Indian Journal of Clinical Anaesthesia 2022;9(3):336–341

Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Clinical Anaesthesia

Journal homepage: www.ijca.in

Original Research Article

Post-operative morbidity and mortality in patients with RT-PCR confirmed COVID-19 undergoing surgery – A single centre retrospective case control study

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ARTICLE INFO

Article history:
Received 13-04-2022
Accepted 28-05-2022
Available online 13-08-2022

Keywords:
COVID- 19
Postoperative care
Length of stay
Morbidity

ABSTRACT

Background and Aims: The coronavirus pandemic continues to spike in various parts of the world. Anaesthesiologists face coronavirus positive patients for emergency and urgent procedures. Initial case series showed a high postoperative mortality for COVID-19 positive patients undergoing surgery. We aimed to find the postoperative morbidity and mortality in RTPCR positive patients undergoing urgent and emergency surgery.

Materials and Methods: We retrospectively analysed all COVID-19 RTPCR positive patients undergoing surgery between May 2020 and December 2020. Selected controls were matched for age sex and type of surgery.

Results: We identified 27 patients who were COVID-19 positive prior to surgery. The average age was 43 years. 37% (10/27) of patients were males. All surgeries were either emergencies or urgent procedures. 40% of the surgeries were exploratory laparotomies, 37% were caesareans, 11% were abscess drainages, 7.4% were trauma surgeries and 3.7% were bladder clot evacuations. 48% patients received spinal anaesthesia, 51.9% patients received general anaesthesia. This was matched in the control group as well. 30 day mortality was 7.4% in COVID-19 patients compared to 3.7% in controls. The length of ICU stay and hospital stay was significantly longer in COVID-19 patients compared to controls. The median age of survivors was 34 years compared to 86 years in non-survivors (p=0.023).

Conclusion: 30-day mortality was not significantly higher in COVID-19 positive patients undergoing surgery though they did have significantly longer ICU stay and duration of hospitalisation.

1. Introduction

Coronavirus 19 or COVID-19 or SARS CoV 2 was declared a pandemic by the WHO in March 2020.[1] The world went into a lockdown to control the pandemic, and elective surgeries were cancelled. As preoperative and postoperative patients started testing positive and it was speculated that postoperative mortality would be higher.

One of the firsts was a study from China in January – February 2020 of 34 patients showing a 20.5% mortality in post operative patients who developed perioperative covid 19 infection.[2] A large multi-centre cohort study by the CovidSurg collaborationshowed a 23.8% 30-day mortality with nearly half the postoperative patients suffering from respiratory complications.[3] A review and meta analysis by Wang et al showed a overall 6% mortality.[4] As elective surgical procedures were not undertaken at the peak of the coronavirus crisis, the initial high mortality was probably compounded by the fact that the procedure itself was a high risk emergency procedure. Further data has shown that perioperative morbidity and mortality is dependent on patient factors like age and sex, symptomatic coronavirus disease and type of surgery.[3,5,6]

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https://doi.org/10.18231/j.ijca.2022.067

Most of these data included patients who tested positive in the preoperative period as well as patients testing positive in the postoperative period up to 30 days. Patients getting infected with COVID-19 postoperatively after the stress of a surgical procedure could have a different pathophysiologies amounting to a different outcome as compared to patients testing positive preoperatively. Our retrospective analysis aims to describe the outcomes of COVID-19 positive patients undergoing surgery who are RTPCR (Reverse Transcription Polymerase Chain Reaction) positive at the time of undergoing the surgery and not patients who test positive in the postoperative period. We are already more than 2 years into the pandemic and with new variants we will continue to see patients testing positive preoperatively. This data will be useful to anesthesiologists to explain the risks to patients who have to undergo emergency surgery when COVID-19 positive.

2. Materials and Methods

We performed a retrospective case control study of COVID-19 positive adult patients who underwent surgery from 1^{st} May 2020 to 31^{st} December 2020 after ethical clearance by the hospital ethics committee and CTRI (Clinical Trials Registry-India) registration (CTRI/2021/03/031666). All patients who underwent surgery in our tertiary care multi-speciality hospital were tested with a nasopharyngeal swab for RT-PCR preoperatively. Only those patients whose preoperative sample was positive were included in the study. Patients who tested positive in the post operative period were excluded. We excluded patients who underwent cardiac or neurosurgery or underwent surgeries under local anaesthesia.

COVID-19 positive patients were matched in a 1:1 ratio with patients of the same sex and age as well as ASA-PS (American Society of Anesthesiologists Physical Status),undergoing the same surgery in early 2020 to form the control group (Non COVID group).

2.1. Outcomes

Our primary outcome was 30 day mortality, post operative complications and length of ICU and hospital stay. Our secondary outcome was to identify risk factors for postoperative complications or mortality.

2.2. Data collection

The following data was collected for all cases and controls. Age, sex, comorbidites and ASA status, type of surgery. COVID-19 symptoms were classified into mild, moderate or severe according to the guidelines published by the Ministry of health and family welfare.[7] Investigations like CBC, albumin and blood group were available in all patients. Preoperative need for oxygen or invasive or non invasive ventilation was also noted. Type of anesthesia and intra-operative details like need for blood transfusion and vasopressors was also noted. Post operative duration of oxygen requirement, invasive or non invasive ventilatory support, cardiac complications like arrhythmias, acute coronary syndrome and neurological complications like stroke were noted. Length of ICU and hospital stay was also recorded.

2.3. Statistical analysis

Data was coded and recorded in Microsoft Excel spreadsheet program. Statistical Package for Social Sciences version 23 (SPSS Inc.; Chicago, IL, USA) was used for data analysis. Descriptive statistics were elaborated in the form of means/ standard deviations and medians/ IQRs for continuous variables, and frequencies and percentages for categorical variables. Group comparisons for continuously distributed data were made using independent sample 't' test when comparing two groups. If data was non-normally distributed, appropriate non-parametric tests in the form of Wilcoxon test were used. Chi-squared test was used for group comparisons for categorical data. Linear correlation between two continuous variables was explored using Pearson's correlation (if the data were normally distributed) and Spearman's correlation (for non-normally distributed data). Statistical significance was kept at $p<0.05$.

3. Results

We found 27 patients who were operated when COVID-19 RTPCR positive between between 1 May 2020 and 31 December 2020. The average age was 43 years. 37% (10/27) of patients were males. All surgeries were either emergencies or urgent procedures. 40% of the surgeries were exploratory laparotomies, 37% were caesareans, 11% were abscess drainages, 7.4% were trauma surgeries and 3.7% were bladder clot evacuations. 48% patients received spinal anaesthesia, 51.9% patients received general anaesthesia. This was matched in the control group as well.

15 of the 27 patients (55%) were asymptomatic and incidentally detected to be covid 19 positive. 29.6% had mild symptoms, 11% had moderate symptoms and only 1 patient had severe symptoms. 29% patients received oxygen supplementation preoperatively of which 1 was intubated. 18% (5/27) patients were diabetic, 26% (7/27) were hypertensive, 7.4% (2/27) were obese. 1 patient each had asthma, cardiovascular disease, cerebrovascular disease and thyroid abnormality. Only 22% were classified as ASA1, rest were ASA2 or more, which included all pregnant patients classified as ASA2.

51.9% patients received intraoperative steroids, 40% received postoperative steroids. 33% patients received remdesivir and 51% received anticoagulants.

In the preoperative investigations, albumin among the COVID-19 positive patients was significantly lower than the controls (3.19 vs 3.58, p= 0.030). Total leukocyte count (p=0.001) and NLR (neutrophil lymphocyte ratio) (p=0.036) was significantly higher among COVID-19 patients.

37% COVID-19 patients received postoperative oxygen compared to 22% controls in the postoperative period. 14.8% COVID-19 patients received non-invasive ventilation compared to none in the control group. 33.3% COVID-19 patients were ventilated for an average of 5 days postoperatively versus 11% of controls who required an average of 1.04 days of postoperative ventilation. Postoperative ICU stay was significantly longer in COVID-19 patients at 7.6 days versus 1.83 days in control group (p=0.02). COVID-19 patients stayed in hospital significantly longer than non covid patients (9 vs 5 days, p=0.046). The Length of Stay (LOS) among COVID-19 patients varied from 6.27 days in asymptomatic patients, 9.88 days in patients with mild disease, 20 days in patients with moderate COVID-19 and 12 days in the single patient with severe COVID-19 (p=0.058).

2 COVID-19 patients (7.4%) died within 30 days of surgery whereas 1 patient (3.7%) in the control group died in the same period (p=1). Both COVID-19 positive patients who died were over 70 years of age and had undergone emergency laparotomies and were classified as ASA 3.

The median age (Interquartile range) of survivors in the COVID-19 group was 34 years (30-43) versus 86 (86-86) years in non-survivors. There was a significant difference in the two groups by the Wilcoxon- Mann- Whitney U test (p=0.023).

We noted cardiac, respiratory and neurological complications and the incidence of blood transfusions and surgical re-explorations. No statistically significant difference was found in both groups as regards the above complications.

Cardiac complications: Among the covid patients, 2 (7.4%) patients developed postoperative atrial fibrillation of which 1 patient had developed acute coronary syndrome and later died on postoperative day 28. 1 patient in the control group developed chest pain and shortness of breath at home and died before hospital admission on postoperative day 17.

Respiratory Complications: 2 COVID-19 patients developed pneumonia and 1 patient developed ARDS. All patients recovered and were alive at the 30 day follow up. None of the controls developed any pulmonary complications.

Neurological complications: 1 COVID-19 patient who had undergone laparotomy developed altered sensorium and stroke and died.

Wound re-explorations: 2 covid positive patients required re-exploration of the wound, compared to 1 among the controls (p=1.0).

Blood transfusions: 22.2% of covid patients required blood transfusions versus 14.8% of controls (p=0.48).

4. Discussion

Our retrospective observational study of 27 COVID-19 positive patients undergoing surgery, matched with 27 controls had an average age of 43 years. 55% of patients were asymptomatic. Hypertension was the most common comorbidity. COVID-19 patients had a significantly higher NLR (Neutrophil lymphocyte ratio) and leukocyte count. Preoperatively diagnosed COVID-19 patients undergoing surgery showed a 30 day mortality of 7.4% compared to 3.7% in the matched control group which was not significantly higher. The length of hospital stay was significantly longer in COVID-19 patients as was the ICU stay.

A meta-analysis by Brown et al showed that post operative COVID-19 mortality ranged between 9.1% - 66.7% in elective surgical procedures (mean 18.94%), while it ranged between 0 to 100% in emergency procedures.[8] A large cohort of 1128 patients studied by the COVIDSURG collaborative in 24 countries showed a 30 day mortality of 23.8% with 51.2% patients having post operative pulmonary complications.[3] This cohort included patients testing positive by laboratory, clinical or radiological findings 7 days before or 30 days after surgery. Doglietto et al included 41 covid positive patients undergoing various surgeries except gynaecology with a 30 day mortality of 19.5% in contrast with 2.44% in controls.[9] Similar mortality rates were reported by Knisely et al[10] in urgent and emergent procedures (16.7%), Karayiannis et al[11] in trauma and orthopaedic procedures (14.8%) and Inzunza et al[12] in gastrointestinal surgery (12.8%). Abbott et al's population wide epidemiological study showed a 7.1% in hospital mortality in COVID-19 positive patients undergoing elective procedures, while the in hospital mortality was 25.1% in COVID-19 positive patients undergoing emergency surgery.[13] Kayani et al had a postoperative mortality rate of 30.5% in COVID-19 positive patients versus 10.3% in COVID-19 negative hip fracture patients.[14] Egol et al also studied hip fracture patients and reported a mortality of 53% in COVID-19 positive patients but 5.6% in COVID-19 negative patients.[15] Their length of hospital stay was longer, with a greater need of ventilator postoperatively and a higher major complication rate.

Our study reports a lower 30 day mortality at 7.4% compared to these international studies. Our inclusion criteria, age group and type of surgeries have likely contributed to lower mortality.

The above studies have included patients testing positive both pre- and postoperatively in contrast to our analysis which has only included preoperative diagnosis of COVID-19 with a positive RT-PCR. This can be a reason for our comparatively lower mortality, since our patients were

Table 1:

Parameters	Group		p value
	COVID-19 Positive (n = 27)	Control (n = 27)	
Age (Years)	43.33 ± 19.29	43.26 ± 18.49	0.993[1]
Gender			0.776[3]
Male	10 (37.0%)	9 (33.3%)	
Female	17 (63.0%)	18 (66.7%)	
Surgery			1.000[2]
Exploratory Laparotomy	11 (40.7%)	11 (40.7%)	
Caesarean Section	10 (37.0%)	10 (37.0%)	
Abscess Drainage	3 (11.1%)	3 (11.1%)	
Trauma Surgery	2 (7.4%)	2 (7.4%)	
Clot Evacuation	1 (3.7%)	1 (3.7%)	
COVID Status			1.000[3]
Asymptomatic	15 (55.6%)	0	
Mild	8 (29.6%)	0	
Moderate	3 (11.1%)	0	
Severe	1 (3.7%)	0	
Type of Anesthesia			0.586[2]
Spinal Anaesthesia	13 (48.1%)	14 (51.9%)	
General Anaesthesia	14 (51.9%)	11 (40.7%)	
General+Regional Anaesthesia	0 (0.0%)	2 (7.4%)	
Comorbidities: Diabetes (Present)	5 (18.5%)	2 (7.4%)	0.420[2]
Comorbidities: Hypertension (Present)	7 (25.9%)	4 (14.8%)	0.311[3]
Comorbidities: Coronary artery disease (Present)	1 (3.7%)	3 (11.1%)	0.610[2]
Comorbidities: Obesity (Present)	2 (7.4%)	0 (0.0%)	0.491[2]
Comorbidities: Asthma (Present)	1 (3.7%)	2 (7.4%)	1.000[2]
Comorbidities: Thyroid Disorder (Present)	1 (3.7%)	3 (11.1%)	0.610[2]
Preoperative Respiratory intervention Required)***	8 (29.6%)	0 (0.0%)	0.004[2]
ASA Grade			0.311[2]
1	6 (22.2%)	7 (25.9%)	
2	16 (59.3%)	17 (62.9%)	
3	5 (18.5%)	3 (11.2%)	
Serum Albumin (g/dL)***	3.19 ± 0.74	3.58 ± 0.44	0.030[1]
Hemoglobin (g/dL)	11.10 ± 2.68	11.49 ± 1.73	0.534[4]
Total Leucocyte Count (/mm^3)***	13003.33 ± 7972.79	5737.32 ± 7102.01	0.001[1]
Neutrophils (%)	79.54 ± 9.31	75.51 ± 10.07	0.133[4]
Lymphocytes (%)***	12.47 ± 8.06	17.73 ± 8.93	0.034[1]
Neutrophil Lymphocyte Ratio (NLR)***	10.73 ± 9.15	5.93 ± 3.74	0.036[1]
Intraoperative Steroids (Yes)	14 (51.9%)	10 (37.0%)	0.273[3]
Perioperative Blood Transfusion (Yes)	6 (22.2%)	4 (14.8%)	0.484[3]
Post-Operative Oxygen(nasal prongs/mask) (Yes)	10 (37.0%)	6 (22.2%)	0.233[3]
Post-Operative Non invasive Ventilation (Yes)	4 (14.8%)	0 (0.0%)	0.111[2]
Post-Operative Ventilation (Yes)	9 (33.3%)	3 (11.1%)	0.050[3]
ICU Admission (Yes)	13 (48.1%)	9 (33.3%)	0.268[3]
Post-Operative Ventilation Days	5.10 ± 6.04	1.04 ± 1.01	0.054[1]
ICU Admission Days***	7.69 ± 10.70	1.83 ± 1.58	0.024[1]
Cardiac Complications			0.491[2]
None	25 (92.6%)	27 (100.0%)	
Atrial Fibrillation	2 (7.4%)	0 (0.0%)	
Respiratory Complications			0.236[2]
None	24 (88.9%)	27 (100.0%)	
Pneumonia	2 (7.4%)	0 (0.0%)	
ARDS (Acute Respiratory Distress Syndrome)	1 (3.7%)	0 (0.0%)	
CNS Complications			1.000[2]
None	26 (96.3%)	27 (100.0%)	
CVA (Cerebrovascular Accident)	1 (3.7%)	0 (0.0%)	
Reexploration (Yes)	2 (7.4%)	1 (3.7%)	1.000[2]
Mortality (Yes)	2 (7.4%)	1 (3.7%)	1.000[2]
LOS (Length of Stay) (Days)* **	9.07 ± 9.64	5.00 ± 3.75	0.046[1]

***Significant at p<0.05, 1: Wilcoxon-Mann-Whitney U Test, 2: Fisher's Exact Test, 3: Chi-Squared Test, 4: t-test
ASA- American Society of Anesthesiologists; CNS-Central Nervous System; ICU- Intensive Care Unit

already diagnosed and managed according to the treatment guidelines during that time. COVID-19 presenting in the postoperative period may have higher morbidity and mortality owing to the recent surgical stress and their exclusion has contributed to the lower mortality in our study.

Our retrospective study had 10 patients (37%) undergoing Caesarean sections with no mortality which has been reflected in other papers as well. Parturients undergoing caesarean section have shown low mortality in 2 papers with 17 and 9 patients each.[16,17] A larger series with 115 patients undergoing Caesarean section under spinal anaesthesia reported 114 complete recoveries and 1 death.[18] Similarly Zhong et al reported 49 patients (91% Caesarean sections) under spinal anaesthesia with low morbidity and no mortality.[6] Phelps et al analysed data from 6 studies and included their own onco-gynaecology data to find low mortality in women undergoing Caesarean sections and in gynaecological oncological surgery.[5]

The COVIDSURG collaborative found age > 70 years to be associated with 30 day mortality.[3] The average age of our patients was 43 years which is lower than the average age in the papers published by Egol et al 82 years,[15] Doglietto et al 76 years,[9] Knisely et al 61 years,[10] Abbott et al 57 years.[13] Wang et al published a meta analysis of 47 studies with a mean age of 50.91 years and overall mortality of 6%.[4] This supports our observation of a lower average age being associated with lower mortality. The mean age of survivors was 39.9 years whereas it was 86 years in non-survivors.

Severity of COVID-19 is also a factor affecting surgical morbidity and mortality. Knisely et al reported that symptomatic COVID-19 patients were more likely to have in hospital mortality and complications compared to asymptomatic patients.[10] Abbott et al reported that the mortality was 33.7% for COVID-19 positive patients with respiratory symptoms whereas it was significantly lower at 6.8% in COVID-19 patients without respiratory symptoms.[13] Inzunza et al concluded that asymptomatic patients with preoperative COVID-19 have better outcomes than those symptomatic preoperatively or those diagnosed in the postoperative period.[12] 84.6% of our patients were asymptomatic or mildly symptomatic which again contributed to our low mortality rate. The length of hospital stay in our study was 5 days in control group versus 6.27 days in asymptomatic patients, 9.88 days in patients with mild disease, 20 days in patients with moderate disease, and 12 days in the only patient with severe disease in our study.

The small sample size is the primary limitation of our study. The varied surgical procedures have also curtailed the meaningful results regarding possible risk factors that can be obtained from the statistical analysis. Since it's a retrospective observational study, the decision making regarding treatment, surgery and length of hospital stay was decided by the admitting surgeon and not standardised. With COVID-19 being an evolving scenario, the treatment guidelines changed within the timeframe that we studied, therefore all COVID-19 positive patients did not get the same treatment. The strength of the study is the fact that we have only included true preoperative positives in the study. Our hospitals universal preoperative testing policy allowed us to detect all asymptomatic COVID-19 patients as well, which likely would be missed in other studies where COVID-19 RTPCR testing was limited to suspected cases only or not easily available.

5. Conclusion

To conclude, 30 day mortality was not significantly higher in preoperatively diagnosed COVID-19 patients undergoing surgery. COVID-19 positive patients undergoing surgery did have significantly longer ICU stay and duration of hospitalisation.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare no conflict of interest.

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Cite this article: Paranjape S, Dahiya S, Valecha UK. Post-operative morbidity and mortality in patients with RT-PCR confirmed COVID-19 undergoing surgery – A single centre retrospective case control study. *Indian J Clin Anaesth* 2022;9(3):336-341.