



The following information resources have been selected by the National Health Library and Knowledge Service Evidence Virtual Team in response to your question. The resources are listed in our estimated order of relevance to practicing healthcare professionals confronted with this scenario in an Irish context. In respect of the evolving global situation and rapidly changing evidence base, it is advised to use hyperlinked sources in this document to ensure that the information you are disseminating to the public or applying in clinical practice is the most current, valid and accurate. For further information on the methodology used in the compilation of this document including a complete list of sources consulted please see our [National Health Library and Knowledge Service Summary of Evidence Protocol](#).

YOUR QUESTION

What does the literature say about cardiothoracic surgery in the context of COVID-19?

IN A NUTSHELL

As hospitals come under increasing pressure it is advised that routine elective cardiothoracic surgery should be postponed^{1,3,5,7}. During the pandemic, surgeons will still need to continue ensuring the provision of non-deferrable treatments such as primary percutaneous coronary interventions or emergency cardiac surgical procedures^{10,12}. For suspected or confirmed COVID-19 patients, only essential and life-saving surgery where there is no other viable option should be performed². Li et al¹¹ also note that COVID-19 has been associated with poor prognosis for patients undergoing cardiothoracic surgery, especially for those with COPD.

The AATS guidelines recommend that all cardiac surgery patients should have nasal swabs or PCR testing—subject to availability—before surgery¹². Also if possible, a CT scan is recommended as the most sensitive screening tool for recognizing COVID-19 lung infection²⁴.

COVID-19 patients are highly contagious during cardiothoracic surgery procedures and effective protection measures are needed for surgical staff. All theatre staff should wear appropriate masks, gowns, gloves and eye protection during skin preparation and draping of the patient^{2,11}.

Aerosol-generating procedures such as cardiopulmonary resuscitation, endotracheal intubation and non-invasive ventilation should be performed in airborne infection isolation rooms (AIIRs) with HCPs using adequate respiratory protection. Procedures including bag-valve mask, nebulizers and non-invasive positive pressure ventilation should be avoided as these

procedures may generate aerosols⁴. Airborne infection isolation rooms should be reserved only for patients undergoing aerosol-generating procedures. These rooms are negative-pressure areas and are recommended for airborne infections as they prevent micro-organisms from escaping into hallways and corridors¹³.

Once the pandemic has passed, there will be significant challenges in dealing with patients that have experienced delayed procedures. This will require significant effort and planning and may result in increased collateral mortality⁹. Operating capacity at pre-pandemic levels will not be sufficient to clear the backlog²².

It is probable that the pandemic will be the catalyst for increased use of telemedicine, which may involve follow-up clinics run virtually by video or telephone ^{9,23}.

If time allows, simulating the response to the pandemic would allow surgical staff to identify potential problems, raise awareness and improve systems workflows⁸.



IRISH AND INTERNATIONAL GUIDANCE

What does the Health Protection Surveillance Centre say?

[Use of PPE to support infection prevention and control practice when performing aerosol generating procedures on confirmed or clinically suspected COVID-19 cases in a pandemic situation](#)

HPSC guidance states that all staff working in an area where aerosol generating procedures are being performed must wear appropriate PPE. The minimum number of staff required must be present. The guidance includes a table entitled: "Aerosol generating procedures which have been associated with increased risk of transmission of respiratory infection."

*There is no specific guidance provided relating to cardiothoracic surgery.

What do international cardiac organisations say?

[PCR Online. Cardiac surgery and the COVID-19 outbreak: what does it mean?](#)¹

Cardiac surgeons have a responsibility to ensure that evidence-based, essential cardiac operations are provided to the public; at the same time the wider burden of procedures must be minimized in times of COVID-19. In a progressively escalating situation as we now have in most European countries, routine elective cardiac surgery should be stopped. These surgeries are best managed by delaying their care until a few weeks or even months later. Patients with acute coronary syndrome in the case of severe coronary artery disease who are not eligible for conservative or interventional treatment may be operated on. If the pandemic escalates into a crisis with absolute shortage of ICU beds, cardiac operations may be limited to absolutely essential emergency surgeries.

Health care workers are among those at high risk of infection with COVID-19. N95 masks are recommended for use in the operating theatre to protect surgical staff. This is especially true if COVID-19 patients undergo emergency cardiac surgery. Operative theatre doors should be shut at all times.

Negative pressure rooms would be optimal. After surgery, before leaving, contaminated equipment must be left in the operating theatre and discarded into a container.



[Society for Cardiothoracic Surgery \(2020\) SCTS ACTACC SCPS Joint COVID-19 Theatre Guidance²](#)

Only essential and lifesaving surgery where there is no other viable option should be performed on a suspected or confirmed COVID-19 patient. The decision to operate should be a multi-disciplinary decision involving at the very least the surgeon and the anaesthetist. Patients should be appraised of the added risk associated with acute viral infection as part of the consent process and their views should be documented on any advance directives, long term ICU care and end of life care. The viral status of patients will often be unknown. High-risk procedures for virus transmission are those generating an aerosol. Other transmission is mostly from contact and transfer to mucosal membranes. Staffing should be kept to a minimum. All staff present should be recorded on the theatre recording system to allow contact tracing.

All theatre staff should wear FFP3 masks, with gowns, gloves and eye protection during skin preparation and draping of the patient. More detailed instructions are included in the document.

[NHS England \(2020\) Clinical guide for the management of cardiothoracic surgery patients during the Coronavirus pandemic³](#)

Cardiothoracic practice may not seem to be in the frontline in the response to COVID-19, but we do have a key role to play. In response to pressures on the NHS, the elective component of our work may be curtailed. However, the non-elective patients $\frac{3}{4}$ emergency, urgent and trauma $\frac{3}{4}$ will continue to need care. As cardiothoracic surgeons, we do have a specific responsibility to ensure that essential cardiothoracic care is provided and not cancelled unnecessarily, but the burden on the wider NHS should be minimised. We should also ensure that in the context of public health we should support the initiatives that minimise the risk to our patients and staff. Cardiothoracic surgeons have generic skills that apply to patients in intensive care. If extra ICU capacity involves anaesthetic rooms and operating theatres, then cardiothoracic surgeons may have a role in helping intensivists look after these patients.

Some of our patients may be best managed by delaying their care until later in the year. This may be due to constrained resources but may also be in the patient's best interests. Day surgery may be worth considering. An increase in day surgeries would avoid unnecessary admissions, free up beds and reduce exposure of individuals to a hospital environment.



[American Heart Association \(2020\) Interim Guidance for Healthcare Providers during COVID-19 Outbreak⁴](#)

It is recommended that HCPs adopt standard and transmission-based precautions when caring for patients with known or suspected COVID-19, including adequate hand hygiene, and the use of personal protection equipment ^¾ respirators or facemasks, eye protection, gloves and gowns ^¾ before entering a patient's room or care area.

Aerosol-generating procedures such as cardiopulmonary resuscitation, endotracheal intubation and non-invasive ventilation should be performed in airborne infection isolation rooms (AIIRs) with HCPs using adequate respiratory protection. A limited number of providers should be present for the procedure and the AIIRs should be cleaned and disinfected after the procedure. In patients requiring intubation, rapid sequence intubation should be adopted. Procedures including bag-valve mask, nebulizers and non-invasive positive pressure ventilation should be avoided as these procedures may generate aerosols.

[American College of Surgeons \(2020\) COVID-19 update: guidance for triage of non-emergent surgical procedures⁵](#)

Each hospital, health system and surgeon should thoughtfully review all scheduled elective procedures with a plan to minimize, postpone or cancel electively scheduled operations, endoscopies or other invasive procedures until we have passed the predicted infection point in the exposure graph and can be confident that our health care infrastructure can support a potentially rapid and overwhelming upsurge in critical patient care needs.

Immediately minimize the use of essential items needed to care for patients ^¾ including but not limited to: ICU beds, personal protective equipment, terminal cleaning supplies and ventilators. There are many asymptomatic patients who are nonetheless shedding virus and are unwittingly exposing other inpatients, outpatients and health care providers to the risk of contracting COVID-19.



[Romaguera et al \[Spain\] \(2020\) Consensus document of the Interventional Cardiology and Heart Rhythm Associations of the Spanish Society of Cardiology on the management of invasive cardiac procedure rooms during the COVID-19 coronavirus outbreak⁶](#)

In patients with suspected or confirmed COVID-19 infection, we recommend the following measures:

- consider procedures involving airway and/or esophageal manipulation as very high risk
- allow only essential staff to enter the procedure room
- keep doors shut at all times
- prepare drugs before patient entry to the procedure room
- avoid leaving the procedure room with contaminated equipment [eg gown, gloves, mask, etc.] to collect material [eg stents, catheters, etc.] and consequently try to predict necessary equipment as much as possible

POINT-OF-CARE TOOLS

What does UpToDate say?

[UpToDate \(2020\) Coronavirus Disease 2019 \(COVID-19\)⁷](#)

No specific advice or contraindications are given for cardiothoracic surgery and COVID-19. It is suggested that elective procedures in general may be postponed to reduce risk.

INTERNATIONAL LITERATURE

What does the international literature say?

[Zhang et al \(2020\) Experiences and lesson strategies for cardiology from the COVID-19 outbreak in Wuhan, China, by 'on the scene' cardiologists⁸](#)

To contain possible transmissions in the cardiology ward, the use of personal protection equipment $\frac{3}{4}$ facial and eye protection, gown and gloves $\frac{3}{4}$ are considered crucial since the main transmission routes of COVID-19 are respiratory droplets and contact. Once percutaneous coronary intervention is required, all staff engaged should be under level-3 protection and thorough environmental disinfection must be given after each PCI. An in-hospital multidisciplinary consultation involving experts from cardiology, ICU, the department of infectious diseases and the emergency department should be organized in cases of acute myocardial infarction or other cardiovascular emergencies complicated with COVID-19. Care should also be taken by cardiologists since they may also confront COVID-19 cases. Prompt identification could be challenging when the patients are asymptomatic or still in an incubation period at admission, highlighting the importance of early protection measures.

[Ferrari et al \(2020\) 2019 CORONAVIRUS: What are the implications for cardiology?⁹](#)

Specific protocols should be developed for the management of acute myocardial infarction in the context of the COVID-19 outbreak. Taking a careful epidemiological anamnesis, measuring the fever and searching for pulmonary lesions before starting primary angioplasty is mandatory. This will drive enhanced personal protection and ensure post-procedural sufficient sterilisation and adequate follow-up of patients who may need isolation.

Pressure on hospital space may lead to re-organisation. An effect of this is that elective cardiothoracic surgeries and interventional procedures may have to be postponed.

[Driggin et al \(2020\) Cardiovascular Considerations for Patients, Health Care Workers, and Health Systems During the Coronavirus Disease 2019 \(COVID-19\) Pandemic¹⁰](#)

The coronavirus disease-2019 (COVID-19) has significant implications for the cardiovascular care of patients. First, those with COVID-19 and pre-existing cardiovascular disease have an increased risk of severe disease and death. Second, infection has been associated with multiple direct and indirect cardiovascular complications including acute myocardial injury, myocarditis, arrhythmias and venous thromboembolism.

Cognizant of the need for ICU beds after cardiac surgery, medical management or percutaneous interventional approaches may need to be preferentially considered for urgent scenarios that cannot wait ³/₄ eg percutaneous coronary intervention rather than coronary artery bypass graft surgery or transcatheter valve solutions rather than surgery ³/₄ to minimize ICU bed utilization.

[Li et al \(2020\) Clinical and Transmission Characteristics of COVID-19 – A Retrospective Study of 25 Cases from a Single Thoracic Surgery Department¹¹](#)

The outbreak of COVID-19 imposes a major challenge in managing patients undergoing surgical operation. SARS-CoV-2 is highly infectious and is susceptible to all populations. Thoracic surgery requires patients to do respiratory function exercises after operation, including productive cough. Cough training will produce a large amount of droplets and aerosols to the surrounding space, which can increase efficacy of exposure. COVID-19 patients are highly contagious when they are having thoracic surgery performed on them and effective protection measures are needed for surgical staff.

It is concluded that COVID-19 is associated with poor prognosis for patients undergoing thoracic operation, especially for those with COPD.

Implementation of comprehensive protective measures is important to control nosocomial infection.

[Pisano et al \(2020\) Protecting High-Risk Cardiac Patients During the COVID-19 Outbreak¹²](#)

During the COVID-19 pandemic surgeons will still need to continue ensuring the provision of non-postponable treatments: eg primary percutaneous coronary interventions or urgent cardiac surgical procedures. Every patient admitted to the hospital with urgency criteria such as acute myocardial

infarction, cardiogenic shock or aortic dissection potentially might be infected and once transferred to either a coronary unit or ICU may disseminate the contagion among patients already admitted to these units and among health care personnel. During the ongoing health emergency, all new patients admitted to hospital units hosting immunocompromised, complex, critical, and, more generally, acutely ill patients should be isolated initially and screened for SARS-CoV-2 infection, and separate pathways provided until the virological test results are obtained.

[Tan et al \(2020\) Response and Operating Room Preparation for the COVID-19 Outbreak: A Perspective from the National Heart Centre Singapore¹³](#)

As the mode of transmission for Sars-CoV-2 appears to be droplet in nature, adherence to droplet precautions, proper environmental hygiene and sound infection control practices are indicated. Airborne infection isolation rooms should be reserved only for patients undergoing aerosol generating procedures. These rooms are negative-pressure areas and are recommended for airborne infections as they prevent micro-organisms from escaping into hallways and corridors. Ideally, all COVID-19 suspected or confirmed patients should be operated in a negative-pressure operating room to reduce contamination of adjoining corridors or rooms. A team of cardiothoracic anesthetists, surgeons, perfusionists and nurses carried out a simulation as per the workflow developed during SARS. This allowed us to identify potential problems, raise awareness and improve systems workflow.

[Fudulu and Angelini \(2020\) Cardiac surgery in the time of the coronavirus¹⁴](#)

To achieve reduced length of stay, the authors describe how they are now diverting a significant proportion of urgent cases to interventional cardiology. However, how optimal are the long-term outcomes of these percutaneous cases that were meant to be treated surgically? The resultant backlog will require significant effort and planning and will potentially increase collateral mortality.

A new challenge is operating on confirmed or suspected COVID-19 positive patients. To mitigate the risk of infection, we must cope with wearing special PPE during cardiac procedures and adhere to specific theatre protocols. We also have to respect designated hospital zones that aim to limit inpatient transfers to contaminated areas and be vigilant to assess and screen



patients for COVID-19 before transfer from peripheral hospitals. The COVID-19 outbreak has completely reshaped the way we do cardiac surgery in a matter of months.

Undoubtedly, the pandemic will be a catalyst for the rapid development and retention of telemedicine. One example is that most of our follow-up clinics are now run by video or telephone. Similarly, multidisciplinary meetings and mortality and morbidity meetings are set up in a virtual space.

[Stephens et al \(2020\) COVID-19: Crisis Management in Congenital Heart Surgery¹⁵](#)

The biggest threat to our patients is the sudden lack of resources, including the requisition of ORs [transformed into ICUs], ventilators and healthcare providers for the fight against COVID-19. As a result, the surgical schedule must be culled to only the most urgent cases, which in our specialty is very difficult with many gray zones. Many factors pertaining to an individual case must be weighed including: 1. resource-utilization such as anticipated ventilator duration, intensive care unit stay, blood product usage, and other supplies that are or may become limited; 2. clinical status of the patient and risk of delaying surgery; 3. risk of exposure for the patient, family and healthcare staff; 4. co-morbidities and complexity of the procedure with implications on the usage of hospital resources; 5. in teaching hospitals, training may have to be curtailed and the most experienced surgeons used liberally; and 6. the safety of the patient's social and clinical situation if surgery is delayed.

Given the small size of each institutional workforce practicing congenital cardiac surgery — with unique skillsets not replaceable by other providers — strategies to maintain the integrity of the workforce are crucial. Institutions may re-deploy members of the congenital cardiac surgery team to other patient-care settings, further depleting resources and also increasing exposure. In response, employing workplace strategies to reduce overall exposure, such as week on, week off rotation schedule for selected health-care providers, appropriate use PPE and downsizing of clinical teams and worksites seems prudent.

Unprecedented times call for unprecedented measures. Prioritization and appropriate timing of surgery are necessary at this time. Practical guidance strategies range from ensuring safety and tactics for specific lesions of the patients to maintaining emotional stability of the staff. Our specialty has been marked by solidarity and carries a history notable for collaboration,

flexibility, adaptation and instant readiness. The time to execute these qualities is here and now.

[Cafarotti and Patella \(2020\) Lung Cancer Surgical Management During the Outbreak of Coronavirus Disease 2019¹⁶](#)

We established in our Lung Cancer Unit a new risk stratification for lung cancer progression and COVID-19 infection. We matched both and elaborated a new integrated stratification risk to prevent adverse outcomes from COVID-19 after oncologic treatment. We promote new therapeutic options on the basis of the integrated classification as follows:

- Stage I: Anatomical lung resection. The early stages allow definitive oncologic treatment without the need for further hospital admission or adjuvant treatments [low risk of infection].
- Stage IIa: Anatomical lung resection [low risk of infection].
- Stage IIb: Discuss with the patient the possibility of a follow-up [up to 3 months] before a definitive therapeutic decision after the epidemiologic peak has been overcome. Personalized treatments are evaluated.
- Stage III: Consider exclusive nonsurgical treatments.

This algorithm of care tries to balance the risk of dying from cancer with the risk of incurring a potentially fatal infection after major surgery or any oncologic treatment. It is partially evidence-based and mostly on the basis of common sense and on the need for supporting the current emergency without forgetting our patients.

[Lazar \(2020\) \[Commentary\] Compliance with the American Association for Thoracic Surgery guidelines will prevent sternal wound infections and minimize postoperative complications in cardiac surgery patients during the COVID-19 pandemic¹⁷](#)

During the current COVID-19 pandemic, patients who have required ICU care have tended to be older [mean age= 66 years] and have a higher incidence of obesity, smoking, and underlying cardiovascular disorders including diabetes, hypertension, hyperlipidemia, chronic pulmonary disorders and cardiac disease. In respect of these associated co-morbidities, a percentage of these patients will require urgent or emergent cardiac surgery for acute coronary syndromes, valvular dysfunction, as well as surgery for aortic dissections and thoracic aneurysms. Unfortunately, the risk factors for



mediastinitis following cardiac surgery—obesity, smoking, diabetes, emergent surgery and hospitalization prior to surgery—are similar to the profiles of patients who are most likely to require cardiac surgery during the COVID-19 pandemic. This commentary will review how compliance with the AATS guidelines for the prevention of sternal wound infections will help to minimize infections and wound complications, and help to reduce all postoperative complications in patients requiring cardiac surgery during the COVID-19 pandemic. Among the recommendations considered are:

Preoperative Screening

There are currently no society guidelines [in the United States] for screening patients with COVID-19 before cardiac surgery. In respect of the fact that patients requiring surgery may be asymptomatic carriers of the virus, it is not unreasonable that all patients undergoing cardiac surgery during the COVID-19 pandemic should be screened for the virus. Screening will identify patients who will require isolation perioperatively and HCWs who must wear personal protective equipment in caring for those patients. Where available, surgery should be performed in an operating room with a negative-pressure environment to reduce the dissemination of the virus to locations outside the OR. If a negative pressure room is not available, a higher frequency of air exchanges will help to more rapidly reduce the viral load within the OR.

Screening and Treating All Distant Infections Prior to Surgery

The AATS guidelines give a recommendation that all distant, extrathoracic infections should be treated prior to cardiac surgical procedures. This should include all respiratory tract infections. While it may not be possible to delay surgery to achieve a full course of antibiotic therapy in COVID-19 patients until the infection has resolved, it is important that cultures are obtained and the appropriate antibiotics instituted prior to surgery. Since the respiratory system is the most common site for severe COVID-19 infections, and in respect of the fact that a significant number of patients will have underlying pulmonary disease and a history of smoking, sputum specimens should be obtained in addition to nasopharyngeal swabs to detect underlying pulmonary bacterial infections which could contribute to postop pulmonary insufficiency requiring prolonged ventilatory support. Since COVID-19 patients tend to be older, they may suffer from benign prostatic hypertrophy and preoperative urine cultures should also be obtained in addition to routine urine analyses.



Screening and Treating Staphylococcus Nasal Carriers

The AATS guidelines recommend that all cardiac surgery patients should have nasal swabs or polymerase chain reaction (PCR) testing—subject to availability—before surgery, and that routine intranasal mupirocin administration is recommended for all cardiac surgery procedures in the absence of PCR testing or nasal cultures positive for staphylococcus colonization. If the cultures are negative, mupirocin should be discontinued to avoid mupirocin resistance.

Perioperative Glycemic Control

Optimizing glycemic control is essential in order to not only eliminate all sternal wound infections, but also decrease morbidity and mortality in COVID-19 patients undergoing cardiac surgery. A significant number of these patients will have diabetes mellitus and suboptimal glycemic control.

[Perioperative Antibiotics]

Postoperative Nutrition

A low serum albumin is one of the strongest predictors of postoperative morbidity and mortality following cardiac surgery. Patients with a preoperative serum albumin <2.5 mg/dl have a significant increase in operative mortality and sternal wound infections. Whenever possible, surgery should be delayed for 7-10 days to allow for implementation of nutritional support, preferably through the enteral route which avoids intravascular catheter infections and metabolic complications. However, patients undergoing cardiac surgery during the COVID-19 pandemic will require urgent and emergent procedures. Many of these patients may have already been in the hospital or in an ICU on ventilator support for days prior to surgery. Patients with an albumin <2.5 mg/dl, those with weight loss >10% of body weight within 6 months and who have evidence of muscle wasting will benefit the most from early postoperative nutritional support. These patients will more likely require prolonged ventilator support, so that enteral feedings should be initiated as soon as hemodynamic stability has been achieved.

Cardiac surgery performed during the COVID-19 pandemic will force surgeons to operate in uncharted waters. Adherence to the AATS guidelines for prevention of wound infections in conjunction with the STS guidelines for perioperative glycemic control and the STS guidelines for antibiotic usage



will provide a pathway for surgeons to safely navigate a postoperative course to decrease postoperative infections, minimize complications and improve survival.

[Levy et al \(2020\) COVID-19 FAQs in Pediatric Cardiac Surgery¹⁸](#)

The world at large and the United States' health care infrastructure face unprecedented challenges in the COVID-19 pandemic, and the congenital heart disease (CHD) community is no exception. These challenges include potential resource scarcities of equipment, personnel and blood products. There is also a potential risk of infection to healthcare providers and family members. The relatively small size of the CHD workforce adds another dimension to the challenge since the rapid spread of COVID-19 could result in programmatic collapse at a moment's notice secondary to insufficient personnel from infection or quarantine. While many segments of our culture can pause during this period of crisis, pediatric patients' diseases require continuing care, particularly among newborns and infants who often require surgery during a narrow window of time to avoid death and provide for optimal outcomes. The medical community has been overwhelmed with videoconferences, webinars and newsletter updates that have covered a broad range of topics. Many of the questions now center on critical care and infectious disease related issues: screening techniques, preventative measures, treatment options, etc. Crisis management strategies for congenital heart disease have recently been published. The purpose of this review is to succinctly summarize frequently asked questions related to COVID-19 as it relates to children with congenital heart disease.

[Zhang and Chen \(2020\) \[Commentary\] Challenges to Thoracic Surgeons in the Global Coronavirus Pandemic¹⁹](#)

During this virus outbreak, many elective surgeries have been postponed. However, thoracic malignancy — especially lung cancer — has a very high incidence. For thoracic surgeons, the risk of tumor progression with delay of definitive surgery cannot be ignored.

Peng and colleagues investigated the clinical course of 11 patients diagnosed with COVID-19 after thoracic surgeries in January 2020. Of these patients, 7 underwent resection for lung cancer, 2 for esophageal cancer, 1 for pulmonary sclerosing pneumocytoma and 1 for bronchiectasis. 3 patients died of respiratory failure, 5 recovered and were discharged and 3 remained hospitalized. Physiological changes after thoracic surgeries, such as



leukocytosis, lymphopenia and changes in computed tomography images might overshadow early signs of viral pneumonia.

This article presented some important results for us to understand COVID-19 after thoracic surgeries. The COVID-19 infection rate after thoracic surgeries was high [11/121; 9.1%]. There was also a high proportion of severe illness [36.4%] and mortality rate [27.3%] of COVID-19 after thoracic surgeries. Therefore, during the pandemic, patients planned for thoracic surgeries should be managed with great caution.

In circumstances in which surgeries cannot be delayed, there should be strict measures to prevent COVID-19 transmission. As the incubation period of COVID-19 is generally within 14 days following exposure, patients with an epidemiologic history should be observed for at least 2 weeks before surgery. For suspicious patients, nucleic acid testing should be performed. During anesthesia in emergency surgeries, the endobronchial blocker may be a better choice than the double-lumen bronchial tube, since the lung is not directly exposed to the air. Surgery can cause adverse effects on immune functions which may make these patients more vulnerable to COVID-19 infection. Therefore, strict infection control practices should be followed. Since the early signs of COVID-19 may be masked by physiological changes following thoracic surgeries, thoracic surgeons should cautiously monitor their patients and also protect themselves from infection.

[Wood et al \(2020\) Precautions and Procedures for Coronary and Structural Cardiac Interventions During the COVID-19 Pandemic: Guidance From Canadian Association of Interventional Cardiology²⁰](#)

This document from the Canadian Association of Interventional Cardiology specifically addresses the implications for the care of patients in the cardiac catheterization laboratory in Canada during the COVID-19 pandemic. The core principles are to maintain essential interventional cardiovascular care while minimizing risks of COVID-19 to patients and staff and maintaining overall health care resources. As the COVID-19 pandemic evolves, procedures will be increased or reduced based on the current level of restriction to health care services. Although some consistency across the country is desirable, provincial and regional considerations will influence how these recommendations are implemented. We believe the framework and recommendations in this document will provide crucial guidance for clinicians and policy makers on the management of coronary and structural procedures as the COVID-19 pandemic escalates and eventually abates.



[Hassan et al. \(2020\). Cardiac surgery in Canada during the COVID-19 Pandemic: A Guidance Statement from the Canadian Society of Cardiac Surgeons²¹](#)

Cognizant of concerns over growing resource constraints, cardiac surgeons throughout Canada have been forced to make drastic changes to their clinical practices. From prioritizing and delaying elective cases to altering therapeutic strategies in high-risk patients, cardiac surgeons □ along with their heart teams □ are having to reconsider how best to manage their patients. The Canadian Society of Cardiac Surgeons and its Board of Directors have come together to formulate a series of guiding statements. With strong representation from across the country and the support of the Canadian Cardiovascular Society, the authors have attempted to provide guidance to their colleagues on: leadership roles that cardiac surgeons may assume during this pandemic; patient assessment and triage; risk reduction; and real-time sharing of expertise and experiences.

[Li et al \(2020\) Preliminary Recommendations for Lung Surgery During COVID-19 Epidemic Period²²](#)

Based on the experience of Chinese thoracic surgeons, we hereby present the following preliminary suggestions to thoracic surgeons worldwide for extensive discussion and reference:

- Patients with lung space occupying lesions are encouraged to seek treatment nearby and locally so that patient transport and personnel flow are minimized.
- Patients with lung space occupying lesions with respiratory symptoms such as fever, cough and wheezing should first be diagnosed at a fever clinic designated by the local government. If they are suspected of having SARSCoV-2 infection, they should be admitted to a designated isolation ward. After SARS-CoV-2 infection has been excluded and space occupying lesions in the lungs confirmed by CT scan, they could be transferred to thoracic surgery for further diagnosis and treatment.
- PET-CT or percutaneous pulmonary puncture biopsy indicates benign lesions. If patients need elective surgical treatment, it is recommended for them to be followed up outside the hospital for observation [no less than three months] and a surgical treatment chosen after the outbreak is over or relatively stable.
- PET-CT or percutaneous pulmonary puncture biopsy indicates malignant lesions. If the tumor is of central type [bronchoscopy is not

recommended during the outbreak prevention and control period], patients can be recommended to receive neoadjuvant therapy first, and choose the surgical treatment after the outbreak is over or relatively stable.

- Patients with central malignant lesions accompanied by massive hemoptysis or patients with major airway involvement accompanied by severe dyspnea and in critical condition can be treated with emergency surgery.
- For peripheral solid nodules with a diameter of less than 3 cm considered as malignant lesions by PET-CT or percutaneous pulmonary puncture biopsy, short-term regular follow-up once a month can be recommended during the outbreak prevention and control period. If the nodules increase by more than 20% during the follow-up period, surgical treatment should be considered. If the diameter of the nodules is ≥ 3 cm, surgical treatment should be considered.
- Lung ground-glass nodules: According to the results of the national lung screening test, the malignant risk of chest CT review of 4–5 mm GGNs is 0.4% annually. The risk of malignancy for CT re-examination every six months is 1.1%, 3.0%, and 5.2%, respectively. The risk of malignancy is 10.9% for chest CT re-examination every three months with a nodule diameter greater than or equal to 20 mm. Therefore, we suggest that during the epidemic prevention and control period, whether the patient has pure GGNs, mixed GGNs or multiple GGNs [SARS-CoV-2 infection should be excluded for multiple GGNs], follow-up re-examination should be the main recommendation and surgery should not be carried out. For those with nodules 5 mm or less in diameter, they should be re-examined again in less than one year; for those with nodules with a diameter of 6–19 mm, they should be re-examined six months later; for those with a diameter of ≥ 20 mm, they should be re-examined less than three months later to reduce the risk of cross infection. At the same time, great attention should be paid to the pulmonary imaging features of new coronary pneumonia, which are ground-glass changes in the lungs. For newly discovered GGNs or space-occupying lesions in the lungs, follow-up should be conducted for at least three months to exclude the possibility of pulmonary changes in new coronary pneumonia.



[Thoracic Surgery Outcomes Research Network \(2020\) COVID-19 Guidance for Triage of Operations for Thoracic Malignancies: A Consensus Statement From Thoracic Surgery Outcomes Research Network²³](#)

The COVID-19 pandemic has forced hospitals to progressively reduce surgical volumes to both minimize disease transmission within the hospital, and to preserve human, PPE and other resources needed to care for COVID-19 patients. In response, many hospitals have abruptly reduced or eliminated elective surgeries. As the COVID-19 burden on a hospital increases, procedures that improve survival may similarly have to be reduced or eliminated: ie semi-elective, urgent and perhaps some emergent operations. For some cancer patients, surgery may be delayed for months or even years without negative consequences. However, in other scenarios, failure to perform an indicated cancer surgery in timely fashion may have long term implications on a patient's survivorship or significant permanent deficits in their quality of life. Therefore, cancer patients and the oncology teams that treat them are likely to face difficult decisions between suboptimal management strategies. Thoracic oncology decisions are further complicated by the fact most of the patients with lung, oesophageal and other thoracic malignancies would be considered to be a high risk group for poor outcomes with COVID-19: advanced age, emphysema, heart disease. Further, the indicated therapeutic procedures can both impair lung function [lung isolation, removal of lung tissue], and expose clinical teams to aerosolised viral load [bronchoscopy, double-lumen endotracheal tube placement, airway surgery, laparoscopy and possibly lung surgery particularly with parenchymal lung leaks]. We have assembled a document to offer guidance intended to facilitate these difficult decisions when caring for patients with thoracic malignancies during the COVID-19 pandemic.

[Thornton et al \(2020\) Management of the Airway and Lung Isolation for Thoracic Surgery During the COVID-19 Pandemic²⁴](#)

Intra-operative aerosol generating procedures are arguably unavoidable in the routine provision of thoracic anaesthesia. Airway management for such patients during the COVID-19 pandemic including tracheal intubation, lung isolation, one-lung ventilation and flexible bronchoscopy may pose a significant risk to healthcare professionals and patients. Still there remains a need for timely thoracic surgery for patients with lung cancer or thoracic trauma. The thoracic anaesthetic community has been confronted with the need to modify existing techniques to maximise safety for patients and healthcare professionals. With appropriate modification, aerosol generation



may be mitigated against in most circumstances. We developed a set of practice-based recommendations for airway management in thoracic surgical patients which have been endorsed by the Association for Cardiothoracic Anaesthesia and Critical Care and the Society for Cardiothoracic Surgery in Great Britain and Ireland.

[Engelman et al \(2020\) Adult Cardiac Surgery and the COVID-19 Pandemic: Aggressive Infection Mitigation Strategies Are Necessary in the Operating Room and Surgical Recovery²⁵](#)

The COVID-19 pandemic necessitates aggressive infection mitigation strategies to reduce the risk to patients and healthcare providers. This document is intended to provide a framework for the adult cardiac surgeon to consider in this rapidly changing environment. Pre, intra and post-operative detailed protective measures are outlined. These are guidance recommendations during a pandemic surge to be utilized for all patients while local COVID-19 disease burden remains elevated.

[Haft et al \(2020\) Adult cardiac surgery during the COVID-19 Pandemic: A Tiered Patient Triage Guidance Statement²⁶](#)

This document has been generated to provide guiding statements for the adult cardiac surgeon to consider in a rapidly evolving national landscape. Acknowledging the risk for a potentially prolonged need for cardiac surgery procedure deferral, the authors have created a proposed template for physicians and interdisciplinary teams to consider in protecting their patients, institution and their highly specialized cardiac surgery team. In addition, recommendations on the transition from traditional in-person patient assessments and outpatient follow-up are provided. Lastly, we advocate that cardiac surgeons must continue to serve as leaders, experts and relevant members of our medical community, shifting our role as necessary in this time of need.

[Salenger et al \(2020\) The Surge after the Surge: Cardiac Surgery post-COVID-19²⁷](#)

The COVID-19 pandemic has dramatically reduced adult cardiac surgery case volumes as institutions and surgeons curtail non-urgent operations. There will be a progressive increase in deferred cases during the pandemic that will require completion within a limited time frame once restrictions ease. We investigated the impact of various levels of increased post-pandemic



hospital operating capacity on the time to clear the backlog of deferred cases.

We collected data from four cardiac surgery programs across two health systems. We recorded case rates at baseline and during the COVID-19 pandemic. We created a mathematical model to quantify the cumulative surgical backlog based on the projected pandemic duration. We then used our model to predict the time required to clear the backlog depending on the level of increased operating capacity.

Cardiac surgery volumes fell to 54% of baseline after restrictions were implemented. Assuming a service restoration date of either June 1 or July 1, we calculated the need to perform 216% or 263% of monthly baseline volume, respectively, to clear the backlog in one month. The actual duration required to clear the backlog is highly dependent on hospital capacity in the post-COVID time period and ranges from one to eight months depending on when services are restored and degree of increased capacity.

Conclusions: Cardiac surgical operating capacity during the COVID-19 recovery period will have a dramatic impact on the time to clear the deferred cases backlog. Inadequate operating capacity may cause substantial delays and increase morbidity and mortality. If only pre-pandemic capacity is available, the backlog will never clear.

[Seese et al \(2020\) Programmatic Responses to the Coronavirus Pandemic: A Survey of 502 Cardiac Surgeons²⁸](#)

Despite the severity of the ongoing public health crisis, the results of this survey suggest that the majority of cardiac surgical programs responded expeditiously by decreasing elective case volume and implementing telemedicine approaches for patient evaluations. These approaches serve several important purposes: 1. reductions in elective case volume help conserve necessary hospital resources such as ventilators and impede transmission of COVID-19 to both patients and hospital providers; and 2. prevent surgeons from operating on patients who are unknowingly within the COVID-19 incubation period ³/₄ a practice that has been shown to exacerbate the pulmonary consequences of the virus.

Lessons from the early US cardiac surgery response to COVID-19 that can be extrapolated to future pandemics include the importance of involving cardiac surgeons in policy decisions regarding cardiovascular patients, the need for enhanced communication between hospital leadership and service lines as well as improved access to PPE for all providers. The collective experience from the COVID-19 pandemic can help serve as a catalyst to



prepare permanent systems-based plans for future pandemic response situations.

[Bonalumi et al \(2020\) The COVID-19 Outbreak and Its Impact on Hospitals in Italy: The Model of Cardiac Surgery²⁹](#)

A modification of traditional workflow is mandatory during the COVID-19 outbreak, beginning with the assumption that asymptomatic persons may also be potential sources of SARS-CoV-2. We advise that a computed tomography scan is performed for every patient who is being evaluated for non-elective surgery. A CT scan is the most sensitive tool for recognizing a COVID-19 lung infection.

OTHER

[American College of Cardiology \(2020\) General Guidance on Deferring Non-Urgent CV Testing and Procedures During the COVID-19 Pandemic³⁰](#)

With the primary objectives of reducing the risk of infection or spread of COVID-19, protecting our patients and care teams, enhancing capacity to respond to the pandemic and preserving access to necessary cardiovascular care, many clinics and hospitals have begun deferring non-urgent cardiovascular testing and procedures. In general, it is reasonable to consider deferring any test or procedure that is unlikely to directly impact clinical care or outcomes over the next several months.

A list of tests and procedures with the potential for deferral are listed.

[Zhejiang University School of Medicine \(2020\) Handbook of COVID-19 Prevention and Treatment³¹](#)

Requirements for Operation Rooms and Staff PPE

1. Arrange the patient in a negative pressure operating room. Verify the temperature, humidity and air pressure in the operation room;
2. Prepare all required items for the operation and use disposable surgical items if possible;
3. All surgical personnel including surgeons, anesthesiologists, hand-washing nurses, and charge nurses in operating room should put on their PPE in the buffer room before entering the operating room. Put on double caps, medical protective mask, medical goggles, medical



- protective clothing, boot covers, latex gloves, and powered air-purifying respirator;
4. The surgeons and the hand-washing nurses should wear disposable sterile operating clothes and sterile gloves in addition to the PPE as mentioned above;
 5. Patients should wear disposable caps and disposable surgical masks according to their situation;
 6. The charge nurses in the buffer room are responsible for delivering items from the buffer area to the negative pressure operating room;
 7. During the operation, the buffer room and the operating room shall be tightly closed and the operation must be carried out only if the operation room is under negative pressure;
 8. Irrelevant personnel shall be excluded from entering the operating room.



Produced by the members of the National Health Library and Knowledge Service Evidence Team[†]. Current as at 11 May 2020. This evidence summary collates the best available evidence at the time of writing and **does not replace clinical judgement or guidance**. Emerging literature or subsequent developments in respect of COVID-19 may require amendment to the information or sources listed in the document. Although all reasonable care has been taken in the compilation of content, the National Health Library and Knowledge Service Evidence Team makes no representations or warranties expressed or implied as to the accuracy or suitability of the information or sources listed in the document. This evidence summary is the property of the National Health Library and Knowledge Service and subsequent re-use or distribution in whole or in part should include acknowledgement of the service.

The following PICO(T) was used as a basis for the evidence summary:

	PATIENTS NEEDING CARDIOTHORACIC SURGERY
	CARDIOTHORACIC SURGERY

The following search strategy was used:

(COVID-19 OR COVID OR "novel coronavirus" OR coronavirus OR "corona virus" OR "Wuhan virus" OR "2019-nCoV2" OR "2019 nCoV" OR "SARS-CoV2") AND (cardiothoracic OR "cardio-thoracic" OR chest OR lung OR cardiac OR cardiology OR coronary OR heart OR pacemaker OR "bypass surgery" OR cardiopulmonary OR cardiovascular OR ventricular OR aortic OR thoracic OR thoracotomy OR lobectomy OR thymectomy OR pleurectomy OR pneumonectomy) AND (surg* OR procedure* OR operat*)

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¹ PCR Online. Cardiac surgery and the COVID-19 outbreak: what does it mean? <https://www.pconline.com/News/Whats-new-on-PCRonline/2020/Cardiac-Surgery-and-the-COVID-19-outbreak-what-does-it-mean>. [Accessed 07 April 2020].

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