ORIGINAL ARTICLE

DOI: 10.4274/hamidiyemedj.galenos.2025.95867

Hamidiye Med J

Evaluation of Surgery Services in Terms of Health Management During the COVID-19 Pandemic

COVID-19 Pandemisinde Cerrahi Hizmetlerin Sağlık Yönetimi Açısından Değerlendirilmesi

Pınar Ünkür[1], Elif Serap Esen[2], Fatma Kantaş Yılmaz[3], M. Fevzi Esen[4]

[1]*Tokat Gaziosmanpaşa University Faculty of Erbaa Health Sciences, Department of Health Management, Tokat, Türkiye*

[2]*University of Health Sciences Türkiye, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital, Clinic of Family Medicine, İstanbul, Türkiye*

[3]*University of Health Sciences Türkiye, Hamidiye Faculty of Health Sciences, Department of Health Management, İstanbul, Türkiye*

[4]*University of Health Sciences Türkiye, Hamidiye Institute of Health Sciences, Department of Health Information Systems, İstanbul, Türkiye*

ABSTRACT

Background: The Coronavirus Disease 2019 (COVID-19) pandemic has negatively affected global health, social welfare, and the economy at a level unprecedented in modern history. study aimed to compare surgery services in a training and research hospital in İstanbul before and after COVID-19 and evaluate these services regarding health management.

Materials and Methods: This retrospective study encompassed all surgical procedures conducted in the hospital's operating room from 2019 to 2023. The data were analyzed using frequency, percentage and chi-square tests.

Results: The dataset encompasses 46,041 surgical procedures and 18 different disease groups. Major surgical procedures account for 66.8% of emergency surgeries and 84.2% of elective surgeries. 71.5% of the major surgeries, 88% of the moderate surgeries, and 83.4% of the minor surgeries are emergencies. Major surgical procedures are prevalent across all age demographics. 11,834 (25%) surgeries were performed in 2019, and 4,344 (9%) surgeries were performed in 2020. The pandemic significantly reduced emergency (n=3984, 11%) and elective (n=360, 3%) surgeries. There was a notable rise in the frequency of hospital visits after surgeries involving the circulatory system, ocular interventions, and operations in the middle ear as age progressed.

Conclusion: The pandemic period witnessed notable reductions in the volume of emergency, elective, major, medium, and minor surgical procedures. Surgeries experienced a decline across all disease categories, except for two: foreign body, implant, and graft surgeries, and incidents involving accidents, poisoning, contact with sharp objects, and weapons. Most surgeries can be classified as emergency procedures, with notable prevalence in cases involving the eye and middle ear, genitourinary system, skeletal structure, circulatory system, digestive tract, and respiratory ailments. Emergency, eye, and middle ear surgeries were more prevalent among individuals aged 60 and above, whereas elective surgeries were more frequently observed in the 19-30 age group. Most emergency and elective surgeries were major surgeries. The number of postoperative check-ups increased among the older age demographics.

Keywords: COVID-19, pandemic, surgery, health management

ÖZ

Amaç: Koronavirüs Hastalığı 2019 (COVID-19) salgını, küresel sağlık, sosyal refah ve ekonomiyi modern tarihte benzeri görülmemiş bir düzeyde olumsuz etkilemiştir. Çalışmanın amacı, İstanbul'daki bir eğitim ve araştırma hastanesinde COVID-19 öncesi ve sonrası dönemde sunulan cerrahi hizmetleri karşılaştırmak ve sağlık yönetimi açısından değerlendirmektir.

Gereç ve Yöntemler: Bu retrospektif çalışma, hastanenin ameliyathanesinde 2019'dan 2023 yılına kadar gerçekleştirilen tüm cerrahi prosedürleri kapsamaktadır. Veriler, frekans, yüzde ve ki-kare testleri kullanılarak analiz edilmiştir.

Bulgular: Veriler, 46.041 ameliyat ve 18 farklı hastalık grubundan oluşmaktadır. Acil ameliyatların %66,8'i, elektif ameliyatların ise %84,2'si büyük ameliyatlardır. Büyük ameliyatların %71,5'i, orta ameliyatların %88'i, küçük ameliyatların %83,4'ü acil ameliyatlardır. Her yaş grubunda büyük ameliyatların yoğunlukta olduğu görülmektedir. 2019 yılında 11.834 (%25); 2020 yılında ise 4344 (%9) ameliyatın yapıldığı görülmüştür. Bu durum hem acil (n=3984, %11) hem de elektif (n=360, %3) ameliyat rakamlarında ciddi

Address for Correspondence: Pınar Ünkür, Tokat Gaziosmanpaşa University Faculty of Erbaa Health Sciences, Department of Health Management, Tokat, Türkiye
E-mail: pinar.unkur@gop.edu.tr **ORCID ID:** orcid.org/0000-0001-8335-555X

Received: 21.03.2025 **Accepted:** 04.08.2025 **Epub:** 02.09.2025

Cite this article as: Ünkür P, Esen ES, Kantaş Yılmaz F, Esen MF. Evaluation of surgery services in terms of health management during the COVID-19 pandemic. Hamidiye Med J. [Epub Ahead of Print]

öz

düşüşlerin yaşanmasına sebep olmuştur. Yaş ilerledikçe dolaşım sistemi ile göz ve orta kulak ameliyatları sonrası hastaneye gelme sıklıklarının arttığı görülmüştür.

Sonuç: Pandemi döneminde acil, elektif, büyük, orta ve küçük ameliyatların sayısında ciddi oranda düşüşler görülmüştür. İki hastalık grubu (yabancı cisim, implant ve greft operasyonları ile kazalar, zehirlenme, keskin cisimlerle-ateşli silahlarla temas) dışındaki tüm hastalık gruplarındaki ameliyat sayılarında düşüşler görülmüştür. Türlerine göre ameliyatların büyük çoğunluğunu acil ameliyatlar oluşturmakta olup, göz ve orta kulak, genitoüriner, iskelet, dolaşım, sindirim ve solunum sistemi hastalıkları ön plana çıkmaktadır. Altmış yaş ve üzeri bireylerde acil, göz ve orta kulak hastalıkları ameliyatlarının 19-30 yaş grubunda ise elektif ameliyatların yoğun olduğu görülmüştür. Acil ve elektif ameliyatların çoğunluğu büyük ameliyatlardır. İlerleyen yaş gruplarında ameliyat sonrası kontrole gelme sıklığının arttığı tespit edilmiştir.

Anahtar Kelimeler: COVID-19, pandemi, ameliyat, sağlık yönetimi

Introduction

Surgical care has been an important component of health care for centuries. As the prevalence of cancers, cardiovascular diseases and traumatic injuries continues to increase, the impact of surgical intervention on public health will continue to grow (1). Some European Union countries performed over four million cataract surgeries and one million cesarean sections (2). As the aged population expands, cardiovascular disorders have emerged as the predominant cause of morbidity and mortality among those over 75 years of age in recent years, illustrated by the percentage of cardiac surgeries (3,4). Advancements in health technology have led to a preference for novel uses, such as robotic surgery, over traditional open surgical methods (5). The Coronavirus Disease 2019 (COVID-19) pandemic has negatively affected global health, social welfare, and the economy, at a level unprecedented in modern history (6). It has also led to significant changes in healthcare services. The number of patients visiting emergency services has almost halved during COVID-19 (7). Besides its detrimental impact on public health, the virus has caused the disruption and cancellation of surgical operations. Moreover, patients have had challenges receiving surgical care, prompting the formulation of a plan specifically for post-pandemic (6,8). Hospitals were considered high-risk environments, with intensive care units and operating rooms identified as the most hazardous regions (9). In the pre-COVID-19 period (2019), elective surgeries were four times more frequent than emergency surgeries, but during the pandemic period, they decreased to twice (10). In the first two months of the pandemic, emergency general surgery applications dropped 37.1% and 43.7%, respectively. Acute appendicitis, cholecystitis, and intestinal obstruction were the most common surgical emergencies encountered during the pandemic (11). In Türkiye, the number of surgeries conducted in 2019 was over 5 million, but it declined to 3 million in 2020, subsequently rising in the ensuing years following the conclusion of the pandemic (12). The pandemic caused elective surgeries to be postponed, and healthcare personnel prioritized COVID-19 patients, leading to disruptions in the provision of other healthcare services (7,13). The pandemic's unprecedented challenges required a fundamental restructuring of global surgical care delivery. Health authorities, including the World Health Organization, Centers for Disease Control and Prevention, and European Centre for Disease Prevention and Control, along with surgical societies such as the American College of Surgeons, European Association for Endoscopic Surgery, and European Society of Coloproctology, promptly released evidence-based guidelines to reduce infection risks and conserve essential resources. The guidelines focused on several fundamental operational pillars:

Tiered Triage Systems: Elective surgeries were prioritized rigorously according to urgency and cancer risk, employing frameworks such as the Medically Necessary Time-Sensitive (MeNTS) scoring system. Surgeries were classified into tiers, including Emergency, Urgent, Semi-Urgent, and Postponable, and the classification was evaluated continuously based on the local COVID-19 burden and resource availability. This frequently resulted in considerable delays for non-urgent procedures such as bariatric and benign hernia surgeries (14).

Enhanced Preoperative Protocols: These protocols mandate universal Severe Acute Respiratory Syndrome Coronavirus 2 screening, typically conducted via reverse transcription – polymerase chain reaction, within 24-72 hours prior to surgery for all patients, including those who are asymptomatic. Preoperative isolation was recommended when feasible. Telemedicine was extensively utilized for preoperative evaluations and consent procedures to reduce hospital exposure (15).

Modifications in Operational Procedures within the Operating Room:

- Infection Control: Rigorous compliance with enhanced personal protective equipment (N95/FFP2 respirators, eye protection, gowns, gloves) is essential for all operating room personnel, particularly during aerosol-generating

procedures such as intubation or laparoscopy. Operating rooms for COVID-19 equipped with negative pressure ventilation were utilized where feasible.

• Personnel and Workflow: Team sizes were reduced, and staff movement between COVID-positive and non-COVID areas was limited. Operating times were optimized, and non-essential equipment was eliminated.

• Surgical Technique: Given the evolving evidence on viral aerosolization, recommendations frequently suggested reducing the use of energy devices (such as electrocautery and ultrasonic scalpels) during laparoscopy and implementing effective smoke evacuation systems (16).

Postoperative Care Adjustments: The procedures involved modifications to pathways aimed at expediting discharge when deemed safe, such as the implementation of enhanced recovery after surgery protocols (17). Dedicated surgical wards and intensive care units free from COVID-19 were established to safeguard non-infected surgical patients. Postoperative follow-up increasingly employs telehealth.

Ethical and Safety Frameworks: These frameworks underscore the importance of equitable resource allocation, transparent communication with patients regarding risks and delays, and the ethical duty to deliver surgical care when deferral may result in substantial harm, such as cancer progression or limb threat. The regulations were primarily motivated by patient safety and the protection of healthcare workers (18).

Surgeons' daily practices and training have been profound, enabling them to become a significant source of personnel in the fight against the virus (19). Restrictions on access to non-urgent care and elective surgeries have postponed bariatric and metabolic surgeries worldwide. Therefore, delaying surgery for patients experiencing a rapid progression of obesity and diabetes has increased the risks of morbidity and mortality (20).

The pandemic has created considerable challenges in managing healthcare services, necessitating that healthcare systems remain flexible and adaptable to these processes. Given that the pandemic yields critical insights for implementing measures against potential future pandemics, it is imperative to monitor this scenario concerning healthcare management. This study evaluates operating room practices during the pre- and post-COVID-19 periods. The study attempts to clarify the influence of the COVID-19 criterion on healthcare planning for the literature and policymakers and to provide resources.

Materials and Methods

Research Design

The retrospective research aimed to statistically evaluate the data obtained from patients who underwent surgery in a 654-bed general education and research hospital in İstanbul Türkiye between 01.01.2019 and 01.10.2023.

Population and Sample

The study universe consists of 46,041 surgeries and 18 different disease groups. All surgeries were analyzed without selecting a sample. The surgery classification was based on the medical standard of surgery; depending on their volume and complexity, surgeries may be minor, medium and major (complex). The disease definition of 46.041 surgeries was made using the International Classification of Diseases-10 (ICD-10) diagnostic codes. The current study included elective and emergency cases as a kind of surgery. Emergency cases occur unpredictably and require immediate attention on the same day. Elective cases may be scheduled for subsequent dates (21).

Ethical Approval

Institutional permission was obtained before the study was conducted, and ethics committee approval was obtained from the University of Health Sciences Türkiye, Hamidiye Scientific Research Ethics Committee (approval number: 1/34, dated: 25.01.2024).

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences 25.0 for Windows (SPSS Inc., Chicago, IL, USA). Multiple limitations require attention. This single-center study conducted at a tertiary hospital in İstanbul may not accurately represent patterns observed in community hospitals or rural settings, where resource constraints vary. Secondly, variations in diagnostic coding within electronic health records (EHRs), such as the misclassification of "urgent" versus "elective", may impact the accuracy of disease groupings, even with the standardized application of ICD-10. Third, we did not monitor long-term outcomes of delayed surgeries, such as cancer progression in deferred biopsies, which would elucidate the clinical implications of triage decisions. Fourth, confounding factors such as local COVID-19 surges, staff shortages, and patient avoidance behaviors were not quantified, although they likely impacted surgery volumes. Ultimately, our data do not evaluate the consistent application of priority frameworks across surgical specialties, which is a recognized challenge during crises. Data were expressed as frequencies and

percentages. The chi-square test was used to evaluate the frequency differences between disease groups. The significance level was accepted as $p<0.05$.

Results

Emergency and elective surgeries, as well as minor, medium, and major surgeries, have decreased during the pandemic (Table 1). The number of surgeries in 2020 decreased by 81% relative to 2019; albeit this reduction differs by disease group. The 34,950 emergency surgeries over a five-year span declined from 24.40% in 2019 to 11.40% in 2020, while 11,091 elective procedures fell from 29.81% to 3.25%. Similarly, there has been a reduction of 90% in the incidence of major procedures. All disease groups, exhibited a reduction in the number of procedures except for two categories: foreign body (implant and graft surgeries), and incidents involving accidents, poisoning, contact with sharp objects, and weapons (Table 1).

Most emergency surgeries involved eye and middle ear diseases (18.8%), genitourinary system diseases (18.2%), skeletal system diseases (10.6%), circulatory system diseases (9.3%), digestive system diseases (7.2%), and respiratory system diseases (5.7%) (Table 2).

Elective surgeries are performed for diseases (36.8%), digestive system diseases (8.9%), muscle-tendon injuries and fractures (8.7%), and skeletal system diseases (8.6%) (Table 2).

Between 2019 and 2023, 73.4% of all surgeries in the 0-18 age group were major, and 70.3% were urgent. These surgeries were mostly performed for respiratory system diseases (15.2%), digestive system diseases (11.7%), injuries due to contact with sharp objects (8.1%), congenital and chromosomal disorders (7.4%), skeletal system diseases (7.3%), muscle-tendon injuries and fractures (6.5%) (Table 3).

Eighty point eight percent of surgeries between the ages of 19 and 30 were major, and 51.4% were elective.

Table 1. Percentage distribution of surgery data according to variables by year

Variables	Categories	Year (%)					
		2019	2020	2021	2022	2023	Total number
Kind of surgery	Emergency	24.40	11.40	12.20	24.50	27.50	34950
	Elective	29.81	3.25	7.72	28.11	31.12	11091
Size of surgery	Major	30.33	2.22	3.02	22.57	41.85	32697
	Medium	34.56	4.23	9.13	24.65	27.43	9848
	Minor	26.74	8.32	11.53	24.49	28.92	3496
Disease group	Infectious diseases	24.30	10.05	12.15	27.34	26.17	428
	Neoplasms and immune system diseases	25.57	4.96	9.85	26.12	33.49	1654
	Endocrine and metabolic diseases	27.15	8.28	12.91	24.83	26.82	302
	Nervous system diseases	19.82	3.69	5.99	15.67	54.84	217
	Eye and middle ear diseases	24.40	8.49	7.96	28.13	31.02	6911
	Circulatory system diseases	24.28	2.65	3.44	30.31	39.32	3431
	Respiratory system diseases	19.83	3.53	7.57	33.69	35.38	2179
	Digestive system diseases	24.38	2.82	6.49	33.03	33.29	3515
	Skin diseases	29.99	2.97	6.56	24.44	36.04	1784
	Skeletal system diseases	26.55	4.94	7.90	24.48	36.13	4656
	Genitourinary system diseases	24.39	2.67	9.28	24.49	39.16	6884
	Gynecological-obstetric diseases	24.39	1.43	10.21	30.46	33.51	5026
	Congenital and chromosomal disorders	24.19	3.74	9.73	21.70	40.65	401
	Unclassified abnormal clinical and laboratory findings*	24.35	3.12	6.29	24.47	41.76	1700
	Muscle-tendon injuries and fractures	24.35	5.17	12.14	23.91	34.43	1606
	Foreign body, implant and graft operations	19.62	20.35	18.73	20.50	20.80	678
	Accidents, poisoning, contact with sharp objects-firearms	19.06	19.33	19.95	20.04	21.63	1128
	Examination, follow-up, observation**	27.22	2.63	15.02	24.48	30.64	3541

*Includes cases coded as R00-R99. These cases cover specific disease categories, a wide range of clinical signs, symptoms, and abnormal test results, and abnormal test results, and are also kept in the surgery database. **It is included as a category in the health information system because it is indexed in the surgery database

Table 2. Distribution of disease groups according to surgery types

Variable	Categories	Types of surgery					
		Emergency			Elective		
		n	Row, n%	Column, n%	n	Row, n%	Column, n%
Disease groups	Infectious diseases	359	83.9	1.0	69	16.1	0.6
	Neoplasms and immune system diseases	1572	95	4.5	82	5.0	0.7
	Endocrine and metabolic diseases	284	94	0.8	18	6.0	0.2
	Nervous system diseases	189	87.1	0.5	28	12.9	0.3
	Eye and middle ear diseases	6554	94.8	18.8	357	5.2	3.2
	Circulatory system diseases	3239	94.4	9.3	192	5.6	1.7
	Respiratory system diseases	1987	91.2	5.7	192	8.8	1.7
	Digestive system diseases	2526	71.9	7.2	989	28.1	8.9
	Skin diseases	1510	84.6	4.3	274	15.4	2.5
	Skeletal system diseases	3698	79.4	10.	958	20.6	8.6
	Genitourinary system diseases	6345	92.2	18.2	539	7.8	4.9
	Gynecological-obstetric diseases	940	18.7	2.7	4086	81.3	36.8
	Congenital and chromosomal disorders	352	87.8	1.0	49	12.2	0.4
	Unclassified abnormal clinical and laboratory findings*	1349	79.4	3.9	351	20.6	3.2
	Muscle-tendon injuries and fractures	646	40.2	1.8	960	59.8	8.7
	Foreign body, implant and graft operations	318	46.9	0.9	360	53.1	3.2
	Accidents, poisoning, contact with sharp objects-firearms	117	10.4	0.3	1011	89.6	9.1
	Examination, follow-up, observation**	2965	83.7	8.5	576	16.3	5.2

*Includes cases coded as R00-R99. These cases are also kept in the surgery database and cover specific disease categories, a wide range of clinical signs, symptoms and abnormal test results. **It is included as a category in the health information system because it is indexed in the surgery database

These surgeries were mainly for gynecological diseases (37.9%), the skeletal system (8.4%), the skin (8%), the respiratory system (7.3%), and the digestive system (6.3%) (Table 3).

Sixty-seven point eight percent of surgeries between the ages of 31 and 45 were major, and 73.7% were urgent. These surgeries were mainly performed on genitourinary system diseases (18.7%), gynecological diseases (15.9%), circulatory system diseases (12%), skeletal system diseases (10.2%), digestive system diseases (7.2%), and eye and middle ear diseases (5.4%) (Table 3).

Sixty-four point one percent of the surgeries between the ages of 46 and 59 were major, and 87.7% were urgent. These surgeries mainly involved the genitourinary system (22.5%), eye and middle ear (17.2%), skeletal system (12.2%), circulatory system (10%), and digestive system (8.6%) (Table 3).

Seventy-three point three percent of the surgeries performed on individuals over the age of 60 were major, and 89% were urgent. Surgeries were performed for eye and middle ear diseases (37.2%), genitourinary system diseases (14.4%), skeletal system diseases (10.3%), digestive system diseases (6.6%), neoplasms and immune system diseases (5.6%), and circulatory system diseases (4.8%) (Table 3).

Sixty-six point eight percent of emergency surgeries and 84.2% of elective surgeries are major. Seventy-one point five percent of major surgeries, 88% of moderate surgeries, and 83.4% of minor surgeries are urgent. Surgeries are generally included in the major surgery group. However, it was determined that foreign body, implant, and graft surgeries (49.3%) and circulatory system diseases (31.1%) constitute the majority of the minor surgery group (Table 4).

The frequency of individuals coming to the hospital after surgery increases in older age groups. The frequency of hospital visits increases with age, especially for individuals having minor surgeries, and diseases of the circulatory system, eye, and middle ear between the ages of 19 and 59 (Table 5).

The predominant types of gynecological procedures include spontaneous vertex deliveries (n=2754) and emergency and elective cesarean deliveries (n=766). In genitourinary system disorders, procedures for abnormal uterine and vaginal hemorrhage (n=1401) and irregular menstruation (n=1252) are primarily conducted. Chronic venous insufficiency (n=2528) is predominantly conducted in circulatory system diseases, with a significant majority in the 31-45 age. The predominant types of

Table 3. Distribution of surgeries by age groups, size, type and disease groups

Variables	Categories	Age groups															Total (%)
		0-18			19-30			31-45			46-59			60+			
		Count	Row	Column	Count	Row	Column	Count	Row	Column	Count	Row	Column	Count	Row	Column	
Size of surgery	Major	3205	9.8%	73.4%	6240	19.1%	80.8%	8602	26.3%	67.8%	6642	20.3%	64.1%	8008	24.5%	73.3%	32697 (100%)
	Medium	1105	11.2%	25.3%	926	9.4%	12.0%	2570	26.1%	20.3%	2850	29.0%	27.5%	2397	24.4%	22.0%	9848 (100%)
	Minor	58	1.7%	1.3%	556	15.9%	7.2%	1504	43.1%	11.9%	866	24.8%	8.4%	512	14.6%	4.7%	3496 (100%)
Kind of surgery	Emergency	3071	8.8%	70.3%	3750	10.7%	48.6%	9333	26.7%	73.7%	9078	26.0%	87.7%	9718	27.8%	89.0%	34950 (100%)
	Elective	1303	11.7%	29.7%	3966	35.8%	51.4%	3336	30.1%	26.3%	1281	11.5%	12.3%	1205	10.8%	11.0%	11091 (100%)
Disease group	Infectious diseases	24	5.6%	0.6%	86	20.1%	1.1%	144	33.5%	1.1%	89	20.8%	0.9%	85	19.9%	0.8%	428 (100%)
	Neoplasms-immune system diseases	32	1.9%	0.7%	110	6.7%	1.4%	433	26.1%	3.4%	474	28.7%	4.6%	605	36.7%	5.6%	1654 (100%)
	Endocrine and metabolic diseases	2	0.7%	0.0%	25	8.3%	0.3%	103	34.1%	0.8%	97	32.1%	0.9%	75	24.8%	0.7%	302 (100%)
	Nervous system diseases	11	5.1%	0.3%	13	6.0%	0.2%	39	18.0%	0.3%	86	39.6%	0.8%	68	31.3%	0.6%	217 (100%)
	Eye and middle ear diseases	109	1.6%	2.5%	278	4.0%	3.6%	684	9.9%	5.4%	1783	25.8%	17.2%	4057	58.7%	37.2%	6911 (100%)
	Circulatory system diseases	13	0.4%	0.3%	331	9.7%	4.3%	1526	44.5%	12.0%	1035	30.2%	10.0%	526	15.3%	4.8%	3431 (100%)
	Respiratory system diseases	664	30.5%	15.2%	562	25.8%	7.3%	480	22.0%	3.8%	251	11.5%	2.4%	222	10.2%	2.0%	2179 (100%)
	Digestive system diseases	509	14.5%	11.7%	488	13.9%	6.3%	908	25.8%	7.2%	894	25.4%	8.6%	716	20.4%	6.6%	3515 (100%)
	Skin diseases	281	15.8%	6.4%	615	34.5%	8.0%	435	24.4%	3.4%	253	14.2%	2.4%	200	11.2%	1.8%	1784 (100%)
	Skeletal system diseases	319	6.9%	7.3%	650	14.0%	8.4%	1297	27.9%	10.2%	1263	27.1%	12.2%	1127	24.2%	10.3%	4656 (100%)
	Genitourinary system diseases	256	3.7%	5.9%	357	5.2%	4.6%	2370	34.4%	18.7%	2327	33.8%	22.5%	1574	22.9%	14.4%	6884 (100%)
	Gynecological-obstetric diseases	65	1.3%	1.5%	2927	58.3%	37.9%	2011	40.0%	15.9%	23	0.4%	0.2%	0	0.0%	0.0%	5026 (100%)

Table 3. Continued

Variables	Categories	Age groups												Total (%)	
		0-18		19-30			31-45		46-59		60+				
		Count	Row	Column	Count	Row	Column	Count	Row	Column	Count	Row	Column		
Disease group	Congenital-chromosomal disorders	324	81.0%	7.4%	39	9.5%	0.5%	16	4.0%	0.1%	7	1.8%	0.1%	401	(100%)
	Unclassified abnormal clinical-laboratory findings*	87	5.1%	2.0%	212	12.5%	2.8%	479	28.2%	3.8%	472	27.8%	4.6%	450	26.4%	4.1%	1700	(100%)
	Muscle-tendon injuries and fractures	286	17.8%	6.5%	283	17.6%	3.7%	327	20.4%	2.6%	317	19.8%	3.1%	393	24.4%	3.6%	1606	(100%)
	Foreign body, implant-graft operations	216	32.1%	5.0%	117	17.2%	1.5%	183	27.0%	1.4%	110	16.2%	1.1%	52	7.4%	0.5%	678	(100%)
	Accidents, poisoning, contact with sharp objects-firearms	356	31.6%	8.1%	203	18.0%	2.6%	281	25.0%	2.2%	166	14.7%	1.6%	122	10.7%	1.1%	1128	(100%)
	Examination, follow-up, observation**	814	23.0%	18.6%	422	11.9%	5.4%	960	27.2%	7.6%	715	20.2%	6.9%	630	17.8%	5.8%	3541	(100%)

*Includes cases coded as R00-R99. These cases are also kept in the surgery database and cover specific disease categories, a wide range of clinical signs, symptoms and abnormal test results. **It is included as a category in the health information system because it is indexed in the surgery database

respiratory system diseases involve issues of the nose and nasal sinuses, with procedures for nasal septum deviation (n=408) and other conditions (n=467). In surgical procedures necessitated by accidents, poisoning, and injuries from sharp objects and weapons, those resulting from bites and stings of non-poisonous insects and arthropods (n=520) are particularly prominent, significantly impacting the 0-18 age demographic. Likewise, other surgical procedures conducted across the 0-18 age demographic include foreign body removal, implant placement, and graft surgery. Many individuals undergoing surgery for eye and middle ear problems are aged 60 and above. Diabetic retinopathy procedures (n=1418) and senile cataract surgeries (n=965) are the most prominent in this group (Table 6).

In procedures for the digestive system, a substantial difference was noticed in patients aged 19 to 59. A significant difference was observed in the 19-59 age group for surgeries performed due to venous insufficiency (chronic peripheral), varicocele, and hemorrhoids in circulatory system diseases; in contrast, surgeries performed for abnormal uterine and vaginal bleeding, a significant difference was observed between all age groups, except for the 0-18 age group, in surgeries performed for abnormal uterine and vaginal bleeding. There was a substantial difference in all procedures performed for gynecological illnesses in the 19 to 45 age group. In procedures performed for soft tissue and back pain in skeletal system illnesses, there was a substantial difference within the 19-59 age group. There was a substantial difference in neoplasms and immune system diseases between the 31-60 age group and those above, regarding benign lipomatous neoplasm, trunk skin and subcutaneous tissue neoplasms, benign skin neoplasm, and malignant bladder neoplasm. Eye and middle ear surgeries among individuals aged 31-60 differ significantly from those performed on older individuals. Respiratory system procedures between 18 and 31 years old (excluding nasal septum deviation) differ significantly. All genitourinary system illnesses (excluding benign prostatic hyperplasia) show a substantial variation in the 19- to 59-year-old age group (Table 6).

Table 4. Distribution of surgery sizes by surgery types and disease groups

Variables	Categories	Size of surgery								
		Major			Medium			Minor		
		Count (n)	Row %	Column %	Count (n)	Row %	Column %	Count (n)	Row %	Column %
Kind of surgery	Emergency	23363	66.8	71.5	8671	24.8	88.0	2916	8.3	83.4
	Elective	9334	84.2	28.5	1177	10.6	12.0	580	5.2	16.6
Disease group	Infectious diseases	373	87.1	1.1	54	12.6	0.5	1	0.2	0.0
	Neoplasms and immune system diseases	1564	94.6	4.8%	87	5.3	0.9	3	0.2	0.1
	Endocrine and metabolic diseases	267	88.4	0.8	24	7.9	0.2	11	3.6	0.3
	Nervous system diseases	205	94.5	0.6	7	3.2	0.1	5	2.3	0.1
	Eye and middle ear diseases	3904	56.5	11.9	1927	27.9	19.6	1080	15.6	30.9
	Circulatory system diseases	2018	58.8	6.2	324	9.4	3.3	1089	31.7	31.1
	Respiratory system diseases	1766	81.0	5.4	120	5.5	1.2	293	13.4	8.4
	Digestive system diseases	3298	93.8	10.1	215	6.1	2.2	2	0.1	0.1
	Skin diseases	698	39.1	2.1	1083	60.7	11.0	3	0.2	0.1
	Skeletal system diseases	4066	87.3	12.4	478	10.3	4.9	112	2.4	3.2
	Genitourinary system diseases	3412	49.6	10.4	3248	47.2	33.0	224	3.3	6.4
	Gynecological-obstetric diseases	4876	97.0	14.9	149	3.0	1.5	1	0.0	0.0
	Congenital and chromosomal disorders	372	92.8	1.1	29	7.2	0.3	0	0.0	0.0
	Unclassified abnormal clinical and laboratory findings*	1357	79.8	4.2	208	12.2	2.1	135	7.9	3.9
	Muscle-tendon injuries and fractures	1576	98.1	4.8	30	1.9	0.3	0	0.0	0.0
	Foreign body, implant and graft operations	329	48.5	1.0	15	2.2	0.2	334	49.3	9.6
	Accidents, poisoning, contact with sharp objects-firearms	973	86.3	3.0	133	11.8	1.4	22	2.0	0.6
	Examination, follow-up, observation**	1643	46.4	5.0	1717	48.5	17.4	181	5.1	5.2

*Includes cases coded as R00-R99. These cases are also kept in the surgery database and cover specific disease categories, a wide range of clinical signs, symptoms and abnormal test results. **It is included as a category in the health information system because it is indexed in the surgery database

Discussion

This study aimed to compare operating room services in a training and research hospital in İstanbul before and after COVID-19 and to evaluate them in terms of health management. The number of surgeries performed in 2020 varied by disease groups but decreased by 81% compared to 2019. Thirty-four thousand nine hundred fifty emergency surgeries performed in the five-year period decreased from 24.40% in 2019 to 11.40% in 2020, and 11,091 elective surgeries decreased from 29.81% to 3.25%. Similarly, the rate of major surgeries decreased by more than 90%.

In alignment with the study findings, İlhan et al. (10) examined the impact of the COVID-19 pandemic on emergency and elective surgeries, revealing a decline from 947 surgeries performed in 2019 to 165 in 2020, representing a reduction of approximately 90%. They also reported a decline in the elective surgery rate from 80% in 2019 to 34.5% in 2020 (10). Previous studies indicate that the pandemic adversely affected procedures (22,23). The effective management of patients requiring surgical

Table 5. Distribution of postoperative hospital visit frequency by age groups

Variables	Categories	Age groups				
		0-18	19-30	31-45	46-59	60+
Size of surgery	Major	1	1	2	2	2
	Medium	1	2	1	2	4
	Minor	1	2	3	3	2
Kind of surgery	Emergency	1	2	2	2	2
	Elective	1	1	1	2	1
Disease group	Infectious diseases	1	1	2	2	1
	Circulatory system diseases	1	4	5	5	2
	Eye and middle ear diseases	1	1	2	3	3
	Nervous system diseases	2	2	1	1	1
	Examination, follow-up, observation**	1	2	2	3	2
	Neoplasms and immune system diseases	1	1	1	1	2
	Respiratory system diseases	1	1	1	1	2
	Endocrine and Metabolic diseases	2	1	1	1	1
	Skin diseases	1	1	1	1	1
	Skeletal system diseases	1	1	1	1	2
	Genitourinary system diseases	1	1	1	1	2
	Gynecological-obstetric diseases	1	1	1	2	.
	Congenital and chromosomal disorders	2	1	1	1	1
	Unclassified abnormal clinical and laboratory findings*	1	1	2	2	1
	Muscle-tendon injuries and fractures	1	2	1	1	1
	Foreign body, implant and graft operations	1	1	1	1	2
	Accidents, poisoning, contact with sharp objects-firearms	2	1	1	1	1
	Digestive system diseases	1	1	1	1	1

*Includes cases coded as R00-R99. These cases are also kept in the surgery database and cover specific disease categories, a wide range of clinical signs, symptoms and abnormal test results. **It is included as a category in the health information system because it is indexed in the surgery database

intervention during the pandemic is crucial for preventing mortality from emergencies and for the ongoing, healthy treatment of cancer patients (24). During this period, surgeons experienced a reduction in elective surgical operations to mitigate virus transmission, while the postponement of these surgeries posed significant challenges (25). Due to the necessity of direct interaction between the patient and the surgeon in surgical diseases, remote healthcare services are deemed inadequate. Therefore, the surgical workforce faced greater challenges than internal medicine during the COVID-19 pandemic (26). Surgeons were instructed to make decisions regarding the prioritization and postponement of surgeries in relation to patient exposure to COVID-19 (27). Similarly, surgeries for patients infected with the virus were deferred, and it was deemed essential to perform surgeries with minimal medical staff in emergency situations (28). Consequently, a significant finding of the present research is that COVID-19 reduced the number of surgeries, which aligns with existing literature. Nonetheless, research indicates that the pandemic did not alter the incidence of certain cases, although the number of such cases studied is limited (29).

Emergency surgeries are categorized by kind as follows: eye and middle ear (18.8%), genitourinary system (18.2%), skeletal system (10.6%), circulatory system (9.3%), digestive system (7.2%), and respiratory system (5.7%). The predominant severe consequence in COVID-19 patients is acute hypoxemic respiratory failure or acute respiratory distress syndrome necessitating oxygen and ventilation interventions (30). Given that elective surgeries were predominantly suspended during the pandemic, and emergency procedures were conducted on patients diagnosed with or suspected of COVID-19 (30), it can be asserted that COVID-19-related complications (such as arrhythmias and acute cardiac damage) also influence the categories of surgeries performed.

Table 6. Frequency table for distribution of surgeries by age groups

Disease groups and types	Age groups, n (%)					n	Disease groups and types	Age groups, n (%)					n	Disease groups and types	Age groups, (%)					n
Circulatory system diseases	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Digestive system diseases**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Neoplasms/ immune system diseases**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**
Venous insufficiency	15_a	250_b	1695_c	522_d	46_e	2528	Unilateral/ unspecified inguinal hernia	114_a	47_a	209_b	239_b	140_a	749	Benign lipomatous neoplasm	12_a	31_a	229_b	137_c	52_a	461
Hemorrhoids	-	23_a	80_b	29_a	12_c	144	Gallbladder stones and diseases	6_a	74_b	303_c	230_c	88_b	701	Benign skin neoplasm	10_a	33_a	122_b	44_a	15_a	224
Atherosclerotic heart disease	-	15_a	12_a	55_b	36_b	118	Acute appendicitis	156_a	207_a	200_a	49_b	18_b	630	Malignant neoplasm of bladder	-	-	13_a	41_b	55_b	109
Occlusion/ astenosis of the carotid artery	-	-	7_a	17_a	76_b	100	Anal fissure & anal fistula	8_a	72_b	174_c	56_b	13_a	323	Benign neoplasm of bladder	-	-	12_a	34_b	59_b	105
Varicocele	13_a	30_b	33_b	9_a	7_a	92	Cholelithiasis	7_a	16_a	82_b	66_b	19_a	190	Uterine leiomyoma	-	6_a	62_b	18_a	6_a	92
Congenital and chromosomal disorders	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Gynecological-obstetric diseases**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Unclassified abnormal clinical and laboratory findings***	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**
Cryptorchidism	110	-	3	-	-	113	Spontaneous vertex delivery	-	1867_a	887_b	-	-	2754	Abnormal cytological findings in specimens from female genital organs, unspecified	6_a	36_a	200_b	65_a	7_a	314
Hypospadias	97	-	-	-	-	97	Emergency cesarean section	-	617_a	544_a	15_b	-	1176	Abdominal pain	59_a	67_a	92_b	40_a	32_a	290
Talipes equinovarus	39	-	-	-	-	39	Elective cesarean section	-	303_a	463_b	-	-	766	Hematuria	6_a	5_a	49_b	84_b	72_b	216
Pektus excavatum	18	14	1	-	-	33	Abortion	-	54_a	37_a	-	-	91	Skin changes	7_a	20_a	83_b	33_a	15_a	158
Hypertrophic nails	1	9	3	3	2	18	Ectopic pregnancy	-	7_a	30_b	-	-	37	Urinary incontinence	8_a	5_a	55_b	52_b	16_a	136
Endocrine/ metabolic diseases	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Skin diseases**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Muscle-tendon injuries/ fractures**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**
Thyroid disorders	-	10_a	46_b	30_b	11_a	97	Nail disorders	152_a	246_a	167_a	45_b	36_b	646	Distal radius fracture	12_a	13_a	42_b	41_b	10_a	118

Table 6. Continued

Disease groups and types	Age groups, n (%)					n	Disease groups and types	Age groups, n (%)					n	Disease groups and types	Age groups, (%)					n
Vitamin D deficiency	-	-	19_a	6_b	8_b	35	Pilonidal cyst	101_a	285_b	123_a	13_c	10_c	532	Distal humerus fracture	91_a	6_b	8_b	6_b	6_b	117
Iodine deficiency-related multinodular goiter	-	8_a	17_b	5_a	5_a	35	Skin abscess, furuncle-carbuncle	-	34_a	64_b	32_a	13_c	143	Rotator cuff injury	6_a	7_a	23_a	56_b	16_a	108
Obesity	-	4	11	3	-	18	Epidermoid cyst	8_a	10_a	48_b	22_a	8_a	96	Femoral neck fracture	6_a	6_a	13_a	12_a	69_b	106
Obesity due to excess calorie intake	-	5	8	1	-	14	Dermatitis	7_a	8_a	22_b	25_b	12_a	74	Pertrochanteric fracture	-	-	7_a	6_a	74_b	87
Nervous system diseases	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Skeletal system diseases**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Foreign body, implant and graft operations**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**
Carpal tunnel syndrome	-	-	53_a	76_b	19_c	148	Soft tissue disorders	241_a	488_a	1189_b	598_a	313_a	2829	Ocular foreign body	11_a	85_b	186_c	51_b	8_a	341
Epilepsy	1	5	-	3	1	10	Low back pain	7_a	19_a	177_b	160_b	78_b	341	Internal orthopedic devices, implants, and grafts	54_a	8_b	18_b	5_b	19_b	104
Headache syndromes	-	2	2	5	-	9	Gonarthrosis	-	6_a	8_a	57_b	114_c	179	Nasal foreign body	80	-	-	1	-	81
Blepharospasm	-	-	1	3	-	4	Trigger finger	7_a	6_a	45_b	66_b	14_a	138	Ear foreign body	37_a	6_b	10_b	7_b	7_b	67
Hydrocephalus	3	-	-	1	-	4	Meniscal displacement	-	11_a	43_b	26_a	8_a	81	Oral foreign body	10	-	2	2	-	14
Eye and middle ear diseases	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Genitourinary system diseases**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**	**Accidents, poisoning, contact with sharp objects-firearms**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	**n**
Diabetic retinopathy	-	-	84_a	781_a	553_b	1418	Abnormal uterine and vaginal bleeding	-	36_a	946_b	349_c	70_a	1401	Bite and sting by non-venomous insects and arthropods	195_a	64_b	166_a	70_b	22_c	520
Senile cataract, other	-	6_a	28_a	283_b	647_c	965	Irregular menstruation	-	42_a	928_b	259_c	23_a	1252	Sharp object injury	33_a	36_a	59_b	21_a	6_c	155
Macular/ posterior pole degeneration	-	7_a	43_b	267_c	476_d	793	Acute vaginitis	-	49_a	436_b	149_c	32_a	666	Fall	30_a	19_a	21_a	18_a	24_a	112
Senile cataract	-	-	21_a	152_b	447_c	620	Benign prostatic hyperplasia	-	-	21_a	252_b	386_c	659	Collision with objects	21_a	13_a	21_a	13_a	11_a	79

Table 6. Continued

Disease groups and types	Age groups, n (%)					n	Disease groups and types	Age groups, n (%)					n	Disease groups and types	Age groups, (%)					n
Other disorders of the lacrimal gland	6_a	33_b	104_c	126_d	107_c	376	Ureteral stone	3_a	51_b	249_c	87_b	37_b	427	Gunshot wound	7_a	31_b	15_a	6_a	8_a	64
Respiratory system diseases	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	n	**Infectious diseases**	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	n	**Examination, follow-up, observation****	**0-18**	**19-30**	**31-45**	**46-59**	**60+**	n
Disorders of the nose/nasal sinuses	24_a	209_b	178_b	48_c	8_d	467	Viral warts	6_a	46_b	67_b	7_a	7_a	133	Postoperative recovery	87_a	121_a	218_b	154_b	127_a	707
Nasal septum deviation	-	191_a	175_b	42_c	-	408	Other infectious diseases	10_a	11_a	18_a	13_a	21_a	93	Gynecological examination	5_a	20_a	379_b	130_b	28_a	562
Adenoid hypertrophy	225_a	8_b	7_b	7_b	5_b	252	Salmonella infections	-	6_a	17_b	16_b	9_a	48	Routine & Religious circumcision	541_a	6_b	5_b	1_b	-	553
Tonsillar hypertrophy	235_a	6_b	7_b	-	-	248	Anogenital warts	-	8_a	22_b	7_a	-	37	Physical examination	47_a	46_a	198_b	121_b	72_a	484
Conchal hypertrophy	7_a	45_b	68_b	12_a	7_a	139	Other bacterial agents	3	2	5	1	3	14	Observation for suspected disease	14_a	34_a	60_b	22_a	33_a	163

The cells with an expected count of less than 5 or with zero counts are removed from the analysis. *Includes cases coded as R00-R99. These cases are also kept in the surgery database and cover specific disease categories, a wide range of clinical signs, symptoms and abnormal test results. **It is included as a category in the health information system because it is indexed in the surgery database

The decline in elective surgeries corresponds with the tiered prioritization frameworks established globally during the pandemic. International guidelines categorize surgical urgency into four levels: Emergency (requiring immediate intervention within hours to avert mortality), Urgent (time-sensitive procedures necessary within the days), Semi-urgent (procedures necessary within the 1-4 weeks), and Elective (deferrable for the ≥3 months without substantial harm) (31). This stratification facilitated organized resource distribution and reduced the risks associated with COVID-19 transmission. Our data indicate an 81% overall reduction, with elective surgeries decreasing to 3.25%, which reflects strict adherence to protocols that deferred Category 3-4 procedures (32,33). The prevalence of gynecological-obstetric surgeries, comprising 36.8% of elective procedures, highlights the prioritization of obstetric time-sensitivity and maternal-fetal health factors (34). The increased frequency of foreign body/implant surgeries may indicate their classification as Category 2 procedures, where delays pose a risk of infection or functional impairment (35). The necessity of these triage decisions may have worsened surgical backlogs for chronic conditions, highlighting a crucial aspect for future health system preparedness (36).

Most elective surgeries were performed in the 19-30 age group (35.8%), primarily due to gynecological diseases (36.8%). The incidence of cesarean deliveries is rising globally and within Türkiye. When cesarean delivery is conducted based on medical need, it significantly decreases perinatal mortality and morbidity; nevertheless, when performed electively, it may result in adverse outcomes for maternal and child health, akin to other surgical procedures (37,38). The study's findings indicate that while the incidence of spontaneous vertex births is elevated, elective and emergency cesarean births occur at comparable rates.

Many emergency procedures are conducted on patients aged 60 and over, accounting for 27.8%. The aging process alters the body's structure and functioning across various dimensions. Therefore, this circumstance requires that surgical interventions on older patients be conducted with increased caution and precision (39). Aging-related physiological changes elevate the incidence of chronic diseases, as well as mortality and morbidity rates among older adults (40). The use of health services by older people is rising due to the prevalence of chronic diseases (41). Therefore, chronic disease management is a pivotal concern that necessitates emphasis on the effective and efficient delivery of health services. The research demonstrated that the incidence of hospital visits after surgery for circulatory system ailments increased with

age. This condition can be linked to the rising prevalence of chronic diseases correlated with age.

Recent literature emphasizes the necessity of guaranteeing the reliability and authenticity of medical databases in hospitals through the implementation of standardized procedures. The accuracy of EHRs is essential for clinical decision-making, healthcare operations, and research. Nonetheless, errors frequently emerge from erroneous data entry, absence of standardization, irregular updates, and similar factors. Recent studies support the implementation of standardized data entry protocols, including the utilization of consistent coding systems like Systematized Nomenclature of Medicine – Clinical Terms and ICD-10, to reduce heterogeneity in clinical documentation (42). Furthermore, routine audits and error-checking systems, including automated data validation procedures, are essential for preserving data integrity. Hospitals must develop staff training programs to ensure healthcare personnel are proficient in these requirements and the proper utilization of EHRs (43). By formalizing these standardized procedures, hospitals can reduce the risks of errors that jeopardize data integrity and patient safety.

Regarding the validity of health data, the literature recommends integrating real-time monitoring systems that can flag inconsistencies and alert clinicians to potential data inaccuracies (44). This could involve using artificial intelligence-driven tools to identify incorrect or missing information patterns, enabling timely corrections. Another recommendation is to use interoperable data exchange systems, allowing for the seamless sharing of patient data across different healthcare institutions, which can reduce redundancy and enhance data accuracy (45). These interoperable systems, combined with regular quality checks and continuous improvement processes, ensure that data remains current, relevant, and valid. Hospitals can enhance the trustworthiness and utility of their medical databases through such structured and regularized procedures, thus improving patient outcomes and supporting data-driven healthcare advancements.

Conclusion

The COVID-19 pandemic has resulted in alterations to nearly all medical procedures, particularly surgical treatments. This study analyzed 46,041 procedures conducted from January 1, 2019, to October 1, 2023, at a prominent teaching and research hospital in İstanbul province, assessing data from 18 distinct illness groups based on numerous variables.

Substantial reductions were noted during the pandemic in emergency, elective, major, medium, and minor surgical procedures. All illness groups exhibited a reduction in the number of procedures, except for two categories: foreign body, implant, and graft surgeries, as well as accidents, poisoning, and contact with sharp objects and weapons. The majority of surgeries are classified as emergency procedures, including conditions of the eye, middle ear, genitourinary system, skeletal system, circulatory system, digestive system, and respiratory system. Emergency surgeries for eye and middle ear diseases were predominantly conducted on those aged 60 and above, while elective procedures were primarily carried out on those aged 19 to 30. Most emergency and elective procedures are classified as major surgeries. The incidence of surgical follow-up visits escalates with older age demographics.

Critical care requirements for COVID-19 patients significantly diminished surgical resources, resulting in a 90% reduction in capacity for major surgeries and redirecting emergency attention towards time-sensitive conditions, such as ocular and genitourinary emergencies in the elderly. Moreover, the fear of nosocomial infection led to a decrease in hospital presentations, especially for "semi-urgent" conditions such as chronic venous insufficiency, thereby worsening age-related disparities in post-operative follow-up.

The COVID-19 pandemic revealed significant weaknesses in surgical systems, including insufficient contingency planning for aging populations, as indicated by disproportionate emergency surges among individuals aged 60 and older. The contrast between sustained obstetric volumes and the collapse of elective procedures highlighted the inflexible triage protocols for time-sensitive non-emergent care. Furthermore, unaddressed backlog risks were exemplified by delays in chronic disease management. The identified gaps require a fundamental restructuring of surgical practices to enhance resilience against pandemics. This can be achieved through the establishment of institutionalized tiered prioritization frameworks, such as MeNTS, which dynamically balance resource limitations with procedural urgency; the development of age-optimized pathways that include dedicated operating room slots and rapid discharge protocols for vulnerable elderly patients; and the implementation of real-time backlog surveillance systems aimed at high-risk deferred cases, including circulatory disorders and cancer diagnostics, to mitigate complications. Incorporating these strategies into surgical disaster planning is crucial for ensuring the continuity of essential care during future crises.

During the pandemic, isolation measures were essential for delivering a comprehensive and well-equipped health service. Planning the operating room process requires the implementation of infection control measures. Preparing crisis plans for potential outbreaks in hospital medical

processes is essential, as is developing specific emergency plans for surgical and operating room procedures, which are specialized units. Effective human resource planning necessitates the organization of the surgical team and the ongoing training of assistants and nurses. The management of patients diagnosed with COVID-19 prior to, during, and following the surgical procedures requires thorough examination. The surgical team must focus on patient management during both the preoperative and postoperative phases. Health managers should prioritize and plan for both emergency and elective surgeries, oversee the management of materials and devices, optimize time management, implement infection control measures, and maintain effective communication and high staff motivation within operating room processes during the pandemic.

Ethics

Ethics Committee Approval: Institutional permission was obtained before the study was conducted, and ethics committee approval was obtained from the University of Health Sciences Türkiye, Hamidiye Scientific Research Ethics Committee (approval number: 1/34, dated: 25.01.2024).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Concept: P.Ü., E.S.E., F.K.Y., M.F.E., Design: P.Ü., E.S.E., F.K.Y., M.F.E., Data Collection or Processing: E.S.E., M.F.E., Analysis or Interpretation: E.S.E., F.K.Y., M.F.E., Literature Search: P.Ü., E.S.E., F.K.Y., M.F.E., Writing:P.Ü., E.S.E., F.K.Y., M.F.E.

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

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. World Health Organization. Safe surgery [Internet]. 2024 Jul 31 [cited 2025 Feb 10]. [Crossref]
2. European Commission. Surgical operations and procedures statistics [Internet]. 2023 [cited 2025 Feb 10]. [Crossref]
3. Alexander KP, Newby LK, Cannon CP, Armstrong PW, Gibler WB, Rich MW, et al. Acute coronary care in the elderly, part I: Non-ST-segment-elevation acute coronary syndromes: a scientific statement for healthcare professionals from the American Heart Association Council on Clinical Cardiology: in collaboration with the Society of Geriatric Cardiology. Circulation. 2007;115:2549-2569. [Crossref]
4. Lal S, Gray A, Kim E, Bunton RW, Davis P, Galvin IF, et al. Frailty in elderly patients undergoing cardiac surgery increases hospital stay and 12-month readmission rate. Heart Lung Circ. 2020 ;29:1187-1194. [Crossref]
5. Flegar L, Groeben C, Koch R, Baunacke M, Borkowetz A, Kraywinkel K, et al. Trends in renal tumor surgery in the United States and Germany between 2006 and 2014: organ preservation rate is improving. Ann Surg Oncol. 2020;27:1920-1928. [Crossref]
6. Søreide K, Hallet J, Matthews JB, Schnitzbauer AA, Line PD, Lai PBS, et al. Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services. Br J Surg. 2020;107:1250-1261. [Crossref]
7. El-Abbassy IH, El-Hakim H, Wong MK, McIntyre R. Impact of COVID-19 on surgical services in a District General Hospital in the United Kingdom: benefits versus drawbacks. Int J Surg. 2021;8:440-448. [Crossref]
8. Albuz Ö, Uludağ M. Covid-19 pandemisi ve cerrahi perspektivite üzerine etkileri. Avrasya Sağlık Bilimleri Dergisi. 2020;116-119. [Crossref]
9. Çelik B, Yasak K, Turhan Damar H, Çakır Umar D, Öğce F. Operating room and case management during COVID-19 outbreak. Journal of Anatolia Nursing and Health Sciences.. 2020;23:331-342. [Crossref]
10. İlhan E, Oztop M, Üreyen O, Yıldırım M. COVID-19 pandemisinin genel cerrahi kliniğinde acil ve elektif cerrahi girişimlere olan etkisinin değerlendirilmesi: kesitsel çalışma. Ankara Eğt. Arş. Hast. Derg. 2020;53:202-205. [Crossref]
11. Çelik SU, Lapsekili E, Alakuş Ü. Impact of the COVID-19 pandemic on emergency general surgery outcomes: a single-center retrospective cohort study. Ulus Travma Acil Cerrahi Derg. 2022;28:900-910. [Crossref]
12. T.C. Sağlık Bakanlığı. Sağlık istatistikleri yıllığı [Internet]. 2022 [cited 2025 Feb 10]. [Crossref]
13. Şahin S, Kayılıoğlu I, Yazkan C, Dere Ö, Özcan Ö. Impact of COVID-19 pandemic on general surgery. J Surg Arts. 2024;17:6-9. [Crossref]
14. Prachand VN, Milner R, Angelos P, Posner MC, Fung JJ, Agrawal N, et al. Medically necessary, time-sensitive procedures: scoring system to ethically and efficiently manage resource scarcity and provider risk during the COVID-19 pandemic. J Am Coll Surg. 2020;231:281-288. [Crossref]
15. COVIDSurg Collaborative. Preoperative nasopharyngeal swab testing and postoperative pulmonary complications in patients undergoing elective surgery during the SARS-CoV-2 pandemic. Br J Surg. 2020;108:88-96. [Crossref]
16. World Health Organization. Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19): interim guidance [Internet]. Geneva: WHO; 2020 [cited 2025 Feb 10]. Report No.: WHO/2019-nCov/IPC_PPE_use/2020.2. [Crossref]
17. Francis N, Dort J, Cho E, Feldman L, Keller D, Lim R, et al. SAGES and EAES recommendations for minimally invasive surgery during COVID-19 pandemic. Surg Endosc. 2020;34:2327-2331. [Crossref]
18. Emanuel EJ, Persad G, Upshur R, Thome B, Parker M, Glickman A, et al. Fair allocation of scarce medical resources in the time of Covid-19. N Engl J Med. 2020;382:2049-2055. [Crossref]
19. Al-Jabir A, Kerwan A, Nicola M, Alsafi Z, Khan M, Sohrabi C, et al. Impact of the coronavirus (COVID-19) pandemic on surgical practice - part 1. Int J Surg. 2020;79:168-179. [Crossref]
20. Rubino F, Cohen RV, Mingrone G, le Roux CW, Mechanick JI, Arterburn DE, et al. Bariatric and metabolic surgery during and after the COVID-19 pandemic: DSS recommendations for management of surgical candidates and postoperative patients and prioritisation of access to surgery. Lancet Diabetes Endocrinol. 2020;8:640-648. [Crossref]
21. Lamiri M, Xie X, Dolgui A, Grimaud F. A stochastic model for operating room planning with elective and emergency demand for surgery. EJOR. 2008;185:1026-1037. [Crossref]

22. Kokurcan A, Çakıcı MÇ, Keser F, Miçooğulları U, Altan M, Kısa E, et al. Effect of the coronavirus pandemic on laparoscopic urological surgery. Endourol Bull. 2021;13:70-77. [Crossref]
23. Durhan A, Şenlikci A, Bezirci R, Süleyman M, Koşmaz K, Pekçici MR. Effect of COVID-19 pandemic on emergency general surgery and elective oncological surgery: retrospective cross-sectional study. Medical Journal of İzmir Hospital. 2021;25:87-92. [Crossref]
24. Alimoğlu O, Erol CI. Approach to general surgery practice during COVID-19 pandemic. Anatolian Clin. 2020;25:102-110. [Crossref]
25. Diaz A, Sarac BA, Schoenbrunner AR, Janis JE, Pawlik TM. Elective surgery in the time of COVID-19. Am J Surg. 2020;219:900-902. [Crossref]
26. Kibbe MR. Surgery and COVID-19. JAMA. 2020;324:1151-1152. [Crossref]
27. Moletta L, Pierobon ES, Capovilla G, Costantini M, Salvador R, Merigliano S, et al. International guidelines and recommendations for surgery during Covid-19 pandemic: a systematic review. Int J Surg. 2020;79:180-188. [Crossref]
28. Coccolini F, Perrone G, Chiarugi M, Di Marzo F, Ansaloni L, Scandroglio I, et al. Surgery in COVID-19 patients: operational directives. World J Emerg Surg. 2020;15:25. [Crossref]
29. Yalçınlı S, Ersel M, Kıyan G, Karbek F, Altunci YA, Uz İ, et al. COVID-19 enfeksiyonu ilişkili pandemi döneminde Ege Üniversitesi Tıp Fakültesi Hastanesi Acil Servisi'ne başvuran hastane dışı kardiyak arrest vakalarının retrospektif değerlendirilmesi. ETD. 2021;60:121-127. [Crossref]
30. Memikoğlu O, Genç V. COVID-19. Ankara: Ankara Üniversitesi Basımevi; 2020. [Crossref]
31. American College of Surgeons. COVID-19: guidance for triage of non-emergent surgical procedures [Internet]. 2020 [cited 2025 Feb 10]. [Crossref]
32. COVIDSurg Collaborative. Global guidance for surgical care during the COVID-19 pandemic. Br J Surg. 2020;107:1097-1103. [Crossref]
33. Prachand VN, Milner R, Angelos P, Posner MC, Fung JJ, Agrawal N, et al. Medically necessary, time-sensitive procedures: scoring system to ethically and efficiently manage resource scarcity and provider risk during the COVID-19 pandemic. J Am Coll Surg. 2020;231:281-288. [Crossref]
34. Royal College of Obstetricians and Gynaecologists. Coronavirus (COVID-19) infection in pregnancy [Internet]. 2020 [cited 2025 Feb 10]. [Crossref]
35. Aziz MF, Schenning K, Koike S, O'Glasser A, O'Reilly-Shah VN, Sera V, et al. Perioperative mortality of the COVID-19 recovered patient compared to a matched control: a multicenter retrospective cohort study. Anesthesiology. 2024;140:195-206. [Crossref]
36. COVIDSurg Collaborative. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. Br J Surg. 2020;107:1440-1449. [Crossref]
37. Çakmak B, Arslan S, Nacar MC. Opinions of women about ceserean delivery on maternal request. Firat Med J. 2014;19:122-125. [Crossref]
38. Duman FN, Gölbaşı Z. The effects of increasing cesarean birth rate on mother-infant health and strategies for reducing cesarean births. TJFMPC. 2023;17:188-194. [Crossref]
39. Demir A, Pepeşengül E, Aydınlı B, Tezcan B, Eke H, Taşoğlu İ, et al. Cardiac surgery and anesthesia in an elderly and very elderly patient population: a retrospective study. Turkish Journal of Thoracic and Cardiovascular Surgery. 2011;19:377-383. [Crossref]
40. Koldaş ZL. Vaccination in the elderly population. Turk Kardiyol Dern Ars. 2017;45(Suppl 5):124-127. [Crossref]
41. Kaya A, Gamsızkan Z. The number of chronic diseases of elderly people and their visits to a family health centre: a single unit retrospective study. Türk Aile Hek Derg. 2022;26:1-5. [Crossref]
42. Alotaibi YK, Federico F. The impact of health information technology on patient safety. Saudi Med J. 2017;38:1173-1180. [Crossref]
43. de Lusignan S, van Weel C. The use of routinely collected computer data for research in primary care: opportunities and challenges. Fam Pract. 2006;23:253-263. [Crossref]
44. Mehta S, Wang X, Curtis L. Enhancing data quality in healthcare through real-time monitoring and AI-driven solutions. J Med Syst. 2022;46:103. [Crossref]
45. Rumbold B, Baker R, Ferlie E, Fitzgerald L. The role of interoperability in digital health innovation. BMC Health Serv Res. 2022;22:345. [Crossref]