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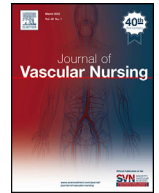
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Review of Article: Lal, B.K. et al. Periprocedural complications in patients with SARS-CoV-2 infection compared to those without infection: A nationwide propensity matched analysis. *American Journal of Surgery*. 2021; 222(2):431-437.

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Introduction

The COVID-19 pandemic has caused major disruption to access and acquisition of healthcare services, including surgical procedures.¹ Many have reported an increase in pulmonary complications and mortality in the perioperative period in COVID-19 positive patients^{2,3} with a particular increase in vascular and thromboembolic complications affecting younger individuals who have fewer comorbidities compared to pre-pandemic rates of complications.^{4–8} Current guidelines developed out of the United Kingdom recommend those who have had mild or asymptomatic COVID-19 infections wait at least seven weeks for elective surgery.⁹

Increased mortality and pulmonary complications in the perioperative period following surgery has been attributed, in part, to COVID-19 associated coagulopathy. Hypercoagulation, vascular injury, and inflammation from humoral and cellular pathways all contribute to increased risk of venous and arterial thromboembolism and have been widely reported in the literature.^{6,10} This raises particular concerns for patients with vascular disease, who are already considered to be in a hypercoagulable state.¹¹

The COVIDSurg Collaboration recently completed an analysis to project the impact of Omicron surges on elective surgery capacity over the next three months, estimating a potential decrease of approximately 15.3% capacity.¹² As we enter the winter months in the Northern Hemisphere with the new Omicron variant, and with many Americans still unvaccinated, we need to better understand the outcomes, timing, and risk for elective surgery so that we might prioritize care using robust evidence to provide equitable and ethical healthcare. The following study is the first to match COVID-19 positive with negative cases controlling for demographics, premorbid risk factors, procedure type, and procedure urgency. This design allows for a more accurate comparison of outcomes in those with and without COVID-19 infection than unmatched studies.

Article Summary

To determine risk of surgery after COVID-19 infection, elucidate optimal delay in surgery post infection, and understand postoperative outcomes, a nation-wide, prospective, propensity matched trial was conducted comparing a cohort of COVID-19 positive and COVID-19 negative patients undergoing the same procedure with the same level of urgency.

Participants

Data was collected between March 1st 2020 and August 15th 2020. During this time, 78,972 patients underwent 93,031 procedures. Of these, there were 51,238 patients who never tested positive for COVID-19 and 449 with a history of COVID-19 infection. After matching the final sample included in the analysis was $n = 432$ patients who had COVID-19 infection any time prior to surgery and a propensity score matched group of COVID-19 negative patients ($n = 1,256$).

Data Collection

The study was conducted across 170 Veterans Health Administration (VHA) hospitals in the United States. The VA Informatics and Computing Infrastructure (VINCI) database and electronic health record (Computerized Patient Record System, CPRS) were used to extract the data. Data extraction included: patient age, race, ethnicity, body mass index, American Society of Anesthesiologists physical status classification, Charlson Comorbidity Index (CCI) derived from International Classification of Disease (ICD-10) codes from the two years pre-surgery, Current Procedural Terminology (CPT) codes, case urgency (emergent, urgent, elective), and anesthesia used (general or other), and procedure type.

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Results

Patients who had previously had COVID-19 had a significantly longer median length of stay (7 vs. 5 days, $p < 0.001$), higher 30-day rates of pneumonia (20.6% vs. 6.0%, $p < 0.001$), higher rates of postoperative mechanical ventilation (7.6% vs. 4.1%, $p < 0.01$), higher rates of acute respiratory distress syndrome (ARDS) (17.1% vs. 6.8%, $p < 0.001$), higher rates of ischemic stroke (5.8% vs. 2.9%, $p < 0.01$), and higher rates of septic shock (13.7% vs. 6.8%, $p < 0.001$).

Rates of pulmonary embolism were similar. Myocardial infarction was higher among those with prior COVID-19 infection, but the difference was not statistically significant (4.6% vs. 2.7%, $p < 0.07$). Mortality, reoperations, and readmission were not different between those with and without prior COVID-19 infection.

Risk and Timing of Surgery

In the COVID-19 positive group, $n=70$ patients (16.2%) were diagnosed within ten days prior to surgery, $n=96$ (22.2%) were diagnosed between 11 and 30 days, and $n=266$ (61.1%) were diagnosed between 30 and 150 days prior to surgery. The greatest odds of pneumonia and septic shock were experienced in those diagnosed in the ten days prior to surgery, however, even after 30 days, higher odds of pneumonia, ARDS, and septic shock persisted after having a positive test compared to not having had COVID-19. Odds of requiring mechanical ventilation and risk of ischemic stroke persisted even at 30 days post diagnosis.

Limitations

Although propensity matching may control for a number of variables, there are still differences between the two groups that were not controlled for. Additionally, the VA population is mostly older men with more comorbidities than the general population.

The authors conclude that delaying elective surgery for 30 days or more, especially for those with pre-existing pulmonary and atherosclerotic disease, may be beneficial in reducing postoperative complications. Careful evaluation of patients with atherosclerosis should be given since COVID-19 infection has been implicated in destabilization of plaque, increased hypercoagulability, and increased inflammation.

Reviewer Comments

This study provides a valuable comparison of a propensity matched control group vs. COVID-19 positive group. Patients with COVID-19 may require more emergent surgery under worse conditions than a pre-pandemic control, and thus controlling for the type and urgency as well as using patients from the same time-frame, all contributes to the strength of this evidence. This study was conducted early in the pandemic. New variants may give rise to different findings. Given that the apparent lethality of the Omicron variant is, currently, thought to be less than the Delta variant, and that this study demonstrated an increase in non-mortality outcomes such as ventilation, ARDS, stroke, pneumonia, and septic shock, it is vital that we understand the impact of new variants on outcomes beyond the mortality rate.

Consistent with this study, the COVIDSurg Collaborative, which investigated complications and mortality following emergent and elective surgeries in patients with perioperative COVID-19 infection, found that half of patients had pulmonary complications ($n=577$). In contrast to this study, however, the COVIDSurg Collaborative study found the 30-day mortality was 23.8% ($n=268$) compared to 3.5% in this study (3.5% in COVID-19 positive and

2.2% in COVID-19 negative, $p=0.22$). Some contributing factors for this stark contrast are 1) the timing of infection and 2) the inclusion of emergent and elective procedures. Patients in the COVIDSurg Collaborative study had perioperative infection, meaning they could have had a positive test 7 days prior to surgery or during the 30-day period. Second, in the COVIDSurg Collaborative study, only about a quarter of the surgeries were elective, though the elective surgery and minor surgery mortality rates were still 18.9% and 16.3%, respectively (vs. 25.6% in emergency procedures and 26.9% in major surgery procedures).² Thus, it was particularly important to analyze patients who were at various stages of recovery or were post recovery.

Many questions about COVID-19 remain. This study took place in 2020 before anyone was vaccinated. Do these findings apply to vaccinated individuals with breakthrough infections? Are individuals with post-acute COVID syndrome (aka Long COVID) at elevated or persistent risk of complications in surgery? It is estimated that approximately 13% of patients with COVID-19 will experience post-acute COVID syndrome, yet few guidelines address care for this subpopulation of people affected by COVID-19.¹³ Do new variants carry the same risk? An updated study is needed to address these questions.

Nursing Implications

The results of this study support preprocedural screening for COVID-19 infection and delayed elective surgery for patients with COVID-19 of at least 30 days. Shared decision making and patient education related to increased risk of complications from COVID-19 infection should be central aspects of planning elective surgery. Future studies might investigate the effects of adjunctive therapies such as pre-habilitation, postoperative rehabilitation, supervised exercise therapy, ongoing venous thromboembolism prevention, and/or enhanced postoperative monitoring, particularly for patients with atherosclerosis and vascular disease who are likely eligible for exercise programs and at higher risk of complication. In the case of individuals with PAD, ensuring that patients are first offered supervised exercise therapy, before surgery or endovascular procedures, may be of greater importance now than pre-pandemic.

Declaration of Competing Interest

The author declares that there is no conflict of interest.

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