



Case Series

Increase of lung function usage bronchoscopy in COVID-19 patients: Three case series in Indonesian adult

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ABSTRACT

Background: COVID-19 is a virus that is spread by aerosol which can cause worsening of hypoxia and bronchoscopy procedures in COVID-19 patients may be considered.

Method: The design of this study is a case series reported using the Preferred Reporting of Case Series in Surgery (PROCESS) 2020 Guideline. Data collection was carried out in the period January–April 2021. All participants underwent X-ray examination and blood gas analysis as well as signs of infection before and after bronchoscopy.

Result: Three intubated patients with COVID-19 were confirmed from PCR nasopharyngeal swab present with worsening on chest X-ray. All three patients had a normal bronchial wall with some inflammation and thick mucus resulting in lung atelectasis and massive inhomogeneous opacity on chest X-ray. Patients showed improvement on chest X-ray after bronchoscopy intervention.

Conclusion: The bronchoscopy procedure can improve the lung function of COVID-19 patients and if it is carried out by medical personnel who pay attention to universal precautions, it will minimize the occurrence of transmission.

1. Introduction

Severe acute respiratory syndrome coronavirus (SARS-CoV)-2 is a new virus identified in Wuhan, Hubei, China on 30 December 2019 and spread rapidly through human transmission caused by coronavirus disease 2019 (COVID-19). The Majority of COVID-19 cases require specialized airway management in intensive care (ICU) [1]. Infected patients spread viral particles through expiratory activities and procedures (suctioning, endotracheal intubation, and bronchoscopy). These activities result in varying sizes of aerosols, which dry up upon exhalation. Aerosolization procedures carry a high risk of transmitting the virus, making health workers particularly vulnerable to exposure [2].

Bronchoalveolar lavage, bronchial wash, and brushing are bronchoscopy procedures used to collect microbiological samples from the lower airways. Bronchoscopy procedure in COVID-19 patients is still needed for managing complications (atelectasis, hemoptysis, etc.), obtaining microbiology samples, and guiding artificial airways management [3]. Bronchoscopy in COVID-19 patients is still a matter of

debate, but if airway complications (atelectasis and hemoptysis, etc.) occur in COVID-19 patients, the bronchoscopy procedure must be carried out immediately [2,4]. Based on the description above, we are interested in reporting a case series bronchoscopy procedure in Indonesian people with COVID-19.

2. Method

The design of this study is a prospective study reported using the Preferred Reporting of Case Series in Surgery (PROCESS) 2020 Guideline [5]. Data collection was carried out in the period January–April 2021 at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The diagnosis of COVID-19 was obtained using real-time polymerase chain reaction (PCR) taken from nasal swabs, tracheal aspirates, and bronchoalveolar lavage [6,7]. The bronchoscopy procedure was given to participants with the following indications for worsening hypoxia that was difficult to explain, microbiological sampling (tracheal aspirate, and bronchoalveolar lavage) to guide the selection of appropriate

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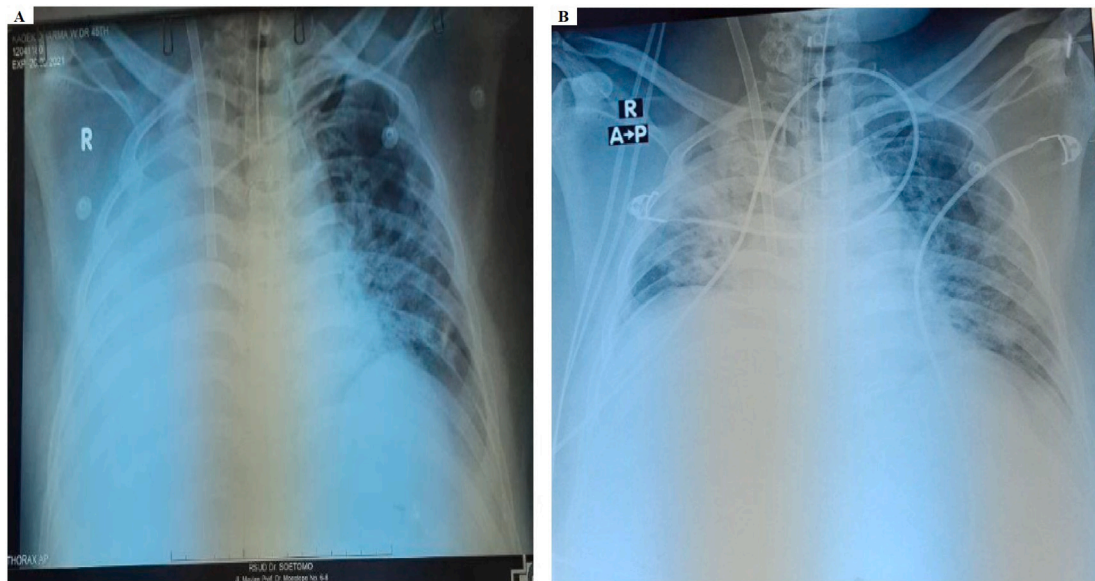


Fig. 1. X-ray examination results on the first participant.

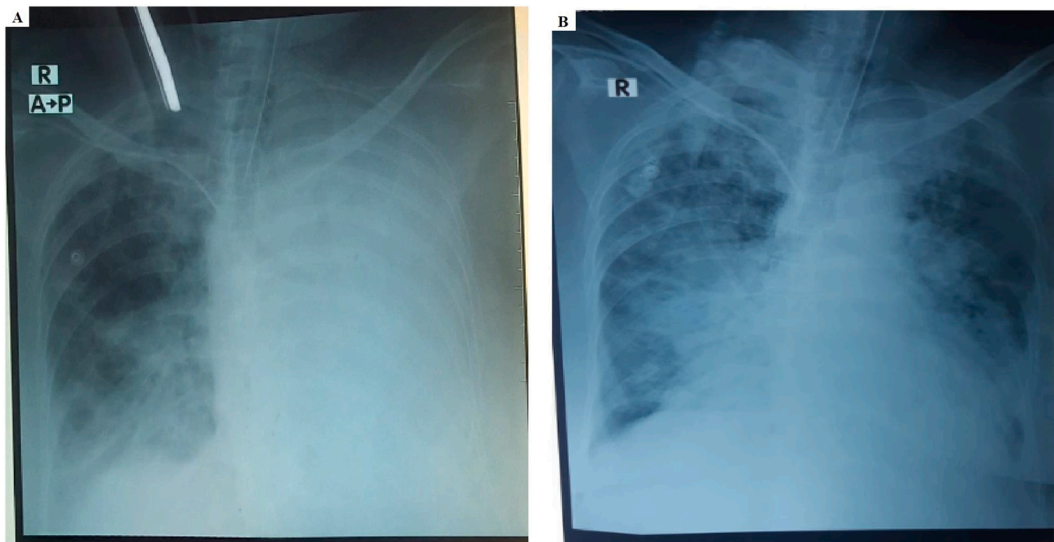


Fig. 2. X-ray examination results on the second participant.

antimicrobials or to remove bronchial plugs [4,8]. Preparation for bronchoscopy includes the use of extra personal protective equipment by the operator, a room with negative pressure, and the patient in the supine position. The equipment used is a reusable bronchoscopy operated by a professional lung specialist. Bronchoscopy is inserted through an endotracheal tube that has been previously installed until it finds the location of the BAL which washing to be finished [9]. Bronchoscopy operators have received training and certification in this procedure since 2013. All participants underwent X-ray examination and blood gas analysis as well as signs of infection before and after bronchoscopy. In addition, the post-bronchoscopy fluid was cultured.

3. Result

Most of the participants were women as much as 66.67% of which the average age of the participants was 59.67 ± 12.74 years. All participants experienced worsening hypoxia and real-time PCR results showed COVID-19. Most of the participants had undergone continuous

renal replacement therapy (CRRT) as much as 66.67%. The first patient had atelectasis, the second and third patients developed progressive hypoxia. All participants received 1 bronchoscopy each. The results of X-ray examinations before and after bronchoscopy can be seen in Figs. 1-3 where there is a significant difference between the two X-rays. The results of laboratory examinations showed the same results, only there were differences in anemia, leukocytosis, and hypernatremia. Meanwhile, the results of blood gas analysis before and after bronchoscopy did not show significant differences, which were pH (7.311 ± 0.105 vs 7.159 ± 0.072), pCO₂ (55.3 ± 15.8 vs 71.8 ± 34.6) mmHg, pO₂ (79.3 ± 20.8 vs 75.0 ± 18.7) mmHg, BE (3.0 ± 15.1 vs -2.3 ± 17.8), HCO₃ (29.4 ± 13.6 vs 26.7 ± 16.7) mEq/L, PEEP (10.7 ± 1.2 vs 10.7 ± 1.2), and FiO₂ (91.7 ± 2.9 vs 91.7 ± 2.9) %. Details of participant conditions can be seen in Table 1. After the X-ray bronchoscopy, the participants experienced an improvement in their lung conditions but clinically, the participants did not experience significant differences.

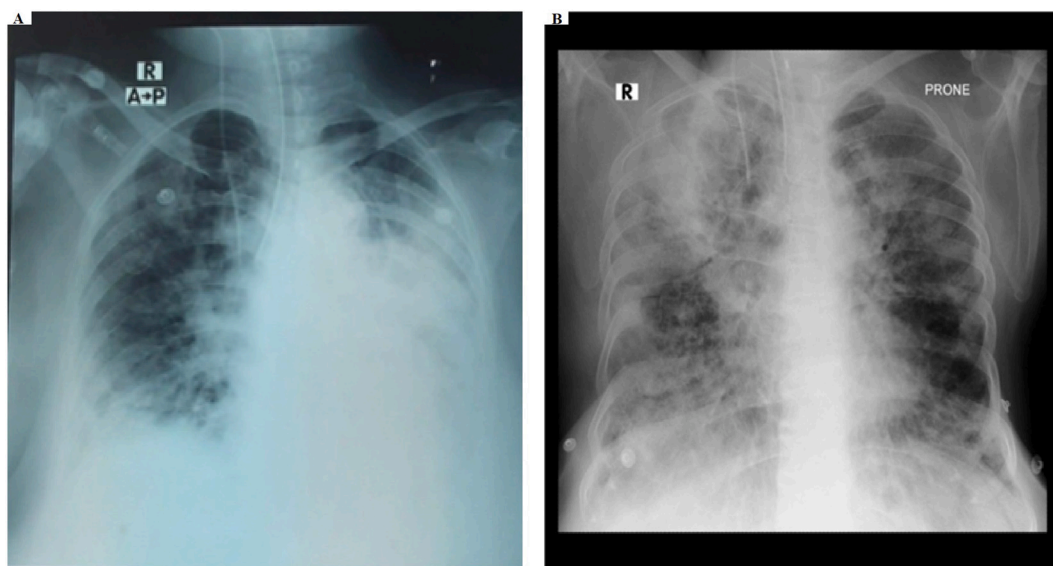


Fig. 3. X-ray examination results on the third participant.

Table 1
Detail condition of 3 participants.

Information	Case 1	Case 2	Case 3
Gender	Male	Female	Female
Aged	45 years	68 years	66 years
Complaint	breathless	breathless	breathless
Real time PCR	positive	positive	positive
Intubate	23 days	5 days	5 days
Treatment history	ECMO (+), CRRT (+)	CRRT (+)	–
Before			
bronchoscopy			
X-ray	Right lung atelectasis with inhomogenous opacities in 1/3 lower left lung	Left lung atelectasis with inhomogenous opacities in 2/3 lower right lung	Bilateral pneumonia, with worsen inhomogenous opacities on left lung
Laboratory	Anemia, leukocytosis, renal function (↑), liver enzymes (↑), hyperbilirubinemia, hypoalbuminemia, D-dimer (↑), procalcitonin (↑)	Anemia, leukocytosis, renal function (↑), liver enzymes (↑), hyperbilirubinemia, hypoalbuminemia, D-dimer (↑), procalcitonin (↑)	Hypernatremia, liver enzymes (↑), hyperbilirubinemia, hypoalbuminemia, D-dimer (↑), procalcitonin (↑)
Blood gas			
pH	7.363	7.189	7.38
pCO ₂ (mmHg)	46	46.3	73.5
pO ₂ (mmHg)	102	75	61
BE	1	–11	19
HCO ₃ (mEq/L)	26.2	17.6	44.3
PEEP	10	10	12
FiO ₂ (%)	90	90	95
After			
bronchoscopy			
X-ray	Improvement	Improvement	Improvement
Laboratory	–	–	–
Blood gas			
pH	7.158	7.087	7.232
pCO ₂ (mmHg)	39.7	67.2	108.4
pO ₂ (mmHg)	81	90	54
BE	–15	–10	18
HCO ₃ (mEq/L)	14.1	20.3	45.6
PEEP	10	10	12
FiO ₂ (%)	90	90	95
Microorganism	<i>Pseudomonas aeruginosa</i>	<i>Acinetobacter baumannii</i> (D), <i>Moraxella catarrhalis</i> (S)	<i>Candida tropicalis</i> , <i>Pseudomonas aeruginosa</i>

Note: PCR = polymerase chain reaction; ECMO = extracorporeal membrane oxygenation; CRRT = continuous renal replacement therapy; pH = power of hydrogen; pCO₂ = partial pressure of carbon dioxide; pO₂ = partial pressure of oxygen; BE = base excess; HCO₃ = blood bicarbonate; PEEP = positive end-expiratory pressure; FiO₂ = fraction of inspired oxygen; D = dextra, S = sinistra.

4. Discussion

Bronchoscopy is one of the high-risk procedures in COVID-19 patients because it causes airway obstruction and the use of high pressure for oxygenation and ventilation during the procedure. In addition to the

close contact between the medical personnel involved in bronchoscopy and the patient, coughing and suctioning can generate large numbers of droplets or aerosols, contaminate equipment in the room, room air, all personnel, and even cause a high risk of cross-infection between patients [2]. To protect healthcare workers and patients, a standardized

approach should be implemented to minimize the risk of exposure while maintaining the ability to perform medically appropriate aerosol-generating procedures such as bronchoscopy [10]. The use of extra personal protective equipment in the bronchoscopy procedure is highly recommended according to previous research [2,10,11].

Based on previous literature, it is stated that bronchoscopy is carried out for COVID-19 patients with medical staff who understand the bronchoscopy procedure and universal precautions well [12]. Other literature also states that modification of bronchoscopy technique to minimize exposure to medical personnel is highly recommended during the COVID-19 pandemic [13]. Because, it was reported that 30% of COVID-19 patients in the ICU experienced bronchoalveolar lavage (BAL) and worsening hypoxia so that the bronchoscopy procedure could be used to prevent multidrug resistance antibiotics [9,14]. The efficacy of bronchoscopy in COVID-19 has not been published numerically but bronchoscopy can increase lung capacity in patients over 50 years of age [15].

5. Conclusion

Urgent life-saving bronchoscopy can be performed with the expectation that it would significantly affect the patient's clinical prognosis. Bronchoscopy must be performed using full PPE, limiting the personnel involved during the procedure in a negative pressure room. BAL sampling for the microbiological examination can assist in further management of the patient. The use of additional personal protective equipment minimizes the transmission of COVID-19 to medical staff.

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Ethical approval

We have conducted an ethical approval base on the Declaration of Helsinki at Ethical Committee with a registry of research in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

Consent

We have explained the purpose of our research to participants and their families. Those who are willing to participate in the study must first fill out the consent form provided consciously.

Author contribution

All authors contributed toward data analysis, drafting, and revising the paper, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Registration of research studies

Not applicable.

Guarantor

Isnin Anang Marhana is the person in charge of the publication of our manuscript.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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