

Frequency of Minor and Major Surgeries in Patients with COVID19

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Abstract

Background: COVID-19 has significantly affected surgical care, leading to increased rates of emergency interventions in hospitalized patients. Understanding the frequency and types of minor and major surgeries in this population is essential for planning and resource allocation during pandemics. Therefore, the purpose of this study was to assess frequency of minor and major surgeries in patients with COVID19.

Methods: This cross-sectional study included patients with COVID-19 who underwent minor or major surgeries in Kowsar Semnan Hospital during 2018-2019. Data were collected using a structured checklist encompassing demographic and clinical characteristics extracted from patients' medical records. Data were analyzed using SPSS26 software. Descriptive statistics including mean ($\pm$ SD) and frequency (%) were applied, and analytical comparisons were performed using appropriate statistical tests with a significance level of $P < 0.05$.

Results: The mean ages ($\pm$ SD) of men and women were 63.37 ($\pm$ 18.38) and 65.64 ($\pm$ 18.79) years, respectively. Overall, 74% of patients were hospitalized in the ICU and 26% in the general ward. Among minor procedures, central venous catheter insertion and Shaldon catheter placement were most frequent (58.2% and 43%, respectively). Orthopedic, general, thoracic, and neurosurgical procedures were the most common major surgeries (6%, 4.7%, 2.7%, and 2.3%, respectively). The frequency of minor surgeries in men hospitalized in the ICU was higher than in women. Similarly, major surgeries—including orthopedic, neurological, urological, vascular, and plastic interventions—were more frequent in men.

Conclusion: In this cohort of COVID-19 patients, central venous catheterization and Shaldon catheter insertion were the predominant minor procedures, whereas orthopedic, general, thoracic, and neurosurgical operations were the leading major surgeries. Ensuring adequate preparedness for these interventions is essential during epidemics such as the COVID-19 pandemic.

Keywords: Minor Surgery, Major Surgery, COVID-19

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Introduction

The global COVID-19 pandemic, one of the most formidable threats to healthcare systems in recent history, originated in Wuhan, China, during (1). Like other viral infections, COVID-19 can be transmitted through the respiratory tract and mainly causes respiratory tract infection, eventually leading to severe pneumonia. Death due to respiratory failure can occur in the severe form of this disease. While the infection affects individuals across all

age groups, older adults and those with preexisting comorbidities face substantially greater risks of adverse outcomes (2). Conditions such as coronary artery disease, diabetes mellitus, active cancer, atrial arrhythmias, cognitive impairment, and prior cerebrovascular accidents further elevate mortality risk in COVID-19 patients (3).

Surgical intervention constitutes an additional factor capable of exacerbating COVID-19 disease trajectory. Ad-

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Key Messages:

↑What is “already known” in this topic:

COVID-19 patients, especially those in the ICU, often require urgent invasive procedures such as central venous access or chest tube insertion, and may need essential major surgeries due to complications or underlying conditions.

→What this article adds:

Central venous catheterization and Shaldon catheter placement were the most common minor procedures, while orthopedic, general, thoracic, and neurosurgical operations were the most frequent major surgeries. The study also identifies significant differences in surgical patterns between men and women admitted to the ICU, which can be useful for resource planning and hospital preparedness during epidemics.

vanced age, comorbid conditions, operative duration, and procedural complexity (ranging from minor to major operations) all correlate with unfavorable postoperative prognosis (4, 5). The COVID-19 infection not only causes problems in the correct diagnosis of surgical patients, but it is also related to the increased possibility of death after surgery. In the post-surgery period, persistent fever or its pulmonary complications may pose a diagnostic challenge and make the patient's recovery difficult (6, 7). Although indications for urgent surgical procedures remained consistent with pre-pandemic standards, clinical decision-making for patients with suspected COVID-19 proved challenging, particularly in distinguishing from postoperative pneumonia (8, 9).

Evidence suggests that performing surgery on COVID-19-positive patients increases the incidence of postoperative complications and mortality (10). Multiple investigations have documented elevated rates of pulmonary morbidity following surgery in this population (11). Recognition of these surgical risks has shaped operative decision-making paradigms, leading to suspension of elective procedures and preferential management of emergent cases (12, 13). Another challenge in the field of surgical protocols is the need for diagnostic tests for COVID-19 and related issues (14). Conversely, surgical deferral carries inherent risks of disease progression and heightened operative complexity upon eventual intervention (15). Given these considerations, the current investigation systematically examined the prevalence patterns of principal surgical interventions among hospitalized COVID-19 patients.

Methods

Study Design and Subjects

This cross-sectional study included 335 patients with confirmed COVID-19 who underwent minor or major surgical procedures at Kowsar Semnan Hospital during 2018–2019. All eligible patients in this time frame were included, and the sampling approach was therefore a census of the target population. Inclusion criteria comprised a diagnosis of COVID-19 verified by a positive RT-PCR test, having at least one major surgery (general, orthopedic, neurosurgery, urology, vascular, thoracic and plastic) or minor (insertion of central venous catheter, chest tube and Shaldon catheter). Exclusion criteria were incomplete and illegible medical records.

Data were collected using a structured checklist capturing demographic and clinical variables, completed by reviewing medical records in the archives of Kowsar Hospital. Statistical analyses were conducted using SPSS version 26, and P -values < 0.05 were considered statistically significant. Descriptive statistics for quantitative variables were reported as mean (standard deviation) and frequency (percentage). In the analytical phase, Chi-square tests were applied to assess associations between categorical variables. The study protocol adhered to the ethical principles of the Declaration of Helsinki and was approved by the Deputy of the Research and Ethics Committee of Semnan University of Medical Sciences (ID number: IR.SEMUMS.REC.1400).

Results

The study population comprised 335 patients with COVID-19 who underwent either minor or major surgical interventions. Male patients comprised 58.2% ($n=195$) of the cohort, while females accounted for 41.8% ($n=140$). Among minor procedures, central venous catheter placement and Shaldon catheter insertion were the most prevalent, affecting 58.2% ($n=195$) and 43% ($n=144$) of patients, respectively. The leading major surgical categories included orthopedic (6%, $n=20$), general surgery (4.7%, $n=16$), thoracic surgery (2.7%, $n=9$), and neurosurgery (2.3%, $n=8$). Mean ages ($\pm$ SD) were 63.37 (± 18.38) years for males and 65.64 (± 18.79) years for females. Additionally, 74% of patients required admission to the intensive care unit, with the remaining 26% managed in general wards (Table 1).

Table 2 presents the distribution of minor procedures stratified by age group and gender among COVID-19 patients. As shown, the frequency of central venous catheter insertion (42.5 vs. 36.5%), chest tube insertion (57.5 vs. 28.5%), and Shaldon catheter insertion (50 vs. 25.7%) in men hospitalized in the ICU was higher than in women. Also, in the ≥ 75 age group hospitalized in ICU, the frequency of central venous catheter insertion (31.5%), chest tube (28.5%) was higher than other age groups. But the insertion of a Shaldon catheter (27.8%) was higher in

Table 1. Demographic characteristics of the patients under study

Variable		N	%
Sex	Male	195	58.2
	Female	140	41.8
Age	<45	45	13.5
	45 - 64	101	30.1
	65 - 74	73	21.8
	≥ 75	116	34.6
Inpatient ward	ICU	248	74
	General	87	26
Variable		Mean	S.D
Age	Male	63.37	18.38
	Female	65.64	18.79

Table 2. Frequency distribution of minor surgeries in patients with COVID19

Insertion of central venous catheter		ICU (%)	General (%)
Sex	Male	83 (42.5)	23 (18.1)
	Female	71 (36.5)	18 (9.2)
	<45	13 (6.5)	6 (3)
Age	45 - 64	38 (19.5)	17 (9)
	65 - 74	42 (21.5)	4 (2)
	≥ 75	61 (31.5)	14 (7)
Insertion of chest tube		ICU (%)	General (%)
Sex	Male	12 (57.5)	1 (4.5)
	Female	6 (28.5)	2 (9.5)
	<45	4 (19)	0 (0)
Age	45 - 64	5 (23.8)	2 (9.5)
	65 - 74	3 (14.2)	0 (0)
	≥ 75	6 (28.5)	1 (5)
Insertion of Shaldon catheter		ICU (%)	General (%)
Sex	Male	72 (50)	17 (11.8)
	Female	37 (25.7)	18 (12.5)
	<45	9 (6.2)	7 (4.8)
Age	45 - 64	40 (27.8)	14 (9.8)
	65 - 74	22 (15.3)	12 (8.4)
	≥ 75	37 (25.7)	3 (2)

Table 3. Frequency distribution of major surgeries in patients with COVID19

General surgery		ICU (%)	General (%)
Sex	Male	3 (18.5)	2 (13)
	Female	7 (43.5)	4 (25)
Age	<45	3 (18.8)	1 (6.2)
	45 - 64	3 (18.8)	2 (12.5)
	65 - 74	1 (6.2)	1 (6.2)
	≥75	3 (18.8)	2 (12.5)
Orthopedic surgery		ICU (%)	General (%)
Sex	Male	7 (39)	7 (39)
	Female	2 (11)	2 (11)
Age	<45	4 (22.5)	4 (22.5)
	45 - 64	2 (11)	3 (16.5)
	65 - 74	1 (5.5)	0 (0)
	≥75	2 (11)	2 (11)
Neurosurgery		ICU (%)	General (%)
Sex	Male	5 (62.5)	2 (25)
	Female	1 (12.5)	0 (0)
Age	<45	1 (12.5)	1 (12.5)
	45 - 64	4 (50)	1 (12.5)
	65 - 74	1 (12.5)	0 (0)
	≥75	0 (0)	0 (0)
Urological surgery		ICU (%)	General (%)
Sex	Male	2 (50)	2 (50)
	Female	0 (0)	0 (0)
Age	<45	0 (0)	0 (0)
	45 - 64	0 (0)	1 (25)
	65 - 74	1 (25)	0 (0)
	≥75	1 (25)	1 (25)
Vascular surgery		ICU (%)	General (%)
Sex	Male	2 (66.5)	0 (0)
	Female	1 (33.5)	0 (0)
Age	<45	0 (0)	0 (0)
	45 - 64	2 (66.5)	0 (0)
	65 - 74	1 (33.5)	0 (0)
	≥75	0 (0)	0 (0)
Thoracic surgery		ICU (%)	General (%)
Sex	Male	1 (11)	2 (22)
	Female	3 (33.5)	3 (33.5)
Age	<45	0 (0)	1 (11)
	45 - 64	1 (11)	4 (44.5)
	65 - 74	2 (22.5)	0 (0)
	≥75	1 (11)	0 (0)
Plastic surgery		ICU (%)	General (%)
Sex	Male	2 (40)	3 (60)
	Female	0 (0)	0 (0)
Age	<45	1 (20)	2 (40)
	45 - 64	0 (0)	1 (20)
	65 - 74	1 (20)	0 (0)
	≥75	0 (0)	0 (0)

the 45-64-year age group.

Table 3 presents the distribution of minor surgeries by age and gender among patients with COVID-19. As shown, the frequency of orthopedic (39 %), neurological (62.5 %), urological (50 %), vascular (66.5 %), and plastic (40 %) surgeries in men hospitalized in the ICU was higher than in women. However, the frequency of general (43.5 %) and thoracic (33.5%) surgeries in women hospitalized in ICU was higher than men. The frequency of orthopedic surgery was higher in the <45 age group (22.5 %), neurosurgery (50 %), and vascular surgery (66.5 %) in the 45-54 years age group, and thoracic surgery (22.5%) in the 65-74 years age group.

Discussion

This investigation sought to characterize the prevalence of principal surgical interventions among COVID-19 patients. The cohort comprised 58.2% males and 41.8% females, with mean ages ($\pm$ SD) of 63.37 ($\pm$ 18.38) years for men and 65.64 ($\pm$ 18.79) years for women. Seventy-four percent required ICU admission, while 26% were treated in general wards. Central venous catheterization and Shal-don catheter placement were the predominant minor procedures (58.2% and 43%, respectively), followed by orthopedic (6%), general (4.7%), thoracic (2.7%), and neurosurgical (2.3%) procedures among major procedures. Orthopedic, general, thoracic, and neurosurgery were the most common major surgeries, with 6, 4.7, 2.7, and 2.3%, respectively. The frequency of minor surgeries (central venous catheter, chest tube and Shaldon catheter) in men hospitalized in the ICU was higher than in women. In major surgeries, the frequency of orthopedic, neurological, urological, vascular and plastic surgeries in men hospitalized in the ICU was higher than in women.

Mattingly et al. (2021) examined surgical volume trends during the US COVID-19 pandemic and reported a 50% reduction in procedures during March-April 2020, though systems later recovered baseline capacity through adaptive measures. This initial decline reflected adherence to guidelines restricting elective operations in favor of urgent cases (16). Mitkovic et al. observed an 18.9% decrease in orthopedic fractures during Serbia's 54-day quarantine, with females showing increased femur fracture incidence and elevated femoral neck fractures compared to pre-pandemic levels (17). Obamiro et al. documented COVID-19-related shifts in orthopedic care, including altered injury mechanisms, higher mortality, diverse anatomical involvement, and increased surgical volume (18).

McBenedict et al. analyzed surgical services in Brazil during the pandemic and found reduced admissions and hospital stays, except for thoracic surgery, which maintained volume due to its emergent nature (19). Amin Mansour et al. reported significant variations in neurosurgical admissions, procedures, and elective cases across pre-, intra-, and post-pandemic phases in Isfahan hospitals, along with increased spine pathology during the peak COVID-19 period. Capacity for both elective and emergent neurosurgery remained intact, though post-pandemic volumes declined relative to baseline (20). Abdorrahim-Kashi et al. documented a 64% drop in general surgery admissions during Iran's initial COVID-19 wave, with unchanged hospitalization duration and complication rates; trauma admissions also decreased (21).

The existing literature indicates that surgical intervention may exacerbate COVID-19 progression. Advanced age, comorbidities, operative duration, and procedural magnitude represent key predictors of adverse postoperative outcomes. COVID-19 complicates surgical candidate evaluation and elevates perioperative mortality risk (22).

Our observations highlight central venous access, Shal-don catheter placement, and orthopedic/ general/ thoracic/ neurosurgical operations as the most frequent interventions in COVID-19 patients. These data have important implications for both clinical practice and hospital policy.

From a clinical perspective, surgical and ICU teams can use knowledge of procedural patterns among COVID-19 patients to proactively allocate human resources and necessary equipment, minimizing unnecessary patient exposure during critical periods (23-24). Additionally, identifying the most commonly performed procedures can aid in developing safety protocols and prioritization strategies during epidemics, potentially reducing postoperative morbidity and mortality (25). From a policy standpoint, these findings can help hospital administrators and healthcare decision-makers optimize resource planning, ICU allocation, staffing, and the development of surgical prioritization guidelines. This approach can ensure the continuation of essential surgical services during epidemics while alleviating pressure on healthcare systems (26). Furthermore, analyzing the frequency of procedures in COVID-19 patients may support predictive modeling of surgical demand in future crises and improve hospital preparedness for similar epidemics (27).

Conclusion

Our study showed that in COVID-19 patients, central venous and Shaldon catheter insertions were the most common minor procedures, while orthopedic, general, thoracic, and neurosurgical operations were the most frequent major procedures. These findings provide insight into surgical needs during epidemics and have practical implications for both clinical practice and hospital management. Clinically, awareness of the most frequent procedures can help healthcare teams allocate personnel, equipment, and ICU resources efficiently, prepare for essential surgeries, and reduce unnecessary patient exposure. From a policy perspective, this information can guide hospital administrators and policymakers in prioritizing surgeries, optimizing resource management, and developing safety protocols, ensuring continuity of critical surgical services and reducing postoperative complications and mortality during health crises. Furthermore, understanding surgical patterns in COVID-19 patients can support predictive modeling of surgical demand, enhance hospital preparedness, and alleviate pressure on healthcare systems during future epidemics.

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Conflict of Interests

The authors declare that they have no competing interests.

Authors' Contributions

Conceptualization, project supervision, funding acquisition, and resource provision: Hamid Reza Hemmati and Amir Molaei; Study methodology: Shahrzad Izadi and Hamid Reza Hemmati; Data acquisition: Mohammad Nozare; Statistical analysis: Fatemeh Paknazar; Investigation and manuscript preparation: All authors.

Ethical Considerations

This study received ethical approval from the Research and Ethics Committee of Semnan University of Medical Sciences (ID-number: IR.SEMUMS.REC.1400).

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Data Availability

Data supporting the reported findings are accessible from the corresponding author upon reasonable request.

AI Use Statement

The authors used artificial intelligence tools (ChatGPT, OpenAI) only for language editing and improvement of readability. All scientific content, analysis, and conclusions were developed by the authors.

References

- Giorgi P, Villa F, Gallazzi E, Debernardi A, Schirò G, Crisà F, et al. The management of emergency spinal surgery during the COVID-19 pandemic in Italy: A preliminary report. *Bone Joint J.* 2020;102(6):671-6.
- Emami A, Javanmardi F, Pirbonyeh N, Akbari A. Prevalence of underlying diseases in hospitalized patients with COVID-19: a systematic review and meta-analysis. *Arch. Acad Emerg Med.* 2020;8(1).
- Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *JAMA.* 2020;323(18):1775-6.
- Doglietto F, Vezzoli M, Gheza F, Lussardi GL, Domenicucci M, Vecchiarelli L, et al. Factors associated with surgical mortality and complications among patients with and without coronavirus disease 2019 (COVID-19) in Italy. *JAMA Surg.* 2020;155(8):691-702.
- COVIDSurg Collaborative. Outcomes and their state-level variation in patients undergoing surgery with perioperative SARS-CoV-2 infection in the USA. *Ann Surg.* 2021;275(2):247-251.
- Aminian A, Safari S, Razeghian-Jahromi A, Ghorbani M, Delaney CP. COVID-19 outbreak and surgical practice: unexpected fatality in perioperative period. *Ann Surg.* 2020;272(1):e27-e9.
- Asti E, Lovece A, Bonavina L. Gangrenous cholecystitis during hospitalization for SARS-CoV2 infection. *Updates Surg.* 2020;72:917-9.
- Gao Y, Xi H, Chen L. Emergency surgery in suspected COVID-19 patients with acute abdomen: case series and perspectives. *Ann Surg.* 2020;272(1):e38-e9.
- Rodrigues-Pinto R, Sousa R, Oliveira A. Preparing to perform trauma and orthopaedic surgery on patients with COVID-19. *J. Bone Joint Surg Am.* 2020;102(11):946-50.
- Knisely A, Zhou ZN, Wu J, Huang Y, Holcomb K, Melamed A, et al. Perioperative morbidity and mortality of patients with COVID-19 who undergo urgent and emergent surgical procedures. *Ann Surg.* 2021;273(1):34-40.
- Collaborative C. Mortality and pulmonary complications in emergency general surgery patients with COVID-19: A large international multicenter study. *J Trauma Acute Care Surg.* 2022;93(1):59-65.
- COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. *Lancet.* 2020;396(10243):27-38.
- Sadat S, Badruddoza M. Importance of Pre-Operative COVID 19 Screening of Asymptomatic Patients Undergoing Maxillofacial Surgery. *J Bangladesh Coll Phys Surg.* 2020;38(4).
- 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;15:1-7.
15. Johnson BA, Waddimba AC, Ogola GO, Fleshman JW, Preskitt JT. A systematic review and meta-analysis of surgery delays and survival in breast, lung and colon cancers: implication for surgical triage during the COVID-19 pandemic. *Am J Surg.* 2021;222(2):311-318.
 16. Mattingly AS, Rose L, Eddington HS, Trickey AW, Cullen MR, Morris AM, et al. Trends in US surgical procedures and health care system response to policies curtailing elective surgical operations during the COVID-19 pandemic. *JAMA Netw Open.* 2021;4(12):e2138038-e.
 17. Mitkovic MM, Bumbasirevic M, Milenkovic S, Gajdobranski D, Bumbasirevic V, Mitkovic MB. Influence of coronavirus disease 2019 pandemic state of emergency in orthopaedic fracture surgical treatment. *Int Orthop.* 2021;45:815-20.
 18. Obamiro E, Trivedi R, Ahmed N. Changes in trends of orthopedic services due to the COVID-19 pandemic: A review. *World J Orthop.* 2022;13(11):955.
 19. McBenedict B, Hauwanga WN, Petrus D, God-dowell OO, de Moraes Mangas G, do Nascimento MI. The impact of the COVID-19 pandemic on surgical services in Brazil's healthcare system: A retrospective cross-sectional study. *Cureus* 2023;15(9).
 20. Aminmansour B, Parvar S, Fakhr M, Mahabadi A. Ascertain Changes in the Volume of Neurosurgical Procedures Carried Out Before, During, and After the COVID-19 Pandemic. *Iran J Health Insur.* 2023;6(2):123-30.
 21. Abdorrahim-Kashi E, Azadchehr MJ, Aminipour M, Talari H, Ghafoor L, Abedzadeh-Kalahroudi M, et al. General surgery admissions, operations, and patient outcomes during the COVID-19 pandemic. *Arch Trauma Res.* 2022;11(3):118-22.
 22. Lei S, Jiang F, Su W, Chen C, Chen J, Mei W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. *EClinicalMedicine.* 2020; 21: 100331.
 23. Obidike P, Chang A, Calisi O, Lee JJ, Ssentongo P, Ssentongo AE, et al. COVID-19 and mortality in the global surgical population: a systematic review and meta-analysis. *J Surg Res.* 2024;297:88-100.
 24. Cobianchi L, Pugliese L, Peloso A, Dal Mas F, Angelos P. To a new normal: surgery and COVID-19 during the transition phase. *Ann Surg.* 2020;272(2):e49-e51.
 25. Alzerwi NAN, Rayzah M, Alnemare AK, Elkhailifa AME. Optimizing surgical care amidst COVID-19: a scoping review of practices and policies. *Healthcare (Basel).* 2024;12(1):96.
 26. Ross SW, Lauer CW, Miles WS, Green JM, Christmas AB, May AK, et al. Maximizing the calm before the storm: tiered surgical response plan for novel coronavirus (COVID-19). *J Am Coll Surg.* 2020;230(6):1080-1091.
 27. Araz OM, Ramirez-Nafarrate A, Jehn M, Wilson FA. COVID-19 Models for Hospital Surge Capacity Planning: A Systematic Review. *Disaster Med Public Health Prep.* 2022;16(1):390-397.