



Coronavirus COVID-19

BC Centre for Disease Control | BC Ministry of Health



Infection Prevention and Control (IPC) Protocol for Pediatric Surgical Procedures During COVID-19

Updated: May 25, 2021

This guidance is intended for health-care providers. It is based on known evidence as of March 17, 2021.

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Ministry of Health



BC Centre for Disease Control

If you have fever, a new cough, or are having difficulty breathing, call 8-1-1.



Guiding Principles

- Provider safety
- Patient safety
- Personal protective equipment (PPE) stewardship

Approach to IPC Includes

- Patient COVID-19 assessment
- Surgical risk assessment
- [PPE recommendations](#)

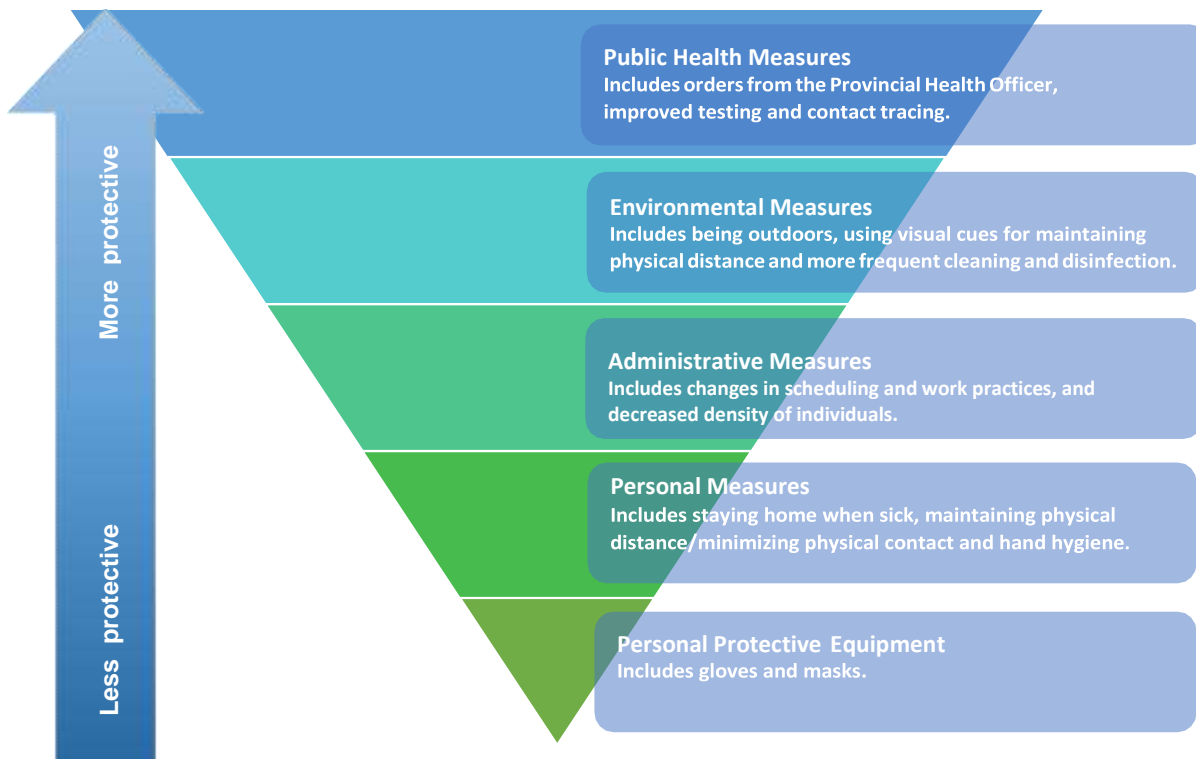
Background/Current Status

The protection of both patients and health-care workers (HCWs) is the basis of ethical guidelines established for the management of the COVID-19 pandemic. Health-care facilities should continue to ensure that they meet all current public health and infection prevention and control (IPC) recommendations. This applies to all staff, patients, family and visitors.

The guidance in this document is intended as **the minimum requirement** for facilities performing surgical procedures during the COVID-19 pandemic. This guidance is meant to be implemented as part of the hierarchy of controls (see figure 1) to reduce the risk of COVID-19 in health-care facilities, independent of population prevalence. Health authorities, under the guidance of public health, may choose to implement additional controls in select hospitals (e.g., management of surgical volumes and testing of certain high-risk patient populations) based on local or regional COVID-19 epidemiology. When COVID-19 prevalence is low, universal testing remains of limited additional value, with disadvantages including the detection of false positives and recovered COVID-19 positive patients with inactive virus.



Figure 1: Hierarchy for Infection Prevention and Exposure Control Measures for Communicable Disease



Scope

This protocol applies to all children (under the age of 19) undergoing a surgical procedure in B.C. during the COVID-19 pandemic. An individual patient risk assessment should be applied to every surgical patient, when time permits. See the provincial [point-of-care risk assessment tool](#) for more information.

Obstetric and adult populations have additional considerations and hospitals should also refer to these guidance documents for specific recommendations:

- [IPC protocol for adult surgical procedures during COVID-19](#)
- [IPC protocol for obstetrical procedures during COVID-19](#)



COVID-19 Risk in Pediatric Surgical Patients

Based on the current epidemiology of COVID-19 in B.C.,ⁱ the percentage of positive tests has varied from 3 to 15% across different health authorities, since at least November 2020. As the epidemiology of COVID-19 changes over time, we recommend referring to the [B.C. COVID-19 data webpage](#) for up-to-date information.

People who are scheduled for surgery and do not have risk factors for, or symptoms of, COVID-19 can still be considered low risk for having COVID-19. The B.C. Centre for Disease Control (BCCDC), Provincial Health Office (PHO) and the Provincial Infection Control Network of British Columbia review the epidemiology on a regular basis and will amend or update this advice as required. Worldwide, the prevalence of COVID-19 is still lower in children than in adults, making up 5 to 16% of all cases. As of April 9, 2021, 17.7%ⁱⁱ of cases in Canada were in those under 19 years old.

The decision to proceed with an elective, urgent or emergent surgical procedure and the selection of the appropriate PPE should be based on a patient's COVID-19 risk assessment which includes:

- assessing for risk factors;
- screening for symptoms; and
- COVID-19 testing if clinically indicated.

Within the pediatric surgical setting, children must be considered in the context of their household members. Children are more likely than adults to have minimal symptoms or no symptoms of COVID-19. Transmission is also more likely to occur in the household setting from caregiver to child because of the close nature of household contacts. **Therefore, all pediatric patients and their caregiver/household members must be assessed for risk factors and symptoms.** When deciding whether to order a COVID-19 test, consider both risk factors and symptoms and use the most up-to-date [BCCDC testing criteria](#).

As such, the decision to proceed with surgical procedures and the appropriate PPE to be used should be based on an individual COVID-19 patient and caregiver/household members risk assessment.

This guidance includes a patient screening tool and classification of patients based on a patient risk categorization into green (low risk), yellow (unknown or moderate risk) and red (highest risk) categories – please see section E for more information.

Experience from earlier versions of this guidance have shown:

- The timing of a pre-admission patient risk assessment for elective surgical patients will vary depending on availability and turn around time of local COVID-19 testing.
- For urgent/emergent surgical patients admitted to hospital, risk assessment is best done early in the patient's admission to best plan for disposition and the need for testing.
- A patient risk assessment is susceptible to variability and checklist fatigue. Hospitals are encouraged to rigorously apply and monitor the patient risk assessment process.

ⁱ Epidemiologic considerations: Daily case counts; test positivity rate; incidence rate; point prevalence.

ⁱⁱ Source: Government of Canada [COVID-19 Daily Epidemiology Update](#).



The entire surgical team (including anesthesiologist, surgeon, assistant, nurses, etc.) are responsible for deciding the patient risk category together.

Risk categorization provides direction for:

- PPE for those providing care, those providing aftercare and those responsible for cleaning and preparing the operating room;
- different anesthesia approaches;
- management of surgeries with high risk of aerosolization; and
- patient disposition.

When to Proceed with Surgery in Patients with Confirmed, Suspected or Recovered COVID-19 Patients

The decision to proceed with elective, urgent or emergent surgical procedures in a patient with confirmed, suspected or recovered COVID-19 requires the consideration of several factors. The decision is not always straightforward, nor does published evidence inform the correct timing for each affected individual. The following factors must be considered along with the risk associated with delaying surgery:

- Potential for COVID-19 transmission to HCWs and other patients;
- Increased risk of patient morbidity and mortality in the context of active or recent infection; and
- Options for alternative anesthesia (e.g., local/regional vs. general).

Multisystem Inflammatory Syndrome in Children (MIS-C)

MIS-C is an emerging entity that has been observed in the pediatric population during the COVID-19 pandemic. Based on current literature, MIS-C is thought to be a post-infectious entity that occurs two to six weeks after infection with COVID-19. Even though it is post-infectious, a substantial proportion of MIS-C patients have a positive ribonucleic acid (RNA) polymerase chain reaction (PCR) test at initial presentation. Many children may not have a history of symptomatic COVID-19 infection or even a significant exposure. The infection control management of these children are as follows:

- Children with MIS-C who have a positive COVID-19 PCR test should be treated as a COVID-19 infected patient. While waiting for results, the patient should be treated as a person-under-investigation (PUI).
- Children with MIS-C who have a negative COVID-19 PCR test (regardless of serology results) can be treated with routine precautions unless the point-of-care risk assessment indicates otherwise.
- Children with MIS-C who have a negative COVID-19 PCR test and do not have symptoms attributable to an acute COVID-19 infection do not require another PCR test pre-operatively. However, if there is clinical concern about reinfection they should be re-tested.
- In all situations, it is equally important to ask if the caregivers/household members are sick or have had any recent exposures to COVID-19 and manage them accordingly.

Serology is not useful to determine the infectivity of a person and should not be used to make decisions for infection control practices. The optimal timing of an elective procedure following a MIS-C diagnosis is addressed in the following section of this document.



What is the Effect of COVID-19 or MIS-C on Perioperative Morbidity and Mortality?

In adults, both [The Lancet](#) and the [COVIDSurg Collaborative](#) from the *British Journal of Surgery* have reported that major surgical patients with concurrent COVID-19 infection have a higher risk of respiratory complications and a higher associated perioperative mortality within the first several weeks of diagnosis. Data for children is sparse. The latest COVIDSurg Collaborative dataset reported a pulmonary complication rate of 1.3%ⁱⁱⁱ in children. Data from UT SouthWestern shows a much higher rate of respiratory complications in children with COVID-19 compared to matched controls (odds ratio 14.37).^{iv} A pediatric multicentre study of outcomes after surgery in children with COVID-19 is underway.

For pediatric patients who have had COVID-19 or MIS-C, pre-surgical patient assessment should consider optimal timing of the procedure post-illness, taking into consideration the limited data on perioperative adverse events after COVID-19 and MIS-C in children (particularly those with severe lung diseases). Prior to COVID-19, children who had a significant upper respiratory tract infection would have their elective surgery delayed for two weeks.

Based on this, it is reasonable to delay any elective procedure on 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. This is especially pertinent for children who have had complicated pneumonias or MIS-C with persistent cardiac dysfunction. The decision to proceed with the surgery after this delay period should be made by the surgeon, anesthesiologist and any relevant subspecialties involved.

When is a Patient with COVID-19 No Longer Infectious?

Prior to surgery (regardless of urgency), the infectivity of a patient who has been diagnosed with COVID-19 should be determined. Refer to the BCCDC's [Interim Guidance: Public Health Management of Cases and Contacts Associated with Novel Coronavirus \(COVID-19\) in the Community](#) for information about COVID-19 incubation and communicability period. Live viral shedding may occur for longer in those with COVID-19 illness of greater severity and those who are immunocompromised.

Recovered patients can continue to have non-replicating COVID-19 RNA detected in their upper respiratory specimens for up to 12 weeks. It is important to not rely on re-testing when determining infective status.

For further information on discontinuation of isolation and other disease transmission-based precautions, see the provincial guidance on [discontinuing additional precautions related to COVID-19 for admitted patients in acute care](#) for a list of diagnoses. Consultation with local infection control/medical microbiology/infectious diseases is recommended.

Local epidemiological data has shown that reinfection can occur as early as 60 days after a positive COVID-19 test. During this period, the primary infection conveys relative immunity such that the risk of reinfection is low. After this period, however, the risk of reinfection increases.

Therefore, after **60 days post-positive COVID-19 test**, the patient should be treated as per the guidance in this algorithm (appendix 1) and health authority protocols.

ⁱⁱⁱ Nepogodiev, Dmitri. Personal communication. By Dr. Simon Whyte, 10 March 2021.

^{iv} Saynhalth, Rita. Personal communication. By Dr. Simon Whyte. 9 April 2021 (data in peer review).



Immunization Status (COVID-19 Vaccine)

Immunization against COVID-19 in B.C. began in December 2020. As of March 2021, key populations are being prioritized to receive the vaccine. All of the approved vaccines available in Canada are not approved for the paediatric population at this time. Based on the limited data, it is too early to determine the impact vaccines have on a patient's risk of transmission, perioperative risk and long-term immunity.

All patients and their caregivers, regardless of immunization status, should continue to be screened based on the current algorithm with the appropriate risk stratification. This recommendation is subject to change as immunization rollout becomes more widespread and our knowledge about the vaccines evolves.

Should Testing for COVID-19 be Performed for Asymptomatic Patients Prior to Elective Surgery?

Case reports and recommendations in favour of universal testing for asymptomatic patients prior to elective surgery are increasing. Patients presenting in the asymptomatic or pre-symptomatic phase of infection are an exposure risk for HCWs and other patients, particularly when patients are admitted to hospital post-operatively. The ability for preoperative screening of asymptomatic patients to mitigate this risk is unknown. Identifying asymptomatic or pre-symptomatic COVID-19 pre-surgical patients with testing allows health-care teams to minimizing the risk of COVID-19 exposure by delaying surgery. However, there is a possibility of the detection of false positives and recovered COVID-19 positives with inactive virus.

The benefits of universal pre-operative testing may outweigh the disadvantages in certain patient populations when the COVID-19 incidence is high. There is evidence to suggest that in high prevalence areas, pre-operative testing of patients undergoing major surgery reduces the risk of pulmonary complications and mortality in some patient populations ([COVIDSurg Collaborative](#)). Therefore, the addition of pre-operative testing to symptom-based screening may be of value in certain patient populations in areas where SARS-CoV-2 transmission risk is high.

Patient populations and the needs of each facility are unique, therefore, pre-operative testing will vary across health authorities or facilities. When prevalence is high in a given area,[†] there is an opportunity for local multi-disciplinary discussion (at the emergency operations centre (EOC) level or equivalent) that considers all of the administrative, environmental and public health measures to reduce transmission risk. In addition to the individual patient risk assessment already in place, this includes pre-operative testing of asymptomatic individuals undergoing high-risk procedures.

[†] Data is limited and each metric has unique limitations. Recent experience in Fraser Health provides one definition of what triggered testing-based screening for "high prevalence." Testing-based screening was initiated and continued when the testing positivity rate exceeded 5% and there were two or more COVID-19 outbreaks in an acute care facility in the health authority.



Guidance for Testing Patients Pre-Operatively for COVID-19

A. Urgent/Emergent Surgical Procedures - Patient Risk Assessment

Urgent or emergent surgical procedures should proceed as medically indicated, regardless of the patient's COVID-19 status. **Surgery should not be delayed for testing or test results.**

Testing is recommended in the following situations:

- Asymptomatic pediatric patients with a caregiver/household member who has had a significant exposure to COVID-19 or has symptoms consistent with COVID-19.
- Any pediatric patient (regardless of symptoms) who has had a confirmed or suspected contact with COVID-19. Confirmation of the exposure with public health is not necessary prior to urgent/emergent surgeries.
- Any patient with symptoms that may be consistent with COVID-19 (any symptom on page 12, question 2).
- Any patient (regardless of symptoms) who lives in a setting (e.g., group home) or attends school/activities that are part of a COVID-19 outbreak.
- Children with medical or surgical conditions that have overlapping symptoms of SARS-CoV-2 infection or MIS-C. Examples of such conditions include, but are not limited to, acute appendicitis, foreign body airway obstruction and complicated pneumonias. It is recommended that these children undergo COVID-19 testing early in their diagnostic evaluation to minimize the risk of treatment delay while awaiting a test result. Patients who cannot wait for a test result must be treated as PUIs with all necessary precautions to protect the OR, recovery room and ward staff.
- All patients undergoing solid organ transplant, given the risk of COVID-19 disease exacerbation with start of immune suppression post-transplant. Patients called-in for deceased donor transplant should undergo symptom screen and testing immediately upon arrival. A microbiologist on call should be paged for a rapid PCR test. Patients undergoing living donation should have COVID-19 test completed within 24 to 28 hours prior to transplant surgery.
- For asymptomatic patients who reside in a health authority or area with a high prevalence of COVID-19, it is recommended the addition of test-based screening be considered when the following criteria are met: community test positivity rate exceeds 5% for a sustained period of time, incidence rate is greater than 10.1/100,000 and two or more COVID-19 acute care outbreaks. Evidence supporting this intervention is limited to the regional or local level at this time. The final decision around proceeding with test-based screening should be made based on local criteria that meet the needs of patient care, providers, infection prevention and control, and public health.

Regardless of test results, patients with a recent COVID-19 contact should be cared for using appropriate precautions during the 14-day incubation period (i.e., yellow or red risk category depending on test results).

B. Elective Surgical Procedures – Patient Risk Assessment

Elective surgical patients and their household members should [self-monitor for symptoms](#) prior to surgery. Additionally, they must follow all current PHO public health orders to minimize risk of COVID-19.



Any elective surgical patient who has been told to self-isolate by public health because of a contact with a confirmed COVID-19 case (e.g., household contact or part of a cluster investigation) must inform their surgeon immediately.

Testing is recommended in the following situations:

- Elective surgical patients who develop symptoms consistent with COVID-19 up to 14 days preoperatively *must* get a COVID-19 test and phone their surgeon's office.
- Patients who have contact with a confirmed COVID-19 case. Elective surgery should be delayed to allow for the full 14 days self-isolation period as directed by public health. (If the patient is diagnosed with COVID-19 during that time, please see the next point). If the patient remains symptom free, surgery can proceed after the self-isolation period is complete. However, the patient should still be tested for COVID-19 pre-operatively.
- For patients who have had recent COVID-19. Elective surgery should be delayed until the patient is deemed no longer infectious and at least four weeks from resolution of symptoms (see the sections on perioperative surgical morbidity and duration of precautions).

If an elective procedure becomes urgent/emergent, surgical intervention should not be withheld. Please refer to section A for management of such patients.

C. Pre-Surgical Patient Assessment

For scheduled surgical procedures, the COVID-19 surgical patient assessment form (see appendix 1) should be completed 48 to 72 hours prior to scheduled surgical procedure by the pre-admission unit (nurse, medical office assistant or anesthesiologist) over the phone and then repeated in person when the patient arrives at the hospital on the day of surgery.^{vi} It is prudent to time the first risk assessment early enough to allow for COVID-19 testing and result, should it be required. Testing turnaround times vary between communities.

For urgent or emergent surgical procedures, the COVID-19 surgical patient assessment form should be completed upon arrival to the preoperative area. There needs to be a mechanism in place within each facility or surgical unit to ensure the COVID-19 surgical patient assessment form is included in the patient chart.

IPC risk categories have been developed to guide PPE use before, during and after a surgical procedure (see the patient risk category table on page 12). Risk categories are designated as green (low risk), yellow (unknown or moderate risk) and red (highest risk).

D. Pre-Surgical Procedure Huddle

The pre-surgical huddle, when the full surgical team is engaged (anesthesiologist, surgeon, assistant, nurses, etc), is one of the strongest determinants for achieving the highest levels of safety and quality in surgical environments. All of the other usual elements of the surgical checklist should also be discussed at this time. Patient risk assessment and risk categorization should be reviewed and agreed upon by the surgical team (appendix 1).

^{vi} Every attempt should be made to assess the patient in their preferred language.



Recommended PPE to be used during the surgical procedure is provided in section E: protocol for management of pediatric surgical patients.

Consider anesthesia techniques which maintain spontaneous ventilation with minimal risk of needing respiratory support which can be performed using contact and droplet precautions whenever possible. These can be facilitated with the use of local or regional anesthesia techniques.



E. Protocol for Management of Pediatric Surgical Patients

Infection Prevention & Control Risk Category			
	Green	Yellow	Red
Presence of Caregiver at Induction	If caregiver is NEGATIVE on screening, follow institutional policies regarding parental presence at induction.	Do not allow caregiver to accompany child to procedure room, unless risk assessment favours parental presence.	Do not allow caregiver to accompany child to procedure room, unless risk assessment favours parental presence.
Intubation & Extubation Team <i>Limit personnel in the operating room (OR) to anesthesiologist, registered nurse (RN) +/- anesthesia assistant (AA)</i>	All staff in OR suite don: <ul style="list-style-type: none"> Surgical mask Eye protection Gown/gloves if dictated by point-of-care-risk assessment (PCRA) 	All staff in OR suite don: <ul style="list-style-type: none"> Fit-tested N95 respirator Eye protection Gown/gloves 	All staff in OR suite don: <ul style="list-style-type: none"> Fit-tested N95 respirator Eye protection Gown/gloves
Surgical Team	All staff in OR suite don: <ul style="list-style-type: none"> Surgical mask Eye protection Gown/gloves 	All staff in OR suite don: <ul style="list-style-type: none"> Fit-tested N95 respirator* Eye protection Gown/gloves 	All staff in OR suite don: <ul style="list-style-type: none"> Fit-tested N95 respirator Eye protection Gown/gloves
Extubation Team <i>Limit personnel in the OR to anesthesiologist, RN +/- AA</i>	All staff in OR suite don: <ul style="list-style-type: none"> Surgical mask Eye protection Gown/gloves if dictated by PCRA 	All staff in OR suite don: <ul style="list-style-type: none"> Fit-tested N95 respirator Eye protection Gown/gloves 	All staff in OR suite don: <ul style="list-style-type: none"> Fit-tested N95 respirator Eye protection Gown/gloves
Phase 1 Recovery	<ul style="list-style-type: none"> In the post-anesthesia recovery (PAR) in routine precautions. No need to delay moving patient to PAR following extubation. 	<ul style="list-style-type: none"> Patient may be moved to appropriate isolation room after appropriate air exchanges. Use droplet / contact precautions, adding airborne precautions if an AGMP is performed. 	<ul style="list-style-type: none"> Recover in the OR suite until ready to move to appropriate isolation room. Patient may be moved to appropriate isolation room after appropriate air exchanges. Use droplet / contact precautions, adding airborne precautions if an AGMP is performed.
Air Exchange	<ul style="list-style-type: none"> Cleaning and disinfecting may begin immediately. No minimum air exchanges required. 	<ul style="list-style-type: none"> Begin cleaning and disinfection after period of appropriate air exchanges. 	<ul style="list-style-type: none"> Begin cleaning and disinfection after period of appropriate air exchanges.
Cleaning and Disinfection Staff	All cleaning staff in OR don: <ul style="list-style-type: none"> Surgical mask Eye protection Gown/gloves 	All cleaning staff in OR don: <ul style="list-style-type: none"> Surgical mask Eye protection Gown/gloves 	All cleaning staff in OR don: <ul style="list-style-type: none"> Surgical mask Eye protection Gown/gloves
Disposition	Return patient to appropriate inpatient unit.	Return patient to appropriate inpatient unit based on further patient risk assessment.	Return patient to appropriate COVID-19 ward if confirmed positive or isolation room if unknown.

*At the discretion of the surgical team, surgical masks may be used in place of N95 respirators after appropriate air exchanges after an AGMP is performed (see section D). Any member of the surgical team may choose to wear an N95 respirator. Individual decisions shall be respected by the surgical team, but need not change the patient risk category.



Appendix 1: COVID-19 Surgical Patient Assessment Form - Pediatric

Health Authority LOGO

Patient Information
Name:
Date of Birth:
Language:
PHN:

Please use Patient Risk Category to assess risk based on the following questions:

NURSE OR MEDICAL OFFICE ASSISTANT SCREEN:

Able to obtain history?

Patient	Caregiver/Household
<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

Name of caregiver & relationship to patient:

1. Does the patient or caregiver/household member have a risk factor for COVID-19 exposure? In the last 14 days has the patient and caregiver/household member:

Returned from travel outside of Canada or another province?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Been in close contact with anyone diagnosed with lab confirmed COVID-19?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Lives/ works/attends school or daycare in a setting that is part of a COVID-19 outbreak? (without wearing the appropriate PPE)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Been advised to self-isolate or quarantine at home by public health?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

2. Does the patient or caregiver/household member have new onset COVID-19 like symptoms in the last 14 days?

* Please note - the symptoms listed below differ from those listed in the COVID-19 public health guidance for K-12 school settings as the purpose behind the two symptom lists are different.

24 - 72 hrs Prior	Date/ Time: _____	Day of Surgery	Date/Time: _____		
	Patient	Crgv/Hshld	Patient		
			Crgv/Hshld		
Fever or chills	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Fever or chills	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Cough	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Cough	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Difficulty breathing	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Difficulty breathing	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Diarrhea	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Diarrhea	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Nausea and/or vomiting	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Nausea and/or vomiting	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Headache	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Headache	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Runny nose/ nasal congestion	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Runny nose/ nasal congestion	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sore throat or painful swallowing	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Sore throat or painful swallowing	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Loss of sense of smell	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Loss of sense of smell	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No



Loss of appetite	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Loss of appetite	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Body aches	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Body aches	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Extreme fatigue	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Extreme fatigue	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

Screened by: _____ **Signature:** _____ **Screened by:** _____ **Signature:** _____

PHYSICIAN/SURGEON SCREEN: PATIENT

COVID-19 NP/gargle test performed within the last two weeks (of OR date) Yes No Date: _____
 Result: Negative Positive

If COVID-19 NP/gargle test has not been performed, do you recommend testing patient? Yes No Reason: _____

Unable to perform swab/gargle test? Yes No Reason: _____

Screened by: _____ **Signature:** _____ **Date/Time:** _____

PHYSICIAN/SURGEON SCREEN: CAREGIVER/HOUSEHOLD MEMBER

COVID-19 NP/gargle test performed within the last two weeks (of OR date) Yes No Date: _____
 Result: Negative Positive

If COVID-19 NP/gargle test has not been performed, do you recommend testing patient? Yes No Reason: _____

Unable to perform swab/gargle test? Yes No Reason: _____

Type of anesthesia to be used General Local/Regional

Screened by: _____ **Signature:** _____ **Date/Time:** _____

FINAL SURGICAL TEAM ASSESSMENT:

	Patient	Caregiver/Household member
COVID-19 risk factor (travel, contact, outbreak)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown
COVID-19 like symptoms that cannot be explained by another medical or surgical diagnosis?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown
COVID-19 test result?	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending <input type="checkbox"/> N/A	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending <input type="checkbox"/> N/A



Patient Risk Category Table

Consider consulting medical microbiologists and/or infectious disease physician for certain scenarios.

Step One			Step Two (If COVID-19 PCR results available)*	
Must have this information prior to surgery		COVID-19 risk category	COVID -19 test results **	COVID-19 risk category
Answered yes to any question in part 1?	COVID-19 symptoms*			
No	No	Green	Negative**	Green
No	Yes/Unknown	Yellow		Green
Yes	No	Yellow		Yellow
Yes	Yes/Unknown	Yellow		Yellow
Unknown	Unknown	Yellow		Yellow
			Positive***	Red

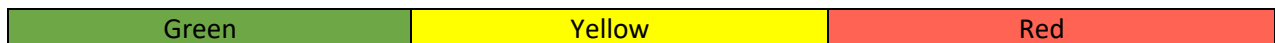
* If a caregiver/household member is symptomatic or has risk factors, that household member should be tested as well.

**Interpret the negative test in terms of the clinical context. If there is confirmed COVID-19 exposure within the household and a strong clinical suspicion of COVID despite negative testing, treat as YELLOW.

*** If within 10 days of positive result for child with mild disease for immunocompetent patients only. For immunocompromised patients, or patients with severe illness please consult infection control.

For non-immunocompromised patients with a history of COVID-19 but are outside the infectious window:
 10 – 60 days post positive result, if mild disease and not immunocompromised → GREEN
 >60 days post positive, screen as if they have not had COVID-19 as reinfection is possible.

Patient Risk Category (Circle one and refer to protocol for management of pediatric surgical patients):



Physician Signature: _____ Date: _____
 (Surgeon or Anesthesiologist)

Appendix 2: Evidence Review to Support Surgery Protocol Updates

How has the epidemiology in children changed since the last update?

Previously, the proportion of children affected by COVID-19 was estimated to be <5%. However, current data suggests this to be 5 to 16%.¹ In Canada, the proportion of cases in those ≤19 years old is 17.7% as of April 9, 2021.²

How do children infected with COVID-19 present?

Asymptomatic infection

Asymptomatic infection of COVID-19 in children is relatively common.

Public Health of Ontario published an umbrella review to summarise COVID-19 in children. Forty-eight systemic reviews were included. The analysis of included reviews found 10 to 19% of children with COVID-19 had asymptomatic infection.¹

It is unclear if asymptomatic children will have normal chest imaging during their infectious period.¹ Additionally, young children with minimal symptoms may be challenging to identify as younger children are unable to verbalise their mild symptoms.¹ A recent Canadian study by King et. al showed that in 1,987 children with COVID-19 confirmed infection, 1/3 were asymptomatic.³ Local data from April to September 2020 reported 33% of children who tested positive (11/33 cases) had 0 to 1 symptoms.

Symptomatic infection

The most common clinical signs and symptoms in children 0 to 19 years old are fever, cough, sore throat/pharyngeal erythema, dyspnea/shortness of breath and rhinorrhea/nasal congestion.¹

Why is the list of symptoms in the CRG surgical guidelines different from the COVID-19 public health guidance for K-12 school settings?

The public health guidance for K-12 school settings and public health testing guidance aim to be very practical guidance for families to follow. The aim is to minimize the number of people tested where the probability of a positive test is low.

The risk of using a less sensitive testing list in a health-care setting is that some pauci-symptomatic or asymptomatic children will be missed. However it is not clear that these children will have a major effect on transmissions within school settings.

The symptom list in surgical guidelines aim to be as sensitive as possible due to the risk to health-care workers of performing aerosol generating medical procedures on patients who are undiagnosed. The purpose of maintaining a more comprehensive list of symptoms in the surgical guidelines is to ensure that any child with any possible symptom of COVID-19 is identified and that the HCW seeing them will be alerted to test the patient.



There is no single symptom that is highly predictive of a positive SARS-CoV-2 test in children. However, it is important to ensure a very thorough screening process to minimize the potential spread of COVID-19 from a patient to either another patient or a health-care worker in the hospital.

Fever, cough, sore throat, dyspnoea and rhinorrhea are common symptoms in those with a positive test (but also common among those with negative test results).^{1,3,4} Anosmia/ageusia, have consistently been reported as most predictive of a positive result for a SARS-CoV-2 swab.³⁻⁷ However, these are uncommon in children and young children are unable to express whether they have these.

What are the suggestions around preoperative testing for asymptomatic children who have risk factors for COVID-19?

Current literature indicates asymptomatic infection in children is common.^{1,8} The strongest predictor of a positive test is a contact with another COVID-19 patient.⁹

There are no studies that have examined the risk of transmission from an asymptomatic individual with COVID-19 to a health-care worker during an AGMP. In that context, prudence is critical to protect health-care worker safety. Because the risk of transmission in this setting is unknown, testing these children preoperatively will minimise the risk of transmission of COVID-19 to a health-care worker.

Similarly, if a caregiver/household member has symptoms consistent with COVID-19, we strongly recommend testing for the accompanying caregiver as part of the preoperative assessment.

What are the recommendations around universal pre-operative testing?

The utility of universal pre-operative testing will vary based on the incidence of COVID-19 at the time. Pediatric universal preoperative testing in children:

- Sii et. al did not have any positive cases in their low risk cases screened (n=66).¹⁰
- Blumberg et. al reported 0.58% (n=7) tested positive and 6/7 of those children were asymptomatic.¹¹
- Lamberghini et. al found asymptomatic COVID-19 positivity rate of 2.3% (21 of 921) in dental patients.¹²
- Mehl et. al reported 23% (15 of 66) children who tested positive pre-op for COVID-19 had no symptoms attributable to COVID-19.¹³

Adult universal preoperative testing:

- Lewis et. al found six of 1,580 patients who underwent preprocedural testing (0.4%) had positive results. No patients reported symptoms at the time testing was ordered but after results were reported, two had symptoms and one person had a resolved illness. Percentage positivity rate at the time was ~5%.¹⁴
- Gruskay et. al reported 99 patients underwent pre-operative testing, 12 (12.1%) tested positive, of whom seven (58.3%) were asymptomatic.¹⁵



- Kannan et. al reported 413 patients tested pre-op eye surgery, nine (2.2%) were positive. All were asymptomatic. Local prevalence was unknown.¹⁶
- Jou et. al reported 1,491 tested pre-op, three patients (0.2%) tested positive, of which one was asymptomatic (0.02%).¹⁷
- Fraser Health conducted an evaluation of enhanced testing in the fall of 2020 (unpublished) at a time where the test positivity rate was >5%. Out of 5,681 (89%) patients who were admitted from the emergency department and scheduled for elective surgery, 65 (1.7%) did not meet testing criteria but tested positive. Of the 2,969 patients booked for elective surgery and tested preoperatively, 11 (0.4%) had asymptomatic infection and no risk factors for COVID-19 identified.

There are no studies that guide the threshold of local infection prevalence where universal pre-operative testing would be beneficial. **If the proportion of positive test results in the province are consistently above 5%, universal testing of children preoperatively can be justified. If the proportion of positive tests is $\geq 10\%$, universal preoperative testing should be implemented.**

Considerations for universal pre-operative testing include:

- Additional burden to our testing facilities/laboratories
- Turnaround time of tests
- Cost of each test
- Timing of testing pre-operatively (48 to 72 hours)
- Logistics of testing children traveling to another health authority for surgery (e.g., those children having surgery at BC Children's Hospital from outside of Vancouver)
- Consent from parents
- Support from public health

As an alternate strategy, why not treat all patients as "red" (i.e., use universal N95 masks for AGMPs)?

In adults, there is literature suggesting poorer outcomes for procedures during an acute COVID-19 infection. Many surgical procedures in children are not urgent/emergent and would be delayed if a viral infection was present to minimize risk of perioperative adverse events.

Consideration also has to be given to PPE supply if all surgical cases were to be treated as red risk category.

Why delay elective surgery after COVID-19 and/or MIS-C?

Non-COVID-19 viral upper respiratory tract infections (URTI) are associated with increased risk of perioperative adverse events (PRAE).¹⁸ The current standard of practice for elective surgeries in children with significant (non-COVID-19) URTI is to postpone the procedure for at least two weeks.



In adults with COVID-19 infection, perioperative mortality and morbidity is significantly increased.¹⁸⁻²¹ In children, sparse data suggests an increase in perioperative mortality (1%) and morbidity (13.6%).²¹ These figures are significantly higher than in the perioperative URTI literature.

Mehl et. al reported 66 children with confirmed COVID-19, 65% had no comorbidities. The majority were general surgery procedures (68%) – uncomplicated appendicitis (35%).¹³ Post-op:

- 41% were discharged the same day
- 9% needed post-op ICU resources, 5% received post-op invasive mechanical ventilation
- 7% had post-operative complications
- 6% were re-admitted
- 6% had to be re-operated
- no mortality was reported

Based on the literature described, it is recommended that elective surgeries be delayed for four weeks after full resolution of symptoms attributable to COVID-19 regardless of the severity of infection. A delay longer than four weeks should be considered in children who still have residual symptoms or underlying comorbidities that would place them at risk for PRAE.

The above suggestion is also relevant for children who have been diagnosed with MIS-C. The current understanding of the aetiology of MIS-C is a dysregulated inflammatory response to the SARS-CoV-2 virus. Cardiac abnormalities that have been reported in cases of MIS-C include ventricular dysfunction, coronary artery dilation or aneurysms, arrhythmia and conduction abnormalities and, more rarely, pericarditis and valvulitis.²³ Long-term sequelae of the disease and the natural history of coronary artery involvement is unknown.²²



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