

A Retrospective Cohort Study to Assess Postoperative Outcomes in Surgical COVID-19 Patients**Prajacta Patil¹, Ranjeet Kamble²**¹Senior Resident, Department of Pediatric Surgery, PGIMER, Chandigarh, India.²Associate Professor, Department General Surgery, Lokmanya Tilak Municipal Medical College and General Hospital, Mumbai, Maharashtra, India.

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Conflict of interest: Nil

Abstract

Background: While 30-day mortality and postoperative results in SARS-CoV-2 infected patients have been reported, the majority of these studies are from Europe and the Middle East and do not provide information on the pandemic's overall effect on surgical outcomes. Hence, the present study was done to examine the impact of the SARS-CoV-2 pandemic on overall surgical treatment and describe the characteristics and surgical outcomes of probable COVID-19 patients in our nation.

Methods: This was a retrospective cohort study carried out for 5 months between 1st January 2021 and 31st May 2021 among those who had tested positive for SARS-CoV-2 preoperatively. Acute kidney injury, thrombotic-associated complications (pulmonary embolism, myocardial infarction, stroke, and cardiac arrest), 30-day survival following surgery, and postoperative incidence of respiratory complications (atelectasis, pneumonia, ARDS, and pulmonary aspiration) as well as non-pulmonary infectious complications were documented. Data was analysed using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0; SPSS Inc., Chicago).

Results: 90% of COVID-19 positive subjects as well as 80% of subjects without COVID-19 underwent emergency surgery. Postoperative complications were reported in 31(62%) of COVID-19 positive study subjects. 30-day mortality was 11(22%) in COVID-19 positive patients compared to 3(6%) in those not suffering from COVID-19. Postoperative complications were reported in 17(34%) of COVID-19 negative study subjects. P-value was 0.005 and was significant at $p < 0.05$. Pulmonary complications were seen in 48% of COVID-19 study subjects, p-value 0.039(significant). Sepsis was observed in 36% of COVID-19 positive subjects, p-value < 0.001 (significant). Thromboembolic complications were observed in 22% study subjects, p-value-0.021(significant). AKI was observed in 8 % of COVID-19 positive study subjects, p-value-0.695 (not significant).

Conclusion: This study identified that an overall 30-day mortality was higher in patients suffering from COVID-19. According to the current study, postoperative pulmonary problems are linked to a high death rate and affect almost half of patients who have perioperative SARS-CoV-2 infection. Men aged 60 years or older were most vulnerable to adverse outcomes.

Keywords: Postoperative Outcomes, Morbidity, Mortality, Covid-19 Patients.

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Introduction

Results of surgery for individuals infected with SARS-CoV-2 have been previously documented. According to recently released statistics, between 19 and 24% of patients died 30 days after surgery, and over half of them had pulmonary problems. The majority of these investigations were conducted in Europe and the Middle East, and they did not report on the pandemic's overall effect on surgical activity.

Therefore, the main goal of the current investigation was to characterise the perioperative features and postoperative results of SARS-CoV-2 infected patients who underwent surgery. Our secondary goals

were to explain the effects of the SARS-CoV-2 pandemic on surgical treatment in general, investigate the relationship between symptoms and outcomes, and characterise the features and prognosis of probable COVID-19 patients. [1-3]

Materials & Methods

This was a retrospective cohort study carried out for 5 months between 1st January 2021 and 31st May 2021 among those who had tested positive for SARS-CoV-2 preoperatively, in the Department of General Surgery at a tertiary healthcare teaching

hospital among postoperative patients. The two study groups comprised 50 subjects undergoing surgeries on elective or emergency basis. The following parameters were studied:

1. 30-day survival after surgery.
2. Respiratory problems following surgery, such as pneumonia, pulmonary aspiration, acute respiratory distress syndrome (ARDS), and atelectasis.
3. Complications related to non-pulmonary infections, acute renal damage, and thrombotic-related issues (heart attack, stroke, pulmonary embolism, and cardiac arrest),

The statistical package for social sciences (SPSS) for Windows programme (version 22.0; SPSS Inc., Chicago) was used to analyse the data. For continuous data, descriptive statistics were derived as

mean and standard deviation (SD); for categorical variables, frequencies and percentages were computed. For categorical variables, the chi-square test was used to analyse the relationship between the variables. The analysed data was visually represented using bar charts. A significance threshold of 0.05 was used.

Results

Majority of the study subjects belonged to the age group of 51 to 60 years (24% and 22% in either group), followed by 31 to 40 years (22% and 18% in either group.) The covid status of the various age groups in the study population is as shown in Table 1.

Table 1: Association between Age and COVID-19 Status (N = 100)

Age (Years)	COVID-19 Status	
	Positive	Negative
≤ 20	3 (6.0)	2 (4.0)
21-30	8 (16.0)	7 (14.0)
31-40	11 (22.0)	9 (18.0)
41-50	6 (12.0)	10 (20.0)
51-60	12 (24.0)	11 (22.0)
61-70	2 (4.0)	6 (12.0)
71-80	8 (16.0)	5 (10.0)
Mean (SD)	45.94 (17.73)	47.06 (16.54)

As shown in Table 2, COVID related symptoms were reported among 66% subjects with COVID-19 and 8% subjects without COVID-19 (The p-value is < 0.001. Significant at p<0.05)

Table 2: Association between COVID-19 Related Symptoms and COVID-19 Status (N=100)

COVID-19 Related Symptoms	COVID-19 Status	
	Positive	Negative
Dyspnoea	18 (36.0)	1 (2.0)
Fever	14 (28.0)	1 (2.0)
Respiratory Distress	14 (28.0)	1 (2.0)
None	17 (34.0)	46 (92.0)
Chi-Square Test, P-Value <0.001, Significant		

90% of COVID-19 positive subjects and 80% of subjects without COVID-19 underwent emergency surgery (The p-value was 0.161 not significant at p<0.05).

Postoperative complications were reported in 31(62%) of COVID-19 positive study subjects. We observed that postoperative complications were reported in 17(34%) of COVID-19 negative study subjects. P-value was 0.005 and significant at p<0.05.

Pulmonary complications were seen in 48% of COVID-19 positive study subjects, p-value 0.039(significant). Non-pulmonary (sepsis) complications were observed in 36% of COVID-19 positive subjects, p-value<0.001(significant). Thromboembolic complications were observed in 22% study subjects, p-value- 0.021(significant). AKI was observed in 8 % of COVID-19 positive subjects, p-value-0.695 (not significant). Table 3, Figure 3.

Table 3: Association between pulmonary and non-pulmonary complications and COVID-19 Status

Complications	COVID-19 Status		P-Value
	Positive	Negative	
Pulmonary	24 (48.0)	14 (28.0)	0.039*
Non-Pulmonary (Sepsis)	18 (36.0)	2 (4.0)	<0.001*
AKI	4 (8.0)	3 (6.0)	0.695
Thromboembolic	11 (22.0)	3 (6.0)	0.021*
* P-value is significant at p<0.05			

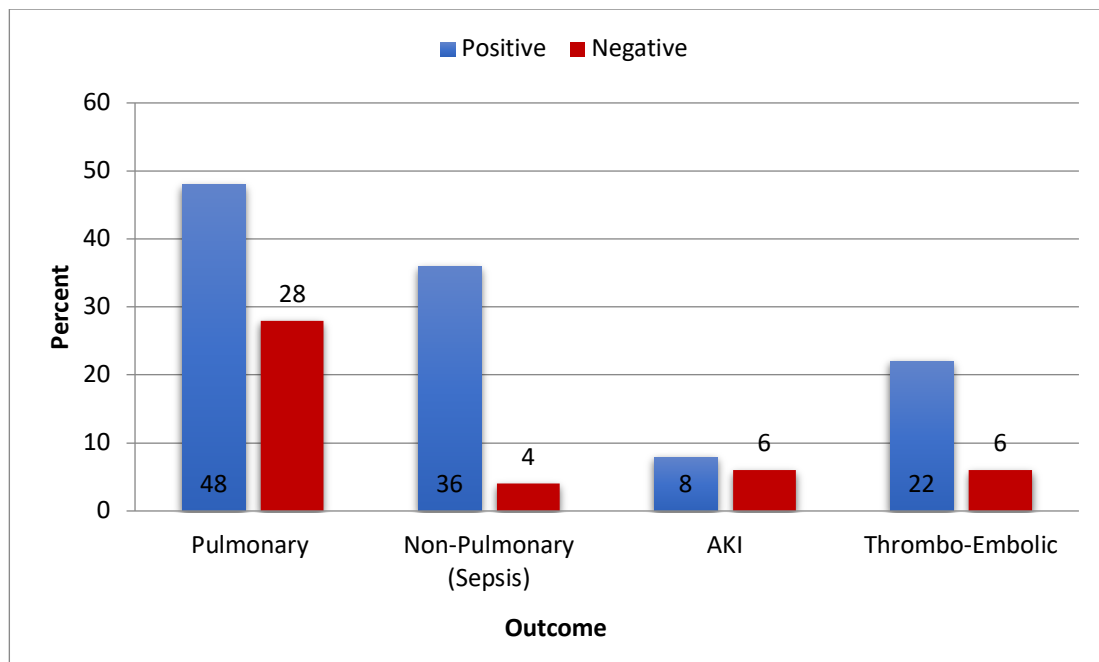


Figure 3: Association between pulmonary and non-pulmonary complications and COVID-19 Status

Table 4 and Figure 4 show that the need for supplemental oxygen was observed among 36% and 16% of subjects in either study group. Need for mechanical ventilation was observed among 32% and 10% subjects in either study group. The p-value was 0.022 and 0.006 respectively and was significant at $p < 0.05$.

Table 4: Association between need for respiratory support and COVID-19 status

Parameters	COVID-19 Status		P-Value
	Positive	Negative	
Need for Oxygen	18 (36.0)	8 (16.0)	0.022*
Need for Mechanical Ventilation	16 (32.0)	5 (10.0)	0.006*

*P-value is significant at $p < 0.05$

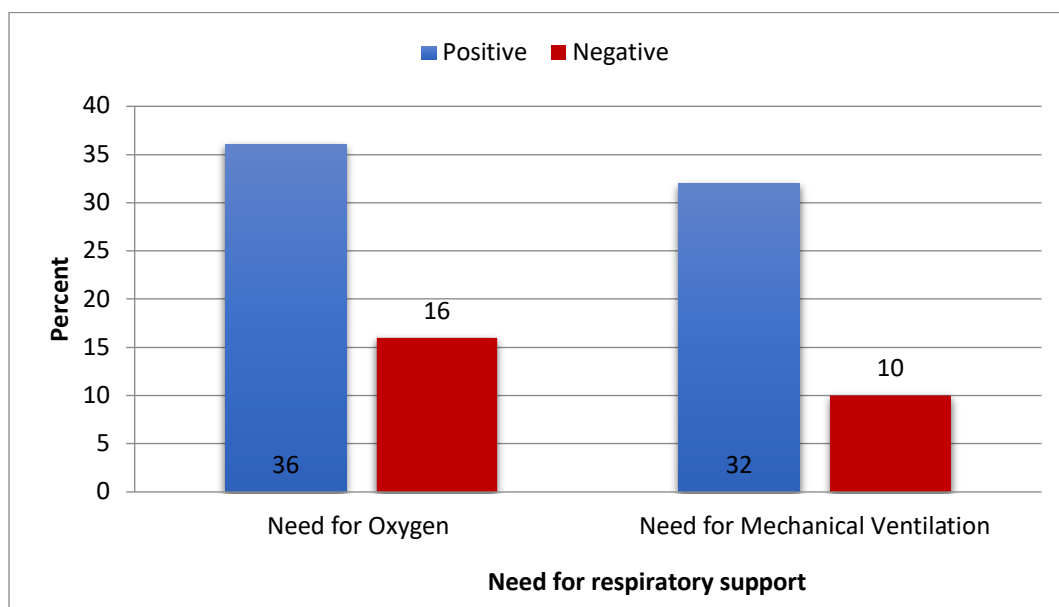


Figure 4: Association between need for respiratory support and COVID-19 status

Respiratory failure was the cause of death among 22% and 2% subjects in either study group. Septic shock as a cause of death was observed among 8%

and 4% subjects in either study group. The p-value was 0.179 was not significant at $p < 0.05$.

COVID-19 positive patients had a 30-day mortality rate of 11(22%), while study participants without COVID-19 had a 30-day mortality rate of 3 (6%). We observed that majority of the study subjects in COVID-19 cohort belonged to the age group of 61-70 years (100%) followed by 71-80 years (62.5%). The p-value is 0.037, significant at $p < 0.05$. We observed that majority of the study subjects in non-COVID-19 cohort belonged to the age group of 71-80 years (20%) followed by 21-30 years (14.3%). The p-value is 0.609 not significant at $p < 0.05$.

Discussion

Because of the pro-inflammatory cytokine and immunosuppressive reactions to surgery and mechanical breathing, patients undergoing surgery are a vulnerable population that is more susceptible to exposure to SARS-CoV-2 in hospitals and may also be more prone to pulmonary problems thereafter. Research has demonstrated that operating in hospitals exposed to SARS-CoV-2 is safe. [4]

The effects of perioperative physiological stress on predisposition to or recovery from COVID-19 are not known, but it is assumed that relative immunocompromise after surgical intervention worsens the prognosis of those who contract COVID-19 perioperatively.

The objective of this research was to evaluate the impact of the COVID-19 pandemic on SARS-CoV-2 infected patients who underwent surgery in a tertiary healthcare facility during the peak of the disease's social and health effects. At the same time, the COVID-19-negative subgroup of patients was compared for mortality rates and detect the differences in postoperative evolution between the 2 epidemiological contexts.

We observed that majority of the study subjects belonged to the age group of 51 to 60 years (24% and 22% in either group), followed by 31 to 40 years (22% and 18% in either group.) Majority of the study subjects were males (60% and 54% in either study group.)

COVID related symptoms were reported among 66% subjects with COVID-19 and 8% subjects without COVID 19.

Francois Martin Carrier et al, [3] in their study observed dyspnoea in 30% study subjects (COVID-19 positive), respiratory distress in 21% subjects, and fever in 39% study subjects. The same study observed that 71% of the surgeries performed on COVID-19 positive patients were urgent while 36% surgeries performed were major. Of the 25% of COVID-19 positive subjects, infectious complications were seen in 9% of study subjects, acute kidney Injury in 18% study subjects and thromboembolic complications in 5% of study subjects. Need for supplemental oxygen was in 27% study subjects and need for mechanical ventilation was in 18% of

study subjects. 30-day mortality was 15.9% in COVID-19 positive study subjects.

A study published by The Lancet [1] observed that 74% COVID-19 positive patients had emergency surgeries and 24.8% had elective surgeries. 51.2% of patients had pulmonary complications. 30-day mortality amongst COVID-19 positive patients who underwent surgery was 23.8%. Men had higher 30-day mortality than women (28.4% versus 18.2%). Patients aged 70 years or older had higher mortality than patients younger than 70 years (33.7% versus 13.9%). Mortality was higher after emergency surgery than after elective surgery (25.6 % versus 18.9%).

Few reports were published on the outcome of surgical procedures in diagnosed COVID-19 patients and even fewer on the surgical outcomes of asymptomatic undiagnosed COVID-19 surgical patients. Several small studies have suggested that patients with positive test results for COVID-19 infection may experience worse perioperative outcomes and increased mortality after surgery. [5-7]

A 30-day postoperative overall death rate of 24% was found in a recently published study of 1,128 patients with perioperative SARS-CoV-2 infections following surgery in different health care systems worldwide. Fifty-one percent of patients were reported to have pulmonary problems. When compared to routinely published rates in comparable elective and emergency surgeries before the pandemic, the 24% fatality rate in SARS-CoV-2 positive patients was exceptionally high. When compared to a historical control group, the study revealed that 41 SARS-CoV-2 positive individuals had a higher risk of thromboembolic complications (OR 13.2, 95% CI 1.5-∞) and pulmonary problems (OR 35.6, 95% CI 9.3-205.6). This single-centre study, while relevant, is limited by the small number of SARS-CoV-2 positive patients and the overall methodology, which leads to imprecise estimations. In order to enhance perioperative clinical decision-making for this patient group during the anticipated next waves of SARS-CoV-2 infections, it is crucial to give doctors access to more precise data. [8]

In a Canadian trial, 30-day mortality was high (15.9%) and pulmonary problems were common (25%) in the study. Although not statistically significant ($p = 0.118$), patients with symptoms had a greater death rate (23.1%) than individuals without symptoms (5.6%). [3]

A global, multicentre cohort study comprising all surgical patients with SARS-CoV-2 infection at 235 institutions across 24 countries revealed a 30-day death rate of 23.8% (268 of 1128). The 30-day mortality rate was greater in males than females (28.4% [172 of 605] vs. 18.2% [94 of 517], $p < 0.0001$). Individuals over 70 years of age experienced a greater rate of death compared to those under 70 (33.7%

[188 of 558] vs. 13.9% [79 of 567], $p < 0.0001$). Compared to elective surgery (18.9% [53 of 280]), mortality following emergency surgery was greater (25.6% [214 of 835]; $p = 0.023$). According to this study, 50% of patients who had perioperative SARS-CoV-2 infection experienced postoperative pulmonary problems, which are linked to a high death rate.

Another Italian cohort research included patients treated surgically between February 23 and April 1, 2020, and who tested positive for COVID-19 either one week before or following surgery. The investigation was done among patients in general, vascular and thoracic surgery, orthopaedic, and neurosurgery units. The COVID-19 group had a considerably higher mortality rate (8 patients [19.51%] vs 2 patients [2.44%]; OR, 9.5; 95% CI, 1.77-96.53). There was also a substantial increase in the frequency of complications (OR, 4.98; 95% CI, 1.81-16.07) if the CCI score was 0 or 1.

In patients with COVID-19, pulmonary problems (if present, 0; otherwise, 1) were the most common and substantially more common (OR, 35.63; 95% CI, 9.34-205.55). The second most common postoperative adverse event was haemorrhagic complication, which was mostly manifested as the requirement for a blood transfusion. However, there was no discernible difference in haemorrhagic complications and the control group (OR, 0.90; 95% CI, 0.38-2.09). [9]

Severe pulmonary problems were linked to cardiac issues, which were very uncommon. When neurosurgical patients were excluded, neurological problems (such as delirium) were likewise uncommon and temporary. Local side effects, including as dehiscence and surgical site infections, were very uncommon and did not vary from the control group. [8] Patients with very high D-dimer levels have the greatest risk of thrombosis and may benefit from active monitoring. Prognosis of patients with thromboembolic events have 1.93 times the odds of dying compared with patients without venous thromboembolism. [10]

Conclusion

This study identified that an overall 30-day mortality was higher in patients suffering from COVID-19. According to the current study, postoperative pulmonary problems are linked to a high death rate and affect almost half of the patients who have perioperative SARS-CoV-2 infection. Men aged 60 years or older are most vulnerable to adverse outcomes.

References

1. COVID Surg 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.
2. Nahshon C, Bitterman A, Haddad R, Hazzan D, Lavie O. Hazardous postoperative outcomes of unexpected COVID-19 infected patients: a call for global consideration of sampling all asymptomatic patients before surgical treatment. *World J Surg* 2020;44(8):2477-81.
3. Carrier FM, Amzallag É, Lecluyse V, Côté G, Couture ÉJ, D'Aragon F, et al. Postoperative outcomes in surgical COVID-19 patients: a multicenter cohort study. *BMC Anesthesiol* 2021;21:15.
4. COVID Surg 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.
5. 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.
6. Li J, Gao R, Wu G, Wu X, Liu Z, Wang H, et al. Clinical characteristics of emergency surgery patients infected with coronavirus disease 2019 (COVID-19) pneumonia in Wuhan, China. *Surgery* 2020;168(3):398-403.
7. Pearse RM, Moreno RP, Bauer P, Pelosi P, Metnitz P, Spies C, et al. Mortality after surgery in Europe: a 7 day cohort study. *Lancet* 2012;380(9847):1059-65.
8. Jonker PKC, van der Plas WY, Steinkamp PJ, Poelstra R, Emous M, van der Meij W, et al. Perioperative SARS-CoV-2 infections increase mortality, pulmonary complications, and thromboembolic events: a Dutch, multicenter, matched-cohort clinical study. *Surgery* 2021; 1690020(2):264-74.
9. Doglietto F, Vezzoli M, Gheza F, Lussardi GL, Domenicucci M, Vecchiarelli L, Zanin 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
10. Nalbandian A, Sehgal K, Gupta A, Madhavan MV, McGroder C, Stevens JS, et al. Post-acute COVID-19 syndrome. *Nature Medicine* 2021; 27(4):601-15.