

Flexible bronchoscopy during the COVID-19 pandemic: A concise clinical review and practical recommendations

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ABSTRACT

Bronchoscopy is an extremely useful diagnostic and therapeutic procedure that finds an invaluable place in Pulmonology practice. Due to aerosol generation, bronchoscopy carries a high risk of infection transmission to health care workers and other patients. This fact is even more important in the present times of COVID-19 pandemic owing to its droplet- (and possibly aerosol-) mediated spread. With this background, a working group extracted literature through electronic search of PubMed and Google Scholar databases. All relevant documents were comprehensively reviewed and consensus recommendations formulated based on the level of available evidence. Where evidence was insufficient, Usual Practice Points were formulated based on expert opinion. This resultant document attempts to present clinical recommendations for performing flexible bronchoscopy in COVID-19 suspect/confirmed patients. It outlines important general considerations for bronchoscopy in these cases, provides an algorithmic approach to patient selection for bronchoscopy during these extraordinary times, and enlists critical do's and don'ts that should be followed before, during, and after the procedure. To conclude, flexible bronchoscopy must be cautiously performed amid the COVID-19 crisis. Judicious case selection and meticulous contact and airborne precautions are important to minimise infection transmission.

KEY WORDS: COVID-19, flexible bronchoscopy, recommendations, severe acute respiratory syndrome novel coronavirus-2

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INTRODUCTION

Clinical background

Flexible bronchoscopy is a diagnostic and therapeutic tool of paramount importance in Pulmonology. In view of the present COVID-19 pandemic which is known to spread by respiratory droplets, it is necessary during bronchoscopy to take additional measures for minimizing infection transmission to health-care workers and other patients. Thus, the need for an evidence-backed document fulfilling

this aim was felt and hence the present manuscript was conceived. Practical recommendations on the subject have recently been published by various international expert groups.^[1-4] This document illustrates important considerations for performing flexible bronchoscopy in non-intubated as well as intubated patients amid these times. Additional clinically relevant issues such as

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high-flow oxygen supplementation (which is associated with increased aerosol generation) if required during bronchoscopy, measures to reduce post-procedure cough, etc. have also been addressed. To the best of our knowledge, this is the first Indian document presenting clinical recommendations for performing flexible bronchoscopy in COVID-19 suspect/confirmed cases.

Target audience

The recommendations made in this document have been prepared in light of the most recent evidence available on the subject, and are intended to serve as practical guidance for all clinicians performing flexible bronchoscopy in the current times of the COVID-19 pandemic. The information provided should be used in the background of the patient's clinical details on a case-by-case basis, and are not meant to replace the physician's clinical judgment.

METHODS

A working group comprising faculty members of the Department of Pulmonary Medicine from two apex tertiary care teaching medical institutions of North India, was constituted. Extensive internet search of electronic databases such as PubMed and Google Scholar was performed, and all relevant documents including guidance, guidelines, reviews, and recommendations were thoroughly scanned.

Practical issues with respect to performing bronchoscopy during the times of the COVID-19 pandemic were enumerated, and discussions over these points were held. Discussions were conducted in multiple sittings – physically, through e-mail, or by video conferencing – whichever was feasible. Consensus recommendations on each of the issues were formulated based on the level of available evidence. Wherever evidence was insufficient, expert opinion was used to formulate usual practice points (UPPs). The modified Grading of Recommendations, Assessment, Development, and Evaluations system^[5] was used to classify the quality of available evidence as 1, 2, 3, or UPP [Table 1]. Strength of recommendation was graded as A or B depending on the level of evidence [Table 1].

The resultant present document highlights important general considerations for bronchoscopy in a COVID suspect/confirmed case; presents an algorithmic approach to patient selection for bronchoscopy during these extraordinary times; and enlists critical do's and don'ts that should be followed before/during/after the procedure.

The terms “COVID-19 suspect” and “laboratory-confirmed COVID-19 case” are standard terms used in this document, derived from updated case definitions of the National Centre for Disease Control, Ministry of Health and Family Welfare, Government of India.^[6]

Table 1: Quality of evidence and recommendations

Quality of evidence	Level
Evidence from ≥ 1 good-quality and well-controlled RCTs or meta-analysis of RCTs	1
Evidence from at least one RCT of moderate quality, or well-designed clinical trial without randomization, or from cohort or case-controlled studies	2
Evidence from descriptive studies, or reports of expert committees, or opinion of respected authorities based on clinical experience	3
Not backed by sufficient evidence; however, a consensus reached by the working group based on clinical experience and expertise	UPP
Strength of recommendation	Grade
Strong recommendation to do (or not to do) where the benefits clearly outweigh the risk (or <i>vice versa</i>) for most, if not all patients	A
Weak recommendation, where benefits and risk are more closely balanced or are more uncertain	B

UPP: Usual practice point, RCT: Randomized controlled trial

RECOMMENDATIONS

General considerations for bronchoscopy in COVID suspect/confirmed case

1. In the times of the COVID-19 pandemic, wherever possible, a non-bronchoscopic approach should be preferred over bronchoscopic approach for diagnosis as well as treatment. An algorithm in this regard is given in Figure 1 (UPP)
2. Patients with suspected COVID-19 disease should NOT undergo bronchoscopy for purposes of establishing a diagnosis of COVID-19 (3A)
3. Patients with suspected or diagnosed COVID-19 disease with additional non-urgent pulmonary pathologies (e.g., new consolidation, mild hemoptysis) should undergo a non-bronchoscopic intervention for evaluation preferentially (UPP)

Comments for 1–3: Research for the treatment of COVID-19 is currently in its early phase, and, at present, there is no evidence-backed treatment available. Hence, the most effective method of epidemiological control presently is prevention. Upper respiratory tract sampling for the diagnosis of COVID-19 is the method of choice. Bronchoscopy is classified as a procedure with high risk for aerosolization of infected material.^[7] Thereby it is best advised to avoid a bronchoscopic evaluation for purely diagnostic purposes. With a negative upper respiratory sampling and persistent suspicion, repeat upper respiratory sampling is advisable. Similarly, suspects or proven COVID-19 cases with non-life-threatening indications for bronchoscopy are best managed with conservative or empirical management rather than a routine bronchoscopic evaluation.

4. Patients with suspected or diagnosed COVID-19 disease who need bronchoscopy should undergo the procedure as per a priority list based on the anticipated outcome (UPP)

Comments for 4: Some cases with suspected or diagnosed COVID-19 disease may have life-threatening pathologies

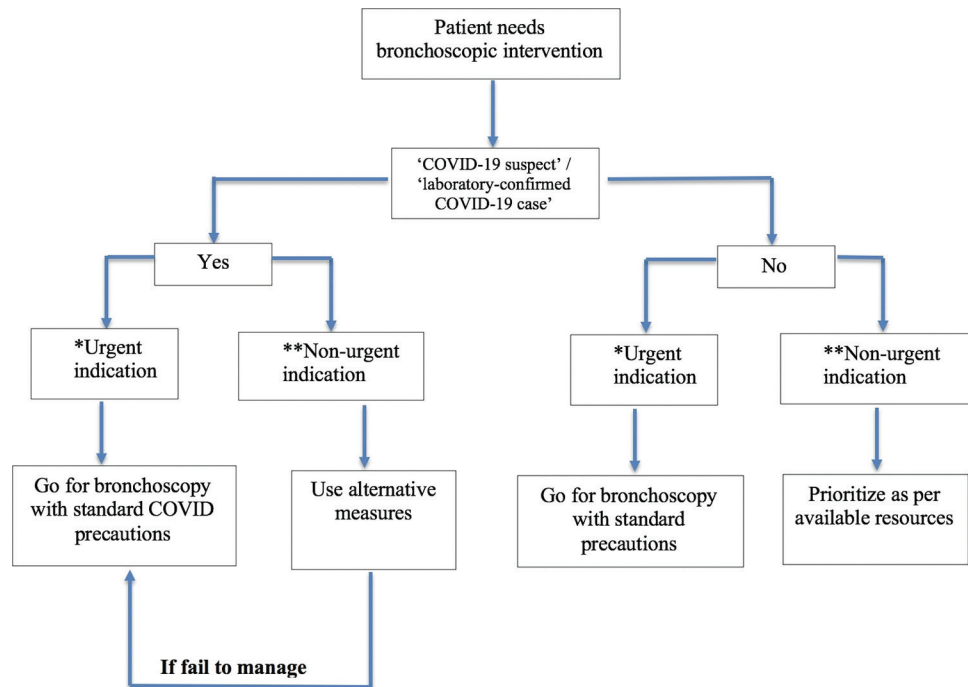


Figure 1: Algorithm for patient selection for bronchoscopy. *Urgent indication: Lung collapse with significant hypoxemia due to mucous plug/blood clot, not manageable by conservative methods; Life-threatening hemoptysis; Symptomatic/difficult-to-ventilate central airway obstruction due to airway stenosis/endobronchial growth/extrinsic airway compression; For obtaining bronchoalveolar lavage if diagnosis cannot be established with other less invasive techniques (e.g., sputum analysis in non-intubated patients, endotracheal tube aspirate/mini-bronchoalveolar lavage in intubated patients). **Non-urgent indication: Other bronchoscopy indications where alternative methods have failed.

needing urgent bronchoscopic evaluation or where despite all methods of non-bronchoscopic evaluation, there persists a treatment-dictating pathology which can be evaluated by bronchoscopy. In the times of pandemics, it is likely that there will be multiple such cases and limited resources. Thereby a priority list is essential before proceeding for a bronchoscopy. This can be done keeping in mind the possible clinical outcome of the patient (in terms of salvageability) and availability of resources.

5. Patients requiring bronchoscopy who are neither “COVID-19 suspects” nor “laboratory-confirmed COVID-19 cases,” and present with urgent pulmonary pathologies [as described in Figure 1], should undergo an evaluation as per human and equipment availability in individual centers (UPP)
6. Patients who are neither “COVID-19 suspects” nor “laboratory-confirmed COVID-19 cases,” who present with non-urgent pulmonary pathologies [as described in Figure 1] and require bronchoscopy after alternative methods have failed, should be deferred and a priority list for the same should be established for assessment in the postpandemic period (UPP)
7. Bronchoscopy should be performed in a negative-pressure ventilation room with a minimum of 12 air exchanges per hour and preferably at the patient’s place of care (3A).

Comments for 7: As per Occupational Safety and Health Administration (OSHA)^[7] and World Health Organization (WHO)^[8] recommendations,

for aerosol-generating procedures (which include bronoscopies), additional engineering controls as a part of airborne precautions for prevention of exposure are essential. These include negative-pressure ventilation rooms, installation of high-efficiency particulate air filters, and increased ventilation rates.

Pre-bronchoscopy preparation

1. The number of personnel for bronchoscopy should be restricted, preferably to two. For intubated patients, if the bronchoscopist is not an intensivist, then an intensivist may be included in the bronchoscopy team for assistance in sedation and paralysis (UPP)
2. Arrange all necessary bronchoscopy accessories, including drugs on the sterile trolley, before entering the isolation room (UPP)
3. Use a disposable bronchoscope if possible; otherwise, follow the routine recommendation for sterilization of bronchoscope as per manufacturer instruction (3A)
4. The complete plan of the procedure, including the role of each member, must be discussed within the team, and a short rehearsal can be done outside the bronchoscopy room (UPP)
5. For intubated patients, always check the size of the endotracheal/tracheostomy tube. The inner diameter of the endotracheal/tracheostomy tube should be at least 2 mm more than the outer diameter of the bronchoscope to facilitate smooth entry of the bronchoscope and for optimal ventilation during the procedure^[9] (3A)

6. Donning and doffing of personal protective equipment (PPE) should be in a designated place outside the bronchoscopy room. All personnel for bronchoscopy should wear full PPE including filtering face piece (FFP)-3, eyeshield/goggles, hood/cap, gown, shoe covers, and double gloves (3A)
7. The patient should be draped completely with a sterile sheet (UPP).

Comments: The minimum necessary personnel and equipment should be kept during the procedure so as to reduce the risk of infection. As per the Centers for Disease Control and Prevention (CDC), WHO, and OSHA guidelines, full PPE inclusive of an FFP3, eye shield/goggles, hood, gown, shoe covers, and double gloves should be made available for all the involved personnel.^[7,8,10] Given the limited evidence currently available for the virus, a separate or disposable bronchoscope must be considered for procedures in COVID-19-suspected or proven cases.^[11] The recommendations for sterilization during the previous severe acute respiratory syndrome (SARS) epidemics have varied, however, practicing high-level disinfection with routine bronchoscope reprocessing advice as per the manufacturer should be continued till further evidence is available. Adequate planning of the procedure with role identification is essential to minimize the duration of the procedure and ensure smooth entry and exit. An ante-room to the bronchoscopy area is advisable as suggested by the CDC for airborne infection isolation measures,^[12] which can serve the dual purpose of a planning area and an area for donning and doffing of PPE.

During the procedure

1. Position the sterile trolley and team members as decided outside of the procedure area. All team members should position themselves at an arm's length from the patient bed (UPP)
2. The risk of aerosolization in bronchoscopy is higher in a patient who coughs during the procedure, therefore appropriate measures to prevent the same need to be in place. These include:
 - a. Bronchoscopy should be done preferably in deep sedation (with an airway conduit if resources are available) to minimize coughing and aerosol generation (UPP). For intubated patients, pre-bronchoscopy medication should include sedation and paralytic agents unless contraindicated otherwise (3A)
 - b. For bronchoscopy, use of a transnasal approach^[13,14] with a surgical face mask, is preferred over a transoral approach (3A).
3. In intubated patients, a three-way (swivel) adapter for bronchoscope entry is recommended. This avoids disconnection of the ventilator circuit during bronchoscope introduction and also helps maintain positive end-expiratory pressure (UPP). It thus allows optimal simultaneous ventilation and the snug fit limits the air leak, thereby also the exposure during bronchoscopy

4. Procedure duration should be minimized as far as possible, and, to achieve this, the following measures can be taken:
 - a. Cricothyroid administration of local anesthetic is advisable over the spray-as-you-go method, as the former is associated with better patient comfort in terms of lesser cough and lower cumulative dose of the local anesthetic agent^[15] (1A)
 - b. Consider the evaluation of only those bronchopulmonary segments suspected to be involved as against screening normal airways as well (UPP)
 - c. In intubated patients, avoid instillation of local anesthetic if patient is in complete paralysis (UPP).
5. Bronchoscopist should hold the bronchoscope at an arm's length from himself/herself (UPP)
6. There is an increased possibility of aerosol generation when oxygen is administered by nasal cannula at a flow rate >6 L/min. To minimize this risk, oxygen should preferably be given through the working channel of bronchoscope when this channel is not being used for any sampling procedures. During sampling, oxygen can be continued through the oronasal route (UPP)
7. Suctioning may lead to airway inflammation/edema, which may worsen post-procedure cough and deteriorate the overall condition of the patient. To minimize this risk:
 - a. Keep suction pressure as low as possible (UPP)
 - b. Avoid unnecessary endotracheal/endobronchial suctioning. (UPP)
8. For bronchoalveolar lavage, use manual suction preferably in place of wall/machine suction and use an in-line mucus extractor (UPP).

After the procedure

1. Handle the bronchoscopy samples (if taken) as per infection control guidelines^[16,17] (3A)
2. Doffing of all personnel and disposal of PPE must be as per guidelines (3A) (<https://www.cdc.gov/hai/prevent/ppe.html>)
3. Standard disinfection protocols should be followed for cleaning the flexible bronchoscope and accessories (3A)
4. Postprocedure sterilization for reusable bronchoscopes should be as per routine recommendation for sterilization of bronchoscope (as per manufacturer's instruction)
5. For all personnel involved in the bronchoscopy, post-procedure decontamination with a shower is recommended (3A).

Comments: Given the highly infectious nature of the virus, lower respiratory tract samples should be handled with utmost care. The American College of Chest Physicians (ACCP) recommendations for the same in the post-SARS epidemic era and the recently released CDC guidelines for sample handling differ in the degree of caution.^[16,17] Till more data related to sample

handling-related infection rates are available, the more stringent ACCP guidelines may be considered.

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Conflicts of interest

There are no conflicts of interest.

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