Risk Factors Associated With Postoperative Mortality Among COVID-19 Positive Patients: Results of 3027 Operations and Procedures

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Objective: To investigate the predictors of postoperative mortality in coronavirus disease 2019 (COVID-19)–positive patients.

Background: COVID-19–positive patients have more postoperative complications. Studies investigating the risk factors for postoperative mortality in COVID-19–positive patients are limited.

Methods: COVID-19–positive patients who underwent surgeries/procedures in Cleveland Clinic between January 2020 and March 2021 were identified retrospectively. The primary outcome was postoperative/procedural 30-day mortality. Secondary outcomes were length of stay, intensive care unit admission, and 30-day readmission.

Results: A total of 2543 patients who underwent 3027 surgeries/procedures were included. Total 48.5% of the patients were male. The mean age was 57.8 (18.3) years. A total of 71.2% had at least 1 comorbidity. Total 78.7% were included. Total 48.5% of the patients were male. The mean age was 57.8 (18.3) years. A total of 71.2% had at least 1 comorbidity. Total 78.7%

Conclusions: COVID-19–positive patients have higher risk of postintervention mortality. Risk factors should be carefully evaluated before intervention. Further studies are needed to understand the impact of pandemic on long-term surgical/procedural outcomes.

Keywords: COVID-19, pandemic, postoperative mortality, SARS-CoV-2, surgery

In December 2019, an outbreak of a novel coronavirus infection was identified in Wuhan, China. Later named “Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2),” the pathogen responsible for pneumonia was referred to as “coronavirus disease 2019 (COVID-19)” by the World Health Organization (WHO). Since being declared a pandemic on March 11, 2019, COVID-19 has impacted virtually every aspect of health care. This includes challenges for clinicians, surgeons, and patients regarding the access to health care, concerns about safety, and limitations of supplies. Surgeons were advised to give priority to the urgent, emergent, and nondeferrable oncological cases to limit the viral spread, protect patients and caregivers, and use limited resources effectively.

Considering the proinflammatory cytokine release and immunosuppression after surgery, COVID-19–positive patients were feared to have higher complication rates in the postoperative period. In the early phase of pandemic, the effect of COVID-19 on postoperative outcomes was reported in small retrospective series, and it was suggested that COVID-19 infection itself, whether symptomatic or asymptomatic, was associated with higher postoperative complication and 30-day mortality rates. Later, larger series were published and reported higher postoperative morbidity and mortality among COVID-19–positive patients as well. Ultimately, the impact of the pandemic on health care outcomes may not be realized for decades.

Graselli et al reported the outcomes of COVID-19–positive patients admitted to the intensive care units (ICU) in Lombardy, Italy. Older age, male sex, history of chronic obstructive pulmonary disease, hypercholesterolemia, and type 2 diabetes mellitus were independent risk factors for mortality. The COVIDSurg Collaborative group investigated the outcomes of 1128 COVID-19–positive surgical patients and found that male sex, age older than 70 years, American Society of Anesthesiologists (ASA) scores 3 to 5, underlying malignancy, emergency versus elective surgery and major versus minor surgery were associated with increased postoperative mortality. Despite these initial results, there remains a lack of literature investigating the risk factors for postoperative mortality in COVID-19–positive patients, especially when stratified by the type of surgery and/or procedure.

Therefore, the aim of this study is to investigate the risk factors for perioperative/procedural mortality in COVID-19...
positive patients undergoing a wide array of operations and procedures from a large cohort in a quaternary medical center. We hypothesized that in COVID-19–positive patients, higher ASA scores, emergency surgery, and presence of comorbidity would increase the risk of postoperative/procedural mortality.

**METHODS**

After the Institutional Review Board (IRB) approval, we identified all patients with preoperative laboratory-confirmed SARS-CoV-2 infection who underwent surgery and/or procedures between January 2020 and March 2021 in Cleveland Clinic Main Campus, Cleveland, OH. The cohort was identified and queried using an IRB-approved prospectively maintained COVID-19 database and the requirement for informed consent was waived by the local IRB.

Laboratory confirmation of SARS-CoV-2 infection was defined as positive real-time polymerase chain reaction test of collected nasopharyngeal specimens.

Patients undergoing procedures and/or surgeries in the following specialties were included: Gastroenterology, General Surgery, Orthopedics, Urology, Colorectal Surgery, Ophthalmology, Vascular Surgery, Obstetrics/Gynecology, Cardiothoracic Surgery, Neurosurgery, Thoracic Surgery, Otolaryngology, Plastic Surgery, Pain Management, and others.

Collected data included the patient demographics [eg, age, sex, and body mass index (BMI)], perioperative characteristics (smoking status, comorbidities, ASA scores, types of anesthesia, transfusion of blood products, duration of surgery, and days from COVID-19 diagnosis to surgery), length of hospital stay (LOS), ICU admission, length of ICU stay, 30-day readmission, and 30-day mortality. Cases were classified into 4 groups: trauma, urgent, emergent, and elective. Patients’ admissions were also recorded to investigate the outcomes of outpatients, inpatients, and patients admitted through the emergency department separately.

The primary endpoint of the study was postoperative/procedural 30-day mortality. Secondary endpoints were LOS, ICU admission, and 30-day readmission.

**Statistical Analysis**

All clinical characteristics and perioperative outcomes were presented as mean (SD), median [interquartile range (IQR); 25th, 75th], or frequency (percent). Accounting for multiple surgeries from the same patient, univariable and multivariable generalized estimating equation (GEE) logistic regression models were used to identify potential risk factors for postoperative 30-day mortality, readmission, LOS, and ICU admission. Variables significantly associated with outcomes in univariable model were included in the multivariable regression model. A mixed effect model, with a random intercept for patients, was used to identify risk factors for LOS. Because of its skewed distribution, a log-transformation of LOS was used as outcome. The number of independent variables in each model was determined after the 10 events per variable rule. For the association of surgical services with postoperative 30-day mortality, univariable GEE logistic regression model was used. Surgical service was treated as time-varying covariate in the GEE model. Gastroenterology was taken as a reference category in the analysis. We hypothesized that as gastroenterological procedures include less invasive procedures, they would be associated with less morbidity and mortality. In addition, from the statistical standpoint, as gastroenterology category had the largest cohort compared with other surgery services, it was more likely to provide a robust estimation. All analyses were performed with R Studio [R Studio Team (2018). RStudio: Integrated Development for R. RStudio Inc.] and P < 0.05 was considered statistically significant.

**RESULTS**

Between January 2020 and March 2021, 2543 COVID-19–positive patients who underwent a total of 3027 surgeries and/or procedures in our institution were included in the final analysis. Patient demographics can be found in Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SLA/E289. Mean age was 57.8 ± 18.3 years with 48.5% of the patients being male. The median BMI was 28.7 kg/m² (IQR: 24.6–34.4 kg/m²). Smoking status was reported in 2098 patients. Among them, 54.6% were nonsmokers, 35.2% were former smokers, and 10.2% were current smokers with a median pack-years of 15 (IQR: 6–30). Overall, 1810 patients (71.2%) had at least 1 comorbidity, with the most common including hypertension (51.0%), diabetes (26.4%), and underlying malignancy (19.6%). ASA scores were reported in 1448 patients, and the most frequent ASA score was III (46.3%).

Descriptive analysis results of perioperative characteristics are listed in Table 1. Most cases were performed in elective setting (2382 procedures, 78.7% of the study group). Anesthesia types were recorded in 3015 cases, and general anesthesia was used in 1728 (57.3%) of the procedures, whereas remaining procedures were done either under procedural sedation (36.6%), local/regional anesthesia (5.47%), or no anesthesia (0.63%). The median duration of operation was 94 minutes (IQR 47.0–162 minutes). In 3027 procedures, a total of 98 (3.24%) blood products were transfused, with 61 being packed red blood cells, 16 fresh frozen plasma, 13 platelets, and 8 cryoprecipitate.

**TABLE 1. Descriptive Analysis of Perioperative Characteristics**

| Perioperative Characteristics | All Surgeries/Procedures (n = 3027), n (%) |
|-----------------------------|-----------------------------------------|
| Case classification         |                                         |
| Elective                    | 2382 (78.7)                             |
| Urgent                      | 462 (15.3)                              |
| Emergent                    | 141 (4.66)                              |
| Trauma                      | 42 (1.39)                               |
| Patients’ admissions        |                                         |
| Ambulatory surgery/outpatient surgery | 1568 (51.8)                             |
| Inpatient/to come in/admit before surgery | 1427 (47.1)                             |
| Emergency department        | 32 (1.06)                               |
| Anesthesia type             |                                         |
| General                     | 1728 (57.3)                             |
| MAC*/procedural sedation    | 1103 (36.6)                             |
| Local/spinal/regional block | 165 (5.47)                              |
| None                        | 19 (0.63)                               |
| Transfusion of blood products: | 98 (3.24)                               |
| Packed red blood cells      | 61 (2.02)                               |
| Cryoprecipitate             | 8 (0.26)                                |
| Fresh frozen plasma         | 16 (0.53)                               |
| Platelets                   | 13 (0.43)                               |
| Duration of operation (min) | 94.0 (47.0;162)                         |

All variables were presented as mean (SD), median (25th, 75th) or frequency (percent).

*MAC indicates monitored anesthesia care.

# Anesthesia type has missing data.
TABLE 2. Descriptive Analysis of Postoperative Outcomes

| Postoperative Outcomes | All Patients (n = 2543) |
|------------------------|------------------------|
| Length of hospital stay median (d) | 1.08 (0.19, 6.45) |
| Length of hospital stay mean (d) | 6.43 (13.4) |
| ICU* admission, n (%) | 446 (17.5) |
| ICU* length of stay (d), n (%) | 3.00 (1.00, 13.0) |
| 30 d readmission | 426 (16.8) |
| Postop 30-d mortality | 102 (4.0) |

All variables were presented as mean (SD), median (25th, 75th) or frequency (percent).

*ICU indicates intensive care unit.

The mean LOS was 6.43 ± 13.4 days. ICU admission was required in 446 (17.5%) patients in the postoperative/procedural period with a median length of ICU stay of 3 days (IQR: 0–13 days). The 30-day readmission rate was 16.8% (426 patients) and overall postoperative/procedural 30-day mortality rate was 4.01% (102 patients). Postoperative/procedural outcomes can be found in Table 2.

Table 3 shows the association between clinical characteristics and postoperative/procedural 30-day mortality. Age at the time of surgery, smoking status, presence of any comorbidity, receiving platelet transfusion, case class, anesthesia type, and admission through the emergency department or inpatient service were found to be significantly associated with mortality in the univariable analysis; and all were subsequently included in the multivariable regression model.

In the multivariable analysis, postoperative/procedural mortality was shown to be increased 66% per 10 years increase in age (OR: 1.66, 95% CI, 1.4–1.98; P < 0.001). Compared with nonsmokers, being a current smoker was significantly associated with mortality (OR: 2.76, 95% CI, 1.3–5.82; P = 0.008). Having at least 1 comorbidity (OR: 3.22, 95% CI, 1.03–10.03; P = 0.043), receiving platelet transfusion (OR: 19.92, 95% CI, 2.19–181.17; P = 0.008), emergency versus elective surgery (OR: 6.35, 95% CI, 3.39–11.89; P < 0.001), and urgent versus elective surgery (OR: 1.78, 95% CI, 1.12–2.84; P = 0.015) remained significantly associated with mortality in the multivariable analysis as well. Patients who were admitted through the emergency department (OR: 15.97, 95% CI, 2.00–127.31; P = 0.009) or inpatient service (OR: 32.28, 95% CI, 7.75–134.46; P < 0.001) versus outpatients also had higher mortality rates.

Unique to this study, patients undergoing various procedures were examined. A total of 3027 surgeries and procedures were performed with Gastroenterology (22.0%), General Surgery (15.4%), and Orthopedic Surgery (12.2%) being the most common. Numbers of procedures and association of the surgery service with postoperative mortality in comparison to Gastroenterology are listed in detail in Table 4. Although there was no mortality among Ophthalmology and Obstetrics/Gynecology patients, Thoracic Surgery patients (OR: 3.76, 95% CI, 1.66–8.53; P = 0.002) had the highest association with postoperative 30-day mortality. Orthopedics (OR: 0.37, 95% CI, 0.18–0.78; P = 0.008), Urology (OR: 0.06, 95% CI, 0.01–0.04; P = 0.005), Colorectal Surgery (OR: 0.37, 95% CI, 0.14–0.94; P = 0.036), and Pain Management (OR: 0.01, 95% CI, 0.01–0.73; P = 0.023) patients had significantly lower mortality rates than Gastroenterology patients.

Supplementary Table 2, Supplemental Digital Content 2, http://links.lww.com/SLA/E290, shows the predictors of readmission. In the multivariable analysis, increased age and the presence of any comorbidity were significantly associated with readmission; however, compared with outpatients, patients who admitted through the emergency department (OR: 2.72, 95% CI, 1.12–6.61; P = 0.027) and inpatient service (OR: 1.63, 95% CI, 1.23–2.17; P < 0.001) had higher readmission rates. The predictors of increased LOS can be found in Supplementary Table 3, Supplemental Digital Content 3.

TABLE 3. Association Between Clinical Characteristics and Postoperative 30-day Mortality

| Clinical Characteristics | Univariable | Multivariable |
|--------------------------|-------------|---------------|
|                          | OR (95% CI) | P             | OR (95% CI) | P               |
| Age at surgery | 1.96 (1.71–2.25) | < 0.001 | 1.66 (1.4–1.98) | < 0.001 |
| sex | Male vs female | 1.27 (0.86–1.87) | 0.23 | — | — |
| BMI* | Per unit increase | 1.02 (1–1.04) | 0.084 | — | — |
| Smoking status | Current smoker vs no | 2.65 (1.4–5.04) | 0.003 | 2.76 (1.3–5.82) | 0.008 |
| Smoking status | Former smoker vs no | 2.01 (1.25–3.25) | 0.004 | 1.11 (0.64–1.94) | 0.71 |
| Any comorbidity | Yes vs no | 2.74 (1.55–4.83) | < 0.001 | 3.22 (1.03–10.03) | 0.043 |
| Transfusion of blood products | | | | |
| PRBC* transfusion | Yes vs no | 4.88 (0.85–28.02) | 0.076 | — | — |
| Cryoprecipitate | Yes vs no | — | — | — | — |
| transfusion† | | | | |
| FFP* transfusion | Yes vs no | 16.8 (0.27–1032.58) | 0.18 | — | — |
| Platelet transfusion | Yes vs no | 44.2 (5.97–327.4) | < 0.001 | 19.92 (2.19–181.17) | 0.008 |
| Patients’ admission | Emergency vs ambulatory surgery/outpatient | 34.78 (5.6–215.83) | < 0.001 | 15.97 (2–127.31) | 0.009 |
| Patients’ admission | Inpatient/to come in/admit before surgery vs ambulatory surgery/outpatient | 61.28 (19.3–194.52) | < 0.001 | 32.28 (7.75–134.46) | < 0.001 |
| Anesthesia type | Local/spinal/block vs general | 0.21 (0.05–0.86) | 0.031 | 0.44 (0.09–2.02) | 0.29 |
| Anesthesia type | MAC/procedural sedation vs general | 0.79 (0.53–1.18) | 0.25 | 0.69 (0.41–1.18) | 0.17 |
| Anesthesia type | None vs general | 9.92 (3.5–28.11) | < 0.001 | 3.34 (0.94–11.85) | 0.062 |
| Case classification | Emergent vs elective | 12.95 (7.94–21.12) | < 0.001 | 6.35 (3.39–11.89) | < 0.001 |
| Case classification | Trauma vs elective | 4.74 (1.78–12.65) | 0.002 | 2.8 (0.79–8.99) | 0.11 |
| Case classification | Urgent vs elective | 3.88 (2.63–5.73) | < 0.001 | 1.78 (1.12–2.84) | 0.015 |
| Duration of surgery | 1.02 (0.92–1.12) | 0.71 | — | — |

Bold values indicate significance (P < 0.05).

* BMI indicates body mass index; FFP, fresh frozen plasma; PRBC, packed red blood cells.
†Cryoprecipitate transfusion failed to converge in model, because there were too few cases in our sample to get the coefficient.

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All patients developed pneumonia in the postoperative period, 15 patients (44.1%) required admission to ICU, and overall mortality rate was 20.5%. According to their report, this was much higher than previously reported mortality rates of COVID-19–positive patients without surgery. Doglietto et al5 compared the postoperative outcomes of 41 patients who had positive test results for COVID-19 either before or within 1 week after surgery with 123 patients without COVID-19 infection. Mortality rate was significantly higher in the COVID-19 group (19.51%) versus the control group (2.44%). In this study, COVID-19 infection itself was significantly associated with higher rates of pulmonary, hemorrhagic, and thrombotic complications.

We evaluated the outcomes of 2543 COVID-19–positive patients undergoing a total of 3027 surgeries or procedures from various departments. To the best of our knowledge, this is the largest observational cohort study including COVID-19–positive patients from a variety of surgical specialties. We found the postoperative 30-day mortality rate to be 4.01%, which was lower than the previous studies reporting mortality rates ranging from 14.7% to 27.3%.4–12 We believe that this difference can be explained by the differences in the study periods, as well as better understanding of the care of patients with COVID-19 and development of perioperative management protocols over time. As our study included patients who had interventions in the height of the pandemic (January 2020 to March 2021), we were able to include a possibly larger proportion of patients who were asymptomatic.11,13 Furthermore, all patients included in this study were screened preoperatively regardless of the symptoms, thus potentially resulting in patients with relatively less potent and asymptomatic disease that lead to lower mortality rates. The conduct of these surgeries and procedures in a quaternary care center with availability of multidisciplinary team resources and expertise also contributed to our overall lower mortality rate.

In the early phases of pandemic, surgeons were advised to proceed only with emergent, urgent, and oncological procedures. In our study, 78.7% of the cases were elective. Our approach to
elective cases was to proceed with them if they deemed essential based on patient pathologies or if the risk of delaying surgeries/procedures outweighed the risk of proceeding with them.

Increasing age, having at least 1 comorbidity, smoking status, emergency versus elective surgery, urgent versus elective surgery, and admission through the emergency department or inpatient service were independent risk factors for postoperative 30-day mortality in our study. The COVIDSurg Collaborative group\(^5\) investigated 1128 COVID-19-positive surgical patients and concluded that male sex, age older than 70 years, ASA grades 3 to 5, and undergoing emergency or oncological surgery were the predictors of postoperative 30-day mortality. Although some of our findings aligned with the results of COVIDSurg Collaborative group, our study also identified being a current smoker as a risk factor. This difference can be explained by our larger population of current smokers (214 vs 106), providing enough power to show the relationship between smoking and mortality. Interestingly, in comparison to the Collaborative results, our study did not show statistically significant association between sex and mortality. Our study demonstrated increasing age to be associated with higher mortality, which was similar to previous studies.\(^5,14\)

We also found undergoing emergency versus elective surgery to be associated with 6-fold increase in mortality. De Luca et al\(^12\) evaluated outcomes of 68 COVID-19–positive patients undergoing emergency or oncological surgeries and reported a mortality rate of 14.7%. They found there was no significant difference between emergent and elective cases in terms of postoperative complication and mortality rates. This difference may be explained by their including only oncological procedures in the elective group. Further evidence is needed to understand whether undergoing cancer surgery versus other elective surgeries is associated with worse outcomes in COVID-19–positive patients.

Our study showed that the presence of any comorbidity was associated with increased mortality. According to Lei et al,\(^5\) the presence of any comorbidity significantly increases the risk of ICU admission, and hypertension alone is associated with higher ICU admission rates. Jonker et al\(^1\) reported that diabetes and peripheral vascular disease were more common among SARS-CoV-2–positive nonsurvivor surgical patients. In our cohort, hypertension was the most common comorbidity (52.1%), followed by diabetes (26.4%) and cancer (19.6%), but we did not analyze the relationship between each comorbidity and postoperative mortality separately. Likely the presence of comorbid condition contributed to the higher mortality through decreased reserve, chronic disease, and poor wound healing.

Unique to this study, we enrolled patients from different surgical service lines and evaluated the association between surgical service and postoperative mortality by taking Gastroenterology as a reference. Thoracic Surgery was significantly associated with the highest mortality. Li et al\(^14\) published a study including 13 hospitalized Thoracic Surgery patients, and the mortality rate was 38.5%. The reported rationale for this finding was that operations involving thorax in COVID-19–positive patients lead to poor surgical outcomes by causing lung function impairment and decreased immunity. In contrast, Orthopedics, Urology, and Colorectal Surgery patients had significantly lower mortality rates than gastroenterology patients. Studies on COVID-19–positive Orthopedics patients reported higher mortality rates up to 34%, but these studies mostly included elderly patients with traumatic injuries.\(^13\) They suggested that overlapping inflammatory response between orthopedic injuries and COVID-19 infection leads to negative surgical outcomes. Interestingly, we found that Colorectal Surgery was associated with lower mortality rates than Gastroenterology. As most colorectal patients underwent abdominal surgeries including cancer operations and symptomatic Crohn and diverticulitis, this may have been more of a representation of COVID-19–positive patients undergoing a gastrointestinal (GI) procedure in the face of other more severe (ie, pulmonary) infections. As some patients included in this study had multiple surgeries, some patients also underwent gastroenterological procedures because of complications of the previous colorectal surgery, resulting potentially in an inappropriate effect of first surgery on mortality being underestimated and attributing association to the GI procedure. Furthermore, review of GI cases revealed interventions for patients with bleeding or ischemia that were secondary manifestations and ultimately dying from a separate process.

Previous studies\(^6,10,11\) reported ICU admission rates between 27% and 44.1%. Although our study reported lower rates of ICU admission (17.5%), it was still high. Knisely et al\(^10\) compared the ICU admission rates of COVID-19–positive and negative patients and reported that COVID-19 positivity was an independent risk factor for the requirement of ICU care. We evaluated the risk factors for ICU admission in COVID-19–positive patients and found that increasing age, male sex, increased BMI, being a former smoker, inpatients versus outpatients, emergency versus elective surgeries, and the increased duration of surgery were significantly associated with higher ICU admission rates. Among all the risk factors, increasing BMI was not associated with other postoperative outcomes in this study, but it was associated with higher ICU admission rates. It was reported that obesity increases the risk of pulmonary complications by attenuating the immune response and impacting lung mechanics.\(^15\) We believe that the underlying reason of increasing BMI being associated with higher ICU admission rates can be because of increased rates of pulmonary complications.

We acknowledge the limitations of this study. First, this was a retrospective study and some patients had missing data (eg, BMI, smoking status, and ASA scores). As a conclusion, the relationship between ASA scores and postoperative mortality could not be evaluated. Second, postoperative morbidity was limited to ICU admission rates. Pulmonary, hemorrhagic, and thrombotic complications were reported to be associated with COVID-19 infection in previous studies\(^4,5,11\) but they were not analyzed in detail in our study. And finally, because of the retrospective nature of our study, it was not possible to assess the degree of symptoms, hence the reliable comparison of the outcomes of patients with asymptomatic versus symptomatic COVID could not be made. However, by definition, we can say that all patients who underwent elective procedures were asymptomatic. Emergent procedures included both asymptomatic and symptomatic patients. And the results of our study showed that undergoing emergency surgery and/or admission through the emergency department were associated with mortality and negative postoperative outcomes. In addition, as we have included patients from a broad time interval (and mainly when COVID was at its peak), data regarding vaccination status was missing for most patients, and some patients were not fully vaccinated. Thus, we were not able to conduct an analysis on the outcomes of vaccinated versus unvaccinated patients. Despite these limitations, we reported the largest cohort including COVID-19–positive patients undergoing a wide array of operations and procedures, which provided generalizable results. Furthermore, as the routine testing for COVID-19 was not available across all sites during
the earlier phases of pandemic, the diagnosis of COVID-19 in previous studies\textsuperscript{5,7,14} was based on the results of laboratory tests and radiologic interpretations that were not standardized. In our study, all patients were diagnosed with real-time polymerase chain reaction test preoperatively, which provided us more standardized results. Currently, there is limited data investigating the risk factors for mortality in COVID-19–positive surgical patients and one of the strengths of our study was that it was designed to evaluate these risk factors. We also evaluated the risk factors associated with ICU admission of COVID-19–positive surgical patients which, according to our best knowledge, was not evaluated in detail before.

In conclusion, COVID-19–positive patients are at higher risk of postoperative mortality with increased age, being a current smoker, presence of comorbidity, undergoing emergency or urgent surgery, admission through the emergency department, or inpatient service being the risk factors. In addition to these factors, increased BMI is a risk factor for ICU admission. Thoracic surgical procedures are more likely to cause mortality than other procedures. During pandemic, patients should be carefully evaluated before surgery with special attention given to the risk factors and emergency of the procedure. Further studies are needed to understand the impact of pandemic on long-term surgical outcomes.

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