Bronchoscopy during the COVID-19 pandemic: A Canadian Thoracic Society position statement

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This position statement aims to provide rapid guidance for those performing bronchoscopy in the pediatric and adult populations during the COVID-19 pandemic. These recommendations are based on the consensus of the authors, who are members of the Canadian Thoracic Society (CTS) Chest Procedures Assembly, and on the information available at the time this document was written, including guidance from other organizations. Changes in our understanding of COVID-19 and the course of the pandemic may affect the recommendations in this statement. Guidance from local public health authorities and from institutional infection prevention and control departments should be considered when assessing information in this document. Readers should consult these resources as they adapt plans for bronchoscopy during the pandemic. We plan to update this guidance regularly as new information becomes available, and recommend periodically checking the Canadian Thoracic Society website for updates.

Overview

Bronchoscopy is a routine endoscopic procedure performed for a range of indications. Bronchoscopy allows for visual inspection of the large airways, and is usually combined with additional interventions that may be diagnostic (i.e., bronchoalveolar lavage, endobronchial and transbronchial biopsy, and endobronchial ultrasound) or therapeutic (i.e., treatment of endobronchial airway obstruction). The urgency of bronchoscopy ranges from emergency to non-urgent, depending on both patient and disease-specific factors. Bronchoscopy is commonly performed in outpatient endoscopy units, operating rooms, intensive care units, and other settings offering appropriate patient monitoring during the pre, intra, and post procedural periods.

SARS-CoV-2, the virus that causes COVID-19, is highly transmissible between persons, and may be transmitted by asymptomatic hosts. COVID-19 poses a significant threat to frontline health care providers (HCPs). As of July 2020, there were 21,842 COVID-19 cases in Canadian HCPs comprising 19.4% of the total cases in Canada.[1] Being an upper and lower respiratory infection transmitted primarily through respiratory droplets, COVID-19 poses a particular challenge to the safe provision of bronchoscopy during the pandemic. The phenomenon of asymptomatic COVID-19 infection, particularly in the pediatric population, poses additional risk to HCPs performing bronchoscopy, as this creates the potential for unexpected and unrecognized transmission of COVID-19 to HCPs.[2,3]

Specific data on the transmission of SARS-CoV-2 and its variants during bronchoscopy are unavailable, but analysis from previous coronavirus outbreaks showed that HCPs participating in airway procedures such as endotracheal intubation and bag mask ventilation were at particularly high risk of infection.[4] Bronchoscopy has also been implicated as a high-risk procedure, but data specific to bronchoscopy was less certain. Under experimental conditions SARS-Cov-2 can remain aerosolized for up to three hours,[5] and has been isolated from central ventilation systems in COVID-19 wards using polymerase chain reaction (PCR) detection.[6] Concern regarding the possibility of airborne transmission prompted the Centers for Disease Control and Prevention (CDC) to recommend airborne precautions for aerosol generating medical procedures (AGMP), including bronchoscopy, in October 2020.[7]

A great deal of uncertainty remains around best practices related to bronchoscopy during the pandemic and post-peak pandemic phases. Mass vaccination may eventually result in a return to near pre-pandemic delivery of health care, but successive waves of high incidence as well as the presence of SARS-CoV-2 variants in Canada are a major challenge at present. This document aims to provide guidance to respirologists and other HCPs performing or participating in bronchoscopy during the COVID-19 pandemic. These recommendations are informed by a limited body of evidence as well as position statements and guidelines from other international expert groups. These recommendations are subject to change as information regarding COVID-19 and its effects are further understood. We plan to update this guidance as new information becomes available. We recommend checking the CTS website (https://cts-sct.ca/covid-19/) for updates.

Indications for Bronchoscopy

Key Statements:

- Prior to performing diagnostic or therapeutic bronchoscopy, clinical judgment is needed to determine the urgency of the procedure.
- Procedures that are non-urgent may be postponed during phases of community spread where the threat of transmission is considered unacceptably high.
- Bronchoscopists should work with local health authorities and infection control experts to determine when postponed procedures can safely be completed.

During the pandemic it has been necessary to limit non-urgent medical services in order to preserve health care resources. Expert position statements and guidelines from earlier in the pandemic were consistent in recommending that non-urgent bronchoscopy be delayed.[8] It is reasonable to expect that phases of higher and lower community spread will occur in most regions during the course of pandemic. In general, this Assembly agrees with postponing non-urgent bronchoscopies during periods where local community spread is present, and the risk of infection transmission related to the procedure is considered unacceptably high. However, the decision to delay non-urgent procedures is only one

component of a broader comprehensive plan that must be linked to provision of other health care services. Ultimately, thresholds for delaying non-urgent care are being determined by provincial and regional health authorities. As such, it is beyond the scope of this document to recommend specific thresholds for postponing or resuming bronchoscopy during the pandemic.

It is the role of the bronchoscopist to decide when a procedure should be performed without delay, and when it may safely be postponed. This should be based on clinical judgement. A procedure should only be performed if it is expected to affect management, and is in accordance with patient values and preferences. Bronchoscopy is considered emergent when it is being performed in the treatment or evaluation of an acutely life-threatening condition. Where avoidance or substantial delay of bronchoscopy is expected to lead to increased morbidity or mortality, the procedure may be considered urgent. A non-urgent bronchoscopy is one that could be reasonably delayed without perceived significant short-term negative consequences for the patient. A list of different examples to help guide practitioners in determining urgency is provided in Table 1. This list is similar to that provided by the American College of Chest Physicians.[9]

Any process used to postpone services should continuously be reviewed as new information regarding COVID-19, such as vaccine efficacy in reducing transmission, and the impact of SARS-CoV-2 variants becomes available. Strategies to mitigate risk including pre-procedure screening (with or without viral testing), and environmental and personal protective equipment (PPE) measures are discussed elsewhere in this document, and should also be considered when judging the perceived risk to HCPs.

Table 1 – Indications for bronchoscopy*

Emergency bronchoscopy	Urgent bronchoscopy	Elective bronchoscopy

• massive hemoptysis
• severely symptomatic central airway obstruction
	• moderately symptomatic central airway obstruction
	• foreign body removal
	• suspicion of lung cancer (lung mass and/or mediastinal or hilar adenopathies)
	• diagnosis of pulmonary tuberculosis (TB) (where induced sputum is unavailable)
	• suspicion of infection in immunocompromised patients
	• diagnosis of infection in a non-sputum producing patient (where treatment decisions would be impacted)
	• investigation for mild to moderate hemoptysis
	• evaluating progressive interstitial lung disease
	• post-lung transplant surveillance in high risk patients including those within 3 months of transplant
		• stable interstitial lung disease
		• chronic cough
		• suspicion of sarcoidosis where there is no indication to initiate therapy
		• mildly symptomatic central airway obstruction
		• therapeutic bronchoscopy for airway disease
		  ○ lung volume reduction
		  ○ bronchial thermoplasty
		• evaluation of tracheobronchomalacia
		• suspicion of non-TB mycobacterial infection
		• surveillance in patients with underlying lung disease
		• routine post-lung transplant screening in low risk patients after 3 months

Patient evaluation prior to bronchoscopy

Key Statements:

- Patients should be screened for COVID-19 symptoms and risk factors prior to bronchoscopy using a standard practice that is supported at the local level.
- Screening should be performed for all patients undergoing bronchoscopy within 72 hours of the scheduled procedure and upon entrance to the facility on the day of procedure.
- Emergency bronchoscopy should not be delayed in patients who screen positive.
- Non-emergency bronchoscopy should be delayed in patients who screen positive.
- Testing for SARS-CoV-2 with reverse transcription (RT) PCR prior to bronchoscopy should be performed in patients who screen positive.
- Testing for SARS-CoV-2 with reverse transcription (RT) PCR prior to bronchoscopy should be considered for all patients as a component of a broader regional screening program where resources allow.
- Providers should work with local public health authorities and infection control personnel to determine if a pre-procedure testing strategy is feasible and/or appropriate.
- Patients should isolate from the time of testing until the date of procedure, with repeat symptom screening upon presenting for the procedure.
- Testing may identify asymptomatic or pre-symptomatic SARS-CoV-2 infection, thereby reducing the risk of exposure of HCPs and other patients in the endoscopy setting.

A screening strategy based on a symptom and risk factor questionnaire is recommended for all patients undergoing bronchoscopy,[10-13] and should be completed within three days prior to and on the day of bronchoscopy.[12] A questionnaire such as the one developed by the British Columbia Ministry of Health and Centre for Disease Control is provided as an example. We recommend HCPs follow screening practices approved by their local facility. We acknowledge that many patients undergoing bronchoscopy have respiratory conditions with symptoms that overlap with COVID-19, therefore, screening should focus on new or changed symptomatology.[14] Non-emergency bronchoscopy should be delayed for patients who screen positive, and they should be referred for confirmatory testing via RT-PCR.[12,13]

Screening questionnaires, however, are unable to adequately identify those patients with asymptomatic COVID-19 infection, of particular relevance to the pediatric patient population.[15] Although there is a paucity of evidence to support pre-bronchoscopy SARS-CoV-2 testing in asymptomatic patients, detecting asymptomatic or pre-symptomatic cases may reduce the risk of exposing HCPs and other patients in the endoscopy setting.[11,13] Several guidelines and position statements recommend testing, however testing asymptomatic patients is associated with higher false positive rates, and full PPE and environmental precautions are still recommended due to the risk of false negatives.[16] Testing could be considered where community transmission is present, or as a part of a broader infection control strategy where ample testing capacity is available.[11,13,17] HCPs should consult with local infection control experts and public health authorities to determine whether a pre-procedure testing strategy is feasible and/or appropriate. If pre-testing is performed, testing should ideally be performed within three days prior to the procedure, and patients should be counselled to isolate following testing. A symptom and risk factor questionnaire should still be completed on the day prior to and on the day of bronchoscopy.

Non-emergency bronchoscopy should be delayed for patients who test positive for SARS-CoV-2 infection. The timing for non-emergency bronchoscopy is discussed elsewhere in this document. Emergency bronchoscopy should not be delayed regardless of screening or testing results. Emergency bronchoscopy should proceed with adequate protection for participating HCWs, assuming that the patient is infected. In this scenario, the patient should be tested for SARS-CoV-2 using either an NP swab, or lower respiratory tract sampling at the time of the procedure. Preventing infection transmission, and testing for SARS-CoV-2 with bronchoscopy is discussed elsewhere in this document.

It is the opinion of this Assembly that any pre-bronchoscopy COVID-19 assessment strategy should be used in conjunction with environmental and PPE recommendations for AGMP as described elsewhere in this statement. If a SARS-CoV-2 testing strategy is used, the risk of false negative tests in asymptomatic patients must be recognized. Universal precautions should be employed for all patients undergoing bronchoscopy, irrespective of test results. Physical distancing in the pre-procedure areas, and restricting any visitors for outpatient procedures is recommended except for circumstances where personal support is required.[18]

Prevention of infection transmission

Key statements:

- HCPs participating in bronchoscopy during the COVID-19 pandemic peak and post-peak phases should wear a fit-tested N95 respirator or equivalent, or higher-level respirators, eye protection, gloves, and gowns.
- Bronchoscopy should be performed in negative pressure spaces wherever possible.
- A negative pressure space for AGMP including bronchoscopy should have 6-12 air exchanges per hour with a pressure differential between outside and inside the room of $\geq$2.5Pa.
- Lidocaine for topical anesthesia should not be administered via nebulization.
- Individual institutions should work with infection control experts to establish protocols to safely recover patients following bronchoscopy.
- The use of novel or modified protocols, medications, or equipment aimed at minimizing transmission should be approved by local infection control experts and/or used as part of an approved research study.

The World Health Organization recommends that AGMPs be performed in negative pressure spaces with a ventilation rate of 6-12 air exchanges per hour with a pressure differential between outside and inside the room of $\geq$2.5Pa.[19] Older facilities in Canada may not be equipped to meet these standards for all AGMPs. As a result, HCPs must use clinical judgement to determine when a negative pressure space is required based on perceived risk. During the COVID-19 pandemic, the use of negative pressure spaces and full airborne precautions is recommended for all bronchoscopies where feasible. If a negative pressure room is not available, the use of HEPA filtration systems with UV germicidal lamps is likely an acceptable alternative.[20] Persons participating in the procedure should wear fit-tested N95 respirators or equivalent, or higher-level respirators.[11] Eye protection, gloves, and protective gowns should also be used. All HCPs involved in bronchoscopies should receive training in proper donning and doffing of PPE. Appropriate PPE and isolation practices have been shown to reduce transmission to HCPs during the pandemic.[4,21]

Recent bronchoscopy guidelines have differentiated between high-risk (patients with known or suspected COVID-19, and regions with community spread) and low-risk procedures in their

recommendations.[13,22] This assembly favours the universal use of negative pressure spaces for bronchoscopy during the pandemic and post-peak pandemic phases along with airborne precautions and full PPE where resources allow. We recognize that the use of negative pressure spaces for all bronchoscopies may not be feasible for some centers, and that pre-assessment screening with or without testing, as well as PPE also have an important role in mitigating risk. Ultimately, protocols to prevent transmission during bronchoscopy should be established at the local level in collaboration with infection control experts.

Guidance for bronchoscopy in critically ill COVID-19 patients on mechanical ventilation have been developed by other groups. General anesthesia and paralysis to minimize coughing has been recommended in this scenario.[23] However, there is no good quality evidence to suggest that altering usual sedation practices for outpatient bronchoscopies during the COVID-19 pandemic reduces transmission. Until there is evidence to suggest otherwise, sedation for outpatient bronchoscopy should be performed using current evidence-based guidelines.[24,25] Topical anesthesia is recommended for bronchoscopy unless contraindicated.[24,25] We recommend against the use of nebulized lidocaine for topical anesthesia due to the risk of viral transmission by contaminated aerosols.[11,26,27]

There have been multiple published reports of modified practices for bronchoscopy and other airway procedures, but there is a lack of evidence at present to support their use. The use of slotted masks, a protective equipment sheath, and tents covering the patient's head have all been described.[28-32] The use of any novel or modified protocol intended to reduce viral transmission during bronchoscopy should be reviewed with local infection control experts, and ideally performed as part of an approved research study. The risk of inadvertent transmission by contamination, as well as patient safety must be considered.

There is a paucity of evidence to guide decision-making on how to safely recover patients during the pandemic. Institutions should work with local infection control experts to establish protocols for outpatient recovery spaces. Incorporating pre-bronchoscopy risk assessment, as described elsewhere in this document, is recommended, and could help guide decision-making.[10,25] Where negative pressure recovery spaces are not available, recovering high-risk patients in procedural spaces could be considered.

The role of bronchoscopy in diagnosis of COVID-19

Key statements:

- A nasopharyngeal (NP) swab for RT-PCR for SARS-CoV-2 should be the first test for diagnosis of COVID-19.
- Bronchoscopy with bronchoalveolar lavage (BAL) may be considered for diagnosis of COVID-19 for patients with suspected disease where both an NP swab and a less invasive lower respiratory sampling technique such as sputum collection or endotracheal aspiration are negative.
- The true sensitivity of testing BAL fluid for diagnosis of COVID-19 remains unknown. Current available evidence suggests that BAL may have a higher sensitivity compared to other testing modalities.

An NP swab for nucleic acid amplification testing for SARS-CoV-2 is the preferred initial diagnostic test for COVID-19 as recommended by global health agencies, scientific societies and government institutions.[33] A systematic review of initial RT-PCR assays for COVID-19 found a summary estimate false negative rate of 13%.[33] In the event of a negative NP swab where there is ongoing clinical suspicion of

disease, the next best testing strategy is uncertain.[34] Expert panel statements have generally recommended multiple negative tests via less invasive means prior to considering bronchoscopy and BAL.[9,13,35] The Infectious Disease Society of America has specifically recommended lower respiratory tract sampling following a single negative upper respiratory sample in hospitalized patients with suspected COVID-19.[36] This recommendation is supported by aggregate data demonstrating superior sensitivity of lower respiratory samples from several studies, three of which are controlled. Two additional studies have suggested that BAL can detect virus in patients with COVID-19 in whom initial NP swab testing is negative.[37,38] Lower respiratory sampling methods include sputum collection, BAL, and tracheal aspiration. Given the available evidence, our Assembly recommends an NP swab before considering bronchoscopy for any patient suspected of having COVID-19. For a hospitalized patient who can generate sputum, sputum testing is recommended for lower respiratory sampling prior to bronchoscopy. Sputum induction is another lower respiratory sampling technique with a reportedly higher diagnostic yield for SARS-CoV-2 than upper respiratory sampling.[39] However, as an AGMP with a presumably similar risk of transmission as bronchoscopy, it should generally be avoided where bronchoscopy is available. In intubated patients, a tracheal aspirate should be performed. Ideally bronchoscopy with BAL should not be used for the diagnosis of COVID-19 unless an NP swab is negative, and sampling of the lower respiratory tract by a less invasive means has been performed as well.

Bronchoscopy for known COVID-19 infected patients

Key statements:

- Bronchoscopy in COVID-19 infected patients should be performed only if it cannot be delayed without significant adverse consequence to the patient.
- The timing of non-urgent bronchoscopy in patients who have recovered from COVID-19 must be individualized. Disease severity, duration of illness, and immunocompromised status must all be considered.

In order to protect HCPs, bronchoscopy for a COVID-19 infected patient should ideally be delayed until the patient is no longer contagious. Where bronchoscopy cannot be delayed, there is evidence that bronchoscopy can be performed safely for HCPs where appropriate environmental and personal precautions are taken.[40,41]

After symptom resolution, patients with confirmed COVID-19 infection continue to shed virus from the respiratory tract for a variable time period.[42-47] Prolonged viral shedding has been associated with many patient risk factors, the most notable being an immunocompromised state, and severe COVID-19 infection. Other factors are likely less impactful. The list of conditions associated with the term "immunocompromised", and the impact of these conditions on COVID-19 infection has been described elsewhere.[48] It is also important to note that viral ribonucleic acid (RNA) has been detected in lower respiratory tract samples for a longer duration than for NP swabs.[42,44,47] However the risk of infection associated with the presence of residual viral RNA on PCR is unclear.

The CDC recommends a symptom-based strategy for discontinuing transmission-related precautions, and this may be helpful in establishing a duration of delay for non-urgent bronchoscopy in COVID-19 positive patients.[49] Ten days of precautions after initial symptoms or since the first positive diagnostic test is recommended for mild cases. Twenty days is recommended for severe COVID-19 illness and immunocompromised patients. The CDC guidelines do not specifically address the timing of

bronchoscopy, thus consultation with local infection control experts for individual cases is appropriate.[49] Repeat RNA testing prior to bronchoscopy is probably not helpful, due to the variable duration of positivity after initial illness.

Learner Participation

Key statements:

- The decision to allow learner participation in bronchoscopy requires consideration of the perceived risk, as well as the educational needs and requirements of the learner.
- Training programs should emphasize competency in appropriate infection control practices for bronchoscopy.

With the aim of protecting HCPs and preserving PPE early in the pandemic, several expert position statements and guidelines recommended minimizing the number of persons participating in bronchoscopy during the pandemic. Some advocated for excluding learners entirely.[12,23,50-52] Subsequent retrospective studies suggest that bronchoscopy is safe in controlled environments where appropriate infection control practices are followed, even in COVID-19 positive patients.[40,41]

Medical learners are an essential component of the pandemic response. Current Canadian respirology and critical care trainees will have completed the majority of their two-year subspecialty programs during the pandemic. Most will have incurred increased personal risk caring for patients with SARS-Cov-2 infection, and many will have been redeployed at times to provide essential service in lieu of usual training activities.

Bronchoscopy is a core competency of practicing Respirologists in Canada. Graduating learners must have demonstrated an ability to perform all aspects of routine flexible bronchoscopy across a range of clinical settings, and differing levels of complexity. During the pandemic there has been a decline in medical and surgical procedure volumes. While simulation may partially compensate for this, it is essential that learners have the opportunity to perform supervised bronchoscopy in patients during their training.

The decision to involve learners in bronchoscopy during the pandemic is ultimately institution-specific. However, removing learners entirely from bronchoscopy for the duration of the pandemic is neither appropriate nor feasible. The decision to involve a learner should consider the perceived risk to the learner, as well as individual educational needs and training requirements. Health care facilities must ensure that appropriate PPE is available to all learners, and that approved infection control practices are understood and followed.

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