Original Article

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TANAFFOS

Safe Practice of Flexible Bronchoscopy for Non-COVID-19 Indications during the SARS-CoV-2 Pandemic

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Background: Flexible bronchoscopy is an aerosol-generating procedure (AGP), which increases the risk of transmission of SARS-CoV-2 infection. We aimed to find COVID-19 symptoms among healthcare workers (HCWs) involved in flexible bronchoscopies for non-COVID-19 indications during the SARS-CoV-2 pandemic.

Materials and Methods: The participants of this hospital-based single-center descriptive study were HCWs of our hospital involved in flexible bronchoscopies of patients with non-COVID-19 indications. These patients had no clinical features of COVID-19 and were tested negative for SARS-CoV-2 by the real-time polymerase chain reaction of nasopharyngeal and throat swabs before the procedure. The study outcome was the occurrence of COVID-19 in study participants after exposure to bronchoscopies.

Results: Thirteen HCWs performed 81 bronchoscopies on 62 patients. Indications for bronchoscopies included malignancy (61.30%), suspected infections (19.35%), non-resolving pneumonia (6.45%), mucus plug removal (6.45%), central airway obstruction (4.84%), and hemoptysis (1.61%). The mean age of patients was 50.44 ± 15.00 years, and the majority was males (72.58%). Bronchoscopic procedures included 51 bronchoalveolar lavages, 32 endobronchial ultrasound- transbronchial needle aspiration (EBUS-TBNA), 26 endobronchial biopsies, 10 transbronchial lung biopsy (TBLB), 3 mucus plug removals, 2 conventional TBNA, and 2 radial EBUS-TBLB. Except for two HCWs who complained of transient throat irritation of non-infectious cause, none of the cases developed any clinical features suggestive of COVID-19.

Conclusion: A dedicated bronchoscopy protocol helps in minimizing the risk of transmission of SARS-CoV-2 infection among HCWs involved in flexible bronchoscopies for non-COVID-19 indications during the SARS-CoV-2 pandemic.

Key words: Bronchoscopy; COVID-19; Protocol; Risk; SARS-CoV-2; Transmission

INTRODUCTION

The natural mode of transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection is via droplets or aerosols from a coronavirus disease 2019 (COVID-19) patient who may be symptomatic or asymptomatic. Microdroplet formation, which occurs during an aerosol-generating procedure (AGP), contributes further to its spread (1). Therefore, many thoracic societies issued guidelines for safe bronchoscopy practices during the COVID-19 pandemic (2-5). Considering these guidelines, a bronchoscopy protocol was formulated at our institute. The objective of this study was to find the

occurrence of COVID-19 symptoms among healthcare workers (HCWs) involved in flexible bronchoscopies for non-COVID-19 indications during the SARS-CoV-2 pandemic.

MATERIALS AND METHODS

Study design and setting

This descriptive study was done from April 1, 2020, to December 31, 2020, in the department of pulmonary medicine at tertiary care teaching hospital in western India. The study was approved by Institutional Ethics Committee (No. 2020/3227, dated 08/09/2020). Study participants were HCWs involved in flexible bronchoscopies of patients with non-COVID-19 indications. All the study participants gave informed consent for using their clinical and laboratory data. These HCWs were monitored daily for COVID-19 symptoms for the entire study duration. The study outcome was the occurrence of COVID-19 symptoms in the study participants.

Bronchoscopy protocol

At the onset of the COVID-19 pandemic in March 2020, we formulated a bronchoscopy protocol referring to the guidelines regarding safe bronchoscopy practices during the SARS-CoV-2 pandemic. We customized them according to our healthcare resources, as illustrated in Figures 1 and 2. All patients posted for bronchoscopy were tested for SARS-CoV-2 by real-time polymerase chain reaction (PCR) of nasopharyngeal and throat swabs before the procedure. Bronchoscopy was performed within 24 hours of a negative PCR test. They were also asked about their history of contact with a laboratory-confirmed COVID-19 patient, any recent travel, and about COVID-19 symptoms. The body temperature of all patients was measured before the procedure. Due to the reduction in the number of non-COVID-19 patients requiring bronchoscopy, we posted one elective bronchoscopy daily for better infection control after the procedure. The distance between waiting and post-procedure recovery areas for patients was 10 meters and 7 meters, respectively, from the bronchoscopy room. A triple-layered surgical face mask was given to the patient to be worn at all times in the waiting and recovery areas. HCWs comprising the bronchoscopy team included pulmonology consultants, trainees, bronchoscopy nurses, and bronchoscopy assistants. All HCWs wore full personal protective equipment (PPE) for bronchoscopies, which included a cover-all gown, shoe cover, gloves, N-95 respirator, goggles, and a face shield. The minimum possible number of HCWs was designated for a particular procedure. For the endobronchial biopsy, bronchoalveolar lavage, transbronchial lung biopsy, and mucous plug removal, the number was limited to three, which included one bronchoscopist (consultant or a pulmonology trainee), one nurse, and one assistant. Additionally, one bronchoscopist wearing full PPE was kept on standby outside the bronchoscopy room to assist in managing any major complications during the procedure. Two bronchoscopists were designated for endobronchial ultrasound transbronchial needle aspirations (EBUS-TBNAs) and endobronchial ultrasound-guided transbronchial lung biopsies (EBUS-TBLBs), increasing the number of team members to four. For this procedure, no additional bronchoscopist was kept on standby. All the HCWs received training in hand washing, donning, and doffing of PPE. Donning was done in the bronchoscopy room, and doffing was done in a separate dedicated room. After donning, the bronchoscopy nurse transported the patient from the waiting area to the bronchoscopy suite in a wheelchair or a trolley.

No room was available with a negative pressure facility. All bronchoscopies were performed in a well-ventilated room. We performed all bronchoscopies under conscious sedation using intravenous midazolam and fentanyl at the doses of 0.5-2.5 mg and 25-150 ug, respectively. Xylocaine jelly (2%) and xylocaine spray (2% and 10%) were used for topical anesthesia. Spray-as-you-go technique was used for anesthetizing the airways. When performing bronchoscopy through the nasal route, the mouth of the patient was covered using a triple-layered surgical mask during the entire procedure. No mask was applied to the patient while using the oral route in the linear EBUS procedure. Immediately after the completion of the procedure, patients were shifted to a recovery area. After the procedure, surface disinfection and fogging were

done using a complex formulation of stabilized hydrogen peroxide 11% w/v with silver nitrate solution (diluted) 0.01% w/v. We discontinued rapid onsite evaluation (ROSE) for TBNA procedures to avoid any risk of infection transmission to the pathologists. All HCWs involved in bronchoscopies were monitored daily for up to 15 days for any COVID-19 symptoms (6). In case of any symptom or sign suggestive of COVID-19, nasopharyngeal and throat swab was advised for SARS-CoV-2 detection by the PCR test.

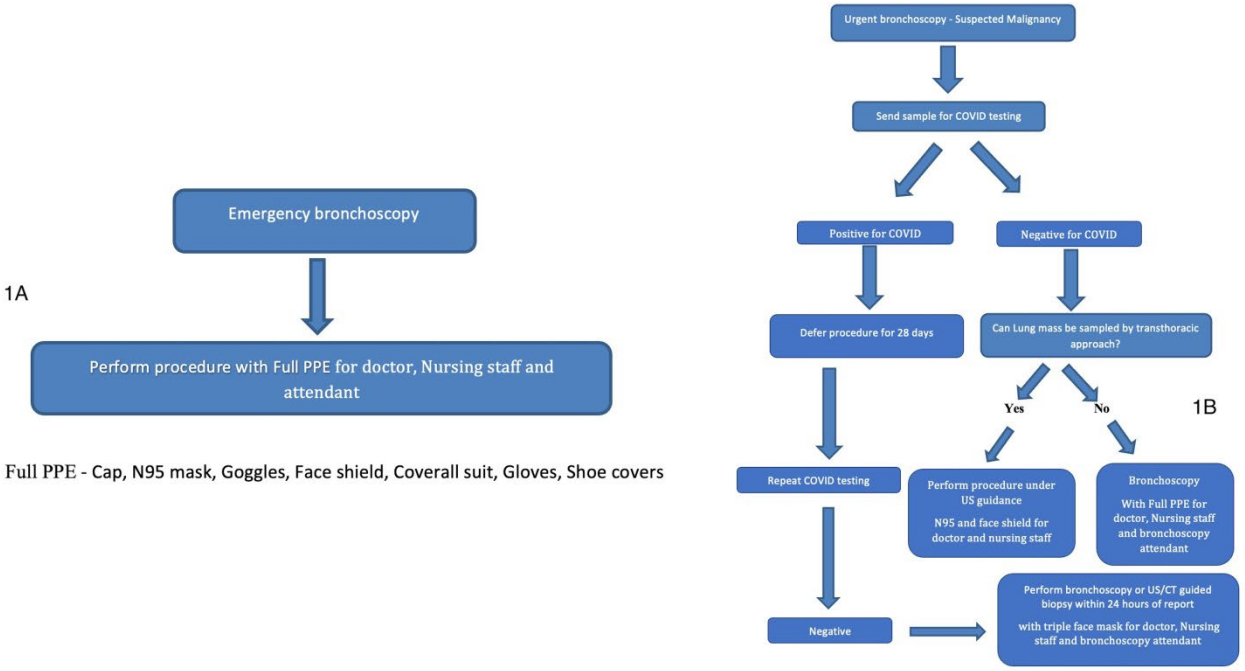

Figure 1. (A) Institutional protocol for Emergency bronchoscopy, (B) Institutional protocol for urgent bronchoscopy in suspected malignancy

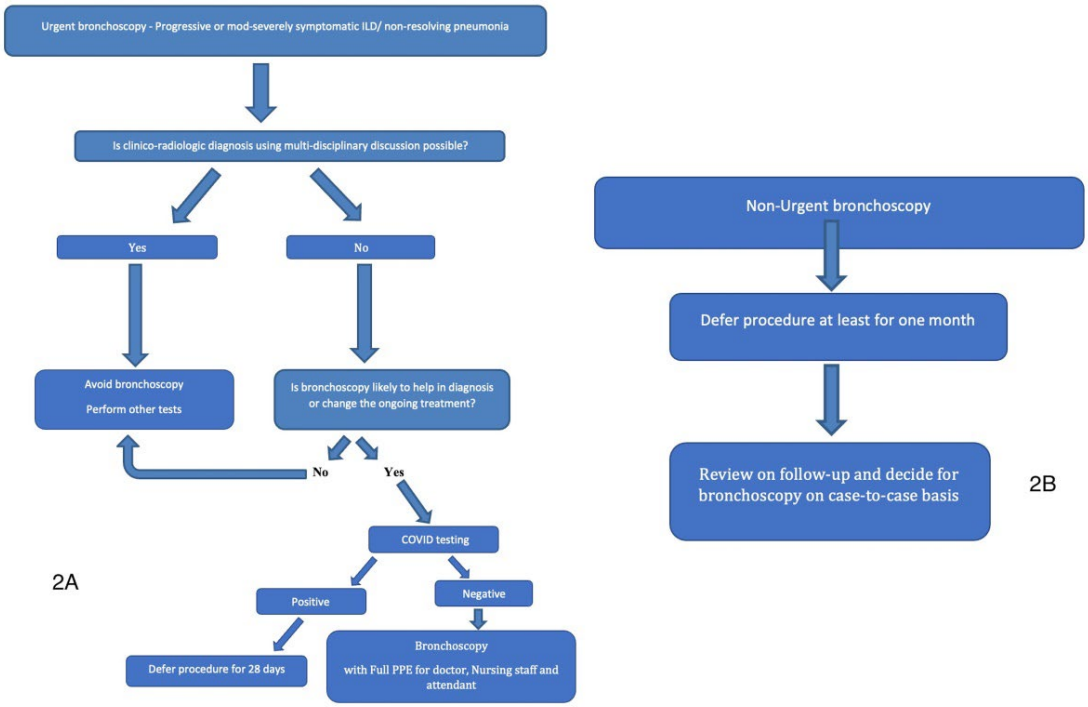

Figure 2. (A) Institutional protocol for urgent bronchoscopy in ILD and non-resolving pneumonia, (B) Institutional protocol for non-urgent bronchoscopy

Data collection and analysis

Data collection was done from the electronic health records of the hospital. Figures 1 and 2 are taken from our hospital COVID-19 policy document. For data analysis, continuous variables were described as mean ± standard deviation, and categorical variables were described as percentages.

RESULTS

A total of 81 bronchoscopies were performed on 62 patients during the study period. The mean age of patients was 50.44±15.00 years, with the majority being males (72.58%). Comorbid illnesses were hypertension (22.59%), ischemic heart disease (11.29%), and diabetes mellitus (8.06%). As shown in Table 1, indications for bronchoscopy included malignancy (61.30%), suspected infections (19.35%), non-resolving pneumonia (6.45%), mucus plug removal (6.45%), central airway obstruction (4.84%), and hemoptysis (1.61%).

Table 1. Patient demographics and clinical characteristics

Demographics and clinical characteristics	Total (n=62)
Age (in years, mean± SD)	50.44±15.00
Gender	
Male	45 (72.58%)
Female	17 (27.42%)
Co-morbidities	
Hypertension	14 (22.59%)
Ischemic heart disease	7 (11.29%)
Diabetes Mellitus	5 (8.06%)
None	36 (58.06%)
Indications	
Malignancy	38 (61.30%)
Suspected Infections	12 (19.35%)
Non-resolving Pneumonia	4 (6.45%)
Mucus plug removal	4 (6.45%)
Central airway obstruction	3 (4.84%)
Hemoptysis	1 (1.61%)

Table 2 shows the different bronchoscopic procedures performed on these patients. These included 51 bronchoalveolar lavages (BAL), 32 EBUS-TBNAs, 26 endobronchial biopsies (EBB), 10 transbronchial lung biopsies (TBLB), 3 mucus plug removals, 2 conventional TBNAs (c-TBNA), and 2 radial EBUS-TBLBs. Figures 1 and 2 depict the institutional protocol for bronchoscopy in COVID-19. A comparison of the number of bronchoscopies performed before and during the pandemic is shown in Figure 3.

Table 2. Bronchoscopic procedures

Procedures	Number (Percentage)
BAL	51(40.48%)
EBUS-TBNA	32(25.39%)
EBB	26(20.63%)
TBLB	10(7.94%)
Mucous plug removal	3(2.38%)
C-TBNA	2 (1.59%)
Radial EBUS guided TBLB	2(1.59%)
Total	126 (100%)

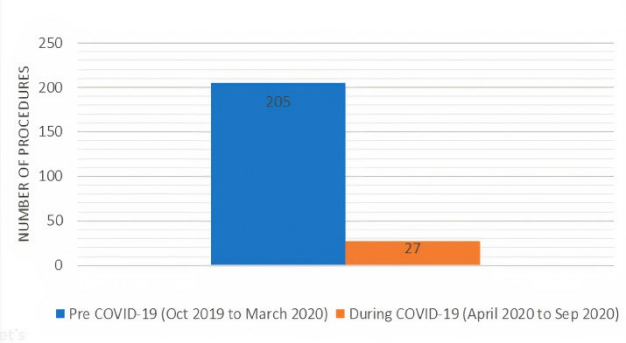

Figure 3. Flexible bronchoscopies before and during COVID-19 pandemic in our institution

We detected a decline in the number of bronchoscopies from 205 in the pre-pandemic period (October 2019 to March 2020) to 81 during the pandemic. HCWs involved included eight bronchoscopists, three nurses, and two bronchoscopy assistants. Two bronchoscopists complained of mild and transient throat irritation at different points of time during the study period. They had negative PCR results and also became asymptomatic in a day. The rest of the HCWs did not develop any symptoms suggestive of COVID-19. Table 3 summarizes the issues and strategies related to flexible bronchoscopy during the COVID-19 pandemic. The bronchoscopy suite with HCWs wearing full PPE is shown in Figure 4.

Table 3. Issues and strategies related to flexible bronchoscopy during COVID-19 pandemic

Issue	Strategy
Limiting the exposure	Careful selection of patients and reduction in the number of healthcare workers involved in bronchoscopy
Screening for SARS-CoV-2 in patients harboring asymptomatic infection	Nasopharyngeal and throat swabs for RT-PCR testing
Protection of health care workers during bronchoscopy	Use of recommended PPE
Reduction of aerosolization during bronchoscopy	Adequate topical anesthesia and conscious sedation using a combination of midazolam and fentanyl
Limiting the risk of airborne transmission	Safe distancing of patient waiting and recovery area
Early detection of COVID-19 in the exposed health care workers	Daily symptoms monitoring for at least 15 days after the procedure

Figure 4. Bronchoscopy suite showing (from left to right) a bronchoscopy nurse, an assistant and a bronchoscopist wearing PPE which included a cover-all gown, shoe cover, gloves, N-95 respirator, goggles and a face shield

DISCUSSION

This descriptive study looked at the incidence of COVID-19 symptoms among HCWs exposed to flexible bronchoscopies of patients with non-COVID-19 pathologies. During this period, we observed a reduction in the number of bronchoscopies at our institute. This was due to the shutting down of the regular outpatient department (OPD), focusing on care for patients hospitalized with SARS-CoV-2 infection. The first visit of patients who were posted for bronchoscopies was in the emergency department as emergency services continued uninterrupted during the pandemic. Telemedicine OPD services were initiated in the following weeks. Despite this, the number of patients requiring bronchoscopies remained low compared to the pre-pandemic period.

Asymptomatic carriage has been a significant transmission source during the SARS-CoV-2 pandemic (7,8). This has been a major determinant in proposing guidelines for safe bronchoscopy practices in this particular period. Most patients who underwent bronchoscopy at our center had suspected lung malignancy. It has been observed that among solid tumors, lung cancer is the highest risk category of disease in patients with SARS-CoV-2 infection (9). Screening patients for SARS-CoV-2 infection prior to bronchoscopy ensures the safety of HCWs involved in the procedure and patients undergoing bronchoscopy. We decided to postpone the procedure if a patient was found positive for COVID-19 in the pre-bronchoscopy screening test. To minimize the risk of any airborne transmission from the patient, we decided to maintain an adequate distance between the waiting area and recovery area from the bronchoscopy room, which was 10 meter and 7 meter, respectively.

We followed the WHO and CDC infection control guidelines, which recommend the use of an N95 respirator and personal protective equipment (gown, gloves, shoe covers, cap, goggles, and face shield) by HCWs during aerosol-generating procedures even if the patient is not a known or suspected case of COVID-19 (10,11). Face masks significantly reduce the chances of aerosol dispersal and decrease viral exposure, providing protection to HCWs (12). All patients were provided triple-layered surgical face masks to be worn before, during, and after bronchoscopy. During the EBUS procedure via the oral route, no masks were applied to patients. Although using a laryngeal mask airway (LMA) during bronchoscopy allows deeper sedation and reduction in cough, its impact on the transmission of infection remains unknown (13). We did not use artificial airways and performed bronchoscopies under conscious sedation and topical anesthesia. The

addition of opioids leads to a reduction in the doses of benzodiazepines (14,15). We chose to co-administer fentanyl not only to complement the sedative action of midazolam but also to use its antitussive action to minimize the chances of aerosolization due to coughing during bronchoscopy. We reduced the risk of exposure by decreasing the procedure time to as low as possible and involving only the most experienced bronchoscopists in the procedures.

Like the influenza pandemic in the past, SARS-CoV-2 could behave in a similar manner resulting in seasonal peaks of transmission after an initial COVID-19 pandemic (16). The pandemic and post-pandemic transmission dynamics of SARS-CoV-2 will depend on multiple factors, including seasonal variation in transmission, duration of immunity, degree of cross-immunity between SARS-CoV-2 and other coronaviruses as well as the intensity and timing of control measures (17). Accordingly, all bronchoscopy centers need to formulate and strictly follow safe bronchoscopy protocols considering the transmission dynamics of SARS-CoV-2. This is further supported by a study by Mondoni et al., where none of the HCWs involved in diagnostic bronchoscopies of COVID-19 suspect patients developed any infection related to the procedure (18).

To the best of our knowledge, our study is the first to describe the experience of flexible bronchoscopy in patients with non-COVID pathologies during the COVID-19 pandemic, supporting the guidelines issued by WHO, CDC, and respiratory societies in terms of the safety of HCWs involved in these bronchoscopies. One limitation of our study was the difficulty in ascertaining the source of infection in case any HCW tested positive during the study.

CONCLUSION

A combination of measures, such as careful selection of patients, pre-procedural testing of patients for SARS-CoV-2 by RT-PCR, the use of recommended PPE, restricting the number of bronchoscopy personnel, the safe distancing of the patient before and after bronchoscopy, and close monitoring of HCWs for any clinical features help in minimizing the risk of transmission of SARS-CoV-2 infection among HCWs involved in bronchoscopies for non-COVID-19 indications during this pandemic.

Informed consent

A written informed consent was obtained from all the study participants for using their clinical and laboratory data before the initiation of the study.

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