studies as of April 18, 2020. They mentioned the use of simulation and virtual reality training. Simulation training programs were not widely used in many centers before the pandemic, as they were not considered necessary. However, due to the limitation of surgical cases during the pandemic, simulation programs started to be used to continue surgical technical training. For example, The Hang Kong Eye Hospital established an oculoplastic stimulation program using goat eyes and eyelids to ensure the continuity of surgical technical training. After broadcasting the procedure, residents were allowed to perform it under the supervision of a supervisor (6).

Table 3. Comparison of the Working Locations, Durations, Rates of Participation in Surgeries with Supervisors, and the Numbers of Endoscopic and Surgical Procedures Performed by Senior Residents Before and During the Pandemic in the General Surgery Clinic

Features	before the pandemic [Median (25-75)]	pandemic period [Median (25-75)]	p
Working area times (months)			
Operating room	3.75 (3-6)	3 (2-6)	0.024
General surgery department	2 (2-2)	2 (1-3)	0.564
General surgery outpatient clinic	1.75 (1-2)	2 (0-2)	0.679
Wound clinic	1.5 (0-2)	0.5 (0-2)	0.063
Surgeries under Supervision (n)			
Faculty member (Ass.Prof.Prof.)	45.5 (33-64)	24.0 (12-74)	0.017
Chief assistant	18.5 (13-32)	12.5 (2-21)	0.035
General surgery specialist	46 (29-62)	22 (14-34)	0.012
Performed End. Procedures (n)			
Upper GI Endoscopy	94 (1-264)	50.5 (18-76)	0.263
Colonoscopy	72 (2-203)	30.5 (3-50)	0.263
Per.endo. gastrostomy	0 (0-4)	3 (0-6)	0.049
Minor Surgical Procedures			
Hemorrhoidectomy	0.5 (0-3)	1.5 (0-4)	0.496
Pilonidal sinus	2 (0-3)	0 (0-1)	0.034
Sebaceous cyst excision	0 (0-1)	1.5 (0-5)	0.026
Breast biopsy	1 (0-3)	11 (6-23)	0.012
Lap. Surgical Preocedures (n)			
Lap. cholecystectomy	43.5 (35-58)	5 (0-34)	0.012
Lap. hernia repair	5.5 (1-14)	0 (0-2)	0.012
Lap. appendectomy	2 (1-10)	3 (1-9)	0.799
Lap. colon surgery	0 (0-0)	0 (0-4)	0.371
Surgical Procedures (n)			
Appendectomy	4 (2-6)	1 (0-16)	0.362
Acute abdomen surgery	10.5 (1-18)	9.5 (2-20)	0.944
Large abscess drainage	0.5 (0-2)	1 (0-3)	0.317
Urgent hernia surgery	2.5 (0-4)	1 (0-2)	0.056
Total gastrectomy	0 (0-0)	0.5 (0-2)	0.063
Colon surgery	1.5 (0-6)	2 (0-8)	0.799
Elective hernia surgery	18.5 (10-34)	2.5 (1-8)	0.011
Mastectomy	3 (0-13)	4.5 (3-9)	0.171
Thyroid surgery	4.5 (1-10)	0 (0-2)	0.035
Elective Liver surgery	0 (0-2)	0 (0-0)	0.180
Diagnostic laparotomy	0 (0-1)	0 (0-4)	0.317
Liver laceration repair	0 (0-2)	1 (0-2)	0.480
Colon perforation	0 (0-3)	1 (0-2)	1,000
Splenectomy	0 (0-0)	1 (0-2)	0.034

Table 4: Comparison of the Thoughts of General Surgery Residents Regarding the Impact of the Pandemic on Their Surgical Training

Features	Senior Assistants (N=6,%)	Junior Assistants (N=8,%)	p
Do you think your general surgical training was insufficient during the pandemic?			0.369
No	0 (0.0%)	1 (12.5%)	
Yes	6 (100.0%)	7 (87.5%)	
"Did working in COVID-19-related clinics outside the general surgery department contribute to your knowledge of pandemic management?"			0.825
No	1 (16.7%)	1 (12.5%)	
Yes	5 (83.3%)	7 (87.5%)	
If you believe that the pandemic negatively affected your general surgical training, are you considering extending your residency training duration?			0.198
No	1 (16.7%)	4 (50.0%)	
Yes	5 (83.3%)	4 (50.0%)	

COVID-19: Coronavirus disease 2019

Aziz et al.'s study (7) conducted in the United States on general surgery residents reported a significant decrease in elective and emergency surgeries during the pandemic. To compensate for this decrease, they implemented online training sessions that included surgical visual videos and increased didactic education hours. In our clinic, after a 2-week suspension of resident theoretical training, all training sessions were conducted via Zoom®, but surgical education was not provided through simulation.

The assignment of general surgery residents to work in COVID-19-related departments outside of their clinics during the pandemic not only led to a decrease in the number of surgical procedures but also affected the types of surgical procedures performed by senior and junior residents. Senior residents performed more acute abdominal surgeries, leading to an increased number of minor surgeries such as pilonidal sinus excision, sebaceous cyst excision, and breast biopsy being performed by both senior and junior residents. This was due to the junior residents being assigned to COVID-19-related units for longer periods. The reason senior residents were assigned more frequently to COVID-19 ICUs is because they were more proficient in invasive procedures such as intubation, central catheterization, as well as managing ICU treatments like mechanical ventilator care, sedation, and analgesia.

In a survey conducted by Şahin et al. (8) among neurosurgery residents, it was found that 85.5% of residents were assigned to work in COVID-19-related departments. Similarly, in a survey study by Yılmaz et al. (9), the impact of the COVID-19 pandemic on general surgery education was examined by comparing the numbers of emergency, elective, laparoscopic, and open surgeries performed between January 2019-April 2019 and January 2020-April 2020. This study reported a decrease in the average weekly elective cases from 69.27 to 13.22 (p=0.001). However, this study relied on average case numbers. In contrast, our study reflects the actual numbers, as each surgery and interventional procedure performed was individually recorded from the records. Therefore, we believe that our study provides valuable insights. Our study included only three questions about whether the COVID-19 pandemic had a negative impact on surgical education and whether residents wanted to extend their training periods based on their personal opinions.

During the COVID-19 pandemic, there has been debate over whether laparoscopic or open surgery carries a higher risk of infection transmission, but it has been suggested that open surgery may be safer (10). In the study by Yılmaz et al. (9), 23.9% of residents considered open surgery to be safer in terms of contamination. They mentioned that laparoscopic surgeries could have longer operating times and require more advanced training and experience. In our study, the number of laparoscopic appendectomies performed by junior residents decreased during the pandemic, and the number of all laparoscopic procedures decreased in both junior and senior residents. This was attributed to the potential risk of aerosolization and the possibility that junior residents might prolong the duration of laparoscopic surgical procedures.

One of the cornerstones of general surgery education is the supervision of residents by an attending or specialist during surgery. This is essential for learning surgical techniques correctly and reducing complications. However, this training process can extend the duration of surgery (11). In our study, although there was a decrease in the number of surgeries performed under the supervision of attending physicians (professors, associate professors, senior residents), there was no significant difference between junior and senior residents. The decrease in surgeries performed under the supervision of general surgery specialists was attributed to the assignment of these specialists to COVID-19 services, ICUs, and contact tracing.

CONCLUSION

the pandemic has numerically demonstrated the negative impact on the surgical education of general surgery residents. While theoretical education continued during the pandemic, the use of simulation technologies could be considered to help residents maintain their surgical skills and gain opportunities for more complex surgical procedures. Additionally, in order to mitigate the adverse effects of the pandemic and ensure that surgical education is not compromised, the training periods of residents, especially those who started their training after March 2020, could be extended in proportion to the duration of their assignments during the pandemic.

ETHICAL DECLARATIONS

Ethics Committee Approval: Permission was received from the Ministry of Health of the Republic of Turkey and the clinical research ethics committee of Dışkapı Yıldırım Beyazıt Training and Research Hospital (Decision No: 135/13).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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