Since the onset of the Covid-19 pandemic, the practice of medicine has changed dramatically. Patients with non–Covid-19 medical conditions have faced delays in accessing care, and all but the most essential surgical care has been put on pause. In planning for a quick post-surge recovery, we aimed to restore nonurgent but essential surgical care at the University of California, San Francisco to address the accumulating surgical needs of our community, while prioritizing both patient and provider safety. A multidisciplinary team — from the departments of surgery, anesthesiology, hospital epidemiology, and infection control as well as the health system leadership — developed a three-phase protocol to initiate universal preoperative screening and SARS-CoV-2 testing. Together, we overcame challenges in the perioperative culture and sought to foster collaborative decisions between care providers. Within 3 weeks, we were able to return to about 50%–60% of pre–Covid-19 surgery volume.

KEY TAKEAWAYS

» Resuming essential surgical care is important and possible during the Covid-19 pandemic but requires strong teamwork and communication.

» Obtaining SARS-CoV-2 testing on 100% of preoperative patients may be possible, but it will take time as barriers exist, such as proximity of testing site locations to patients. It will likely require integration of non–hospital-based SARS-CoV-2 testing sites.
Clear and consistent communication about the testing protocol and expectations as well as channels for escalating issues is essential. The communication needs to be inclusive of all procedural areas and roles (providers, nurses, technicians, clerks, and learners, among others).

Ensure that critical surgical care is not delayed for SARS-CoV-2 testing.

All team members must be empowered to speak up if they have concern for the patient, themselves, or the team.

Daily review of patients who were delayed surgery because of inability to obtain testing or proceeded without testing is needed to ensure communication was appropriate and to identify areas for improvement.

A lack of consistent communication and transparency in the perioperative setting can lead to significant exposure and risk to a large number of health care workers involved in the many aspects of patient care. This will likely inhibit a hospital’s ability to resume surgical care.

The Challenge

Since the first community-transmission of Covid-19 was identified in the United States on February 26, 2020,1 the medical community has experienced an upheaval like never before. Looking to the experiences abroad, urgent steps were taken to reduce surgical cases and preserve inpatient capacity for a potential surge of Covid-19 patients.2 Many patients in need of nonurgent but essential surgical care were delayed those services. At the University of California, San Francisco (UCSF), we recognized the need to avoid adverse outcomes associated with delaying much-needed cancer, cardiovascular, and musculoskeletal procedures. As the chance of a surge decreased, we looked to increase operating room cases.

The challenge for operating rooms is to achieve greater utilization levels to address both the backlog of cases and to serve new patients requiring surgical care. National bodies, including the federal and local governments and professional societies, have made recommendations and even mandates around when and how to resume non–Covid-19-related surgical care,3,4 attempting to ensure that sufficient hospital capacity is reserved for a second surge of Covid-19 patients while upholding provider and patient safety. The latter largely hinges on testing capacity and protocols but, importantly, the nuances of perioperative testing require adaptive changes that may be dependent on a receptive perioperative culture (Figure 1).
Surgeons have long been stalwart advocates for their patients and, now more than ever, we must navigate a path that carefully weighs benefits with new risks. Indeed, the consequences of performing operations on patients with subclinical Covid-19 infection can be dire, with a mortality rate as high as 20% — far higher than the adverse outcomes seen with other perioperative complications, such as surgical site infections or venous thromboembolism. Taking patients to the operating room with unrecognized Covid-19 infection is associated with an overlay of elevated risk both to the patient and all the health care workers in the operating room, clinic, on the floor, and/or in the intensive care unit. Therefore, rightly so, perioperative providers have prioritized asymptomatic testing of all surgical patients as an essential stipulation for establishing a new norm for surgical care.

"Surgeons have long been stalwart advocates for their patients and, now more than ever, we must navigate a path that carefully weighs benefits with new risks. Indeed, the consequences of performing operations on patients with subclinical Covid-19 infection can be dire, with a mortality rate as high as 20%.”
Despite focused efforts, it may be challenging to test every patient in a fail-safe manner prior to surgery given medical (comorbidities or underlying disease prevents additional travel), and logistical (lack of access to transportation for additional testing visit) barriers that prevent a small minority (1–2 patients per day at most) of patients from completing the recommended testing protocols. Effectiveness of nuanced protocols that must take into consideration both the urgency of the surgery as well as the testing status depend on teamwork, communication, and transparency — qualities we have long strived to develop in the perioperative arena. To address the nuances of testing protocol implementation, the UCSF surgical, anesthesia, nursing, and staffing communities recognized the need to develop and communicate a clear guideline for the testing of all surgical patients for evidence of Covid-19.

The Goal

As we aimed to restore nonurgent but essential surgical care at UCSF to address the accumulating surgical needs of our community, we aimed to prioritize both patient and provider safety by developing an asymptomatic surgical patient testing guideline to identify subclinical Covid-19–infected patients.

The Team

Those involved in this effort were UCSF School of Medicine’s Surgical Department Chairs (Orthopedics, Neurosurgery, Obstetrics and Gynecology, Otolaryngology and Head and Neck Surgery, Urology, Surgery, and Ophthalmology) and the Anesthesiology Department Chair; UCSF Health’s Vice Presidents of Perioperative Services (Surgery and Anesthesia) and Director of Perioperative Nursing; the Medical Director of the Pre-anesthesia Clinic and Medical Director of Hospital Epidemiology and Infection Control; the Chief Clinical Officer; and the Chief Medical Officer for Adult Services. Conversations, guided by evidence, were driven to gain consensus as the path forward.

The Execution

Early in the pandemic, it was recognized by the departments of surgery and anesthesia that guidelines were needed to include universal preoperative testing as a part of the plan to resume essential surgical care at UCSF, and a team was formed. The team first met on March 9, 2020, in preparation for the surge. The group continued to be the steward of all major Covid-19 perioperative decision and determined to implement its SARS-CoV-2 testing procedure for surgical patients in a stepwise manner to account for practical conditions that blocked a full rollout on a single date.

“As Covid-19 pathways and patterns of care are being developed seemingly by the hour and day, our existing systems are vulnerable, because frontline providers are unfamiliar with new guidelines, leading to confusion and miscommunication.”
Three phases were planned in a structured manner and in coordination with the intention of the Governor of California to ease restrictions on essential surgical procedures near the end of April following the peak of the virus in California. In Phase 1 (initiated April 2, during peak levels of Covid-19–positive patients in the hospital), testing for asymptomatic Covid-19 infection was initiated as an urgent protocol for select critical surgical patients, such as those set to undergo solid organ transplant; the plan anticipated that, as testing capacity increased, supply chain was restored, and as concerns for an imminent surge passed, preparations would be made to broaden the asymptomatic patient testing program to include all patients planned to go to the operating room. Based on evolving evidence, the chairs of the surgical departments and the chair of anesthesia together with the health system leadership and hospital epidemiology and infection control developed goals and workflows to support preoperative symptom screening and SARS-CoV-2 testing.

Phase 2 (as restrictions on essential surgery were lifted on April 22 and after our projected Covid-19 peak) was focused on the operating rooms, with Phase 3 intended to expand the program to interventional radiology, endoscopy, electroconvulsive therapy suites, and the catheterization lab. Phases 2 and 3 were separated for two reasons. With the unresolved uncertainties in the supply chain (for reagents and nasal swabs, for example) and that asymptomatic testing for surgical patients would add between 50 and 250 patients (normal daily volumes), we recognized that full implementation had the potential to quickly overwhelm the testing system. In addition, patients undergoing operating room procedures with anesthesia already were screened using a combination of telephone and in-person visits by the pre-anesthesia clinic, and this common preoperative checkpoint served as a natural place to initiate the SARS-CoV-2 testing protocol. Recognizing that the test sensitivity and turnaround time would be critical to success, a symptom screen and test pathway was developed in partnership with the pre-anesthesia clinic for Phase 2 (Figure 2).

**FIGURE 2**

**SARS-CoV-2 Testing Care Pathway for Asymptomatic Surgical Patients**

The symptom screen and test pathway for surgical patients was developed as a partnership between the surgical services and pre-anesthesia testing clinic.

- **Surgical Practice**
  - Alerts patient of need for preoperative SARS-CoV-2 test
  - Schedules operation and pre-anesthesia telephone consult

- **Pre-anesthesia Clinic**
  - Conducts Covid-19 symptom screen 1 week prior to surgery
  - If patient is asymptomatic, then schedules patient for respiratory screening clinic and orders Covid-19 test to occur 4 days prior to surgery date
  - Follows up SARS-CoV-2 test results

Source: The authors

NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society
We used reverse transcriptase PCR (RT-PCR) testing to diagnose acute infection of Covid-19. This test detects RNA from the SARS-CoV-2 virus. Given the high analytic sensitivity of PCR testing (>98%) and the low estimated disease prevalence in the Bay Area, the negative predictive value for the test in an asymptomatic patient prior to surgery is very high. For example, if the prevalence in the Bay Area is assumed to be 1% and the sensitivity of a nasopharyngeal swab test is 75%, then the negative predictive value of the test is 99.3%. This high negative predictive value allowed us to depend on the test as an accurate determination of viral status in our asymptomatic surgical population.

“We have changed our preoperative testing workflow to ensure that collaborative decisions occur among surgeons, anesthesia providers, and nurses about what is best for the patient and the team; any controversy leads to a hard stop, and a lack of discussion is not tolerated.”

Thankfully, access to personal protective equipment (PPE) was and is not a factor in our current process of restoring surgical services. Our hospital system was fortunate enough to secure sufficient PPE that supply did not affect our ability to resume our surgical practice.

It was anticipated that positive test results would be communicated to the surgeon by the pre-anesthesia clinic on the day before surgery. Patients who tested positive would be notified of their test result and referred to a UCSF respiratory screening center for counseling and management of their Covid-19–related care. Their surgeons were notified, and a discussion was conducted about next steps for postponing surgery. Surgeons would also be notified if their patients were unable (or refused) to undergo testing, and if results would not be in time. Patients who tested negative proceeded to surgery and underwent a final symptom screen on the day of surgery prior to proceeding to the operating room.

Hurdles

We found the need to address two types of logistical obstacles: one was related to actually getting the patient tested, and another was related to establishing effective communication among stakeholders on testing-related matters.

**Obtaining Preoperative Testing for All Patients**

We were unable to obtain 100% compliance with testing guidelines because of patient-related hurdles with long travel distance, lack of social support, and shelter-in-place orders. In addition, we were facing taxed testing resources. Patients who were unable to report to UCSF for preoperative testing in the desired time window were asked to obtain a test at a local facility. If local testing was not available, attempts were made to obtain testing at UCSF the day before surgery, with hotel accommodation that night in San Francisco, subsidized by the hospital. Tests that failed to be completed were all related to patient logistics hurdles; i.e., the patient was not able to travel...
to San Francisco in the appropriate window before surgery for the test to be resulted in time or, alternatively, they were not able to find a local testing site that was able to complete and result the test in the appropriate window before surgery. Access to the testing supplies themselves was not an issue. As time passed, the proportion of patients that had difficulty obtaining a test before the day of their surgery decreased as we were able to better coordinate testing through facilities closer to a patient’s home.

**Team Communication When a Test Result Is Not Available**

On the third day after the launch of the preoperative universal testing protocol (April 22, 2020, after our projected Covid-19 peak), a patient, located in Los Angeles, was not able to travel to San Francisco for preoperative testing. He had been screened by telephone the week prior to surgery while still at home and deemed to be asymptomatic. The surgeon was notified by the pre-anesthesia clinic, and the decision was made to proceed with the surgical case. Because the details of the stakeholders had not been codified in the guidelines, only the surgeon was notified, while the co-surgeon, anesthesia providers, and operating room were not part of the discussion the day before surgery about whether to proceed without a SARS-CoV-2 test.

The patient arrived on the morning of surgery, still asymptomatic, and proceeded to undergo a 12-hour operation at the sole discretion of the surgeon. A nasopharyngeal swab was obtained the evening after surgery. The following morning, 24 hours into his hospital stay, a positive test result was reported. His complex case involved multiple health care workers documented as participants in his perioperative care, including four anesthesia providers, two attending surgeons, one surgical fellow, two surgical residents, four operating room nurses, one c-arm technician, one cell-saver technician, two vendors, five perioperative nurses, and one patient care assistant. Not included were the many unnamed staff who supported him in reception, the pre-anesthesia area, recovery room, transport, and transfer on the floor.

> The Covid-19 pandemic has been devastating to so many, but we are hopeful that it also will compel us to finally transform perioperative culture. This unprecedented and stressful era has exposed the simmering cultural dysfunction in our perioperative processes."

Fortunately, he recovered uneventfully, but the communication and teamwork pertaining to perioperative SARS-CoV-2 testing had failed, in part due to the perioperative culture of hierarchical and unilateral decision-making and also due to a lack of clarity in the protocol. This was addressed by adding more details to the communication plan around patients who were not able to be tested prior to surgery (i.e., who needed to part of the discussion, and where the discussion was documented in the electronic health record).

Surgical care is complex, and communication failure is the leading cause for perioperative adverse events. Checklists and team training improve teamwork and communication, but implementation has been uneven. Even when interventions are adopted, effectiveness is contingent on ongoing
leadership support and the empowerment of frontline providers to speak up and speak out about perceived barriers to fostering a culture of teamwork and communication to evolve beyond a history of opaque and unilateral decision-making by the surgeon. We are all charting unknown territory, with significant potential for harm related to communication and teamwork failures. There is necessarily a new urgency to much of the care we are providing. As Covid-19 pathways and patterns of care are being developed seemingly by the hour and day, our existing systems are vulnerable, because frontline providers are unfamiliar with new guidelines, leading to confusion and miscommunication (Figure 3). Therefore, it is essential that we sometimes pause, and cautiously move from words to action, together, committing to a collaborative work environment that prioritizes both patient and health care worker safety.
To foster this approach, we have changed our preoperative testing workflow to ensure that collaborative decisions occur among surgeons, anesthesia providers, and nurses about what is best for the patient and the team (Figure 4); any controversy leads to a hard stop, and a lack of discussion is not tolerated.
The Covid-19 pandemic has been devastating to so many, but we are hopeful that it also will compel us to finally transform perioperative culture. This unprecedented and stressful era has exposed the simmering cultural dysfunction in our perioperative processes. Unlike traditional evidence-based guidelines that evolve over many years, our understanding of Covid-19 has evolved rapidly, at times leading to confusion and uncertainty regarding practices and protocols and requiring a unique focus on communication and teamwork. Today, it is time to hold the entire team accountable for working together to ensure that long overdue change lasts into the future.

Metrics

In the first 3 weeks of the second phase of our initiative (April 20 – May 11, 2020) to resume essential surgical care with universal preoperative testing, we scheduled 902 cases across 40 operating rooms, representing about 50–60% of the normal surgical volume with an aim for 100% capacity in the subsequent weeks. Some of the patients with lower-acuity conditions have been concerned about the risks of contracting Covid-19 in the hospital and have elected to delay surgery. Of the 902 patients who planned to come in from home for surgery, 862 patients (96%) were tested for SARS-CoV-2. Patients who were not tested were unable to do so due to patient-related logistics hurdles described above. The proportion of daily surgical patients not tested decreased over time (Figure 5).
Preoperative testing for all patients who are scheduled for surgery continues to be our goal, and we achieved this for 7 of our 15 weekdays. Importantly, after the initial week, all untested patients who proceeded to the operating room were discussed by the surgeon, anesthesia, and nursing coordinators in the operating room.

Where to Start

• Form a steering group with key procedural, anesthesia, and nursing leadership. In an academic medical center, this may include the pertinent department chairs or their designee(s). Covid-19 screening and testing needs to be coordinated across the organization, so it is essential that the
group include representation from the hospital leadership (chief medical or quality officer and hospital epidemiology and infection control).

• Form a testing implementation team including representation from both the ambulatory and hospital settings supported by health informatics and infectious diseases. This group should be tasked with developing the workflows and operational plans. Progress should be reviewed by the steering group, and key decisions should be made in collaboration with the steering group (i.e., timing and content of symptom screens, timing of test acceptable for perioperative decision-making, resources needed for patients unable to travel for testing).

• It is possible to harness existing SARS-CoV-2 testing resources, but it is important to remember that the workflow will be different because the patients likely will be asymptomatic, and timing of the test will be dictated by the date of the planned procedure. It is important that someone familiar with the pre-surgical patient workflow be part of repurposing the respiratory screening clinics.

• Where possible, use the electronic health record to integrate SARS-CoV-2 testing into existing workflows (i.e., surgical scheduling).

• Communications need to be clear and consistent. Ultimately, the operating room is a high throughput area with many providers; messaging about testing protocols and decisions need to be clear and available in the electronic health record.

• Recognize that clinicians may have differences of opinion on how best to proceed in some cases; be sure to establish clear guidelines for Full Stop protocols, including bringing in department chairs if necessary and a time-sensitive method for resolution.

Next Steps

As we move forward to expand our testing to include patients coming to all procedural areas, we look to making pre-procedural testing the new standard. For maximum performance and a smooth workflow, we seek to incorporate the best use of the electronic health record for efficiency in the Covid-19 testing pathway. We strive to improve teamwork and communication through progressive methods including briefings and debriefings, measures of safety and feedback, as well as ongoing leadership support to prioritize an open and transparent culture of safety.

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