

Bronchoscopy Basics: Current approaches-A literature review

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ABSTRACT

Objective: This review article aims to understand the basic airway anatomy, bronchoscopy in high risk patients, premedication in bronchoscopy and performing the procedure in patients on anticoagulation. Basic bronchoscopy is the procedure done by pulmonologists, intensivists, thoracic surgery, and anesthesiologists. After a literature search from several databases, including PubMed, Google Scholar, Medline, Science Direct, Cochrane Library, Update etc., I found several categories of high-risk patients based on clinical history, Mallampati score, and 3-3-2 Rule. These include patients with pulmonary hypertension, renal failure, COPD, asthma, obesity, patients on anticoagulation. I searched the literature to find multiple expert guidelines and recommendations that suggested minimizing the risk of complications in these high-risk patients, including premedication.

Keywords: basic bronchoscopy, high risk, Mallampati score, guidelines, recommendations

INTRODUCTION

Physical Status Classification

American Society of Anesthesiologists (ASA) has classified the airway risk based on the physical status:

I- A normal healthy patient, e.g. with inguinal hernia

II- Mild systemic disease with no impact on the cardiorespiratory system. Controlled diseases, e.g. hypertension, diabetes without end-organ damage.

III- Moderately severe-COPD, bronchial asthma, lung cancer.

IV- Advanced and severe systemic disease-COPD including oxygen-dependent, advanced CHF, advanced Ca lung.

Based on the classification, numerous patients fall into groups II and IV.

Mallampati Score:

It estimates the difficulty in intubation based on the degree of visualization of soft palate, uvula, fauces, and tonsillar pillars. It is classified into 4 classes depending on the severity. Class I is the mildest and Class IV is the most severe.

Scoring has been used to predict the risk of up to 13 complications.

The most important are bronchospasm and oxygen desaturation.

Bronchospasm risk with Mallampati I-III is between 7.5-10.8. The risk peaked at 25.5 with Mallampati IV. (Respiration 2016; 92:158-165).

Oxygen desaturation risk is 36.6 in Mallampati I, and 62 in Mallampati IV.

Conscious sedation is an additional risk.

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3-3-2 Rule

Intubations during bronchoscopy can be difficult as it is likely to be swelling and spasm in the airways. As pulmonologists and intensivists often use fentanyl and midazolam for conscious sedation, no anesthesiologist may be present.

The 3-3-2 rule is a simple measurement to assess the likelihood of difficult intubation.

3- A measurement of 3 fingers (7 cm) between upper and lower teeth to assess good mouth opening.

3- A measurement of 3 fingers from chin to the hyoid bone. If > 3 cm, suggests distance to the posterior pharynx, which will allow easy insertion of the laryngoscope.

2- A measurement of 2 fingers from the base of the mandible to the thyroid notch will indicate the relation of the larynx to the base of the tongue.

Few have been done, but it is a quick and simple method to evaluate the patient's airway.

Bronchoscopy in pulmonary hypertension (PH)

The main issue is that we rarely know the status of pulmonary hypertension in most patients.

The majority of the experts believe that bronchoscopic inspection of the airway is a safe procedure, but TBBx is not.

An ACCP Survey was conducted in a CHEST meeting in 2001 to detect the comfort level of doing bronchoscopy in PH patients. 29% - absolute contraindication, 58%- relative contraindication, 13%- no contraindication, 40%- MPAP>40 is a contraindication. (1)

It is important to be aware of the potential predisposing conditions related to pulmonary hypertension.

Known autoimmune diseases, OHS/ sleep apnea, chronic pulmonary diseases, even COPD

Do 2D Echocardiogram, look for RVSP. If > 40-45 mm Hg, be careful and follow stringent indications. (2)

Bronchoscopy can cause bleeding, which may be minor or major. (3,4)

Minor bleeding usually stops spontaneously or requires local epinephrine or cold saline.

Major bleeding is one that may require balloon tamponade, embolization, surgical intervention, and blood transfusion.

No significant major bleeding occurs with mild to moderate pulmonary hypertension. There is, however, an increased risk of post-procedure prolonged intubation in these patients. There is no consensus in these patients and data is limited.

If PH is > 40-45, one should be very careful, especially when doing transbronchial lung biopsy (TBLBx).

Bronchoscopy in Renal Insufficiency

A study done in 2012 showed procedure-related hemorrhage most commonly occurred in patients with renal insufficiency with an unadjusted odds ratio of 2.94, adjusted odds ratio of 2.85, and $P < 0.0001$. (5)

It is recommended that if blood urea nitrogen(BUN) >30 mm/dl or serum creatinine > 2mm/dl, then desmopressin (DDAVP) should be given 30 minutes before the biopsy or needle aspiration.

Bronchoscopy in COPD

A study was published in 2017, which showed minor and major complications when bronchoscopy was done in COPD patients. (6)

Minor complications included transient desaturation, bronchospasm, epistaxis, and transient hypotension.

Major complications included respiratory failure, pneumothorax, and hemoptysis.

The most significant complication was respiratory failure, which was 4 times more common.

No cut-off for FEV1 or amount of inhaled oxygen has been shown in studies regarding when to do or not to do a bronchoscopy. It depends on individual comfort level. However, if a patient is on 6-10 liters of oxygen, one should be very careful and have all the preparations. The presence of anesthesia can also be helpful.

A study published in CHEST showed that premedication with inhaled short-acting beta-agonist is not recommended. (7)

Bronchoscopy in Bronchial Asthma

Bronchoscopy in severe asthma is usually well tolerated with proper precautions. (8,9,10)

Beta 2 agonists are recommended pre-procedure with or without anticholinergics.

No cut-off for FEV1 has been recommended.

Bronchoscopy in Obesity

A study in 2016 looked at the percentages of complications according to various indices of obesity. (11)

Early termination of the procedure is seen more in obese patients than in non-obese, 6.41 vs 2.78

There are a lot of other issues in these patients. A higher Mallampati score in obese patients has a significantly higher percentage of transient oxygen desaturation and bronchospasm.

If these patients have a triple syndrome with obesity, obstructive sleep apnea (OSA), and COPD, one should be well prepared and ideally, anesthesia should be available immediately if a need arises to intubate these patients.

Obese patients with OSA have a much higher percentage of termination of procedure as compared to obese patients without OSA. 2.5 vs 15.8, $p=0.0002$. They also have a higher percentage of pneumothorax 0.4 vs 5.3.

Based on the current literature, the following is recommended:

Pre-procedure assessment of hypercapnia, anticipate the difficult airway, consider CPAP during bronchoscopy, consider anesthesia support, and consider pre-emptive awake intubation.

Premedication in Bronchoscopy

Routine use of anticholinergics like atropine and glycopyrrolate is not recommended anymore. (12) They may reduce secretions but no reduction in cough, discomfort, desaturation, and procedure time. They have even been shown to be harmful and may contribute to hemodynamic instability.

Topical lidocaine may decrease the cough and the total dose of sedation. Either 1% or 2% should be used. Both have similar efficacy. A 4% concentration is not recommended as it may get absorbed and cause toxicity, including methemoglobinemia. ACCP and Thorax guidelines recommend 7mg/kg body weight to minimize the risk of complications. (13,14,15)

Nebulized lidocaine, in addition to topical lidocaine, has no benefit.

Bronchoscopy in Anticoagulated Patients (16,17,18)

Discontinue clopidogrel (Plavix) 5-7 days before the procedure, especially if a transbronchial biopsy is planned.

Aspirin should be continued.

Warfarin should be stopped 5 days prior to the procedure or based on current INR if < 1.5 and resume in 12-24 h.

LMWH should be held for 24 h (prophylactic for 12 h).

Unfractionated heparin should be held 4-6 h before the procedure.

In DOACs, stop 1-2 days before the procedure. If they have renal insufficiency with $GFR < 50$, then as a general principle, it should be 2-3 days. If renal failure is end-stage, it may be longer than 3 days.

CONCLUSION

Basic bronchoscopy is a safe procedure. However, in high-risk patients, several guidelines and recommendations have been proposed to minimize the complications. The majority of the patients are in ASA Class 3 or 4. $MPAP > 40$ is high-risk for bleeding, especially with TBBx. $BUN > 30$ mg/dl and creatinine > 2 mg/dl is high risk of bleeding. Consider DDAVP. No benefit of short-acting beta agonist in COPD premedication. Short-acting beta-agonist nebulization can be used in bronchial asthma. In Obese patients with BMI. 30, anesthesia support should be considered especially if they have sleep apnea. Lidocaine dose for bronchoscopy is 7 mg/kg. No benefit to adding nebulization.

Abbreviations:

COPD: Chronic Obstructive Pulmonary Disease

TBBx: Trans-bronchial Biopsy

CPAP: Continuous Positive Airway Pressure

MPAP: Mean Pulmonary Artery Pressure

BUN: Blood Urea Nitrogen

GFR: Glomerular Filtration Rate

FEV1: Forced Expiratory Volume in 1 second

DOAC: Direct Acting Oral Anticoagulants

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