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Urgent Surgery with General Anesthesia Can be a Safe Option in Asymptomatic COVID-19 Positive Patients – A Single Institution Experience

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Abstract

Objective: Use of General Endotracheal Anesthesia (GETA) in asymptomatic COVID-19 patients is concerning for a possible precipitation of Systemic Inflammatory Response Syndrome (SIRS) and ultimately respiratory failure. This study evaluates outcomes in patients undergoing urgent surgery with GETA unrelated to their asymptomatic COVID-19 infection.

Methods: This is a retrospective, single institution study from March through December 2020. We included asymptomatic Polymerase Chain Reaction (PCR) positive COVID-19 patients who underwent urgent surgery using GETA. Primary outcomes included unplanned reintubation, mechanical ventilation greater than 48 h, bacterial pneumonia, and mortality. Secondary outcomes included Major Cardiac Adverse Events (MACE), Deep Vein Thrombosis (DVT), Pulmonary Embolism (PE), and intensive care and hospital length of stay.

Results: Twenty-seven patients met inclusion criteria; 12 were trauma activations. There were no unplanned reintubations, 3 patients (11%) required mechanical ventilation greater than 48 h, 1 of which (4%) was diagnosed with bacterial pneumonia, 2 of whom (7%) died. One patient required laparotomy with gastric ulcer ligation for a Gastrointestinal (GI) bleed and remained intubated for open abdomen management. One patient required multiple laparotomies and bowel resections for GI bleed and died from multi-system organ failure. One patient required a decompressive craniotomy after massive trauma and care was withdrawn due to neurologic function. Secondary outcomes are in Table 1.

Conclusion: Patients' morbidity and mortality was more consistent with their underlying clinical presentation and associated surgical procedure, rather than their asymptomatic COVID-19 status. This single institution experience suggests that is may be safe to proceed with urgent surgery if clinically necessary.

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Introduction

The global pandemic caused by the novel Coronavirus SARS-CoV-2 (COVID-19) compelled the postponement of many elective surgeries. However, a number of patients still required non-elective surgery at the height of the pandemic. Many hospitals and healthcare networks, including our institution, were able to mobilize resources to ensure that all patients who interacted with the healthcare system were tested for COVID-19. This included widespread testing in the emergency department, as well as required preoperative testing before proceeding with any operation. This level of testing led to the identification of patients infected with COVID-19 who were asymptomatic and had no known respiratory pathology upon presentation.

Though many institutions and surgical subspecialists have published guidelines on how to approach perioperative and operative care safely in the COVID-19 era, there has been a lack of literature describing how COVID-19 positive patients fare during surgery and postoperatively [1]. This is of unique importance when considering the nature of COVID-19 as a respiratory virus potentially causing a severe viral pneumonia, leaving affected patients at greater risk of requiring intubation and mechanical ventilation [2]. Given that most patients undergoing surgery are intubated, there is concern that COVID-19 positive patients are at greater risk of adverse perioperative events as they enter with potentially compromised respiratory function especially

due to increased lung compliance, necessitating higher ventilatory requirements. In fact, the increase in mortality in mechanically ventilated COVID-19 positive patients has spurred efforts to stave off intubation using techniques such as High Flow Nasal Cannula (HFNC) and proning in order to avoid the known deleterious effects of the ventilator [3].

While some patients do require emergent life-preserving surgical intervention upon initial presentation, there is also a significant cohort of patients whose surgeries, while not distinctly emergent, are time-sensitive and urgent to the degree that the care team will need to carefully weigh the risks and benefits of intubating a COVID-19 positive patient and subjecting them to the corporeal stresses of surgery. Even as institutions have returned to regular elective surgery schedules with systematic required preoperative inpatient and outpatient testing, and are better equipped to safely operate on COVID-19 positive patients, when necessary, the question has remained as to how well this patient population can tolerate surgery. This subgroup analysis of asymptomatic COVID-19 positive patients requiring urgent or emergent surgery is of special consequence given the ongoing pandemic we are experiencing, where clinicians will require a more evidence-based approach to determining whether a COVID-19 positive patient is an acceptable candidate for surgery.

As the medical community continues to grapple with the effects of this virus, there will surely be continued updates and changes to accepted protocols for handling surgical procedures involving COVID-19 positive patients. The purpose of this study is to describe our institution's experience with operating on COVID-19 positive patients during the time period of March through December 2020. We hypothesize that asymptomatic COVID-19 positive patient undergoing urgent or emergent surgery experience minimal pulmonary complications and mortality rates, regardless of operative procedure, suggesting that this patient population may be safe to undergo urgent surgery.

Methods

Data source

This is a review of a retrospectively accumulated database from our institution's surgical case list from March to December 2020. The list was obtained from a master operating room schedule, and patients who underwent an operation in the defined COVID-19 isolation rooms were screened for inclusion. All patients who underwent surgery with positive COVID-19 pre-operative Polymerase Chain Reaction (PCR) test were included in our initial analysis, and this cohort was subsequently screened to include only patients who were asymptomatic upon presentation to the emergency department. Patients who tested positive in the postoperative period but tested negative preoperatively were excluded. Given that this research contains only de-identified patient information, informed consent for participation in this research project was waived. Where applicable, all patients gave informed consent for the operations and treatments during their index hospitalization. This study was approved by our institution's Institutional Review Board (IRB #: NCR202844).

Patient variables

Patients were initially stratified into asymptomatic and symptomatic groups. Asymptomatic was defined as hospital admission for a diagnosis other than COVID-19, or if the patient's admission documents specifically noted lack of fever, cough, shortness of breath, or anosmia. Symptomatic was defined as hospital admission for a diagnosis of COVID-19 or admission documents noting symptoms of fever, cough, shortness of breath, and anosmia, and these patients were subsequently excluded. For those patients whose symptomatology could not be assessed immediately upon arrival due to compromised mental status or injury severity, we examined the earliest charted progress notes detailing patients' symptoms. Symptomatic patients were then excluded from our analysis. Patients undergoing operative intervention for COVID-19-related complications such as post-intubation tracheostomy for airway management due to compromised respiratory status were also excluded from analysis. Preoperative variables included white blood cell count, hemoglobin, platelet count, Blood Urea Nitrogen (BUN), creatinine, D-dimer, IL-6, estimated Glomerular Filtration Rate (eGFR), Hemoglobin A1c (HbA1c), presence of pre-operative sepsis and pre-operative intubation. These patient variables are summarized in Table 2. This study focuses primarily on clinical outcomes for the cohort of asymptomatic patients; thus, given that this group underwent a variety of operative procedures, patients were further stratified by surgical procedure, case classification as urgent or emergent, and whether they arrived at the hospital as a trauma activation. Emergent cases were defined as those in which "Now," "Hot," or "Cold" was selected on the surgical posting form, and urgent cases were defined as those in which "Urgent" or "Elective" was selected.

Outcome variables

The primary outcomes in this study were overall 30-day pulmonary complications. Pulmonary complications were defined as culture-proven pneumonia, mechanical ventilation for over 48 h, unplanned reintubation. Other outcomes measured were Major Adverse Cardiac Events (MACE), Acute Kidney Injury (AKI, defined as rise in serum creatinine by 2 mg/dL over preoperative value), Deep Venous Thrombosis (DVT), Pulmonary Embolism (PE), total Intensive Care Unit (ICU) and hospital length of stay, and whether the patient was discharged on therapeutic anticoagulation.

Results

Patient variables

There were 27 patients who met study criteria and were included for analysis. Upon surgical specialty stratification, 10 (37%) underwent general surgery, 6 (22%) orthopedic surgery, 4 (15%) neurosurgery, 3 (11%) podiatry, 1 (4%) otolaryngology, 1 (4%) OB/GYN, 1 (4%) urology, and 1 (4%) vascular surgery. 12 (44%) of these asymptomatic patients arrived as a trauma activation, and 14 (52%) of which were classified as emergent.

Clinical outcomes

There were two deaths in the asymptomatic group (7%). There were no unplanned reintubations, 3 patients (11%) required mechanical ventilation greater than 48 h, 1 of which (4%) was diagnosed with bacterial pneumonia, 2 of whom (7%) died. One patient required laparotomy with gastric ulcer ligation for a Gastrointestinal (GI) bleed and remained intubated for open abdomen management. One patient required multiple laparotomies and bowel resections for GI bleed and died from multi-system organ failure. One patient required a decompressive craniotomy after massive trauma and care was withdrawn due to neurologic function. Mean ventilator days were 1.4 (standard deviation ± 4.1) days in this group, given that there were two patients who required mechanical ventilation for two days, given extensive traumatic injuries unrelated to COVID-19 infection.

Table 1: Postoperative outcomes in asymptomatic COVID-19 patients undergoing emergent and urgent surgery.

Postoperative Outcomes	N (%)
Unplanned Reintubation	0 (0%)
Mechanical Ventilation >48 hours	3 (11%)
Culture- Positive Pneumonia	1 (4%)
Mortality	2 (7%)
MACE	0 (0%)
Deep Vein Thrombosis	1 (4%)
Pulmonary Embolism	1 (4%)
Hospital Length of Stay # days (± Standard deviation)	14.3 (± 21.2)
Intensive Care Unit Length of Stay # days (± standard deviation)	2.0 (± 4.3)

Table 2: Preoperative variables, continuous variables reported as mean (± standard deviation) and categorical variables are listed as incidence (%).

Preoperative characteristics	Number of Patients (% Patients)
Age	40.9 (± 16.4)
% Male	21 (78%)
Leukocytosis	13 (48%)
(WBC>11)	
Hemoglobin <10	4 (15%)
Thrombocytopenia	5 (19%)
Platelet count <150	
Blood Urea Nitrogen >23	4 (15%)
Creatinine >1.2	3 (11%)
Treated with Anticoagulation	8 (30%)
Sepsis Diagnosed	2 (7%)
Case Designated Emergent	14 (52%)
Trauma Activation	12 (44%)
Intubated	8 (30%)

Discussion

The data from this study suggests that asymptomatic COVID-19 positive patients requiring urgent and emergent surgery may be safe to undergo surgical procedures during their COVID-19 infection. Our results demonstrated a low postoperative mortality and pulmonary complication rate in asymptomatic patients regardless of whether they underwent urgent or emergent surgery. Limited studies have focused on outcomes in COVID-19 positive surgery patients, with the primary data originating from the COVIDSurg Collaborative [4].

Our overall observed 30-day mortality rate for asymptomatic COVID-19 positive patients undergoing surgery was 5.0% (1 of 20 patients), compared with 22.4% (32 of 143 patients) reported by the COVIDSurg Collaborative for the time period January 1st through March 31st, 2020 spanning patients across 24 countries [4]. While others such as Doglietto et al. [5] have compared outcomes of COVID-19 positive patients undergoing surgery to historical matched controls, these analyses do not include patient stratification by symptomology or urgent *vs.* emergent classification. Therefore, it is difficult to compare mortality rates across the literature given the variability in patient population and time periods described, as well as the disparate parameters used for comparison. To our knowledge, the related literature does not compare patients within the asymptomatic cohort based on urgent versus emergent surgery status.

Table 3: Asymptomatic COVID-19 + grouped by surgical specialty and stratified by operative procedure.

Operative Procedure	Emergent	Urgent	Trauma Activation
Orthopedic Surgery			
ORIF Femur	X		Yes
ORIF Tibia Fibula	X		
ORIF Femur			Yes
ORIF Elbow			Yes
Insertion Intramedullary Rod Tibia		X	
ORIF Femur		X	
Neurosurgery			
Lumbar Laminectomy		X	
Craniotomy*		X	Yes
Craniotomy*	X		Yes
Craniotomy and Hematoma Evacuation*	X		
General Surgery			
Diagnostic Laparoscopy	X		Yes
Diagnostic Laparoscopy	X		
Incision & Drainage Lower Extremity*	X		Yes
Exploratory Laparotomy, Flexible Sigmoidoscopy*			Yes
Wound Debridement		X	
Incision & Drainage Rectal Abscess		X	
Exploratory Laparotomy	X		Yes
Scrotum Exploration			Yes
Diagnostic Laparoscopy*	X		Yes
Laparotomy*	X		
Exploratory Laparotomy	X		
Exploratory Laparotomy*	X		
Exploratory Laparotomy	X		Yes
Incision and Drainage	X		
Podiatry			
Exostectomy Foot		X	
Exostectomy Foot		X	
Incision and Drainage Lower Extremity		X	
Otolaryngology			
ORIF Mandible		X	
Vascular Surgery			
Incision & Drainage Lower Extremity*	X		Yes
Obstetrics and Gynecology			
Laparoscopic Salpingo	X		
Oophorectomy			

*Intubated prior to surgery

Regarding pulmonary complications, our study looked specifically at patients who developed culture-positive pneumonia, required mechanical ventilation for over 48 h, number of days on the ventilator, and whether patients underwent unplanned reintubation to determine pulmonary complication rates. Three asymptomatic patients developed pulmonary complications according to these criteria, though these complications were unrelated to their COVID-19 infection, but rather the severity of their underlying injury, two of which were secondary to traumatic injuries and one of which

was secondary to massive gastrointestinal bleed with subsequent hemorrhagic shock. The COVIDSurg Collaborative study reported pulmonary complications in 43.5% (60 of 138) of asymptomatic COVID-19 positive patients [4]. Again, we were unable to compare pulmonary complications in the asymptomatic urgent *vs.* emergent groups across the literature, as the previous studies did not stratify their outcomes based on urgent versus emergent classification as we have done in our analysis.

There is no consensus as of yet in the literature as to why patients present with varying degrees of respiratory distress or other known symptoms of COVID-19. The correlation of symptomatology and viral load remains disputed in the published literature, with some suggesting that lower viral load is associated with less severe clinical symptoms, though this has been refuted with evidence that asymptomatic patients have higher viral loads of SARS-CoV-2 [6,7]. Regardless, this observational data alerts us to one important way in which we might evaluate patients preoperatively, given that asymptomatic status may be associated with a low rate of adverse events, indistinctive of the type and urgency of the operative procedure.

In regards to additional postoperative outcomes for asymptomatic patients, we are able to draw limited comparisons to other studies as the majority of outcomes data is not disaggregated by initial presentation or urgency of operation. While the COVIDSurg Collaboration reports mortality and pulmonary complication rates for asymptomatic patients, outcomes such as ICU length of stay and hospital length of stay are not similarly delineated according to initial presentation. Doglietto et al. [5] reports a mean ICU length of stay for COVID-19 positive patients of 0.90 mean (2.89 standard deviation), in comparison to our observed mean of 0.90 (2.1) days for asymptomatic patients. Hospital length of stay for COVID-19 positive patients in Doglietto et al. [5] was 13.34 (7.63), compared to 10.0 (10.4) for our asymptomatic patients. This range among studies can of course be partially explained by the significant difference in sample size.

While it is widely agreed upon that COVID-19 patients' comorbidities such as diabetes mellitus and hypertension play a significant role in mortality and complication rates [8,9]. We sought to examine adverse outcomes among asymptomatic patients in order to determine whether it may be safe for this group to undergo urgent, though not emergent surgery. Our data provides evidence that evaluation of initial symptomatology is a useful marker in determining which COVID-19 positive patients are at low risk for pulmonary complications and mortality after operative intervention. Furthermore, this initial evaluation can aid in selecting patients who may be safe to undergo urgent surgeries sooner, thereby possibly preventing disease-related adverse events that may arise as a result of delayed operative intervention.

Our study has several limitations. First, this is a single institution descriptive study with a small sample population. Unfortunately, our study is underpowered to detect statistically significant differences. Therefore, our experience may not be generalizable to a larger population or other institutions and our conclusions must be evaluated in this light. Second, our study is unable to evaluate the effect toward surgeons, anesthesiologists, and other operative staff when operating on COVID-19 positive patients. This is an important factor to consider when creating clinical guidelines, and our study cannot comment on this aspect of these patients' care. Lastly, our analysis consists of a heterogenous group of surgical patients including General, Vascular, Orthopedic Surgery, and Podiatry. These specialties often treat patients with different comorbidities and differing surgical risk factors; therefore, our analysis may be affected by compiling these different surgery types into a single cohort.

Conclusion

Patients' morbidity and mortality was more consistent with their underlying clinical presentation and associated surgical procedure than their asymptomatic COVID-19 status. This study suggests it may be safe to proceed with urgent surgery if clinically necessary. We do, however, encourage surgeons to continue to follow currently available guidelines from their respective institutions when making decisions to operate on these patients.

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