

Evidence table

Surgery and COVID-19

14 July 2022

This is the final version of the living evidence table on surgery and COVID-19. This evidence table was last updated in July 2022. The information in this table is no longer monitored on a regular basis.

This table includes information on surgery and COVID-19. It focuses on testing, outcomes, vaccines, workforce, personal protective equipment and aerosol-generating procedures.

Resuming elective surgery	Research evidence
	<p>When resuming elective surgical care, studies suggest a number of considerations/principles/modelling that can be applied to safely and effectively return to full capacity. Modelling has been used to identify and evaluate the optimal postponement and resumption of surgical services in Singapore’s healthcare system.</p> <p>With the growing backlog of planned surgery due to COVID-19, new strategies along with appropriate resources, facilities and mental health support are required to inform surgical recovery plans.</p> <p>Paediatrics: A validated tool in North America has been developed to prioritise elective paediatric orthopaedic cases when resuming elective surgery.</p>
	Published guidance in NSW
Pre-surgical screening	<p>Key principles for resuming non-urgent elective surgical procedures include awareness of local COVID-19 prevalence, surgical demand and hospital capacity, facility readiness, sufficiency of resources, safety and continuity of the workforce, prioritisation of cases and patient preparedness.</p>
	Published guidance in Australia and internationally
	<p>In 2020, the Australian Health Protection Principal Committee developed principles around reintroduction of hospital activity that include equity of access, preservation and appropriate use of PPE, clear timeframes to monitor and review local capacity and access, national COVID-19 testing guidelines and re-introduction of restrictions. Guidance and checklists from surgical societies in the UK and USA are available for safe resumption of services.</p>

Studies predominantly report implementing a comprehensive preoperative screening [process/protocol/checklist](#) to screen COVID-19 symptoms, [travel or contact history](#) and [chest CT scan](#). A [systematic review](#) on cancer surgeries reported triaging pre-operatively, including telephone pre-assessment for suspicious symptoms and history of contact or travel, 14-days self-isolation, in-hospital queries at admission, temperature monitoring, isolation in a single room, facilitating COVID-free ward, and promoting physical distancing.

Pre-operative evaluation [protocols](#) of persons with a history of COVID-19 need to be considered in order to balance any potential risk with benefit.

In asymptomatic patients, [low-dose CT](#) does not appear to add any value to the results of PCR testing and a health questionnaire in preoperative screening for COVID-19.

Novel utilisation of the [strand-specific assay](#) has been posited as an additional test-based validating tool, in an attempt to further stratify patients who repeatedly test positive for SARS-CoV-2 into infectious versus non-infectious for perioperative planning.

Published guidance in NSW

If diagnosed with COVID-19, surgical units should consider the [consensus recommendations](#) before admitting a patient to surgery. Clinical and epidemiological criteria as specified for the identification of suspected or probable COVID-19 cases.

Published guidance in Australia and internationally

Generally, screening of patients including taking a patient history, is recommended in [Australia](#). Royal Australian College of Surgeons recommend that [patient history](#) should be thoroughly examined for potential sources of SARS-CoV-2 exposure, and equal weight should be given to these findings as to clinical presentation. The use of [chest CT scanning alone](#) to diagnose COVID-19 is [not recommended](#) due to nonspecific findings that may overlap with other respiratory illnesses. A [multidisciplinary consensus statement](#) from the UK recommends shared decision making be used regarding time of surgery and that the time before surgery should be used for functional assessment, prehabilitation and multidisciplinary optimisation.

Generally, screening of patients including [taking a patient history](#), is recommended [internationally](#). The use of [chest CT scanning alone](#) to diagnose COVID-19 is [not recommended](#) due to nonspecific findings that may overlap with other respiratory illnesses.

For patients that have been infected with SARS-CoV-2 requiring surgery, [UK position statement](#) advocates for shared-decision making regarding the timing of surgery, along with accounting for severity, ongoing

	<p>symptoms, comorbid and functional status; clinical priority and risk of disease progression; and complexity of surgery.</p> <p>Paediatrics</p> <p>The Royal College of Paediatrics and Child Health (RCPCH) in the UK recommends that pre-operative testing is not required prior to elective surgery in children, irrespective of vaccination status and irrespective of whether the child requires an overnight admission.</p>
<p>Pre-surgical COVID-19 testing</p>	<p>Research evidence</p> <p>During the second wave of COVID-19 infections in Victoria, Australia, routine pre-operative SARS-CoV-2 testing of 4965 elective adult and paediatric surgical patients admitted across eight hospitals showed that four patients (0.12%) had a positive PCR test but screened negative on a questionnaire. There were no reports of transmission to healthcare workers. An Australian study of 3037 patients across 11 hospitals admitted for elective surgery found that no patient returned a positive RT-PCR result.</p> <p>The COVIDSurg Collaborative study found preoperative nasopharyngeal swab testing to be beneficial (lower rate of pulmonary complications) before major surgery and in settings of high SARS-CoV-2 prevalence. There was no proven benefit of swab testing before minor surgery in low prevalence areas.</p> <p>Universal preoperative testing of 19,061 surgical patients for COVID-19 at three Children’s hospitals in the United States found the overall incidence of COVID-19 was 0.85%. Among 162 people that tested positive for COVID-19, 75.9% were asymptomatic.</p> <p>A prospective observational study of 303 elective surgeries in the UK found there was 100% compliance with pre-operative COVID-19 RT-PCR testing. There was no 30-day mortality or major respiratory complications. An international cohort study of 7704 patients from 42 countries found that there was no relationship between preoperative testing for COVID-19 and self-isolation with symptomatic postoperative COVID-19.</p> <p>For surgeries that cannot be deferred without risks, screening by way of routine RT-PCR testing of asymptomatic patients may be effective in preventing in-hospital transmission and avoiding post-operative surgical complications.</p> <p>Published guidance in NSW</p> <p>It is advised that COVID-19 testing prior to surgery should be based on risk assessment.</p> <p>Published guidance in Australia and internationally</p>

	<p>In settings of low prevalence such as Australia and New Zealand, any risk of potential SARS-CoV-2 exposure or presence of specified symptoms are advised to have RT-PCR assay prior to surgery. Routine preoperative testing is not recommended in patients with no risk factors.</p> <p>Internationally, a systematic review including publications mostly from high prevalence settings, found COVID-19 testing before surgery is generally recommended for people undergoing surgery. In the UK, rapid testing is required 72 hours prior to surgery and on the morning of admission. For paediatric patients in Canada, all patients and their caregivers are required to be assessed for risk factors and symptoms prior to surgery, and need to be tested if there are any symptoms of contact with a confirmed COVID-19 case. Timing of when to test before surgery is varied; a review from US institutions found this ranged from 1-5 days. Due to turnaround time for test results in Australia, surgery that can be delayed for ≥ 24 hours without adverse effects should await testing results. When surgery is required within 24 hours, surgery should go ahead. There is an opportunity to perform rapid testing.</p>
<p>Pre-surgical isolation</p>	<p>Research evidence</p> <p>A 14 day self-quarantine program prior to elective orthopaedic surgery in Japan was completed by 304 patients, who then underwent PCR testing and there were no positive results.</p> <p>An international and multicentre cohort study on COVID-19-free surgical pathways (complete segregation of the operating theatre, critical care, and inpatient ward areas) found lower pulmonary complication rates, COVID-19 infection rates and mortality rates among patients using the pathways.</p> <p>A large study across 114 countries found isolation before elective surgery might be associated with a small but clinically important increased risk of postoperative pulmonary complications.</p> <p>Preoperative self-isolation and surgery in institutions not concurrently treating COVID-19 were more likely if the surgery was performed during a COVID-19 peak period in that country, an international cohort study from 42 countries found.</p> <p>Paediatrics</p> <p>In a retrospective review study of paediatric patients scheduled for elective surgery, 81% of patients who tested positive for COVID-19 reached Ct value of 35, which is indicative of a very low likelihood of infectiousness, by day 14. By day 28, 86% of patients reached Ct value of 35. This study recommended that elective surgery should be delayed for a minimum of 28 days from the initial positive test.</p> <p>Published guidance in NSW</p>

	<p>If a decision is made to go ahead with elective surgery, patients are not required to self-isolate prior to admission.</p> <p>Published guidance in Australia and internationally</p> <p>Recommendations from clinical experts in Australia and New Zealand concluded that as RT-PCR is less sensitive to SARS-CoV-2 early in its incubation period, a 14-day quarantine prior to surgery should be considered in asymptomatic patients with a history of potential exposure to COVID-19, however these patients would be expected to be in self-isolation as they are identified by NSW Health as a contact.</p> <p>Many NHS trusts recommend patients limit their social contacts for a 10-day period while awaiting surgery.</p>
<p>Surgery with COVID-19 infection</p>	<p>Research evidence</p> <p>There is consistent evidence that surgery in patients with COVID-19 increases the risk of postoperative mortality compared to patients without COVID-19.</p> <p>Surgical complications are also higher in patients with COVID-19 undergoing surgery, with pulmonary and thrombotic complications amongst the most common.</p> <p>The COVIDSurg Collaborative's study found 23.8% (268 of 1128) of surgical patients with COVID-19 die within 30 days, and 51.2% (577 of 1128) of patients will have major pulmonary complications. A cohort from the same group in the United States found lower mortality 11% (174 of 1581) and pulmonary complication rates 39.5% (622 of 1581).</p> <p>Published guidance in NSW</p> <p>Patients with confirmed COVID-19 should not undergo elective surgery unless postponing the procedure would create a greater risk to life.</p> <p>Published guidance in Australia and internationally</p> <p>Elective surgical procedures for people with COVID-19 should be delayed until the patient is no longer infectious and has demonstrated recovery from COVID-19.</p>
<p>Surgery post COVID-19 infection</p>	<p>Research evidence</p> <p>A COVIDSurg Collaborative study shows that patients with a pre-operative SARS-CoV-2 diagnosis had high levels of mortality, particularly, among those who had surgery within 0–2 weeks, 3–4 weeks and 5–6 weeks of their SARS-CoV-2 diagnosis (odds ratio 4.1, 3.9 and 3.6, respectively). Surgery performed ≥ 7 weeks after SARS-CoV-2 diagnosis was associated with a similar mortality risk to baseline. After a ≥ 7-week delay, patients with</p>

ongoing symptoms had a higher mortality than patients whose symptoms had resolved or who had been asymptomatic.

In a sub-group of patients from the [COVID-Surg-Cancer study](#), patients were operated on at different time points after a previous SARS-CoV-2 infection. Previous SARS-CoV-2 infection was associated with increased odds of pulmonary complications compared to no infection 10.7% (12/122) versus 3.6% (16/448). Pulmonary complications and mortality were lowest at least 4 weeks after notification of a positive swab test.

A [single centre retrospective cohort study](#) in New York City found that detection of SARS-CoV-2 infection within 4 weeks before, or 5 days after surgery, is associated with increased odds of 5-day post-operative respiratory failure and 30-day mortality.

A large [prospective cohort study](#) found major, elective surgery 0-4 weeks after COVID-19 infection was associated with an increased risk of postoperative complications. Surgery performed 8 weeks after COVID-19 diagnosis was not associated with increased complications.

A [retrospective analysis](#) of 340 patients undergoing total joint replacement with prior COVID-19 found no differences in median length of stay or in-hospital complication rates compared to patients with no prior COVID-19 diagnosis.

Paediatrics

The [CovidSurg study](#) analysed the perioperative outcomes of 88 children aged 16 or under with confirmed COVID-19 diagnosis and found that compared to adults, children had favourable outcomes in terms of 30-day postoperative mortality (1.1% vs 23.8%) and pulmonary complications (13.6% vs 51.2%).

A [retrospective cohort study from the United States](#) found that children with preoperative confirmed COVID-19 had favourable postoperative outcomes compared to adults. The postoperative complication rate, readmission rate and reoperation rate were 7%, 6% and 6% respectively.

Published guidance in NSW

If a patient has recovered from COVID-19, met the criteria for release from isolation and is awaiting elective surgery, they should be [informed of the increased risk](#) of adverse outcomes and discuss their individual situation with their surgeon.

Published guidance in Australia and internationally

In Australia, it is recommended that minor [surgery is delayed](#) for a minimum of four weeks, and major surgery for a minimum of seven weeks, after a positive swab test unless, outweighed by the risk of [deferring surgery](#), such as disease progression or clinical priority.

Internationally, a [minimum of 7 weeks](#) of being symptom-free prior to undergoing surgery is generally recommended. The risks of deferring surgery need to be balanced against the risk of postoperative morbidity or mortality associated with COVID-19.

Some jurisdictions such as the US provide suggested [wait time based on severity of COVID-19](#):

- Four weeks for an asymptomatic patient or recovery from only mild, non-respiratory symptoms
- Six weeks for a symptomatic patient who did not require hospitalisation
- Eight to 10 weeks for a symptomatic patient who is diabetic, immunocompromised, or hospitalised
- Twelve weeks for a patient who was admitted to an intensive care unit due to COVID-19 infection.

Paediatrics

The [British Columbia Centre for Disease Control](#) recommends that “elective surgery should be delayed for a child who has had COVID-19 infection (regardless of severity) and/or MIS-C for at least four weeks from full resolution of symptoms or positive PCR test.

Vaccines and surgery

Research evidence

[COVIDSurg, a modelling study](#) based on data from almost 60,000 patients internationally, found that fewer people need to be vaccinated to prevent one death in surgical patients compared with the general population. They estimated that globally, prioritising all surgical patients for preoperative vaccination ahead of the general population is projected to prevent an additional 58,687 COVID-19-related deaths in one year.

Published guidance in NSW

Published guidance in Australia and internationally

Advice from the Royal Australasian College of Surgeons is that Australian patients should receive [COVID-19 vaccine](#) before surgery. The [Australian Government](#) recommend scheduling COVID-19 [vaccination more than 1 week before or after surgery](#).

A paper published by [the Royal Australasian College of Surgeons](#) highlights that perioperative consultation is an opportunity to encourage vaccination against SARS-CoV-2 in patients at high risk of morbidity and mortality.

Recommendation from the [Royal Australasian College of Surgeon’s rapid review](#) states that urgent and emergency procedures should occur irrespective of vaccination status and operating staff should be aware of the potential impact of vaccination status on perioperative management.

International professional societies generally recommend vaccinating patients against SARS-CoV-2 [before elective surgery](#), as this may reduce

	<p>the risk of COVID-19 complications and transmission of the virus during procedures. Recommendations on the timing for preoperative COVID-19 vaccination is variable, ranging from a few days to weeks due to the unknown vaccine immunogenicity. The American Society of Anaesthesiologists recommends waiting at least two weeks, while a letter from the British Journal of Anaesthesia recommends delaying elective procedures until 15 days after the second vaccine dose.</p>
<p>Personal protective equipment</p>	<p>Research evidence</p> <p>A systematic review found that sources of transmission during surgery include aerosol-generating procedures, fumes released during surgery and contaminated body fluids.</p> <p>In a systematic review and meta-analysis not specific to surgical settings, face mask use could result in a large reduction in risk of infection, with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar. Eye protection also was associated with less infection. Similar results were found in an umbrella review specific to emergency trauma surgery.</p>
	<p>Published guidance in NSW</p> <p>The NSW Clinical Excellence Commission Infection Prevention and Control Manual recommends that if the patient is suspected or confirmed to have COVID-19 and the decision is to proceed with surgery, then follow transmission-based precautions for contact and airborne precautions including eye protection.</p> <p>A decision support tool on PPE in the operating theatre and procedural areas includes a risk matrix and was updated to reflect the current Delta outbreak in NSW commencing 26 June 2021.</p>
	<p>Published guidance in Australia and internationally</p> <p>The Australian Commission on Safety and Quality in Health Care recommend that the Australian guidelines for the prevention and control of infection in healthcare need to be followed for non-COVID-19 patients, and specific guidance is available for PPE use for patients with COVID-19. They advise standard precautions and the use of standard operating theatre attire and PPE, which are adequate for the performance of AGPs (such as intubation) on patients who are not suspected of or not confirmed cases of COVID-19, in the absence of another airborne-transmissible infectious agent. A surgical mask, theatre cap, eye protection, gown, and gloves should typically be worn. A P2 respirator is not necessary in this context. If AGPs are being performed on COVID-19 patients, contact and airborne precautions should be used. Formal training on donning and doffing PPE procedures, comprehensive infectious disease control education and good hand hygiene are equally important aspects for the prevention of COVID-19 infection among surgical staff.</p>

	<p>The World Health Organisation personal protective equipment for COVID-19 guidelines include the following recommendations relevant to surgery:</p> <ul style="list-style-type: none"> • Performing surgical procedure: wear fluid resistant medical mask or respirator if AGP is anticipated, wear fluid resistant gown, gloves, and eye protection (goggles or face shield), and perform hand hygiene. • During patient (with COVID-19) transport to and from surgery: wear medical mask, wear eye protection (goggles or face shield) and perform hand hygiene. • During patient (without COVID-19) transport to and from surgery: medical mask need to be worn in areas of known or suspected community, cluster or sporadic SARS-CoV-2 transmission • Assisting patient (with COVID-19) from bed to transport: medical mask, gown, gloves, eye protection need to be worn and perform hand hygiene.
<p>Workforce cohorting</p>	<p>Research evidence</p> <p>Case reports from individual institutions describe the importance of developing a dedicated operating space for suspected or confirmed COVID-19 patients, redeploying surgical team based on both the individual skill set and level of expertise in anticipation of major workforce shortage, preparing staff rotas accounting for potential staff sickness, and assigning a 'stand by' registrar to cover unexpected sickness absence.</p> <p>Studies report sub-dividing surgical teams to function separately to minimise the workforce impact of potential team exposure to COVID-19. Multiple studies describe dividing surgical residents into "active-duty inpatient" team and "remotely-working" team and the two teams alternate with each other every two weeks and another study describes having the same teamwork for three to five days in a row to limit the workforce impact of a potential exposure. There are also examples of designated pandemic wards which provide a natural segregation of staff into independent teams.</p>
	<p>Published guidance in NSW</p> <p>NSW Surgical Services Taskforce sets out key principles for managing surgical procedures to maintain service availability during a period of heavy demand for health system resources. These include:</p> <ul style="list-style-type: none"> • Maintain emergency surgery capability and capacity • Prioritise urgent elective surgery • Mobilise and protect the surgical workforce • Preserve capacity to support the health service COVID-19 • Plans are dynamic and will change as the COVID-19 pandemic unfolds.
	<p>Published guidance in Australia and internationally</p> <p>Royal Australasian College of Surgeons recommends the number of people in the operating theatre to be kept to a minimum and should be</p>

consultant-led with no, or one trainee or registrar. Given the operation will take longer due to COVID-19 PPE requirement, it is advised to consider a second surgeon or team back-up for long complicated operations.

[COVIDSurge Collaborative](#) global guidance for surgical care during COVID-19 pandemic based on a scoping search of literature recommends doubling or cross-covering rotas for surgical teams in anticipation of staff sickness or self-isolation. It also recommends augmenting surgical teams with retired surgeons, clinical academics or final-year medical students. [Royal College of Surgeons of England](#) has set priorities for surgical workforce during the COVID-19 pandemic and these include maintaining emergency surgery capabilities, protecting and preserving the surgical workforce, fulfilling alternate surgical roles and fulfilling alternate non-surgical roles. In a [systematic review](#) of international guidelines for head and neck oncology management in COVID-19 patients, all guidelines recommended only essential staff to be in the operating room.

Research evidence

There have been case reports of single institutions establishing processes for surgery in patients with suspected COVID-19. Key features of these processes include:

- Symptom screening and/or nurse triage
- Transfer of patients with suspected COVID-19 to a [fever clinic](#) OR cases reported to a surgical lookout guard/director
- Patients tested and isolated whilst waiting for results
- If [stable condition](#), wait for test results. If unstable condition, proceed to surgery with precautions (PPE, in a negative pressure room), [dedicated operating room team](#) not allowed out of room, transport patients using dedicated paths to [isolated recovery rooms](#) and begin [decontamination procedure](#) following surgery
- If COVID-19 positive, transferred to designated hospital and if COVID-19 negative, care provided as usual.

Workflow for suspected COVID-19 cases

Published guidance in NSW

The [Agency for Clinical Innovation and Clinical Excellence Commission's](#) principles for resuming elective surgery recommends that patients with confirmed COVID-19, or those in a high risk category, or from a high risk setting for COVID-19, should not undergo elective surgery unless postponing the procedure creates a greater risk to life.

Published guidance in Australia and internationally

The [Australian Commission on Safety and Quality in Health Care](#) advise that patients who, on screening, require further investigation of COVID-19 risk should be referred for COVID-19 testing, as appropriate. These patients should only be considered for emergency surgery, investigations or procedures. Surgery on patients with or suspected of having COVID-19 [should be delayed](#) until they have recovered or performed only in an emergency situation.

	<p>The World Health Organisation state the decision to operate should not be based on COVID-19 status but on risks and benefits of surgery. Recommendations include:</p> <ul style="list-style-type: none">• Postpone elective surgery• Patients with signs and symptoms should be tested• Avoid AGPs if possible• Surgical staff in the operating room and transport staff should use contact and droplet precautions including a particulate respirator if potential for an AGP• Patients should wear a medical mask if tolerated• Ideally, a negative pressure room used• One or more specific operating rooms could be identified• Surgical staff should be limited to essential personnel• Terminal cleaning should be performed after each surgical procedure. <p>A systematic review on the management of surgery during the COVID-19 pandemic includes the following recommendations:</p> <ul style="list-style-type: none">• Consider all patients as COVID-19 positive until proven otherwise• Develop a dedicated transport route or perform AGP in negative pressure rooms• Limit personnel number, equipment, and traffic in and out of the operating room• Allow adequate time between procedures to allow for deposition of aerosolized viral particles• Routine cleaning/disinfection <p>Recommendations from individual institutions and societies in Italy, Saudi Arabia and Europe include:</p> <ul style="list-style-type: none">• Elective surgery should be deferred• Patients with suspected infection should be separated from those with confirmed infection, in single rooms with private bathrooms• Healthcare workers must wear appropriate PPE with a dedicated area for donning/doffing• AGPs should only be performed when strictly necessary and in an isolated room, with negative pressure if possible• Post-surgery patients should be transferred to an outside recovery area with a minimum number of transport workers involved• After separating from the patient, healthcare workers should remove scrub clothes and if possible, shower and change• Room should be cleaned after completion of surgery
<p>Aerosol Generating Procedures</p>	<p>Research evidence</p> <p>There is no consensus or definitive list on what procedures are aerosol generating in healthcare settings.</p>

[WHO](#) lists tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy as aerosol-generating.

The [Centres for Disease Control and Prevention, USA](#) lists open suctioning of airways, sputum induction, cardiopulmonary resuscitation, endotracheal intubation and extubation, non-invasive ventilation (e.g., BiPAP, CPAP), bronchoscopy and manual ventilation as commonly performed procedures that often-considered aerosol generating or create uncontrolled respiratory secretions.

Published guidance in NSW

The [NSW Clinical Excellence Commission](#) Infection Prevention and Control Manual sets out examples of aerosol generating procedures of varying risk based on current evidence and expert opinion. It recommends the following considerations:

- Aerosol-generating procedure should be conducted in a negative pressure room or if unavailable, a single room (that is not positive pressure) with the door closed.
- Aerosol-generating procedure on suspected or confirmed COVID-19 should be performed with a minimum number of staff present and where possible, the most qualified person should carry out the procedure. In circumstances where there may be an ongoing need for the aerosol-generating procedure (e.g., non-invasive ventilation), it is recommended that a plan for review and discontinuation of the aerosol-generating procedure is put in place.
- Nebulisers are not recommended and alternative means of delivering medication (such as pressurised metered-dose inhaler or a spacer) should be used.

A [decision support tool](#) on PPE in the operating theatre and procedural areas includes a risk matrix and was updated to reflect the current Delta outbreak in NSW commencing 26 June 2021. Airborne precautions include P2/N95 respirator (or higher) in place of surgical mask, where possible the patient should be in a negative pressure room and wear a surgical mask.

Published guidance in Australia and internationally

[WHO](#) recommends that healthcare workers performing aerosol-generating procedures:

- perform procedures in an adequately ventilated room
- use a particulate respirator at least as protective as a US National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Union (EU) standard FFP2, or equivalent.
- use eye protection (i.e., goggles or a face shield)
- wear a clean, non-sterile, long-sleeved gown and gloves
- limit the number of persons present in the room to the absolute minimum required for the patient's care and support