Original Article

Incidence and Severity of Postoperative Complications in Patients Undergoing Surgery Following COVID-19 Infection at a Tertiary Care Center in South India

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Abstract

Background: The occurrence of postoperative pulmonary complications (PPCs) and other sequelae of COVID-19 infections like thromboembolic events in patients coming for surgery following COVID-19 infection in the Indian population had not been adequately studied. **Aim of the Study:** We evaluated the incidence of PPCs, acute kidney injury, and thromboembolic complications such as pulmonary embolism, deep-vein thrombosis, myocardial infarction, stroke, and 30-day mortality rate in post-COVID-19 patients undergoing surgery compared to those without a history of COVID-19 infection. **Settings and Design:** It was a retrospective, observational, case–control study conducted in a tertiary care center. **Materials and Methods:** One hundred and sixty-six post-COVID-19 surgical patients were included. A matched control group (n = 166) was formed by choosing patients with no history of COVID-19 who underwent similar surgical procedures under a similar technique of anesthesia. Their medical records were analyzed for the development of postoperative pulmonary and nonpulmonary complications and 30-day mortality. **Statistical Analysis Used:** Independent samples t-test and Chi-squared test were used for statistical analysis. **Results:** The mean age of patients in the control group was significantly higher than those in the post-COVID-19 group. The number of patients who received two doses of vaccine was also significantly higher in the control group. Comparison of the distribution of preexisting medical conditions and postoperative complications, duration of hospital stay, and incidence of 30-day mortality did not show any significant difference in both groups. **Conclusion:** Incidence of postoperative complications, length of hospital stay, and 30-day mortality in post-COVID-19 patients undergoing surgical procedures were comparable with patients with no history of COVID-19 infection.

Keywords: COVID-19 infection, mortality, postoperative complications, pulmonary

Introduction

December 2019 is a landmark year in our lives due to the emergence of the severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) which surged in China and later became a global pandemic. The initial infections were predominantly caused by the Delta variant of the virus which was clinically more severe as compared to Omicron infection which emerged in late 2021.[1] Although resource utilization, hospitalization, and intensive care unit (ICU) admission are fairly documented in COVID-19 patients, data on their surgical needs and outcomes remains limited. The impact of SARS-CoV-2 on postoperative recovery needs to be understood to inform clinical decision-making during and after the COVID-19 pandemic.[2]

The occurrence of postoperative pulmonary complications (PPCs) and other known sequelae of COVID-19 infections such as thromboembolic events like myocardial infarction, stroke, nonpulmonary infectious complications, and acute kidney injury (AKI) in patients coming for surgery following COVID-19 infection have not been adequately studied. Furthermore, the safe period between turning negative for COVID and planning for an elective nonemergent procedure is unclear. Postoperative outcomes in SARS-CoV-2-infected

Access this article online

Quick Response Code:

Website: www.aeronline.org

DOI: 10.4103/aer.aer_134_22

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Submitted: 23-Aug-2022 **Revised:** 01-Sep-2022
Accepted: 12-Sep-2022 **Published:** 07-Oct-2022

How to cite this article: Abraham AS, Sasikumar NK, Rajan S, Abubaker R, Manoharan KS, Kumar L. Incidence and severity of postoperative complications in patients undergoing surgery following COVID-19 infection at a tertiary care center in South India. Anesth Essays Res 2022;16:268-71.

patients have been previously reported.[3-5] These studies were mostly from Europe and the Middle East. The outcomes in post-COVID patients undergoing surgery in the Indian population are less explored.

Our primary objective was to evaluate the PPCs in patients with a history of COVID-19 undergoing surgery. Secondary objectives included evaluation of the occurrence of AKI, thromboembolic complications such as pulmonary embolism (PE), deep-vein thrombosis, myocardial infarction, stroke, and the 30-day mortality rate in these patients.

Materials and Methods

The study was a retrospective, observational, case–control study. All post-COVID-19 patients who underwent surgery were included in the study. The study was conducted after obtaining the institutional ethical committee clearance (IEC-AIMS-2021-ANES-181 dated July 19, 2021). We defined post-COVID-19 patients as those who previously had a positive PCR test and then had two negative antigen tests for SARS-CoV-2 before surgery. The characteristic of COVID-19 infection was noted as asymptomatic, requiring oxygen support minimally through nasal prongs or face masks, and the requirement of noninvasive ventilation (NIV) or mechanical ventilation. Duration of the disease process and the time interval between the last negative testing for COVID to present surgical disease presentation were also noted. A matched control group was formed by choosing patients with no history of COVID-19 but who underwent similar surgical procedures under a similar technique of anesthesia.

Cases and controls were chosen 1 week after the surgical procedure and their medical records were examined. The data collected included age, gender, comorbidities**,** surgery the patient underwent**,** status during previous COVID infection (asymptomatic/oxygen requirement/duration of oxygen requirement/need for mechanical ventilation or NIV), immunization status, and number of vaccines taken.

Then, we looked at whether they developed any complications following the present surgery. We defined PPC as the occurrence of two or more symptoms and signs such as respiratory rate, oxygenation (P/F ratio), auscultatory findings, chest radiological diagnosis chest radiograph, fever/cough, and requirement for postoperative ventilation, reintubation, or use of bilevel positive airway pressure. Length of the ICU stay and type of anesthesia for surgery (general or regional anesthesia) were noted. Occurrences of any nonpulmonary complications such as AKI, thromboembolic complications like PE, deep-vein thrombosis, myocardial infarction, and stroke were also looked for. One month after surgery, medical records are rechecked again to evaluate the mortality rates. The study period was from June 2021 to January 2022. Written informed consent was obtained from the patients for the use of medical data for research and educational purposes and the guidelines of the Declaration of Helsinki were followed.

Statistical analysis

Categorical variables were presented as numbers and percentages, and continuous variables as mean with standard deviation. The differences between the observed means in two independent samples were compared using the independent samples *t*-test and the Chi-squared test was used for comparison of proportions. Statistical analyses were conducted using the SPSS version 20.0 for Windows (IBM Corporation Armonk, NY, USA).

Results

Data from 332 patients were analyzed. It was seen that the mean age of patients in the control group was significantly higher than those in the post-COVID-19 group ($P = 0.0001$). The distribution of gender was comparable in both groups. The number of patients who received two doses of vaccine was also significantly higher in the control group [$P = 0.0004$, Table 1]. Table 2 delineates the severity of COVID infection in the post-COVID-19 group. Comparison of the distribution of preexisting medical conditions and postoperative complications, mean duration of hospital stay, and incidence of 30-day mortality did not show any significant difference in both groups [Tables 3 and 4].

Discussion

In the present study, we observed that the incidence of postoperative complications, length of hospital stay, and 30-day mortality in post-COVID-19 patients undergoing surgical procedures were comparable with patients with no

Table 1: Comparison of age, gender, and vaccination details

Variables	Post-COVID-19 group, *n* (%)	Control group, *n* (%)	*P*
Age (years), mean±SD	43.38±20.15	62.12±4.68	<0.0001
Male	89 (46.4)	74 (44.58)	0.1015
Female	77 (53.6)	92 (55.42)	
COVID vaccination taken			
One dose	77 (46.4)	92 (55.4)	0.1015
Two doses	32 (19.3)	61 (36.8)	0.0004

SD=Standard deviation

Table 2: Severity of COVID infection in the post-COVID-19 group

Post-COVID-19 group	*n* (%)
Asymptomatic	155 (93.4)
oxygen support through nasal prongs/face mask	3 (1.8)
NIV/mechanical ventilation	8 (4.8)
SpO_2 <94	10 (6)
Oxygen therapy	13 (7.8)
Ventilation	2 (1.2)
NIV	5 (3)

NIV: Noninvasive ventilation, SpO_2=Oxygen saturation

Table 3: Comparison of the distribution of comorbidities

Comorbidity	Post-COVID-19 group, *n* (%)	Control group, *n* (%)	*P*
Diabetes	34 (20.5)	30 (18.1)	0.5801
Hypertension	58 (34.9)	68 (40.9)	0.2559
CAD	11 (6.6)	19 (11.4)	0.1271
CVA	3 (1.8)	5 (3.01)	0.4725
CKD	8 (4.8)	14 (8.4)	0.1872
AKI	3 (1.8)	4 (2.4)	0.7035
CLD	5 (3)	11 (6.6)	0.1255
Thyroid dysfunction	14 (8.4)	22 (13.3)	0.1518
Bronchial asthma	9 (5.4)	6 (3.6)	0.4296
Immunosuppressed	6 (3.6)	12 (7.2)	0.1474
Obesity	5 (3)	8 (4.8)	0.3977
Autoimmune disorder	2 (1.2)	4 (2.4)	0.4116
DLP	9 (5.4)	18 (10.8)	0.0718

CAD=Coronary artery disease, CKD=Chronic kidney disease, AKI=Acute kidney injury, CVA=Cerebrovascular accident, CLD=Chronic liver disease, DLP=Dyslipidemia

Table 4: Comparison of the distribution of types of anesthesia and postoperative complications

Variables	Post-COVID-19 group, *n* (%)	Control group, *n* (%)	P
Regional anesthesia	42 (25.3)	42 (25.3)	1.00
General anesthesia	122 (74.7)	122 (74.7)	1.00
Unanticipated postoperative ventilation	2 (1.2)	6 (3.6)	0.1537
Postoperative noninvasive ventilation	2 (1.2)	3 (1.8)	0.6534
Postoperative oxygen requirement	3 (1.8)	8 (3.6)	0.3124
AKI	5 (3)	4 (2.4)	0.7363
Deep-vein thrombosis	1 (0.6)	2 (1.2)	0.5633
Stroke/myocardial infarction/PE	0	0	
Disseminated intravascular coagulation	2 (1.2)	1 (0.6)	0.5633
30-day mortality	3 (1.2)	4 (2.4)	0.4116
Hospital stay (days), mean±SD	6.55±6.67	5.88±3.56	0.2544

SD=Standard deviation, PE=Pulmonary embolism

history of COVID infection. A significant difference in the age of patients observed in both groups could be because in the general population people aged over 60 years were only provided COVID vaccination in the initial period of the pandemic in India. The significant difference in the number of patients who received two doses of vaccine may probably indicate the efficiency of vaccination toward protection against infection.

Earlier publications which reported high postoperative mortality and postoperative complications might have been conducted in patients infected with the Delta variant. It is observed that in patients with COVID-19 who underwent surgery PPCs occur in half of the patients and are associated with high mortality. These pulmonary complications and mortality rates are greater than those reported for even the highest-risk patients before the pandemic. Recently published data suggest an overall postoperative 30-day mortality between 19% and 24%, with more than half of the patients having PPCs.[1,3,5] Our study was conducted when the Omicron variant was prevalent which may explain less postoperative complications and mortality.

In India, the pandemic of COVID-19 began in March 2020 and extended to January 2021 and the infection was predominantly due to the Delta variant of coronavirus. A nationwide lockdown was imposed and on lifting them there was a dramatic resurgence of Delta variant by late March 2021. This wave lasted till June 2021.[6] The worldwide dominance of the Omicron variant of SARS-CoV-2 began in South Africa in November 2021. Published data have shown that infection caused by the Omicron variant is less severe as compared to the Delta variant in terms of admission to hospital.[7] Delta variant showed a 12.1% hospital admission as compared to Omicron which showed a 5.3% admission rate. Supplemental oxygen requirement in the form of noninvasive ventilation or oxygen supplementation through nasal prongs or face mask was also significantly higher in the Delta group (8.4%) as compared to Omicron infection (3%). Similar results were seen in comparing the incidence of invasive mechanical ventilation. The WHO COVID-19 Clinical Progression Scale showed less severity for Omicron infections as compared to Delta infections.[8,9] Our study was conducted from June 2021 to January 2022 during which the predominant strain may be assumed to be the Omicron variant of SARS-CoV-2.

A retrospective review which assessed the incidence of PE during computed tomography pulmonary angiography examinations performed during dominant periods of the ancestral, Delta, and Omicron variants of COVID-19 had shown that COVID-19 vaccination reduced the risk of associated PE. Patients infected with the Delta and Omicron COVID-19 variants were associated with a lower incidence of PE compared with ancestral variants.[10] Unvaccinated patients had an increased risk of COVID-associated PE during the Delta and Omicron periods compared to vaccinated or recovered patients.[10] We have also made a similar observation regarding the efficacy of vaccination in our study.

COVID-19 predominantly affects the respiratory system. Prothrombic coagulation abnormalities, leading to thromboembolism are the main reason for PE seen with COVID-19 infection. This has been attributed to direct viral toxicity, endothelial cell damage, and dysregulation of the immune system.[11,12] PE in these patients represents pulmonary thrombosis instead of embolism[11] and is associated with a higher risk of morbidity and mortality.[13] Elderly male patients of COVID-19 with coronary artery disease having multiple comorbidities are at a high risk of mortality.[14] In the absence of comorbidities, the mortality was <5% until the age of 80 years.[15]

The limitation of our study was that no genome sequencing was done and hence we are not sure which type of COVID variant was prevalent in our study subjects. We are not sure whether control group patients had asymptomatic COVID-19 infection earlier which went undetected. Only a negative history was elicited from them to be included in the control group. We matched cases with patients undergoing similar procedures under similar techniques of anesthesia as our study was mainly on postoperative complications which depend mainly on the type of surgery and anesthesia. However, group comparison showed a similar distribution of existing medical conditions in both groups. At the time of conduct of the study, age matching was not possible due to earlier mentioned reasons.

Conclusion

Incidence of postoperative complications, length of hospital stay, and 30-day mortality in patients with a history of COVID-19 who underwent surgical procedures were comparable with patients with no history of COVID-19 infection.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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