

Bronchoscopy in COVID-19 ARDS Patients: Diagnostic and Therapeutic Implications

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ABSTRACT

Background: Bronchoscopy plays a crucial role in diagnosing and managing airway complications in critically ill patients. However, during the COVID-19 pandemic, its role became debatable due to the aerosol-generating nature of the procedure and potential infection risks to healthcare workers (HCWs). This study aimed to evaluate the diagnostic and therapeutic implications of bronchoscopy in mechanically ventilated COVID-19 ARDS patients and assess its safety for both patients and HCWs.

Methods: This retrospective-prospective observational study was conducted in the Department of Critical Care Medicine, Apollo Hospitals, Bengaluru, from January 2021 to December 2021. A total of 309 mechanically ventilated COVID-19 ARDS patients who underwent bronchoscopy were included. Demographic data, indications, clinical outcomes, and safety aspects were analyzed.

Results: Among 309 patients, 217 (70.23%) were males and 92 (29.77%) were females. The majority (28.48%) belonged to the 61–70 years age group. Common indications for bronchoscopy included hypoxia (58.57%), secretion clearance (23.62%), and bilateral infiltrates (17.80%). Diabetes mellitus (15.86%) and hypertension (14.24%) were the most frequent comorbidities. Sixteen HCWs participated in the procedures; none tested COVID-19 positive during follow-up. The overall mortality rate was 41.75%, attributed to disease severity and comorbidities rather than the procedure.

Conclusion: Bronchoscopy in COVID-19 ARDS patients provides valuable diagnostic and therapeutic information with acceptable safety for both patients and HCWs. It remains an essential bedside tool for clinical decision-making in selected mechanically ventilated COVID-19 patients under strict infection control protocols.

Key-words: Bronchoscopy, COVID-19 ARDS, COVID-19 pandemic, Healthcare workers (HCWs)

INTRODUCTION

In February 2020, the International Virus Classification Committee officially named the novel coronavirus as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) ^[1] and novel coronavirus pneumonia was officially named by the World Health Organization: COVID-19.

The severe acute respiratory syndrome coronavirus (SARS-CoV-2) has been rapidly spreading from person to person worldwide since December 2019. WHO reports that as of October 28, 2022, 626,337,158 people had been diagnosed with coronavirus disease 2019 (COVID-19), and 6,566,610 people have died from it in practically every country and area ^[2-4]. The WHO estimates that there have been over 528,999 recorded deaths and 44,649,088 cases registered in India thus far ^[5].

The genetic recombination of the S protein in the receptor-binding domains (RBD) region of SARS-CoV-2 is likely the cause of the virus's high transmissibility, which may increase its capacity to spread from person to person ^[6,7]. Depending on the person's immunity, the

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incubation period might be anywhere from three to seven days to as long as two weeks ^[8]. Mild, moderate, and severe clinical signs are also possible ^[9].

COVID-19 mainly spreads through droplets released during close contact, although inhalation of aerosols in enclosed, poorly ventilated spaces over extended periods can also transmit the virus. Other members of the coronavirus family, such as SARS-CoV and MERS-CoV, primarily transmit through droplets, with most cases occurring in healthcare settings.

The definitive diagnosis of SARS-CoV-2 infection is made using RT-PCR tests on samples from the upper respiratory tract, including nasal and throat swabs ^[10,11]. Bronchoscopy, first developed in the late 1800s, has become an essential tool for both diagnosing and managing pulmonary disorders ^[12,13]. The rigid bronchoscope was refined in the early 1900s, and flexible bronchoscopy became widely adopted in the 1960s. Innovations like endobronchial ultrasound (EBUS) and electromagnetic navigational bronchoscopy (ENB) now allow precise evaluation and sampling of lung tissue from central and peripheral regions ^[12-15]. Flexible bronchoscopy is considered safe, with very low complication and mortality rates ^[16].

Bronchoscopic techniques allow direct inspection of the airways, helping assess both anatomy and function ^[17]. They also support therapeutic procedures, such as removing obstructions, widening narrowed airways, taking biopsies, and collecting specimens for microbiological or cytological testing ^[18].

Since COVID-19 was declared a pandemic in March 2020, hospitals have adapted their protocols to ensure patient care while minimizing risk ^[19]. Although bronchoscopy remains a vital diagnostic and therapeutic procedure, it generates aerosols, which increase the infection risk to healthcare workers. Careful consideration is therefore needed to determine its use during the pandemic, balancing clinical benefits against potential hazards ^[11].

MATERIALS AND METHODS

Place of study- The present study was conducted in the Intensive Care Unit under the Department of Critical Care Medicine, Apollo Hospitals, Bengaluru, Karnataka.

Study Period, Design, and Population- The study was a

hospital-based retrospective-prospective observational study conducted over one year from January 2021 to December 2021, including mechanically ventilated COVID-19 ARDS patients.

Inclusion Criterion

- ❖ Adult COVID-19 patients with ARDS on mechanical ventilatory support.
- ❖ As part of evaluation of worsening (Clinical and Radiological) of COVID-19 ARDS patients who are mechanically ventilated.
- ❖ COVID-19 Patients with ARDS requiring bronchoscopy for suspected collapse or airway secretion management.
- ❖ In mechanically ventilated COVID-19 patients with suspected superinfections.

Exclusion Criterion

- ❖ Patients who are Hemodynamic unstable requiring high doses/multiple vasopressors.
- ❖ Operator's perception of life-threatening deterioration during the procedure.
- ❖ Positive end expiratory pressure of >10 cm H₂O.

Methodology- Prospectively, a patient or a relative of the selected patient was interviewed and general information, including age, gender, along with past medical history, duration from symptom onset to hospitalization, duration from symptom onset to mechanical ventilation and duration of symptom onset to bronchoscopy and duration of mechanical ventilation to bronchoscopy, was ascertained. Further, premedication, insertion route and indications noted. Further, the patients were subjected to clinical examination and the findings were noted. Retrospectively, the patient's case sheets were retrieved from the department of medical records and the above-mentioned details were obtained.

Statistical Analysis- Data were analyzed using Microsoft Excel and SPSS version 25.0. Descriptive statistics were used to summarize findings. Continuous variables were expressed as mean±SD and categorical variables as percentages. The Chi-square test and Student's *t*-test were applied where appropriate, with *p*<0.05 considered statistically significant.

RESULTS

The present hospital-based retrospective-prospective observational study was conducted in the Intensive Care Unit under the Department of Critical Care Medicine, Apollo Hospitals, Bengaluru, Karnataka, for the period of one year from January 2021 to December 2021. A total of 309 mechanically ventilated COVID-19 ARDS patients

fulfilling the selection criterion were studied. Out of 309 maximum cases were enrolled prospectively, that is, 204 cases and the remaining 105 cases were retrospective.

In the present study, 70.23% of the patients were males and 29.77% were females. The male-to-female ratio was 2.35:1 (Fig. 1).

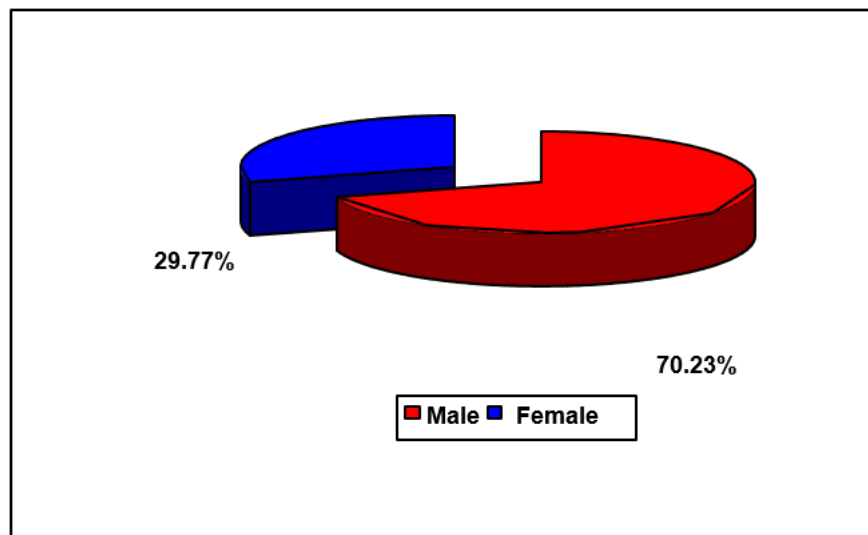


Fig. 1: Distribution of patients according to sex

The age of patients ranged from 18 to 90 years, with the majority (28.48%) belonging to the 61–70 years age group, followed by 51–60 years (18.45%). This indicates

that COVID-19 ARDS predominantly affected the elderly population (Fig. 2).

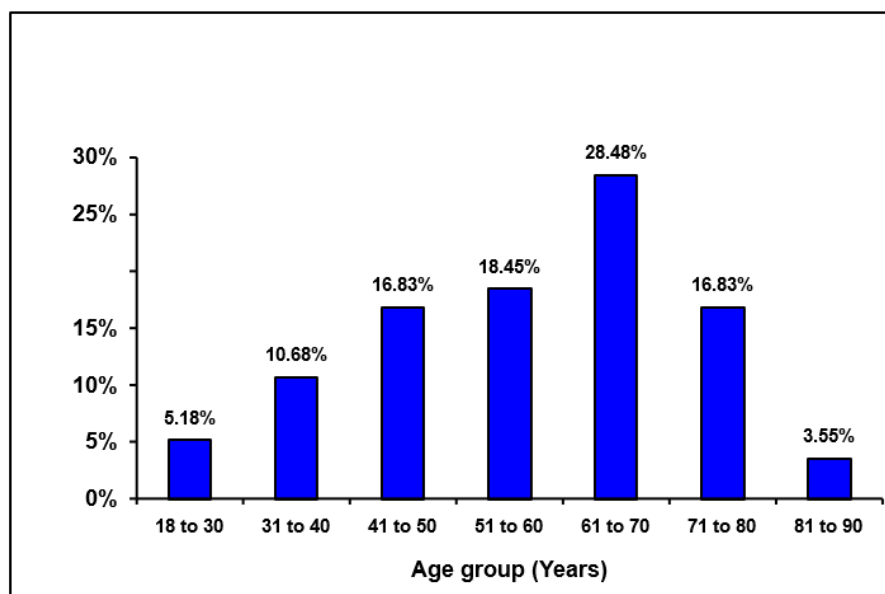


Fig. 2: Distribution of patients according to age

In the present study, 99.03% of the patients were diagnosed to have COVID-19 ARDS, and 0.97% of the

patients had COVID-19 ARDS with pneumonia, shock, and MODS (Fig. 3).

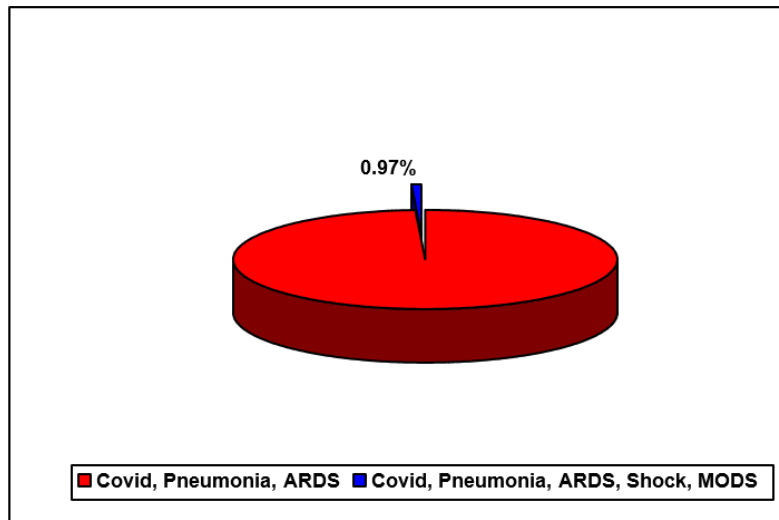


Fig. 3: Distribution of patients according to the diagnosis

In this study, 15.86% of the patients had a history of diabetes mellitus, and 14.24% had hypertension (Table 1).

Table 1: Distribution Of Patients According To The Comorbidities

Comorbidities	Distribution (n=309)	
	Number	Percentage
Diabetes mellitus	49	15.86
Hypertension	44	14.24
Heart disease	24	7.77
Hypothyroid	9	2.91
Renal failure	8	2.59
Malignancy	6	1.94
Others	21	6.80

In the present study, hypoxia was the indication for bronchoscopy in 58.57% of the patients, followed by secretion clearance in 23.62% and bilateral infiltrates in 17.80% (Fig. 4).

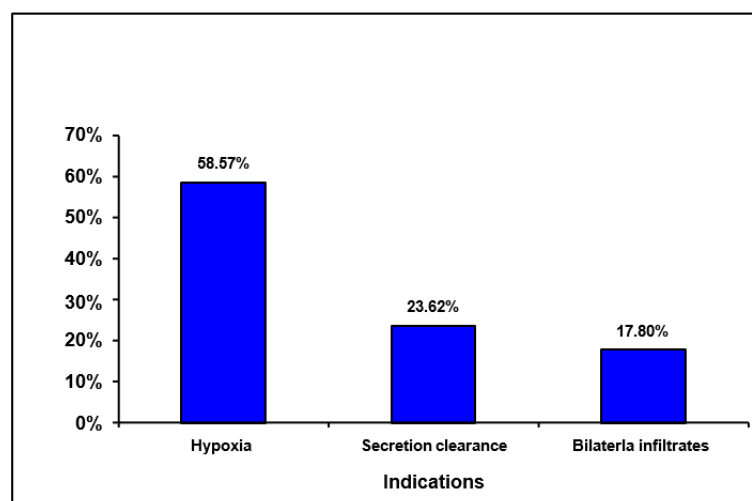


Fig. 4: Distribution of patients according to the indication for Bronchoscopy

DISCUSSION

This hospital-based observational study was conducted in the Intensive Care Unit of the Department of Critical Care Medicine, Apollo Hospitals, Bengaluru, Karnataka. The duration of the study was one year, from January 2021 to December 2021. A total of 309 mechanically ventilated COVID-19 ARDS patients fulfilling the selection criteria were included. During the study period, 2803 patients presented with COVID-19 infection; among them, 2494 were excluded, and 309 eligible ARDS patients were enrolled. Of these, most cases were prospective (n=204), while the remaining (n=105) were retrospective.

Several guidelines have suggested restricting the use of bronchoscopy during the early post-COVID-19 period due to the risk of aerosol generation and possible transmission to healthcare workers (HCWs) [11,19]. Both confirmed and suspected COVID-19 infections were considered relative contraindications for bronchoscopy in light of these risks [12,20]. Nevertheless, it was recognized that bronchoscopy remained essential for certain indications, particularly in mechanically ventilated patients with mucus plugging or unexplained deterioration [13,16]. Some studies also utilized bronchoalveolar lavage (BAL) for microbiological sampling in selected cases [14,18]. However, data regarding the safety, procedural risk, and clinical impact of bronchoscopy in COVID-19 ARDS patients remain limited [15,19]. Therefore, the current study aimed to evaluate the procedural, clinical, and safety aspects of bronchoscopy, as well as its diagnostic and therapeutic roles in COVID-19 ARDS patients on mechanical ventilation.

The present findings indicate that bronchoscopy provides important morphological, microbiological, and pathological information with reasonable safety for both HCWs and patients [17,21]. The procedure significantly aided clinical decision-making for the management of COVID-19 ARDS patients at high risk of deterioration. Thus, bronchoscopic intervention proved valuable for diagnostic, therapeutic, and management-related decisions [22].

In this study, the majority of patients were males (70.23%) with a male-to-female ratio of 2.35:1, suggesting that males were more commonly affected with COVID-19 ARDS than females. This pattern was consistent with the findings of Mehta *et al.*, who

reported 83.6% male predominance among their study population [23].

The age of patients ranged from 18 to 90 years, with a mean of 57.35 ± 15.05 years and a median of 60 (IQR 22) years. The highest number of cases (28.48%) occurred in the 61–70-year age group, followed by 51–60 years (18.45%), indicating that COVID-19 ARDS was more common among the elderly. These results are comparable to the observations of Mehta R. *et al.* (2021), where the mean age was 62.10 ± 11.50 years [23].

In this study, sixteen HCWs were involved in the procedures. All were fully vaccinated against COVID-19 and were monitored for symptoms following exposure. Five HCWs developed mild symptoms, but none tested positive for COVID-19 (RT-PCR), supporting the safety of bronchoscopy when proper infection control measures are followed [24].

The overall mortality rate in this study was 41.75%, which aligns with the findings of Hasan *et al.*, who reported an overall pooled mortality rate of 39% among 10,815 ARDS cases in COVID-19 patients [25]. The slightly higher mortality in the present study may be attributed to the older age group, the presence of multiple comorbidities, and longer delays between symptom onset and hospitalization.

The relatively larger sample size and strict inclusion criteria increase the reliability of this study's findings. Emphasis on HCW safety, hemodynamic stability, and ventilatory parameters, alongside demographic and clinical data, makes this study unique compared to previously published reports [21–25].

CONCLUSIONS

According to the study's findings, bronchoscopy offers patients and healthcare professionals tolerable safety while providing vital morphological, microbiological, and pathological information. As a result, the bronchoscopic procedure is useful for making managerial, therapeutic, and diagnostic decisions. It is a valuable and safe way to improve the efficacy of treating COVID-19 ARDS patients who need mechanical ventilation and are at high risk of worsening.

CONTRIBUTION OF AUTHORS

Research concept- Dr. Santhosh N V, Dr. Sunil Kumar K

Research design- Dr. Sunil Kumar K

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Materials- Dr. Rakshith Sagar D

Data collection- Dr. Rakshith Sagar D

Data analysis and interpretation- Dr. Sunil Kumar K

Literature search- Dr. Rakshith Sagar D

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Article editing- Dr. Sunil Kumar K

Final approval- Dr. Santhosh N V, Dr. Sunil Kumar K, Dr. Rakshith Sagar D

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