January 2021

30-Day Mortality and Cardiopulmonary Complication Rates in Patients Undergoing Emergency Surgery with Perioperative SARS-CoV-2 Infection

Akshay Sood MD
Henry Ford Health System

Nicholas Corsi
Wayne State University, fv9108@wayne.edu

Mohit Butaney MD
Mayo Clinic

Jacob Keeley MS
Henry Ford Health System

Chandler Bronkema
Wayne State University

See next page for additional authors

Authors

Akshay Sood MD, Nicholas Corsi, Mohit Butaney MD, Jacob Keeley MS, Chandler Bronkema, Ziad Affas MD, Guillaume Farah, Michael Chien, Renee Hanna, Stephen Wertheimer, Steven Chang MD, Amarnath Rambhatla MD, Hans Stricker MD, James Peabody MD, Mani Menon MD, Craig Rogers MD, Nikola Rakic, and Firas Abdollah MD

30-Day Mortality and Cardiopulmonary Complication Rates in Patients Undergoing Emergency Surgery with Perioperative SARS-CoV-2 Infection

Akshay Sood MD[1], Nicholas Corsi[1,2], Mohit Butaney MD[3], Jacob Keeley MS[1], Chandler Bronkema[1,2], Nikola Rakic[1,2], Ziad Affas MD[1], Guillaume Farah[1,2], Michael Chien[1,2], Renee Hanna[2], Stephen Wertheimer[1,2], Steven Chang MD[1], Amarnath Rambhatla MD[1], Hans Stricker MD[1], James Peabody MD[1], Mani Menon MD[1], Craig Rogers MD[1], Firas Abdollah MD[1]

[1] Vattikuti Urology Institute, Henry Ford Health System, Detroit, MI; [2] Wayne State University School of Medicine, Detroit, MI

[3] Department of Urology, Mayo Clinic, Rochester, MN

INTRODUCTION

- In March 2020, all hospitals in the state of Michigan were ordered to suspend non-essential surgical procedures[1]
- There are limited data[2,3] regarding the combined impact of COVID-19 surgical intervention on patient outcomes in whom surgery cannot be postponed
- This study sought to answer the question: are patients undergoing an emergency surgical intervention who have SARS-CoV-2 infection or acquire it during the post-operative period at increased risk for mortality compared to COVID-19 positive counterparts?

METHODS

Data Source, Study Population, Study Period

Retrospective review of adult patients diagnosed at Henry Ford Hospital between March and May 2020. COVID-19 patients stratified into two groups: emergency surgery (n=133) vs. not (n=7,948). Control and intervention arms were constructed (Figure 1). Controls matched to patients utilizing a 1:6 propensity score matching, based on age, race, body mass index, and postal code (proxy for socioeconomic status)

Covariates

Clinical parameters were noted: age at diagnosis, race, gender, BMI, comorbidities, history of organ transplant, and diagnosis of active cancer. Additionally, details on whether the COVID-19 diagnosis was clinical or a laboratory test (>95% patients had lab test proven SARS-CoV-2 infection)

Endpoints

The primary outcome of interest in our study was 30-day mortality.
Secondary outcomes: cardiac and pulmonary complications
Given limited sample size, composite endpoints for complications were developed. These included hypoxic respiratory failure, acute respiratory distress syndrome, and new-onset arrythmia, among others

Statistical Analysis

Descriptive statistics of categorical variables focused on frequencies and proportions. Chi-Square and Mann-Whitney U tests were used to compare proportions. Covariates were tested for interactions. Multivariable logistic regression analyses were used to test the association between covariates and odds of mortality.

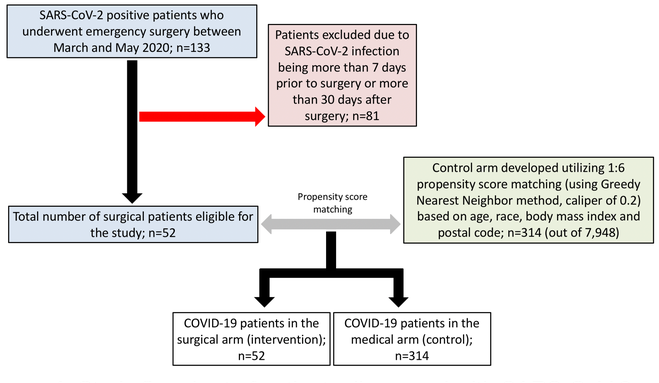
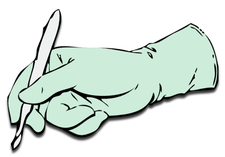


Figure 1: Study flowchart of patients diagnosed with SARS-CoV-2 infection that underwent emergent surgical intervention (n=52) versus not (n=314) at a single tertiary-care institute, March-May 2020.



Emergency surgery vs. Medical-control

Key Point: Based on our single center retrospective study, we demonstrate that patients undergoing emergency surgery with a co-diagnosis of COVID-19 in the perioperative period **do not** have an **increased risk** for **short term mortality** compared to medically treated COVID-19 patients.

RESULTS

- There were no differences in 30-day mortality rate or in the rate of cardiac and pulmonary complications among patients undergoing emergency surgery versus not – a significant proportion of patients were of Black race (surgical arm: 38.5% vs. control 54.1%, p=0.072) and female gender in either of the study groups.
- The 30-day mortality rate was 17.3% in COVID-19 positive patients who had surgery compared to 13.1% in those who did not (p=0.408) (**Table 1**)
- Patient age and made gender were associated with an increased odds for 30-day mortality (OR 1.07, p<0.001 and OR 2.57, p=0.007) and cardiac (OR 1.05, p=0.001 and OR 2.53, p=0.002)
- Charleston Comorbidity Index and race did not have an impact on 30-day mortality or cardiopulmonary complications in COVID-19 positive patients (**Table 2**)

Table 1: Univariable outcomes in patients diagnosed with COVID-19 infection that underwent emergent surgical intervention (n=52) versus not (n=314) at a single tertiary-care institution, March-May 2020

	Overall	Patients with COVID-19 n=314	Patients with COVID-19 who needed a surgical intervention n=52	p
Death, n (%)				
No	316 (86.34)	273 (86.94)	43 (82.69)	0.408
Yes	50 (13.66)	41 (13.06)	9 (17.31)	
Cardiac Complications (arrythmia or cardiac arrest or pressor support), n (%)				
No	291 (79.51)	254 (80.89)	37 (71.15)	0.107
Yes	75 (20.49)	60 (19.11)	15 (28.85)	
Pulmonary Complications (hypoxic respiratory failure or ARDS or PE/DVT or mechanical ventilation), n (%)				
No	182 (49.73)	159 (50.64)	23 (44.23)	0.392
Yes	184 (50.27)	155 (49.36)	29 (55.77)	

LEGEND: ARDS: acute respiratory distress syndrome, PE/DVT: pulmonary embolism/deep vein thrombosis

Table 2: Multivariable adjusted outcomes in patients diagnosed with COVID-19 infection that underwent emergent surgical intervention (n=52) versus not (n=314) at a single tertiary-care institution, March-May 2020

	Mortality			Cardiac complications*			Pulmonary complications**		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Surgery (ref: No surgery)									
Yes	1.39	0.57 - 3.36	0.463	1.79	0.85 - 3.76	0.121	1.62	0.81 - 3.20	0.165
Age (ref: 1 year age increments)									
Age	1.07	1.03 - 1.10	<.001	1.05	1.02 - 1.07	0.001	1.05	1.03 - 1.07	<.001
Body Mass Index (ref: 1 unit of kg/m2 increments)									
BMI	0.98	0.93 - 1.03	0.508	1.03	1.01 - 1.07	0.033	1.04	1.00 - 1.06	0.014
Charlson Comorbidity Index (ref: CCI 0)									
CCI 1	0.41	0.13 - 1.24	0.117	0.90	0.33 - 2.45	0.847	0.98	0.47 - 2.04	0.966
CCI 2	0.39	0.12 - 1.20	0.103	0.70	0.25 - 1.98	0.508	0.72	0.33 - 1.55	0.411
CCI 3+	0.53	0.18 - 1.54	0.247	1.56	0.59 - 4.11	0.364	0.97	0.45 - 2.11	0.949
Gender (ref: Female)									
Male	2.57	1.28 - 5.16	0.007	2.53	1.41 - 4.55	0.002	1.76	1.11 - 2.79	0.015
Race (ref: Whites)									
Blacks	1.05	0.53 - 2.08	0.874	0.92	0.51 - 1.64	0.788	1.01	0.63 - 1.63	0.940
Others	2.52	0.45 - 13.96	0.289	2.93	0.77 - 11.12	0.114	1.99	0.68 - 5.77	0.205

LEGEND: *Cardiac complications composite: new-onset arrythmia, cardiac arrest and/or use of vasopressors, **Pulmonary complications composite: hypoxic respiratory failure, acute respiratory distress syndrome, pulmonary embolism/deep vein thrombosis and/or use of mechanical ventilation, Ref: reference, BMI: body mass index, CCI: Charlson comorbidity index, OR: Odds ratio, CI: Confidence interval

CONCLUSION

- Our findings strengthen the existing literature, these results are in-line with the COVIDSurg Collaborative Study – a large observational study of perioperative SARS-CoV-2 infection that reported 30-day mortality rate of 23.8%[4]
- Similarity, another study that reported on 34 patients in Wuhan, China, at the origin of the pandemic, noted a mortality rate of 20.5% who were unintentionally scheduled for elective surgery[5]
  - However, both of these studies were limited by lack of a control group
- Our study identifies the same risk factors for increased mortality and cardiopulmonary that have been recognized[2,3]
  - However, our study has several limitations, as it is a retrospective cohort at a single tertiary-care center in an inner-city neighborhood that had a significant number of COVID-19 cases, thus limiting generalizability
  - We tried to minimize confounding bias and increase the applicability to a more general SARS-CoV-2 infected population by using a multivariable adjusted analyses
  - Second, the follow-up period is limited to 30-days
- The importance of this study is that an emergency intervention does not portend a poorer prognosis among patients with a confirmed SARS-CoV-2 infection

REFERENCES

1. Governor Whitmer Orders Temporary Restrictions on Non-Essential Medical and Dental Procedures. https://www.michigan.gov/whitmer/0,9309,7-387-90499_90640- 522455--,00.html 2020].
2. Collaborative CO. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. Lancet 2020;396(10243): 27-38.
3. Doglietto F, Vezzoli M, *et al.*. Factors Associated With Surgical Mortality and Complications Among Patients With and Without Coronavirus Disease 2019 (COVID-19) in Italy. JAMA Surg 2020.
4. Collaborative CO. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. Lancet 2020;396(10243): 27-38
5. Lei S, Jiang F, *et al.* Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. EClinicalMedicine 2020;21: 100331.

ACKNOWLEDGEMENTS

- This research was supported and funded by the Office of Medical Student Research and 2020 Medical Student Research Fellowship (MSRF).