



Short title: SARS-CoV-2 elective surgery guideline

1. Purpose

To provide frequently updated advice on safety concerns for surgery in patients with current or previous SARS-CoV-2 infection, or who have recently received or soon plan to receive a SARS-CoV-2 vaccination.

2. Scope

This document is intended to apply to fellows, trainees and SIMGs involved in perioperative care of surgical patients.

3. Background

The Australian and New Zealand College of Anaesthetists (ANZCA) has produced this guideline to provide current advice to our fellows, trainees and SIMGs on navigating surgical patient safety concerns in the rapidly changing environment of the SARS-CoV-2 pandemic.

This document updates previous ANZCA advice:

- ANZCA, ASA, RACS, RANZCOG, RANZCO and RACDS. Guidance on delays to elective surgery post recovery from SARS-COV 2 infection. 5 August 2020.
- ANZCA. Surgery following the Astra Zeneca Vaccine. 8 June 2021.

This document has been produced via a review of current best available clinical evidence and of relevant health sector, regulatory and government body guidance. It is living guidance and will be reviewed and updated frequently. Before making use of this document, please ensure you are accessing the latest version, which is available from the college website (www.anzca.edu.au).

Public health orders in each state, territory or country supersede this guidance and should be followed ahead of this guideline.

We invite suggestions and contributions for future versions, via email to sq@anzca.edu.au.

4. Executive summary

For most patients, it is safe to proceed with surgery **two to three weeks post SARS-CoV-2** infection provided no ongoing symptoms are present. For high-risk patients, it is recommended to perform an individualised risk assessment and utilise Shared Decision Making to determine optimal timing of surgery post SARS-CoV-2 infection.

Patients who are asymptomatic, have returned back to baseline, are vaccinated, aged <70 years and without comorbidity can proceed with non-urgent elective minor surgery (day case) and endoscopy procedures without delay beyond the infectious period (timeframe as per local guideline and expertise)

ALL patient with ongoing symptoms, especially those who have not returned to baseline function and those patients with a history of moderate or more severe²⁵ SARS-CoV-2 infection: recommended delay for **non-urgent elective surgery** is still 7 weeks²⁴.

5. Background for recommendations: surgical patients and SARS-CoV-2 infection, vaccinated and unvaccinated (recommendations 2023)^{23, 24, 25, 26}

a. Impact of variants

The Omicron strain has become the dominant SARS-CoV-2 variant globally. Although more transmissible and better able to evade the immune system and vaccines, it has less pathogenicity, with those being infected less likely to require hospitalisation and ICU admission.

b. Supportive evidence from published study by DROMIS-22²³:

They found in their Omicron-predominant, highly immunised population undergoing general surgery, no association between a SARS-COV-2 infection within the 8 weeks prior to surgery and increased postoperative respiratory morbidity for patients presenting for surgery, provided they had no ongoing symptoms on the day of surgery.

Findings: Of the 4928 patients assessed for the primary outcome, of whom 92.4% were vaccinated against SARS-CoV-2, 705 had preoperative SARS-COV-2 infection. The primary outcome was reported in 140 (2.8%) patients. A SARS-COV-2 infection within 8 weeks before surgery was not associated with increased postoperative respiratory morbidity (odds ratio 1.08) provided the patient was fully recovered on the day of surgery. None of the secondary outcomes differed between the two groups. Sensitivity analyses concerning the timing between SARS-COV-2 infection and surgery, and the clinical presentations of preoperative SARS-COV-2 infection did not show any association with the primary outcome, except for patients post SARS-COV-2 infection with ongoing symptoms the day of surgery (odds ratio 4.29).

c. Supportive emerging evidence from COVIDSurg3 collaborative²⁴

Enrolment of 19 592 patients, 940 hospitals in 89 countries. Overall mortality was 5.8%. Findings demonstrated higher risk for patients older than 70 years, ASA ≥3, having major surgery, especially if emergency surgery. Thirty-day mortality in these groups seems to still be higher than what would be expected from a non-COVID cohort but this was not specifically compared. If patients with preoperative SARS-CoV-2 infection were unvaccinated and symptomatic at presentation for surgery the risk of pulmonary complications was highest (37.1%) compared to unvaccinated and asymptomatic (18.9%), vaccinated and symptomatic (26%) and vaccinated and asymptomatic (12.5%). Strikingly, higher income countries had better outcomes, a reflection of health inequity. Postoperative pulmonary complications increased risk of mortality in all groups.

Risk assessment matrix²⁴:

	Patient related factors	Health system related factors
Low risk	Low risk surgery Age < 70 ASA 1 and 2 Vaccinated and asymptomatic	Ability to access Critical Care Can manage severe PPC (post-operative pulmonary complications)
High risk	Major surgery Age ≥ 70 ASA ≥ 3 Not vaccinated Symptomatic infection	High community SARS-CoV-2 infection rates

d. Supportive evidence OpenSAFELY Collaborative²⁶

The study considered operations performed in England between 17 March 2018 and 17 March 2022 (two years before and after 17 March 2020 when all elective surgery in the UK was temporarily postponed as part of the first COVID lockdown), yielding a cohort of 3,658,140 patients undergoing surgical procedures. Of these, 1,242,180 were conducted since vaccines became widely available, on patients with a mean age of 55 years.

Overall, 30-day post-operative mortality was 0.2% and 30-day post-operative complications was under 1.0% in the pandemic-with-vaccine era. Mortality for surgery conducted within two weeks of a positive test was 1.1% (compared to 9.1% in COVIDSurg), declining to 0.3% by four weeks post SARS-COV-2 infection (5.5% in COVIDSurg).

Even when the authors looked at the pre-vaccine pandemic period (the same era covered by COVIDSurg), results from this new study showed a lower mortality in England than in the global sample, of 4.1 % for surgery conducted within 2 weeks of a positive COVID test, declining to 1.3% by 4-6 weeks and 0.9% by 6 weeks and over.

Before the COVID pandemic began, 30-day mortality post-surgery overall in this study was 0.1% so close to (but slightly less than) the pandemic-with-vaccine era 30-day post-surgery mortality rates found in this new study.

- e. Recommendations: time-sensitive or urgent surgery for patients post SARS-CoV-2 infection in higher risk groups

5.5.1 Time-sensitive surgery, including cancer surgery (risk-benefit analysis) for higher risk groups

For time-sensitive surgery (e.g. cancer surgery), the individual risk versus benefit of proceeding and delaying needs to be carefully assessed. Ideally a plan should be formulated based on individualised risk assessment, clinical judgement and shared decision-making of all involved in the patient's care, to ensure optimal timing.⁶

5.5.2 Children

Studies suggests that the surgical risks in children with SARS-CoV-2 are much lower than in adults, mirroring the lower morbidity of SARS-CoV-2 infection seen in children.⁷ The current recommendation endorsed by Society for Paediatric Anaesthesia in New Zealand and Australia (SPANZA) is to defer elective non-urgent surgery on a similar timeframe as other acute respiratory illness.

5.5.3 Long COVID and other sequelae

Long COVID, cardiorespiratory and/or immunological sequelae post SARS-CoV-2 infection should be considered and optimised, especially in the presence of persisting symptoms including fatigue.

5.5.4 Follow-up of patients whose surgery is delayed

It is of the utmost importance to ensure that patients whose surgery is delayed due to SARS-CoV-2 infection are not lost to follow-up, and unnecessary prolonged delays to diagnostic procedures or surgery are avoided, to prevent poorer short- and long-term outcomes.

5.6 PCR or RAT re-testing after a SARS-CoV-2 infection, prior to elective surgery

Jurisdictional guidelines may vary; therefore, recommendation is to follow local institutional guidelines for pre-operative testing or screening for SARS-CoV-2 infection.

However, re-testing with PCR^{8,9} for SARS-CoV-2 within 90 days of symptom onset or a first positive test is not recommended, since **persistent or recurrent positive PCR tests are common after recovery**. This is presumably due to shedding of viral fragments. The duration of shedding was found to be a median of 19 days (interquartile range 12-28 days).¹⁰

Although RATs may also detect these viral fragments, there is some evidence that a RAT may be used as an indicator for infectiousness after recovery from SARS-CoV-2 infection.¹¹

We recommend consulting with an infectious disease expert to determine when patients are no longer infectious and if there is any doubt about continuing infectiousness and/or a repeat SARS-CoV-2 infection.

5.7 Assessment and optimisation after SARS-CoV-2 infection prior to elective surgery

A formal clinical review must occur *for higher risk patients even after mild SARS-CoV-2 infection and for ALL patients with ongoing symptoms and those who have not returned to baseline function including patients suffering with Long COVID or Post-COVID-19 Conditions.*

This must include evaluation of the cardiorespiratory system, as well as other potentially affected systems, e.g. renal, hepatic, haematological, immunological, musculoskeletal, neurological (memory, sleep) and psychological (fatigue, post-traumatic stress disorder). This is especially important in those who have any persisting symptoms (including fatigue, chest pains or dyspnoea) and those who were hospitalised for COVID-19 care. Where available, the perioperative care team is ideally placed to coordinate the assessment and optimisation of these patients.⁷

5.7.1 Potential investigations

Depending on severity of infection, assessment of functional status and return to baseline, investigations may include:

- N-terminal-pro hormone B-type natriuretic peptide and B-type natriuretic peptide (NTproBNP/BNP).
- Ferritin.
- Transthoracic echocardiogram (TTE), if any indication of cardiac injury or compromise.

There is likely no value in repeating chest x-ray (CXR) or computed tomography (CT) of the chest unless more than 3 months has passed after the initial infection, and there is suspicion of ongoing post-COVID-19 symptoms and/or there are abnormal signs on clinical examination.

5.7.2 Risk of Deep Vein Thrombosis or Pulmonary Embolism (DVT/PE)

There is an increased risk of DVT/PE after SARS-CoV-2 infection. It is encouraged to discuss these patients with Haematology to ensure the implementation of the most appropriate perioperative pharmacological thromboprophylaxis plan, balancing bleeding and thrombosis risk. In addition to pharmacological thromboprophylaxis, it is important to consider perioperative mechanical preventative measures such as calf compressors and stockings.

5.7.3 Further guidance

For helpful further guidance on specific assessment and optimisation, please refer to the Royal Australasian College of Surgeons' guidance, [Delaying surgery for patients recovering from COVID-19](#).³

6 Recommendations: surgical patients and SARS-CoV-2 vaccines

6.1 Timing of elective surgery in relation to SARS-CoV-2 vaccination

6.1.1 Preoperative SAR-CoV-2 vaccination

If time permits, up-to-date vaccination status prior to surgery should be encouraged. Partial vaccination may still be of benefit if time is constrained. Recommendations on the timing for SARS-CoV-2 vaccination before surgery are variable due to the unknown vaccine immunogenicity and are further dependent on what the goal is.

If the goal is to avoid confusion between symptoms of vaccine-related side effects and symptoms of surgical complications: general advice is to have a minimum of 1 week between vaccination and surgery. This is in line with government advice in Australia¹² and New Zealand.⁵

If the goal is to ensure optimal immunological response and better (at least likely adequate) protection from SARS-CoV-2 infection: a minimum of 2 weeks is recommended. Optimal immunological response prior to surgery is especially important before transplant surgery, where the decision should be made in consultation with a specialist immunologist and the transplant team, as the timing may need to be significantly longer (up to 4-6 weeks before surgery).^{13,1}

For those people with prolonged symptoms of COVID-19, vaccination is still recommended but the optimal timing should be determined on a case-by-case basis. Expert advice should be sought for people who have received anti-SARS-CoV-2 monoclonal antibody treatment or convalescent plasma, where deferral of future doses of SARS-CoV-2 vaccine is recommended for at least 90 days.¹¹

6.1.2 Postoperative and opportunistic SARS-CoV-2 vaccination

It is recommended to wait **2 weeks following major surgery** for SARS-CoV-2 vaccination, because it may be difficult to distinguish post-vaccination symptoms from postoperative symptoms in the immediate postoperative period. Additionally, many patients have some discomfort following surgery, and a vaccine-inflammatory response could worsen their discomfort or slow their recovery.

For patients undergoing minor or intermediate surgery who do not have up-to-date SARS-CoV-2 vaccination status, it may be desirable to consider earlier, 'opportunistic' vaccination, including intraoperatively or prior to discharge from hospital, unless they are acutely unwell. This may be particularly useful for patients at risk of being lost to follow up for vaccination, and patients with significant anxiety, behavioural disorders, or needle-phobia, who struggle to tolerate receiving vaccinations. The latter group may benefit from opportunistic vaccination during anaesthesia for their scheduled procedure.

There are no specific safety concerns around interaction between SARS-CoV-2 vaccinations and anaesthetic drugs. However, for the reasons stated at the beginning of this section, acutely unwell patients should not be vaccinated, and for all patients, the risks and benefits should be weighed up during shared decision-making.

¹ We note that our advice here differs from that of RACS, *Influence of COVID-19 vaccines on surgical practice*, October 2021, by making different recommendations based on different goals of the time delay between vaccination and surgery.

Clinicians may need to enquire into local compliance requirements for the administration of vaccinations, including arrangements for recording the vaccination on the Australian Immunisation Register or New Zealand National Immunisation Register, and ensure these are fulfilled.

More information on intraoperative vaccination is available from the Australian Technical Advisory Group on Immunisation (ATAGI) [advice on use of sedation for COVID-19 vaccination](#).¹⁴

6.2 Myocarditis and/or pericarditis post-mRNA SARS-CoV-2 vaccination

Myocarditis is defined as ‘inflammation of the heart muscle, which can reduce the heart’s ability to pump and can cause rapid or abnormal heart rhythms’. Pericarditis is defined as ‘inflammation of the pericardium’. Both conditions can be caused by a wide variety of infectious agents, toxins, and autoimmune conditions.

Myocarditis and pericarditis are rare adverse events post SARS-CoV-2 messenger ribonucleic acid (mRNA) vaccination (Pfizer-BioNTech/Comirnaty and Moderna/Spikevax) with an onset usually within 7 days of vaccination. It is important to note that in general, myocarditis risk is about fivefold in those with SARS-CoV-2 infection compared to mRNA vaccination. The risk of myocarditis following mRNA vaccination increases in patients under 40 years old.

6.2.1 Incidence

Post mRNA SARS-CoV-2 vaccine myocarditis is more common after the second dose and especially in males, with the highest incidence among adolescents, young adults and infants.¹⁵

Most data to date regarding myocarditis post SARS-CoV-2 mRNA vaccine has been captured through VAERS data (Vaccine Adverse Event Reporting System, the US national vaccine safety passive monitoring system), which inevitably overestimates its incidence. VAERS is designed as a research data generating tool; it is not a diagnostic tool and is unable to ascertain causation.

Myocarditis reporting rates were 40.6 cases per million second doses of mRNA SARS-CoV-2 vaccines administered to males aged 12-29 years (versus 2.4 per million second doses administered to males age ≥ 30). The highest reported rates were among males aged 12-17: 62.8 per million second doses, and those aged 18-24: 50.5 per million second doses. This is in contrast to reporting rates among females: 4.2 per million in age group 12-29 and 1 per million second doses in those aged ≥ 30 .^{16,17}

6.2.2 Symptoms

Symptoms of post mRNA SARS-CoV-2 vaccine myocarditis or pericarditis include chest pain, dyspnoea or palpitations. There may be an elevated troponin level and/or abnormal findings on electrocardiogram (ECG), echocardiography or cardiac magnetic resonance imaging (MRI). The most accurate diagnosis is via pathology.

Not every patient with a raised troponin post SARS-CoV-2 mRNA vaccination has myocarditis, as troponin may be released just from other causes such as intense exercise.¹⁸

6.2.3 Recovery and follow-up

It is worth noting that most cases recover with supportive management and simple non-steroidal anti-inflammatory drugs (NSAID) therapy, and that longer-term follow-up of these cases is ongoing.

In patients with a history of vaccine associated myocarditis/pericarditis, it is important to ascertain whether there are any long-term sequelae. It is advised to manage these patients perioperatively in close collaboration with a specialist cardiologist. They may require additional preoperative investigations such as transthoracic echocardiogram (TTE) or cardiopulmonary exercise testing (CPET), and a higher level of monitoring perioperatively.

6.3 Vaccine Induced Thrombosis and Thrombocytopenia (VITT) post-SARS-CoV-2 vaccination¹⁹

Vaccine Induced Thrombosis and Thrombocytopenia (VITT) is a severe prothrombotic syndrome associated with thrombocytopenia, which has been described in a small number of patients exposed to the SARS-CoV-2 AstraZeneca/Covishield or Vaxzevria and Janssen (Johnson & Johnson) vaccines. Even though the exact pathophysiology of the syndrome is unknown, the presence of pathological antibodies against PF4/polyanion complexes has been identified in the majority of cases. It is worth noting that these antibodies are only detectable by specific enzyme-linked immunosorbent assay (ELISA) methods in specialised laboratories.

In patients with confirmed VITT and not HITTS (Heparin Induced Thrombotic Thrombocytopenia Syndrome), the use of subsequent routine heparin prophylaxis is recommended. If there is a history of 'spontaneous HITTS' or the history is unclear, then a haematological review is recommended.

7 Definitions and abbreviations

- Break-through SARS-CoV-2 infection

A SARS-CoV-2 infection occurring in a patient with up-to-date SARS-CoV-2 vaccination status.

- COVID-19

The disease or syndrome caused by SARS-CoV-2 infection.

- Long COVID

This document uses 'Long COVID' to mean post COVID-19 condition as described by the World Health Organization:

Post COVID-19 condition occurs in individuals with a history of probable or confirmed SARS CoV-2 infection, usually 3 months from the onset of COVID-19 with symptoms and that last for at least 2 months and cannot be explained by an alternative diagnosis. Common symptoms include fatigue, shortness of breath, cognitive dysfunction but also others and generally have an impact on everyday functioning. Symptoms may be new onset following initial recovery from an acute COVID-19 episode or persist from the initial illness. Symptoms may also fluctuate or relapse over time.²⁰

- Major and minor surgery

There is no universally agreed definition of major or minor surgery; however, we offer these general descriptions, which are based on expected perioperative systemic stress and/or inflammatory response to the procedure.

- Minor surgery

Procedures generally able to be managed as day procedures, typically superficial surgical procedures involving skin or soft tissues. Such procedures may also include elective minor ear-nose-throat procedures and simple endoscopy involving limited tissue sampling or resection.

- Major surgery

Procedures that involve significant physiological stress to the body as compared to minor surgery. Some examples are: endoscopic resection of prostate, major intra-abdominal surgery such as colorectal resection, thyroidectomy, total joint replacement or lung operations.²¹

- Severity of symptoms (National Clinical Evidence taskforce definition of symptoms) ²⁵

Mild illness	<p>An individual with no clinical features suggestive of moderate or more severe disease:</p> <ul style="list-style-type: none"> no OR mild symptoms and signs (fever, cough, sore throat, malaise, headache, muscle pain, nausea, vomiting, diarrhoea, loss of taste and smell) no new shortness of breath or difficulty breathing on exertion no evidence of lower respiratory tract disease during clinical assessment or on imaging (if performed)
Moderate Illness	<p>A stable patient with evidence of lower respiratory tract disease:</p> <ul style="list-style-type: none"> during clinical assessment, such as <ul style="list-style-type: none"> oxygen saturation 92–94% on room air at rest desaturation or breathlessness with mild exertion or on imaging
Severe Illness	<p>A patient with signs of moderate disease who is deteriorating</p> <p>OR</p> <p>A patient meeting any of the following criteria:</p> <ul style="list-style-type: none"> respiratory rate ≥ 30 breaths/min oxygen saturation $< 92\%$ on room air at rest or requiring oxygen lung infiltrates $> 50\%$
Critical Illness	<p>A patient meeting any of the following criteria:</p> <ul style="list-style-type: none"> Respiratory failure (defined as any of) <ul style="list-style-type: none"> severe respiratory failure ($\text{PaO}_2/\text{FiO}_2 < 200$) respiratory distress or acute respiratory distress syndrome (ARDS) deteriorating despite non-invasive forms of respiratory support (i.e. non-invasive ventilation [NIV], or high-flow nasal oxygen [HFNO]) requiring mechanical ventilation hypotension or shock impairment of consciousness other organ failure

- NAAT
 - Nucleic Acid Amplification Test for SARS-CoV-2.
- PCR
 - Polymerase chain reaction test for SARS-CoV-2.
- RAT
 - Rapid antigen test for SARS-CoV-2.
- Up-to-date SARS-CoV-2 vaccination status

A person has this status if they have received the full course of SARS-CoV-2 vaccine doses and boosters that is recommended for them by their country's national health authority at the time of consideration.^{11,22}

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b. Version control

Date	Author/reviewer	Approved by	Changes
7 Feb 2022	SARS-CoV-2 surgery guideline working group	Professor David Story, Dr Peter Roessler	First published version
17 May 2022	SARS-CoV-2 surgery guideline working group	Professor David Story, Dr Peter Roessler	<ul style="list-style-type: none"> • Minor title change • 4.1: Sections re-ordered • 4.1: Added advice to consult El-Boghdadly et al • 4.1.1: General recommendation for non-urgent elective major surgery changed to minimum 7 weeks (was 8 weeks) in line with ongoing evidence review including El-Boghdadly et al • 4.1.1: Inserted need for individualised risk assessment • 4.1.2: Removed separate recommendation for patients with break-through infection due to lack of evidence • 4.1.2 (now Time-sensitive surgery): Added “including cancer surgery” to title for emphasis • 4.1.2: Added need for risk assessment and clinical judgement • 4.2: Added advice that RAT may be useful inside 90 days of infection, and to seek infectious disease expert advice if in doubt on infectiousness • 4.2.1.a.: Removed distinction between omicron and other variants – period till no longer infectious for stated patient group now 7 days for all variants • 4.2.1.c.: New section on immunocompromised patients • 4.3.1: Important persisting symptoms now include chest pains • 4.3.2: Added criteria for use of TTE • 5.1.1: Added advice about preoperative patients who are post SARS-CoV-2 • 5.2: Additional sentence stressing higher myocarditis risk from SARS-CoV-2 than vaccination • 5.3: Added advice on heparin prophylaxis for VITT patients • 5.3.1-5.3.3: Removed these sections as VITT advice is best sought from Haematology • 6: new definitions for major and minor surgery, NAAT, up to date SARS-CoV-2 vaccination status • Minor editorial changes
4 Aug 2022	SARS-CoV-2 surgery guideline working group		<ul style="list-style-type: none"> • 5.1.2: Added information on intraoperative SARS-CoV-2 vaccination • Minor editorial changes

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The members of the SARS-CoV-2 surgery guideline working group are:

Dr Vanessa Beavis, ANZCA Immediate Past President

Professor Paul Myles

Professor David A Scott

Dr Jill Van Acker

Dr Joreline (Jay) Van Der Westhuizen

We would also like to acknowledge the valuable assistance of:

Dr Philip Choi, Thrombosis and Haemostasis Society of Australia and New Zealand

Dr Ben Turner, Society for Paediatric Anaesthesia in Australia and New Zealand

Professor Mark Frydenberg, Royal Australasian College of Surgeons

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ANZCA website: www.anzca.edu.au