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Original Research Article

Routine pre-operative Covid testing in elective surgeries: Is it worth it?

Jessica K. Liu, Paula A. Porras, Danielle M. Hari, Kathryn T. Chen*

Department of Surgery, Harbor-UCLA Medical Center, 1000 W. Carson Street, Torrance, CA, 90502, United States

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ABSTRACT

Background: Pre-procedural COVID-19 testing in patients scheduled for elective cases have become routine to reduce the risk of COVID-19 exposure and pulmonary complications related to perioperative COVID-19 infection, and to use the specific hospital resources among other reasons. This study evaluates the efficacy of universal COVID-19 testing for elective procedures.

Methods: Single institution retrospective observational study from July 2020 through August 2021.

Results: There were a total of 499 unique patients who were scheduled for 581 surgeries or procedures. A total of 569 anterior nares reverse transcriptase polymerase chain reaction (RT-PCR) tests were completed before scheduled procedure. There were 2 (0.35%) positive COVID tests, both of whom were asymptomatic and unvaccinated at time of testing, and 13 (2.2%) cancelled cases overall. The total cost for labor and materials during this period was $19,738, with each RT-PCR test costing $34.69 and each true positive test costing $9,869.

Conclusions: Given the low COVID-19 positivity in the elective procedural patient population, testing protocols for elective procedures should be re-evaluated as the pandemic evolves.

1. Introduction

The spread of coronavirus disease 2019 (COVID-19) leading to a global health crisis has led to major disruptions in performing surgeries and other procedures requiring anesthesia. Non-urgent cases were cancelled in the early months of the pandemic that began in March 2020, as hospitals were overwhelmed with the influx of patients needing critical care for COVID-19. However, as case counts began trending down, hospitals prepared for reopening of operating rooms for elective surgical procedures, which included protocols for COVID testing in the preoperative setting. Preoperative and preprocedural COVID-19 testing in patients scheduled for elective cases have since become routine.

Universal testing was initially implemented with the intention of minimizing risk of spread of COVID-19 to healthcare workers and other patients, as well as reducing risk of respiratory complications post-operatively from perioperative COVID-19 infection. This was particularly key prior to the availability of vaccinations and the different variants that have since emerged. Additionally, early in the pandemic, personal protective equipment (PPE) supplies were limited along with resources to isolate patients in negative pressure rooms and decontaminate rooms previously occupied by COVID positive patients. Whether universal pre-procedural testing is effective by itself in reducing risk of COVID-19 spread is controversial, with some arguing that protocols should focus on implementation of appropriate PPE. COVID testing typically occurs days prior to surgery, utilizing a reverse transcriptase polymerase chain reaction (RT-PCR) nucleic acid amplification test (NAAT) that identifies genetic material present in COVID-19. This is widely considered the most sensitive test. With an estimated incubation period of 2–11 days and median of 5.1 days and up to 11.7 days, it is likely that preprocedureal testing that occurs days prior to surgery may miss COVID-19 infections. The link between preprocedural COVID-19 testing and reduced COVID-19 exposure in the healthcare setting when patients are screened for symptoms is lacking.

While protocols have been implemented to mitigate exposure and spread of COVID-19 to ultimately reduce the pandemic’s burden on the healthcare system, these protocols have contributed to disruption in surgical care. Pre-procedural COVID-19 testing has required reallocation of healthcare resources in a system already strained by the effects of the pandemic. Additionally, even if pre-operative testing is completed by patients, isolating in the days between testing and surgery is not always feasible for patients. As the pandemic continues to evolve and our institution addresses the backlog of surgical cases, it is even more important to understand the results of COVID-19 testing in order to move forward with a practical and effective strategy for mitigating risk of COVID exposure. Our goal with this study was to evaluate the impact of universal COVID-19 testing for elective procedures and its cost to the institution.

* Corresponding author. Department of Surgery Harbor-UCLA Medical Center, 1000 W. Carson Street, Bldg 1 E Torrance, CA, 90502, United States.
E-mail address: kchen6@dhs.lacounty.gov (K.T. Chen).

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2. Methods

This is a single center retrospective observational study of adults undergoing an elective surgery or procedure from July 2020 to August 2021 at an urban county hospital. The cohort included general surgery and surgical oncology patients who were evaluated at a single surgery clinic and subsequently scheduled for an elective surgery or procedure. Clinical data were obtained from review of electronic medical records. Demographics and clinical data were collected, which included age, sex, history of COVID positivity (asymptomatic or symptomatic), type of vaccine received (none, Pfizer–BioNTech-Comirnaty, Moderna-mRNA-1273, or Janssen-Ad26.COV2.S (Johnson & Johnson)), days from COVID test to surgery or procedure, result of COVID test, whether a surgery or procedure was cancelled, and reason for cancellation.

In line with our institutional COVID pre-procedural protocol, patients who were scheduled for an elective procedure were subsequently scheduled for a pre-procedural COVID test conducted in one of the outpatient clinics prior to surgery date. If patients reported symptoms at any point between scheduling and testing, surgery was cancelled with plans to reschedule at later time once patients recovered from symptoms. Cancelled patients were placed on a surgery queue, which was regularly reviewed to determine when patients could be rescheduled. Particularly, patients undergoing surgery or procedures for a cancer diagnosis were rescheduled for surgery within 4 weeks. However, if patients passed COVID-19 symptom screening (Fig. 1) then patients would proceed with a nursing visit at which point either an anterior nares or a nasopharyngeal RT-PCR swab was performed. Patients were then required to self-isolate until their surgery date. Patients who were fully recovered from COVID infection within last 90 days were not required to obtain a pre-procedural test since viral RNA have been found to be persistently detected by RT-PCR for weeks after SARS-CoV-2 infection.6,7

SPSS V24 (IBM Corp, Armonk, New York) was used to calculate descriptive data. Cost of individual tests and testing supplies, labor costs for obtaining COVID test, and courier and lab costs for running tests were obtained from the institution’s microbiology department. The Institutional Review Board of Lundquist Institute at Harbor-UCLA Medical Center approved this study and waived the need for informed consent as the study did not meet criteria of human subject research.

3. Results

There were 499 unique patients who were scheduled for 581 surgeries or procedures. Some had multiple procedures over the study period, and therefore underwent multiple COVID tests (range = 1–4). The surgeries and procedures performed varied with breast (32%) and laparoscopic/robotic gastrointestinal, hepatobiliary, and endocrine (25%) surgeries as the most common (Fig. 2). Mean age when considering all 581 surgeries and procedures performed was 51±12.7 years (range = 12–81) with 399 (68.7%) females. At the time of surgery or procedure, 214 (36.8%) patients were fully vaccinated, defined as being two weeks from receiving two doses of the Pfizer–BioNTech-Comirnaty or Moderna-mRNA-1273 vaccines or one dose of the Janssen-Ad26.COV2.S vaccine. At the time of the study, booster vaccines for COVID-19 were not available.

A total of 569 either anterior nares or nasopharyngeal RT-PCR tests were completed before the scheduled procedure on the day of or up to 8 days prior (median = 4.3±1.4). There were 2 (0.35%) positive COVID tests, both of whom were asymptomatic and unvaccinated at time of testing. Overall, there were 13 (2.0%) cases cancelled for various reasons. Patients whose cases were cancelled were due to testing positive for COVID from pre-procedural RT-PCR testing (n = 2), reporting symptoms after pre-procedural testing was performed (n = 3), having concerns about COVID exposure (n = 5), missing their testing appointment (n = 2), or being unable to self-isolate (n = 1) (Fig. 3). There were 4 patients who bypassed pre-procedural testing due having a positive COVID test within 90 days (Fig. 3). These patients were still screened for symptoms and waited at least 4 weeks from the time at which they tested positive for COVID-19.

The total cost for labor and materials during this period came out to $19,738, with each RT-PCR test costing $34.69 and each true positive test costing $9,869 (Fig. 4).

4. Discussion

Overall COVID-19 positivity in an elective procedural patient population was low throughout the study period, which included 6 months prior to vaccine availability and during the Delta (B.1.617.2) variant surge in late summer of 2021. The low positivity rate is hypothesized to be due to several contributors. Patients are screened for symptoms of and exposure to COVID-19 prior to pre-procedural testing appointment. Pre-symptom screening that starts well before patient admission and is continued in the hospital setting on top of RT-PCR followed with a 14-

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**Initial Infectious Screening**
1. Fever, chills, or malaise? Yes or No
2. Cough, shortness of breath, or sore throat? Yes or No

**Initial Infectious Screening Grid**
3. Congestion or runny nose? Yes or No
4. Nausea, vomiting, or diarrhea? Yes or No
5. New loss of taste or smell? Yes or No
6. Muscle pain? Yes or No
7. Headache? Yes or No
8. Positive COVID test in the past 14 days? Yes or No
9. Exposure to someone with COVID in past 14 days? Yes or No

**Symptoms of influenza?** Yes or No
Mask applied? Yes or Yes
Has the patient been fully vaccinated for Covid-19? Yes or No
Concerning travel history? Yes or No
Suspected disease contact? Yes or No
Symptoms of disease of interest? Yes or No

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*Fig. 1. Nursing intake COVID-19 symptom screening questionnaire.*
day isolation period has been recommended as an effective strategy to reduce risk of infection. Additionally, over a third of patients were vaccinated in the second half of the study period likely contributing to lower rates of COVID-19 positivity. Vaccination against SARS-CoV-2 is highly effective in reducing the number of new COVID-19 cases, either asymptomatic or symptomatic. However, asymptomatic carriers can still transmit SARS-CoV-2, which is a major impetus for continuing universal pre-procedural testing. Contact tracing of asymptomatic individuals who test positive for COVID-19 have demonstrated that asymptomatic patients can transmit infection to other individuals and also develop chest computed tomography (CT) abnormalities.

Cancellations occurred for several other reasons in this cohort. Patients who reported symptoms between pre-procedural testing and time of surgery were cancelled. While RT-PCR tests have been key in restarting and continuing elective surgeries through the pandemic, accuracy of the test, with a false negative rate of 2–29%, poses a diagnostic challenge. The largest proportion of patients who self-cancelled (8.8%) were those who had concerns about exposure to COVID while in the hospital for their elective procedures. The risk of exposure in context of current community spread and hospital case counts, and measures taken for risk reduction, such as symptom screening prior to admission and donning of appropriate PPE, are discussed with patients when proceeding with non-urgent cases. Despite appropriate precaution, it is still possible for COVID-19 to spread in the hospital setting particularly when community spread is high, and contracting COVID-19 in the perioperative setting can potentially lead to high morbidity and mortality.

### Cost Breakdown of Individual RT-PCR COVID-19 Test

| Component            | Cost   |
|----------------------|--------|
| Aptima® SARS-CoV-2 Assay | $26.00 |
| Clinical Lab Scientist Labor | $4.06 |
| Consumables          | $4.23  |
| Lab Assistant Labor  | $0.40  |
| Cost per test        | $34.69 |

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Fig. 2. Frequency of surgery and procedure types performed in cohort.

Fig. 3. Preprocedural COVID-19 testing results and subsequent cancellations.

Fig. 4. Cost breakdown of individual RT-PCR COVID-19 test.
who were unable to self-isolate or missed their testing appointment. At our institution, preoperative testing required a separate visit to the medical campus from their visits with the surgeon and anesthesiology. Our hospital serves uninsured and under-insured county patients, often with limited financial services. Requiring a separate visit for testing presents a challenge to many of our patients who rely on public transit and require time off from work to make their appointments. Additionally, the protocol of isolating after testing and up until time of surgery is often difficult for our patients who live in larger households or need to ask for additional time off work.

It is unclear whether universal COVID testing is cost-effective or practical for varying reasons. With the low rate of positivity during the study period, each true positive test cost $9,869, not to mention the loss of operating room time. Our study also does not measure the additional facility and staffing costs and indirect costs to patients such as loss of employment income, traveling cost, childcare cost, etc., to obtain COVID-19 testing, which would increase the total of this study’s testing cost. It is also unclear if our patient population also truly self-isolating as requested. In our study, the average number of days between test and surgery or procedure was 4.3 days. If patients continued to work or were not self-isolating for other reasons, this would also decrease the value of pre-operative testing.

The risks of SARS-CoV-2 infection must be seriously considered, as COVID-19 in the perioperative setting has been associated with fatal complications in patients who proceed with surgery, although mortality is primarily reported in symptomatic patients. The unrecognized spread in healthcare setting could lead to healthcare worker exposure that not only puts them at risk for developing serious illness, but also contributes to shortages in frontline workers and further cancellations of elective surgeries. The prevalence of SARS-CoV-2 infection identified on pre-procedural surveillance appears to be low when done in settings with limited community spread. When disease prevalence is low, this also increases the risk of false positives. The nature of the COVID-19 pandemic has made testing strategies uniquely challenging in that the prevalence of the disease has fluctuated drastically. Specifically, the 2020 to 2021 winter surge that affected the region resulted in a reduction in elective cases, and subsequently, less patients were being tested and scheduled for surgery, and more patients were self-cancelling their procedures due to fears of exposure to COVID-19. In our study, the two positive tests occurred in individuals who were presumed asymptomatic carriers of COVID-19 that occurred outside of the 2020 to 2021 winter surge timeframe.

This study has several limitations. This was a single-centered retrospective study with patients from a single surgery clinic. The cost analysis only includes data on testing-related costs. Additional data on cost to the hospital, such as labor and facility costs to run the testing clinic, and indirect costs to the patient were not available. Counter-measure costs from team members being out sick as a result of exposure from COVID positive patients and costs of COVID-related complications after elective surgeries would potentially offer informative context for the current cost analysis. Additionally, the institutional guidelines for this study restrict the usage of same day rapid testing. The pandemic has evolved through the study period with both periods of high and low community transmission. For instance, this study period excludes the most recent Omicron (B.1.1.529) variant outbreak and data on patients who have received their booster vaccines. More patients tested positive for COVID-19 preoperatively with the Omicron variant outbreak in December 2021, leading to a large number of cancellations of scheduled procedures. Evaluating institutions that have eliminated preprocedural testing from their protocols and the impact on patient outcomes may also provide insight into how to move forward with preprocedural testing protocols. It may be that as different variants emerge, policies for COVID testing will need to remain fluid and flexible to maximize benefit and efficacy.

5. Conclusion

Overall COVID-19 positivity from preprocedural RT-PCR testing was low in the time period of July 2020 through August 2021. Given the low positivity rate, we recommend continuing symptom screening prior to testing. Approximate cost per positive COVID-19 test was $9,869. Whether or not universal COVID testing is cost-effective or practical likely depends on a number of different factors, including variant type, patient population, and procedure performed. However, COVID testing appears to continue to be valuable as the risks associated with COVID positivity to both patients and healthcare workers is assumed to be more costly. Further data is needed to understand how newer variants impact anesthesia and surgery risks in patients infected with COVID. As the pandemic continues to evolve, institutional COVID testing protocols for elective procedures should be periodically re-evaluated with the overall benefit of testing to reduce risk of exposure and infection weighed with costs to hospitals as well as patients.

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This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Component | Cost
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Aptima® SARS-CoV-2 Assay | $ 26.00
Clinical Lab Scientist Labor | $ 4.06
Consumables | $ 4.23
Lab Assistant Labor | $ 0.40
Cost per test | $ 34.69

Declaration of competing interest

We have not conflicts of interest to disclose. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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