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COVID-19 GUIDANCE DOCUMENT

Surgical Triage and Timing for Patients With Coronavirus Disease: A Guidance Statement from The Society of Thoracic Surgeons



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The coronavirus disease 2019 (COVID-19) pandemic continues to disrupt the provision of cardiac procedural services due to overwhelming interval surges in COVID-19 cases and the associated crisis of cardiac intervention deferment. Despite the availability of widespread testing, highly efficacious vaccines, and intensive public health efforts, the pandemic is entering its third year, where new severe acute respiratory syndrome-coronavirus-2 variants have increased the likelihood that patients scheduled for a cardiac intervention will contract COVID-19 in the perioperative period. The Society of Thoracic Surgeons (STS) Workforce on Critical Care, the STS Workforce on Adult Cardiac and Vascular Surgery, and the Canadian Society of Cardiac Surgeons have developed this document, endorsed by the STS and affirmed by the Society of Cardiovascular Angiography and Interventions and the Canadian Association of Interventional Cardiology, to provide guidance for cardiac procedure deferment and intervention timing for preoperative patients diagnosed with COVID-19. This document is intended for the perioperative cardiac surgical team and outlines the present state of the pandemic, the impact of COVID-19 on intervention outcome, and offers a recommended algorithm for individualized cardiac procedure triage and timing.

(Ann Thorac Surg 2022;114:387-93)

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At the time of writing of this report, the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19), is now responsible for >410 million cases and 5.8 million deaths worldwide.¹ During the initial wave of the pandemic, health care systems were overwhelmed by both the volume and severity of disease, requiring expansion of existing intensive care units, deferment of nonurgent services, and redeployment of health care providers and staff.^{2,3} As a result, cardiac surgical researchers have identified a crisis of deferment, whereby patients unable to be treated in a timely fashion present both in large numbers and in clinical extremis, further taxing the already constrained medical system. An association has emerged between regional COVID-19 activity and reduced nonurgent cardiac procedural volume, accompanied by a later influx of decompensated patients seeking urgent cardiac intervention.⁴⁻⁶

Over the past 2 years, the development of highly efficacious vaccines, new effective therapies, and public health efforts to limit transmission have allowed hospital systems to continue to offer a broad range of services amidst the pandemic. Despite intensive efforts, conditions have given rise to multiple variant mutations of SARS-CoV-2, each with a unique profile in their relative contagiousness and severity of illness and each associated with a surge in population disease and regional hospital admissions.^{7,8} The most recently identified variant, designated omicron, is notable for a significant replication advantage, greater asymptomatic disease carriage, and immune evasion, leading to more effective transmissibility.⁹ Although associated with an overall lower disease severity,¹⁰ the sheer number of COVID-19 cases has led to hospital and intensive care unit admissions rates that are comparable to or greater than those from prior pandemic waves.

To identify and prevent COVID-19 disease spread, hospital-based inpatient testing programs have become commonplace for patients undergoing nonurgent procedures across North America. The emergence of the omicron variant has driven test positivity rates to alarmingly high levels, with >25% of patients (regardless of symptoms) testing positive for SARS-CoV-2 in high-prevalence locations.¹¹ Although this highlights a remarkable disease burden and reflects the degree of asymptomatic carriage that typifies omicron,¹² there is still significant variability in symptom severity, ranging from asymptomatic to acute respiratory distress syndrome.

Inflammatory responses associated with acute COVID-19 may also exacerbate underlying comorbid illnesses and lead to clinical deterioration. A positive SARS-CoV-2 test thus typically leads to a period of clinical observation for symptom evolution, treatment, and

recovery from acute viral illness, leading to further delays for necessary procedures. For patients awaiting cardiac procedures, even modest delays can contribute to significant morbidity and mortality.

This document serves to provide guidance and clinical recommendations for triage and timing of cardiac patients who contract COVID-19 before surgery. In generating this document, we recognize that data pertaining to this topic are evolving rapidly, almost daily. As such, the recommendations within this guidance document are based on the best available evidence and would be subject to update with discovery of new information.

METHODS

This guidance statement was the product of collaboration between the Society of Thoracic Surgeons (STS) Workforce on Critical Care, the STS Workforce on Adult Cardiac and Vascular Surgery, and the Canadian Society of Cardiac Surgeons, which has been endorsed by the STS and affirmed by the Society of Cardiovascular Angiography and Interventions and the Canadian Association of Interventional Cardiology. Individual members from those groups were empanelled to ensure diversity in clinical discipline, geography, and institutional practice model. A literature search was performed to identify relevant studies and prior guidelines regarding the management and outcomes associated with COVID-19 in the perioperative period, with special focus on cardiac surgical procedures. All authors participated in appraisal of the available literature to develop this document to provide pragmatic guidance for cardiac surgical deferment and intervention timing for preoperative patients diagnosed with COVID-19.

TIERED PATIENT TRIAGE, PERIOPERATIVE TESTING, AND VACCINATION STATUS

Prior guidance from the STS and others has provided detailed recommendations regarding general cardiac service line procedure deferment, which includes tailoring essential services according to local COVID-19 disease burden and existing hospital resource infrastructure.^{13,14} The guidance ranges from tier 1, involving a mild reduction in cardiac surgical capacity and modest deferment of primarily patients with asymptomatic cardiac disease undergoing nonurgent procedures, to tier 4, which limits services to only emergency cardiac surgery due to extreme reduction in operative capacity (Table 1).¹³ Programs are encouraged to couple global triage strategies with comprehensive mechanisms to monitor patients for progression of their cardiovascular disease severity, as patients may qualify for surgery based on further clinical decompensation depending on

Tier, Inpatient COVID-19 Burden	Essential and Deferred Services
1: 0%-30%, mild reduction in cardiac procedural services	All inpatients (urgent, emergent surgery), outpatients with the greatest risk of adverse events. <i>Defer asymptomatic or truly elective procedures.</i>
2: 30%-60%, moderate reduction	All inpatients (urgent, emergent surgery), outpatients with the progressive symptoms or fail medical management. <i>Defer asymptomatic or elective procedures for patients who can be medically managed.</i>
3: 60%-80%, severe reduction	All inpatients who cannot be discharged safely without intervention. <i>Defer all outpatients unless meeting urgent criteria for admission.</i>
4: >80%, minimal capacity	Only emergency services based on resources available. <i>Defer all outpatients and inpatients who can wait.</i>

Table adapted from: Haft JW, Atluri P, Ailawadi G, et al; Society of Thoracic Surgeons COVID-19 Task Force and the Workforce for Adult Cardiac and Vascular Surgery. Adult cardiac surgery during the COVID-19 pandemic: a tiered patient triage guidance statement. *J Thorac Cardiovasc Surg.* 2020;160:452-455. COVID-19, coronavirus disease 2019.

the present COVID-19 response tier. Ultimately, any decision regarding an individual should be made in the context of greater institutional resource availability and operative capacity.

In addition, the STS has recommended universal preoperative SARS-CoV-2 testing, particularly in areas with high disease burden.^{15,16} Preoperative molecular testing (ie, polymerase chain reaction) is preferred, due to its high level of sensitivity and specificity,¹⁷ over antigen-based tests, with testing performed as close to the time of surgery as possible (ie, within 24-72 hours). Regardless of the testing method and patient symptoms or vaccination status, a positive result on preoperative screening should be presumed to represent true COVID-19 illness,¹⁷ and appropriate health measures should be observed, including consideration for surgical postponement. Two primary drivers underpin the rationale for surgical delay: (1) to lessen the risk for nosocomial transmission to other patients and providers, and (2) to reduce the likelihood of medical complications during the perioperative encounter.

INDIVIDUALIZED CARDIAC PROCEDURE TRIAGE AND TIMING

Upon confirmation of SARS-CoV-2 positivity, and depending upon the present tier of the institution's COVID-19 response, subsequent surgical triage and

procedure timing are dictated by a combination of procedure urgency (ie, cardiovascular clinical status) and COVID-19 illness severity, which are defined in [Tables 2¹⁸](#) and [3](#), respectively. The following guidance applies to all adult cardiac surgical and open surgical valve implantation (ie, transapical, direct aortic) procedures and is summarized in the [Figure](#). Regardless of triage decisions, provider teams are strongly encouraged to engage patients and their families through shared decision making, considering the patient's goals, cultural preferences, religious beliefs, and health literacy, to determine the best course of action to maximize patient outcomes.¹⁹ Notably, cardiac surgical predictive risk scores (ie, STS predicted risk of mortality) do not incorporate prior or current COVID-19 as a risk factor, which further complicates procedural decision making in the setting of active or recent COVID-19 and reinforces the shared decision-making model based on guidance offered in this document.

As outlined in previous guidance from the STS, it is recommended that patients complete a full vaccination series against SARS-CoV-2 before surgery, where feasible,¹⁶ owing to the markedly reduced incidence of COVID-19 infection as well as pulmonary and thrombotic complications after surgery compared with non-vaccinated counterparts.^{20,21} However, the following recommendations should be considered independent of the individual's vaccination status, because although

Procedure Urgency	Definition
Emergent	Ongoing refractory cardiac compromise, with or without hemodynamic instability, not responsive to therapy except for procedural intervention. Procedural delay is life threatening.
Urgent	Intervention is required during the same hospitalization to avoid further clinical decompensation. Inpatient monitoring and medical therapy are necessary to avoid clinical compromise.
Nonurgent	Stable cardiac function in the time frame prior to intervention without evidence of further clinical decompensation. Procedural delay with remote symptom management is unlikely to contribute to clinical decline.

Table adapted from The Adult Cardiac Surgery Database ACSD Training Manual V4_20_2 Feb 2022. Seq# 1975, pg 111-112.

TABLE 3 Coronavirus Disease 2019 Illness Severity

COVID-19 Severity	Description
Asymptomatic	Diagnosis based on preprocedural test result, no clinical signs or symptoms of illness.
Mild	Symptomatic (ie, cough, dyspnea, fever, congestion, fatigue), but does not require hospitalization for management.
Moderate	Symptomatic, requiring hospitalization or those with comorbidities with high risk of disease progression (ie, diabetes) or immunocompromised status.
Severe	Symptomatic, requiring organ-supportive therapies, including high flow nasal oxygen and/or positive pressure ventilation (ie, CPAP/BiPAP) and/or, mechanical ventilation and/or vasopressor/inotropic agents.

BiPAP, bilevel positive airway pressure CPAP, continuous positive airway pressure.

vaccination reduces the likelihood of severe symptoms or hospitalization, significant COVID-19 illness may develop in individuals who test positive for SARS-CoV-2 and they still pose a risk of nosocomial transmission.

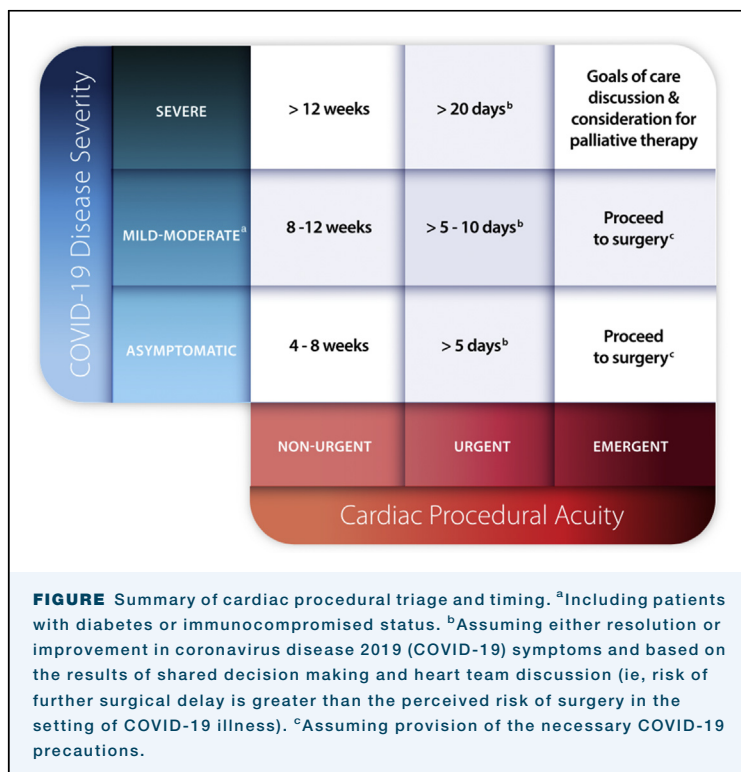
NONURGENT INTERVENTION. For nonurgent cardiac procedures, the following is the recommended time frame for intervention deferment from the time of positive SARS-CoV-2 screening:

- Asymptomatic infection: approximately 4 to 8 weeks from positive screening
- Mild to moderate infection: 8 to 12 weeks
- Severe infection: >12 weeks

This guidance is based on results from several studies investigating outcomes among patients with COVID-19 undergoing surgery and is generally consistent with guidance from the American Society of Anesthesiologists and Anesthesia Patient Safety Foundation for all procedures.²² According to results from both a COVIDSurg Collaborative²³ and an Italian-based matched cohort study,²⁴ patients diagnosed with COVID-19 in the days before or initially after surgery experienced significantly greater pulmonary and thrombotic complications as well as higher mortality rates compared with those without COVID-19. Results are similar among cardiac surgical patients, with several studies reporting worse clinical outcomes, highlighted by a significantly higher rate of pulmonary complication and mortality among patients who were diagnosed with COVID-19 in the perioperative period.²⁵⁻²⁸ An exploratory matched subgroup analysis of patients who tested positive for SARS-CoV-2 showed that 30-day outcomes, including pulmonary complications and mortality, were significantly elevated in the initial 4 weeks after diagnosis.²⁹ These findings are consistent with previous studies showing respiratory infection within 1 month before surgery is associated with significant postoperative pulmonary complications.³⁰

A recent guideline from the Association of Anaesthetists, the Centre for Perioperative Care, the Federation of Surgical Specialty Associations, the Royal College of Anaesthetists, and the Royal College of Surgeons of England suggested that “elective surgery should not be scheduled within 7 weeks of a diagnosis of SARS-CoV-2 infection unless the risks of deferring surgery outweigh the risk of postoperative morbidity or mortality associated with COVID-19.”³¹ This is based on the results of an accompanying international prospective cohort study that showed pulmonary complications and adjusted 30-day mortality remained significantly elevated in SARS-CoV-2-positive patients for the first 6 weeks after diagnosis compared with those without SARS-CoV-2.³² Patients who underwent surgery after symptom resolution and >7 weeks after diagnosis had a postoperative complication risk similar to baseline; however, patients who remained symptomatic at the time of deferred surgery still conferred a greater mortality risk.³³ This suggests a lengthier deferment of surgery is necessary in cases of persistent or prolonged symptoms. Lastly, a recent study involving patients undergoing major elective surgery showed a significant increase in postoperative mortality within 4 weeks, and the risk of pulmonary complication remained elevated for 8 weeks after COVID-19 diagnosis.³⁴ As a result, in order to confer the lowest risk of COVID-19-related complication, preference for the latter end of the deferment time period is recommended.

Although specific data that pertain to the cardiac patient on procedure timing are sparse, these



recommendations are consistent with recent guidance regarding procedural delays, which recommends between 4 and 12 weeks' postponement in patients with a positive SARS-CoV-2 diagnosis who are scheduled for intermediate acuity elective (nonurgent) procedures (ie, certain stable forms of valvular disease) and >12 weeks in low acuity (ie, generally asymptomatic cardiovascular disease) settings.³⁵

URGENT INTERVENTION. The decision to proceed or defer urgent intervention in a patient with COVID-19 requires weighing the risk associated with perioperative COVID-19 and cardiovascular disease progression against the potential benefit associated with cardiovascular intervention. If feasible, the procedure should be delayed until COVID-19 symptoms have resolved and the patient is no longer transmissible. The duration of transmissibility after a SARS-CoV-2 diagnosis is defined by the Centers for Disease Control and Prevention as follows: (1) 5 days (from positive test or symptom onset) for patients with mild illness with resolved or improving symptoms, (2) 10 days for patients with moderate disease, and (3) 20 days for patients with severe disease or those with immunocompromising conditions.^{35,36}

This is the ideal setting for the heart team approach,³⁷ whereby representatives from cardiac surgery, interventional cardiology, and specialty services, which may include critical care, pulmonary medicine, hematology, and infectious diseases, determine the best course of action to both mitigate the harm associated with surgical delay and optimize postoperative outcome in the setting of concomitant COVID-19 infection. In the event teams pursue cardiac intervention, necessary provisions should be made for appropriate postoperative care given the recognition that patients are likely to incur more medical complications and experience longer intensive care unit length of stay.^{26,38,39}

EMERGENT INTERVENTION. If the procedure is deemed emergent or if procedural indication becomes emergent during the period of procedural delay, it is advisable to proceed immediately with the intervention, assuming teams observe the necessary precautions to avoid disease transmission, which are outlined in full in prior guidelines.¹⁵ Exceptions apply to patients with severe COVID-19 who are considered poor candidates for emergent cardiovascular intervention due to the nature of their present clinical condition and potential futility of procedural intervention, which in itself confers substantial perioperative risk, and consideration should be made rather for patient-centered goals of care discussion.

Overall, as clinicians attempt to determine an individual's appropriateness and timing for cardiac procedures, consideration should be made not only for the

cardiac disease severity and accompanying procedure urgency but also for the severity of COVID-19 symptoms and their hospital's present COVID-19 response tier.

REPEAT COVID-19 TESTING AND PREOPERATIVE PLANNING

Patients with procedural delay >90 days from a positive test result should undergo repeat preoperative COVID-19 testing to screen for potential reinfection, whereas testing before this time frame may result in increased false-positive results, particularly with molecular testing.^{20,33} Subsequent procedure triage and timing would follow the outline above. Repeat preoperative cardiopulmonary testing and preoperative optimization is advised for all patients with significant decline in interval functional status or residual upper respiratory or pulmonary symptoms (ie, shortness of breath, exertional dyspnea, syncope, oxygen requirement). Testing may include pulmonary function testing, computed tomographic scan, cardiac echocardiography, or additional cardiovascular interrogation as necessary for procedural planning. Continued or worsened clinical symptoms may be the result of advancement in cardiovascular disease or residual myocardial or cardiopulmonary effects of COVID-19 and should therefore be taken into consideration as part of planning for their cardiac intervention.

At present, there is no convincing evidence to suggest that a specific anesthetic maintenance (ie, inhaled vs total intravenous anesthetic), airway management selection (ie, intubation vs monitored anesthesia care), or the use of regional anesthesia is associated with more favorable postoperative outcomes in the setting of recent COVID-19.³¹ Similarly, no studies have investigated the effect of specific COVID-19 treatments (ie, steroids, immunomodulators) on subsequent surgical timing or postoperative outcome. Therefore, traditional perioperative screening, risk profiling, and optimization should be applied to all patients.

In conclusion, the COVID-19 pandemic has disrupted the provision of cardiac procedural services with an overwhelming series of surges in COVID-19 cases and precipitated an associated crisis of cardiac intervention deferment. We strongly encourage heart teams to engage patients and their families in decision making. Determination of procedural timing and triage is based on a combination of an individual's risk of COVID-19 associated complications and cardiac procedure urgency.

FUNDING SOURCES

The authors have no funding sources to disclose.

DISCLOSURES

The authors have no conflicts of interest to disclose.

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