ORIGINAL ARTICLE

A Study of Role of Bronchoscopy in Intensive Care Units

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Abstract

Objectives: (1) To know the contributions of bronchoscopy in intensive care units (ICUs) in terms of therapeutic benefits and diagnostic purposes. (2) To know the safety of the bronchoscopy procedure in ICUs in critically ill patients.

Materials and methods: This is a retrospective observational study that included 41 patients who underwent bronchoscopy in the ICU of a tertiary care center. Data collected included the patient's clinical profile, vitals, cause of ICU admission, indication for bronchoscopy, and complications.

Results: There were 41 ICU patients who required and underwent bronchoscopy. A number of 15 patients (36.5%) were on mechanical ventilation, and 10 patients (24.3%) were on noninvasive ventilation (NIV) support. The most common indication was lung collapse in 23 (56%) patients. Out of 41 patients who underwent the procedure, 28 patients (68.2%) showed postprocedure improvement, which shows the utility of the procedure. Minor complications occurred in 18 patients (43%) and included hypoxia, bleeding, and bronchospasm. Zero mortality was reported during or after the procedure.

Conclusion: Bronchoscopy provides excellent diagnostic yield and therapeutic benefits in ICU patients with respiratory conditions, and it is relatively safe even in high-risk patients when done by trained consultants.

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Introduction

Bronchoscopy is a procedure to look inside the airway with the help of a camera located at the end of the scope for various diagnostic and therapeutic purposes. The advantage of maneuverability, feasibility of a wide spectrum of diagnosis and therapeutics, patient comfort, and ease of conscious sedation has made bronchoscopy an important tool in the pulmonary medicine field. Its use is increasing in critical care due to its extended diagnostic and therapeutic benefits.

Since the introduction of bronchoscopy in the 20th century, bronchoscopy has played an important role in the pulmonary medicine field. Apart from various diagnostic uses, it is now also used for therapeutic purposes in different clinical scenarios. Bronchoscopy is done in stable patients as well as in critically ill patients, as its portability and flexibility in use allow various interventions at the bedside.[1]

Patients in intensive care units (ICUs) often have various comorbidities and high-risk clinical conditions, which make them high risk for bronchoscopy; therefore, the risk of the procedure must be weighed against the need and benefit from it.[2] In spite of the high risk of the procedure in critically ill patients, bronchoscopy is relatively safe in trained and experienced hands.[3,4]

This study highlights the importance of bronchoscopy in critical care settings and focuses on indications for its use and complications associated with it.

Bronchoscopy indications in the intensive care setup are mentioned below[5,6]:

Diagnostic indications:
- Pneumonia.
- Hemoptysis.
- Tracheal stenosis.
- Inhalation injury/burns.
- Upper airway and vocal cord assessment.

Therapeutic indications:
- Mucus plugging/lung collapse.
- Foreign body removal.
- Difficult endotracheal intubation.
- Intrabronchial instillation of antibiotics/medications.
- Placement of amplatzer device in bleeding segment.
- Bronchopleural fistula closure.
- Debulking of endobronchial tumor.
- Tracheal or bronchial stenting.

Objectives of Study

- To know the contributions of bronchoscopy in ICUs in terms of therapeutic benefits and diagnostic purposes.
- To know the safety of bronchoscopy in ICUs in critically ill patients.

Materials and Methods

Patients in ICU with various respiratory conditions required bronchoscopy for diagnostic and therapeutic purposes.

Calls were received from the ICU for the management of lung collapse, pulmonary infiltrates for diagnosis of offending organisms, retained secretions, suspected foreign body aspiration, and difficult intubation.

Patients admitted to the ICU who gave consent and underwent bronchoscopy were included in my study.

Data of the patients were collected from inpatient files, from hospital information system databases, and from the relatives. Data consisted of age, gender, clinical features, cause of ICU admission, comorbidity, significant past history, mode of ventilation, laboratory investigations, and radiological investigations.

Bronchoscopy was done in 41 patients after analyzing the general condition of the patients and obtaining informed written consent.

Procedure

Bronchoscopy was done according to British Thoracic Society (BTS) guidelines.

Procedure performed in the presence of an anesthesia team under continuous cardiac monitoring.

Procedure done *via* the nasal route in conscious and cooperative patients who were on room air or oxygen support by mask or bilevel positive airway pressure (BiPAP). In intubated patients, the procedure was performed through the endotracheal tube (ET).

A T-tube adapter was used in patients on ventilator support as it allowed bronchoscopy without discontinuation of the ventilator.

Bronchoalveolar lavage (BAL) was taken in all patients, and transbronchial lung biopsy (TBLB) was also taken in selected patients.

One patient had difficulty in intubation due to reduced mouth opening; intubation was done successfully using a flexible bronchoscope.

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Table 1: Mode of ventilation in study subjects

Mode of ventilation	*Numbers (n = 41)*	*Percentage (%)*
Mechanical ventilation	15	36.5
NIV support	10	24.3
Oxygen *via* face mask/nasal prongs	16	39

Table 2: Indication of bronchoscopy in study subjects

Indication	*Numbers (n = 41)*	*Percentage (%)*
Lung collapse	23	56
Consolidation	13	31.7
Foreign body	1	2.4
Lung mass/lesion	2	4.8
Difficult intubation	1	2.4
Intrabronchial instillation of antibiotics	1	2.4

Table 3: Postprocedure clinical–radiological improvement

Air entry and CXR improved	*Numbers (n = 41)*	*Percentage (%)*
Improved	28	68.2
No improvement	13	31.7

Table 4: Organisms isolated in BAL

Organism isolated	*Numbers (n)*	*Percentage (%)*
M. tuberculosis	3	7.5
A. baumannii	11	27.5
Streptococcus pneumoniae	1	2.5
Klebsiella pneumoniae	2	5
E. coli	1	2.5
P. aeruginosa	4	10
Candida	1	2.5
No organism isolated	17	42.5

Study Design

Retrospective observational study.

Study Place

Tertiary care center in Ahmedabad.

Study Period

One year (February 2023 to February 2024).

Results

Total 41 patients in ICU underwent bronchoscopy for various respiratory conditions. All bronchoscopies were performed by the Respiratory Medicine Department, and all procedures were supervised, and sedation was given by the anesthesia team.

In my present study, the maximum age of the subjects was 84 years and the minimum age was 15 years. Out of 41 patients, 21 (51.3%) were males and 20 (48.7%) were females.

Table 1 shows that 15 (36.5%) patients were on mechanical ventilation, in whom the procedure was done *via* ET or tracheostomy tube, 10 (24.3%) patients were on noninvasive ventilation (NIV) support, and 16 (39%) patients were on oxygen support *via* face mask or nasal prongs.

Table 2 shows that the most common indication for which bronchoscopy was performed was lung collapse. About 23 patients out of 41 (56%) had lung collapse. A total of 13 patients (31.7%) had consolidation. One patient who underwent bronchoscopy for suspected collapse or consolidation had a foreign body, which was removed successfully. One patient was found to have an endobronchial growth in the left lower lobe bronchus; an endobronchial biopsy was taken, which turned out to be poorly differentiated nonsmall cell carcinoma. One patient had a lesion in the upper trachea from which a biopsy was taken, which on histopathological examination (HPE) turned out to be mucormycosis. One patient was found to have extensive endobronchial infection, for which intrabronchial instillation of antibiotics was done. One patient was referred for difficult intubation due to reduced mouth opening, in which intubation was successfully done by flexible bronchoscope.

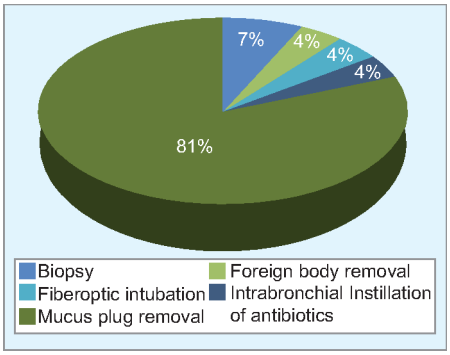

Fig. 1: Bronchoscopy procedures done in study subjects

Table 3 shows that postprocedure clinical and radiological improvement in terms of air entry and chest X-ray findings was observed in 28 (68.2%) out of 41 patients in whom bronchoscopy was done for various above listed conditions.

As shown in Table 4, BAL was done in 40 patients, out of whom 23 patients (57.5%) showed growth in the culture. *Acinetobacter baumannii* was the most common organism isolated in BAL culture, in 11 (27.5%) patients. Three patients (7.5%) showed growth of *Mycobacterium tuberculosis*. Four (10%) patients showed growth of *Pseudomonas aeruginosa*. One patient showed mixed growth of *Escherichia coli* and *Candida*.

As demonstrated in Fig. 1, among bronchoscopy procedures, BAL was taken in 40 patients, as BAL helps in collecting samples for microbiological diagnosis. Mucus plug removal done in 21 patients offered therapeutic benefit to the patients. Biopsy was taken from a growth in two patients, foreign body removal in one patient, intrabronchial instillation of antibiotics in one patient, and fiberoptic intubation was done in one patient.

Complications

Complications associated with the procedure occurred in a total of 18 (43.9%) patients out of 41, including hypoxia (SpO_2 <90% during or after the procedure), bleeding, and bronchospasm. Ten patients out of 41 (24.3%) developed hypoxia, which was resolved upon giving high-flow oxygen for a few minutes. Bronchospasm was observed in five patients (12.1%), which was resolved upon nebulization with bronchodilators. Minor bleeding was observed in three (7.3%) patients. No death occurred during or immediately after the procedure.

Discussion

Bronchoscopy is a widely used procedure in various respiratory conditions. It has become an important tool in ICUs for its therapeutic

and diagnostic benefits. Benefits and safety of the procedure are two key features that have led to its increasing use in ICUs. Patients in ICUs suffer from different types of critical care illness and are likely to develop various respiratory complications like lung collapse and severe pneumonia.[7]

In my present study, lung collapse (56%) is the most common indication for bronchoscopy, where mucus plug removal resulted in significant therapeutic benefit. In a study conducted over 3 years by Krishna et al.,[8] the most common indication was consolidation, which comprised 67.9% of the total patients who underwent bronchoscopy in ICUs.

In a study by Turner et al.,[9] a total of 147 bronchoscopies were performed; 37 were for therapeutic purposes, of which 28 were done for lung collapse. After the procedure, full lung expansion was observed in 20 patients (71%), which is comparable to my study, in which 16 patients out of 23 patients with lung collapse (69.5%) showed significant lung expansion.

Overall efficacy of bronchoscopy in ICU in my current study is 68.2%, which is comparable with the study by Estella (71%)[10] and Patel and Udwadia (75%).[11]

In my study, 23 out of 40 patients (57.5%) had shown growth in their BAL culture, which is comparable with a study by Woske et al.,[12] which yielded a 56% culture positivity rate.

Bronchoscopy is a relatively safe procedure if it is done with basic precautions even in critical patients. The major complication risk is 0.08–2%, and the mortality rate is extremely low (0.01–0.05%).[13]

Most common complication observed in our study was hypoxia in 10 patients out of 41 (24.3%), which improved and resolved with high-flow oxygen support. Minor bleeding was observed in three patients (7.3%), and bronchospasm was observed in five patients (12.1%), which resolved with nebulization. No bronchoscopy-related death occurred in our study.

Dang et al.[14] in his study prospectively evaluated the patients undergoing bronchoscopy over a 12-month period. A total of 558 bronchoscopies were performed. In 216 procedures, transbronchial biopsy was also taken. They found that only 2.2% major complications occurred in the first 4 hours of bronchoscopy, and the complications that occurred also did not require any major intervention.

Olopade and Prakash[15] in their study of 804 bronchoscopies in the ICU did not observe any bronchoscopy-related death.

Major limitation of our current study is that it was carried out at a single tertiary care facility. Ideally, this study should be expanded to multiple centers for better analysis. Another limitation is its small sample size, which makes generalization difficult.

Conclusion

Bronchoscopy in the ICU provides important diagnostic information and therapeutic utility required in patients with various respiratory conditions. Nowadays, bronchoscopy has become an important part of the everyday life of a pulmonologist as well as critical care physicians. Safety and benefits are key features for its use, and it can be performed safely in patients with the above-listed indications when done by trained pulmonologists under basic precautions.

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