



Cross-sectional Study

## Impacts of severity of Covid-19 infection on the morbidity and mortality of surgical patients



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## ABSTRACT

**Introduction:** One of the challenges of surgery on patients with active SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) infection is the increased risk of postoperative morbidity and mortality.

**Aim:** This study will describe and compare the postoperative morbidity and mortality in asymptomatic patients or those with mild infection with those with severe COVID-19 infection undergoing elective or and emergency surgery.

**Materials and methods:** This is a retrospective study of 37 COVID<sub>19</sub> patients who had the infection 7 days prior to and 30 days after emergency or elective surgery. Patients were divided to two groups. Group 1: the asymptomatic or those with mild infection that is diagnosed just before surgery (14 patients). Group 2: those who were admitted to the hospital because of severe COVID-19 and were operated for COVID-19 related complications (23 patients). Morbidity and mortality of both groups was studied.

**Results:** There was no significant difference in gender between the two groups. There were 5 females (2 in group 1, and 3 in group 2) and 32 males (12 in group 1, and 20 in group 2). Mean age for all patients was 49.8 years (38 for group 1 and 57 for group 2). Median age for all patients was 50 years (37.5 for group 1 and 57 years for group 2). Sepsis developed in 7 patients (1 patient in group 1 and in 6 patients in group 2). Statistically there was no significant difference in occurrence of sepsis between the two groups. There was a significant difference in the intensive care stay between the two groups (higher in group 2). Four deaths were reported in group 1 and fourteen in group 2. Eighteen out of thirty-seven patients died.

**Conclusion:** Severity of COVID-19 infection will prolong the hospitalization and ICU stay in surgical patients with no significant effect on mortality.

### 1. Introduction

The population of patients requiring surgery following SARS-CoV-2 infection is growing. One of the challenges of surgery during the COVID<sub>19</sub> pandemic is the perioperative risk of increased morbidity and mortality in patients with active SARS-CoV-2 infection. Evidence suggests a 19.1% and 26.0% 30-day mortality in elective (planned) and emergency surgical patients, respectively. About 50% of those with SARS-CoV-2 infection experience postoperative pulmonary complications [1]. SARS-CoV-2 infection may cause multisystem disease with

both short and long-term sequelae, including chronic pulmonary dysfunction, myocardial inflammatory states, renal impairment, psychological distress, chronic fatigue and musculoskeletal deconditioning [2]. These short and long-term complications of SARS-CoV-2 infection could have an impact on postoperative recovery. Symptoms of COVID<sub>19</sub> present 4–5 days following infection with SARS-CoV-2, and are most contagious in the 2 days before and the 5 days after the onset of symptoms [3]. Asymptomatic carriers, account for 1% of the laboratory confirmed cases of SARS-CoV-2 infection [4]. It is rare for the virus to be cultured beyond 10 days in the asymptomatic patients [5].

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Perioperative risks are increased in patients with persistent symptoms of COVID-19 compared with those who have been asymptomatic at the time of surgery [6]. Symptomatic patients are at a greater risk of 30-day mortality as compared to those who are asymptomatic [7,8]. The aim of this study is to compare the postoperative mortality and morbidity of asymptomatic patients or those with mild infection with those with severe COVID-19 infection undergoing elective and emergency surgery.

## 2. Materials and methods

This work is fully compliant with the STROCSS 2021 criteria [www.strocssguideline.com](http://www.strocssguideline.com). I assure that the work has been reported in line with the STROCSS criteria [9].

This is a retrospective study was conducted at the department of surgery at Sheikh Khalifa Medical City in Ajman between; March 2020 and March 2021. Thirty-seven patients were enrolled in the study.

**Inclusion:** Those patients who were admitted to the hospital with positive COVID<sub>19</sub> infection, diagnosed within 7 days before or 30 days after emergency or elective, minimally invasive or open surgery. Patients would have received some form of anesthesia (local, regional or general).

**Exclusion:** All other patients that did not fulfill the inclusion criteria. Patients were divided into two groups.

**Group 1:** Fourteen patients who required emergency surgery and were discovered to have COVID<sub>19</sub> infection with mild or no symptoms. These patients did not require admission to the hospital.

**Group 2:** Twenty three patients who were admitted to the hospital with severe COVID<sub>19</sub> infection, and subsequently developed COVID<sub>19</sub> related complications requiring surgery.

## 3. Results and statistical analysis

**Table 1** displays the demographic and mortality data. There was no significant difference in gender between the two groups. There were 5 females, 2 (14.3%) in group 1 and 3 (13%) in group 2 and 32 Males, 12 (85.7%) in group 1 and 20 (87%) in group 2. Mean age, (in years) standard deviation, for all patients was 49.8 (15.6), 38(12.2) for group 1 and 57 (12.9) for group2. Median age, (in years), for all patients was 50 (37.5 for group 1 and 57years for group 2). Seven patients developed sepsis (18.9%); 1 patient (7.1%) in group 1, and in 6 patients (26.1%) in group 2. There were 18 deaths out of a total of 37 patients (48.6%); Four (28.6%) in group 1 and 14 in group 2.

## 4. Logistic regression

Based on the survival analysis it is clear that we cannot utilize the time in ICU variable since this will create bias in the results. Instead, we performed a logistic regression analysis looking at the probability of death between the groups. We will consider the explanatory factors of group, age and sex both univariate as sole predictors of death and also in a multivariate model where all factors are included together.

The results are presented in **Table 2**. We can see that the severe infection group has a high odds ratio. In the univariate model the probability of death is 3.89 times higher in the severe infection group

compared to the asymptomatic or mild infection group. In the multivariate model, accounting for age and sex, the probability is still 3.67 times higher in the severe infection group. Neither of these differences in probability of death is, however, statistically significant. We can see that the confidence intervals are very wide and these can be expected due to the small sample size.

## 5. Sepsis

**Table 3** shows the results of a logistic regression for the probability of sepsis. We can see that there are no significant effects in the multivariate model. For univariate analysis, age alone seems to be significant.

## 6. ICU days

**Table 4** shows the results comparing ICU days between the groups. The Mann-Whitney test was used to identify if there is any significant difference in the number of days in ICU between the groups, which was significant.

## 7. Hospital days

**Table 5** compares the difference in hospital stay between the 2 groups. The Mann-Whitney test also confirmed a significant difference in the number of days of hospital stay between the 2 groups.

## 8. Discussion

It is well known that surgery on a patient infected with COVID<sub>19</sub> has a higher morbidity and mortality. Patient's immune function is a major determinant of disease severity. Populations with low immune function, are more vulnerable and have a high mortality after COVID<sub>19</sub> infection [10]. Surgery can cause immediate impairment in immune function [11] and can induce an early systemic inflammatory response this is why a universal decision was taken to postpone and even hold all elective surgery worldwide during COVID<sub>19</sub> pandemic [5,12].

In our study we compare the results of two groups of patients. Group 1 includes 14 patients who were discovered to be infected with COVID<sub>19</sub> and underwent some form of surgery. Group 2 includes 23 patients who had COVID<sub>19</sub> infection complications that required surgery. Like most other centers across the world, we also screened all patients requiring elective or emergency surgery (did not wait for results in case of an emergency). Screening was carried out with a Wuhan PCR test. Inpatients were triaged according to COVID<sub>19</sub> result into; positive, negative and pending results. All elective surgeries were postponed. The aim was to save beds in the wards and ICU for new critical COVID<sub>19</sub> infected patients; This was expected to decrease pressure on ICU, anesthesia and surgery staff, and also decrease the possibility of spreading COVID<sub>19</sub> infection among staff, patients and hospital visitors, It was considered that surgery might accelerate and exacerbate COVID<sub>19</sub> infection progression. This same strategy was adopted by many other centers across the world [5,12]. Group 1 comprised of patients who underwent emergency operations due to trauma (stab wounds in chest and abdomen, falls and road traffic accidents; head injury, wounds and blunt

**Table 1**  
Demographic factors and mortality data.

Factor	Statistic	Asymptomatic or mild infection (N = 14)	Severe infection (N = 23)	Total (N = 37)
Sex: Female	n (%)	2 (14.3%)	3 (13.0%)	5 (13.5%)
Sex: Male	n (%)	12 (85.7%)	20 (87.0%)	32 (86.5%)
Age	Mean (SD)	38.0 (12.2)	57.0 (12.9)	49.8 (15.6)
	Median	37.5	57.0	50.0
Death: No	n (%)	10 (71.4)	9 (39.1)	19 (51.4)
Death: Yes	n (%)	4 (28.6)	14 (60.9)	18 (48.6)
Sepsis: No	n (%)	13 (02.9%)	17 (73.9%)	30 (81.1%)
Sepsis: Yes	n (%)	1 (7.1%)	6 (26.1%)	7 (18.9%)

**Table 2**  
Logistic regression for probability of death after surgery.

Factor	Univariate			Multivariate		
	Odds ratio	95% Confidence Interval	P-value	Odds ratio	95% Confidence Interval	P-value
Group: Severe infection (ref: asymptomatic or mild infection)	3.89	0.98–17.90	0.063	3.67	0.61–27.90	0.171
Age	1.04	0.99–1.10	0.090	1.01	0.95–1.08	0.711
Sex: Male (ref: Female)	0.19	0.01–1.50	0.163	0.16	0.01–1.67	0.162

**Table 3**  
Logistic regression for probability of Sepsis.

Factor	Univariate			Multivariate		
	Odds ratio	95% Confidence Interval	P-value	Odds ratio	95% Confidence Interval	P-value
Group: Severe infection (ref: asymptomatic or mild infection)	4.59	0.67–92.4	0.182	1.57	0.13–41.6	0.329
Age	1.08	1.01–1.16	0.032	1.06	0.98–1.17	0.157
Sex: Male (ref: Female)	0.28	0.04–2.51	0.216	0.58	0.04–9.55	0.685

**Table 4**  
Mann-Whitney test for difference in ICU days.

Statistic	Asymptomatic or mild infection (N = 14)	Severe infection (N = 23)
Mean (SD)	4.43 (10.3)	19.52 (16.97)
Median	0	17
P-value	0.0006	

**Table 5**  
Mann-Whitney test for difference in hospital days.

Statistic	Asymptomatic or mild infection (N = 14)	Severe infection (N = 23)
Mean (SD)	19.29 (31.74)	61.13 (76.37)
Median	7	33
P-value	0.0004	

abdominal trauma that needed urgent laparotomy), cases of complicated infection and inflammation (perforated appendix, perforated sigmoid diverticulitis) and cases of ischemia (like testicular torsion and diabetic foot).

Based on the above strategy, patients in group 2 (known to have COVID<sub>19</sub> infection with complications) underwent minor procedures. A minor procedure is defined as a short surgical procedure usually with local anesthesia, which is unlikely to require postoperative resuscitation, and can easily and safely be performed in a short time). These procedures were required as supportive or lifesaving measures (like insertion of a chest tube, central line, insertion of drainage tube, or debridement of a necrotic area like in diabetic foot). No major surgery was performed in patients in group 2 owing to their poor condition secondary to Covid related complications and the fact that any major intervention in these patients carried a very high risk of complications [4,13]. This approach is supported by Shaoqing et al.'s study from China [14].

Morbidity was higher in group 2 in comparison to group 1; this finding is comparable with that of Martin Inzunza et al. [15] and Doglietto et al. [5]. Yet the mentioned difference in our study was not statistically significant (due to the small number of patients). Length of stay in intensive care ward was longer in group 2; and this was statistically significant, due to the fact that patients in this group had severe and complicated COVID<sub>19</sub> infection that necessitated intensive care ward admission, as opposed to the mild or incidentally discovered infection in group 1.

Probability of developing sepsis was not statistically significant between the two groups (but age was the factor that made statistically significant difference between the two groups in relation to sepsis, higher the age higher the probability of developing sepsis). One patient out of 14 developed postoperative sepsis in group 1 and 6 patients out of 23 developed postoperative sepsis in group 2. This is similar to the

finding of Shaoqing et al. [14].

In our study, we had only one case in group 2 who developed acute respiratory distress syndrome (ARDS). Apart from that no other cases of respiratory failure or acute respiratory distress syndrome (ARDS) were documented in both groups. This is in contrast to the finding of Shaoqing et al. where 11 out of 34 of his patients developed ARDS [14].

Mortality in this study was 48.6% indicating that patients with COVID<sub>19</sub> infection undergoing surgery are at higher risk of mortality. This percentage is much higher when compared with the global prevalence (20%) of perioperative mortality among surgical patients with COVID-19 which was 20% [16]. Martin Inzunza et al. and other studies [2,5,15,17] (please put names of authors et al.) have all confirmed a lower mortality rate. This finding in our study was due to the small number of patients recruited in the study. There are other studies like ours that have also documented a high mortality rate [18]. In our study the mortality rate was much higher in group 2, than in group 1, but this was statistically insignificant due to the difference in the mean age, and in the presence of comorbidities between the two groups (much higher in group 2). The observed differences in morbidity and mortality across different studies can be attributed to a variety of factors such as the implemented protocols, the period and severity of the pandemic, variations in healthcare policies implemented by different countries and between hospital centers and resources [15]. Based on our results, we recommend that the threshold for surgery during COVID<sub>19</sub> pandemic should be higher than during normal practice.

## 9. Limitations of this study

One limitation of this study is its small sample size. This can influence the rates of mortality and complications. Higher mortality and higher number of days spent in ICU by group 2 patients could also be attributed to the fact that our centre is the main tertiary referral centre for emergency cases in the area and that the group of COVID<sub>19</sub> patients referred to our centre had advanced COVID<sub>19</sub> disease.

## 10. Conclusion

Patients with severe COVID-19 infection that need surgery, have a higher possibility of prolonged hospitalization and ICU stay as compared to those who are asymptomatic or have mild infection. There is no statistically significant difference in sepsis and mortality. Based on our results, we recommend that non urgent surgery should be postponed in patients with COVID-19. We also recommend promoting the non-operative treatment, wherever possible, to delay or avoid the need for surgery.

## Ethical approval

Ethics approval was obtained from the ethics committee of Dubai Health Authority.

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## Author contribution

Study concept or design: Amer Al-Ani, Ammar Al-Mashhadi. Data collection: Rafeef Tahtamoni, Yara Mohammad. Data analysis or interpretation.: Amer Al-Ani, Ammar Al-Mashhadi Writing the paper: Amer Al-Ani, Ammar Al-Mashhadi. Fawzi Al-Ayoubi, Nadeem Haider.

## Trail registry number

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Hyperlink to your specific registration (must be publicly accessible and will be checked):

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## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request”

## Declaration of competing interest

Authors declare that they have no conflicts of interest to disclose.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.103910>.

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