Original Article

The Mortality Rate in COVID-19 Patients Undergoing Anesthesia for Surgical Procedures

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Abstract

Background: Planning anesthesia for coronavirus disease (COVID) positive patients remains a big dilemma for anesthesiologists. Aside associated harms of postponing surgeries, there is concern about the outcome of COVID after surgical stress, limitation of resources, and personal safety. Therefore, we aimed to investigate the effect of surgery and anesthesia on the course of coronavirus disease 2019 (COVID-19).

Materials and Methods: A total of 179 patients (COVID-positive) who underwent surgery under anesthesia from March 2020 until March 2021 were retrospectively evaluated. The type of surgery, type of anesthesia, and outcome of patients were recorded. Renal and liver function tests as well as respiratory system function before and after surgery were compared.

Results: Among them, 39 patients died (27%). Laboratory data including creatinine (Cr), Aspartate Transaminase (AST), Alanine Transaminase (ALT), Alkaline Phosphatase (ALK), and troponin were not significantly different preoperatively and post-operatively. 28 patients (15.6%) were intubated due to post-operative respiratory failure. In our study mortality rate for all types of surgery was 27% and the postoperative intubation rate was 15.6%. We did not have any organ failure after interventional procedures.

Conclusion: The risk of infection progression must be weighed before scheduling invasive procedures. Moreover, regional anesthesia may be less harmful in case of urgent or emergent need for surgery in infected patients.

Keywords: COVID, Anesthesia, Mortality, Morbidity, Outcome

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Introduction

An exponential increase in patients suffering from COVID-19 led to an unexpected crisis in healthcare facilities (1). This crisis not only affected the inpatient wards, outpatient facilities, and Intensive Care Units (ICUs) but also drastically affected operating rooms (2). Resource limitations such as personal protection equipment, Intensive Care Unit facilities, and staff shortages in addition to reallocating surgical wards to COVID-19 wards resulted in the inescapable postponement of operations in this era (1, 3). Patients' admissions for elective procedures were also reduced

due to the lockdown and the populations' dread of hospitals as a source of infection (2, 4, 5). Therefore, in this circumstance, a delay in surgery was unavoidable which could have resulted in serious long-term adverse events, especially urgent ones. Various decisions were made in this situation (3). In some countries like ours, according to federal and state governments, orders for non-urgent interventions were postponed (6). At the beginning of the pandemic, all surgical societies recommend re-scheduling and postponing elective surgical cases until the availability of further data (1). Others recommended performing a COVID test before surgery (4). This approach seemed inappropriate since patients might have been affected by COVID during the delay between performing the test and entering the operating room (approximately 48 hours). Although the rate of infection varied universally, reports confirmed the positive rate of less than 1% which questioned the cost-effectiveness of this approach. The third and last approach was triaging patients according to their urgency using domestic or international guidelines (7, 8).

Despite these resource limitations and the lethal risk of surgery, some patients required urgent or emergent surgeries (9). Also during a pandemic, there was a chance of performing surgery in occult cases of COVID-19. In addition, some diagnostic procedures like endoscopic or colonoscopy examinations were necessary for selected patients (3). As it has been said, "Primum non nocere" (first, not harm.), the safety of patients and healthcare personnel are the main priority (10). But the clinical effect of surgery in patients suffering from occult or mild symptoms needs to be defined (11, 12). Although at the beginning of the pandemic, cohort studies stated that mortality increased in patients with COVID-19, it should be noted that these patients were often admitted by delay (filter effect) and also had higher risk due to their age, comorbidities, and in poorer medical condition than before (13).

Until now there is scarce evidence regarding clinical outcomes after surgery in patients suffering from COVID-19 especially in symptomatic patients at the time of surgery. Therefore, this study was conducted to describe clinical outcomes, baseline characteristics, type of surgery, and anesthesia regarding these patients. In addition, these data could be helpful for policy-making and reallocating resources in other pandemic situations.

Methods

This study was approved by the Institutional Review Board of Shahid Beheshti Medical University in December 2020 under the Ethics Code of IR.SBMU.RETECH.REC.1399.838. A retrospective cross-sectional study was conducted on COVID-positive patients who were anesthetized at our hospital from March 2020 to March 2021. Data of all COVID-19-positive patients who underwent surgery were abstracted from electronic medical records. All participants receive and understand informed consent. They could also withdraw entrance to the study as they will.

Several directives have been implemented during the pandemic; initially, all non-emergent cases were canceled. After that, we were permitted to carry out urgent cases. The cap was installed again as the number of confirmed cases increased. Upon vaccination and reduction of COVID-19 prevalence, emergent and urgent surgeries were allowed. We classified our surgeries based on our governmental directives which stated that (a) emergent surgeries were those which were life-threatening or could not be hastened for more than a week like surgery for epidural hematoma or cesarean section; (b) urgent surgery referred to those who could not be delayed upon the end of the pandemic, for example, cancer surgeries or orthopedic fractures; and (c) elective surgeries which were those who could be performed after pandemic like cosmetic surgeries.

Patients with severe COVID symptoms such as fever, cough, and shortness of breath at the time of admission were excluded. Other exclusion criteria were less than 6 hours of hospitalization and the diagnosis of COVID after anesthesia.

At our institute, a positive diagnosis of COVID was confirmed by the characteristic findings of the chest computer tomography (CT) confirmed by an experienced radiologist or positive polymerase chain reaction test (PCR). Patients were transferred to the operating room for a variety of procedures, including general surgery, orthopedic surgery, gynecological surgery, vascular surgery, endoscopic gastrointestinal procedures, and electroconvulsive therapy. All patients

were anesthetized with appropriate personal protective equipment.

Patient demographics were recorded, including age, gender, COVID detection method, type of procedure, and anesthesia type. If available, laboratory tests were recorded before and after intervention including creatinine (Cr), Aspartate Transaminase (AST), Alanine Transaminase (ALT), Alkaline Phosphatase (ALK), and troponin to evaluate kidney, liver, and cardiac morbidity. O2 saturation and the need for mechanical ventilation were also recorded preoperatively and post-operatively. Patients were followed to find out if they were discharged or died during hospitalization. If there were patients who had multiple surgeries, each surgery was considered individually. These data were documented using SPSS software and descriptive analysis was performed.

Results

A total of 56 (31.3%) female and 123 (68.7%) male patients receiving urgent or emergent surgery were included in this study from March 2020 to 2021. All patients were admitted due to complaints other than COVID-19 symptoms and were diagnosed with this disease in the preoperative period by rt-PCR (61.5%) or chest CT scan (38.5%). The mean age of all patients was 53.05 ± 17.51 (13-89) years. Laboratory findings of the patients upon admission to the hospital and after surgery are presented in Table 1.

Of 179 patients undergoing surgery, 140 were discharged and 39 died during hospitalization during the postoperative period. Detailed type of surgeries performed and their survival rate is described in Table-2. As shown in Table-2, the mortality rate was higher in patients requiring General Surgery, Bronchoscopy, and Vascular Surgery (P Value=0.02).

Forty patients were managed by regional anesthesia of whom two were deceased (5.0%). On the other hand, from 139 patients managed by IV sedation or General Anesthesia 37 (26.6%) died in the postoperative period (P Value <0.01). Regional anesthesia was performed on 25 orthopedic surgeries, 10 obstetrics, and gynecology surgeries, and 5 vascular surgeries.

Postoperative respiratory failure requiring intubation occurred in 28 patients (15.6%) of whom only one survived. Also, 12 patients did not show any signs or symptoms of respiratory failure before cardiac arrest. There was no survival after cardiopulmonary resuscitation in these patients.

Discussion

The safety of anesthesia and surgical procedures for patients with COVID-19 infection is an important issue for any anesthesiologist confronting patients who underwent urgent or even elective procedures. As regards it has already been reported that each procedure causes stress response and even a variety of complications in previously healthy patients (14). There are two aspects of view, from one side underlying COVID infection may progress due to exposure to a large number of stress factors. On the

Table 1: Laboratory findings.

Test	At admission	After Surgery	P-value
Creatinine	1.48 ± 1.72	1.47 ± 1.31	0.56
AST	59.29 ± 73.49	68.99 ± 110.51	0.48
ALT	53.87 ± 51.00	53.20 ± 56.98	**0.01**
ALK	399.29 ± 463.88	461.71 ± 359.66	**<0.01**
Troponin	0.00 ± 0.01	0.01 ± 0.09	0.39
O2 saturation	93.74 ± 4.32	92.10 ±8.01	**<0.01**

Aspartate Transaminase (AST), Alanine Transaminase (ALT), Alkaline Phosphatase (ALK).

Table 2: Survival rate in various types of surgery.

Type of intervention	Frequency	Survival Rate
General Surgery	32	34.4%
Bronchoscopy	3	66.6%
Vascular Surgery	23	69.6%
Endoscopic Procedures	57	84.2%
Orthopedic Surgery	46	97.8%
Electroconvulsive therapy	4	100%
Faciomaxillary Surgery	4	100%
Obstetrics and gynecology Surgery	9	100%
Total	179	78.2%

other hand, delay in surgery can cause consequences. Studies show that a modest delay in cancer surgeries can significantly affect a patient's survival (15, 16). Hence, the benefit of performing surgery must be weighed against the risk of disease progression. All over the world, there are reports about performing surgical procedures and general anesthesia in patients with asymptomatic COVID infection; most of them were diagnosed after the procedure. So the main issue remains unsolved in the case of confronting patients with symptomatic or non-symptomatic COVID infection who needs interventional procedures.

In this study, we presented the morbidity and mortality rate of patients with COVID who underwent surgical procedures. The main question was whether surgeries during the whole time of the COVID pandemic can affect COVID progression in cases with mild to moderate infection. In our hospital, 179 procedures were done on COVID-positive patients under regional or general anesthesia during the first year of the COVID pandemic. There are limited data in previous studies.

Among the total of 179 patients with mild to moderate symptoms of COVID at the time of surgery, we had a mortality rate of 27%. This is much more than the infection fatality rate of COVID infection itself which is reported to be approximately 1.4% (16). It could be explained by the underlying disease of the patients that made them admitted to the hospital. Besides, some studies revealed a mortality rate of 21.9% in COVID-infected patients with underlying diseases like cardiovascular disease, diabetes, and hypertension (17). A cohort study of 10 COVID-positive patients with hip fractures who underwent surgical intervention shows that patients with mild to moderate COVID can safely tolerate early orthopedic surgery. In this study, the early mortality rate was 10% mostly due to venous thromboembolism on the 19th day of admission (18). And there is a mortality rate of 30.8% among 13 patients in Italy and 43.8% of 32 patients in China after surgery for hip fracture (18). Osorio et all compared the outcome of 183 COVID-19-positive and 2132 COVID-19-negative patients after emergency general and gastrointestinal surgery. They concluded that the mortality rate of patients with COVID infection was significantly greater than those without (13). All these data as ours demonstrate a mortality rate of more than 1.4 % and it could demonstrate the effect of stress response of interventional procedure or even underlying disease in COVID outcome.

In our study, major organ failure did not happen after surgery. Comparison of the amount of creatinine, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and troponin before and after surgery to evaluate the function of kidney, liver, and

heart in COVID-infected patients did not show any significant difference. The level of alkaline phosphatase had significantly increased postoperatively which could be explained by a large number of our gastrointestinal procedures among all patients. The other significant change in our clinical findings was the amount of oxygen saturation which was 92% after surgery in comparison to 93% preoperatively. This difference was not clinically significant. A clinical review by R. Gupta et al showed a variety range of morbidity reports after emergent and urgent gastrointestinal surgery, from 0% morbidity among 28 Chinese patients to 10.7% pulmonary complication vs 3.6% among 112 patients with and without COVID infection (1). 15.6% of all patients need postoperative intubation. In one study among 22 patients with laparotomy due to abdominal pain, 10 patients needed mechanical ventilation in the first 6 postoperative days which is higher than our results (5).

The analysis also showed that regional anesthesia was associated with a lower mortality rate compared to general anesthesia. Almost all published guidelines and recommendations instruct anesthesiologists to use regional anesthesia whenever possible to reduce staff contamination during intubation and extubation, as well as the theoretical advantage of sparing respiratory interventions (19-22). On the other hand, most regional anesthetic techniques have been performed in orthopedic surgeries. In this type of surgery, only one patient has died whose surgery was performed under general anesthesia. Therefore, our results suggest that performing regional anesthesia, when possible, would be associated with a better outcome compared to general anesthesia.

We did not have any mortality in obstetrics and gynecology surgery, faciomaxillary surgery, and Electroconvulsive therapy. Among all types of surgery, most of our patients went under endoscopic procedures and orthopedic surgery. The mortality rate was less than 15% in these two groups. It is lower than the mean mortality rate reported in other studies which can be due to the type of procedures and type of anesthesia. In our institute, all gastrointestinal procedures perform under deep sedation anesthesia without intubation and regional anesthesia is the most frequent anesthetic approach for orthopedic surgery. The highest mortality rate belongs to general surgery which was 65.6% of 32 patients. Similarly, the mortality rate of general surgeries in some studies is higher than the other type of surgery; it is reported as about 12.6%-31% in general surgeries vs no mortality in obstetric patients (1, 5, 23, 24). But the difference between our statics and the others might be due to the higher rate of upper abdominal surgeries like Whipple in our institute.

One limitation of our study was the number of patients. In addition, we missed laboratory and clinical findings due to the retrospective gathering of data. The study was performed during the first year of the pandemic so there was a lack of evidence and experience in the management and evaluation of disease. There was not sufficient accessibility to PCR tests at the beginning of the pandemic and we had to use radiologic criteria for diagnosis.

Conclusion

Deciding whether to proceed with the surgery in Covid-19 infected patients mainly depends on urgency and the direct impact of the planned procedure on the patient's overall health status. In the case of performing surgery, regional anesthesia is preferred due to less attributable morbidity and mortality.

Acknowledgment

None.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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