Original Article

Diagnostic and Therapeutic Pleuroscopy Using a Flexible Fiberoptic Bronchoscope for Resource-poor Environments: A Case Series

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Abstract

Background. Pleural effusions have always been a challenge to manage. We discuss a cost-effective way of managing pleural effusions using a fiberoptic bronchoscope, through an intercostal drain (ICD).

Methods. Sixty consecutive patients with undiagnosed pleural effusions underwent fiberoptic bronchoscopic pleuroscopy in a tertiary care multi-speciality referral hospital in South India. Under local anesthesia and conscious sedation, ICD were introduced into the intercostal space to allow insertion of the FOB. The parietal pleura, lung surface, diaphragm were visualised and multiple parietal pleural biopsies were taken.

Results. The diagnostic yield of the procedure was 97%. Amongst 60 patients, 29 were diagnosed with malignancy (27 adenocarcinoma, 1 mesothelioma, and 1 breast carcinoma), 27 had tuberculosis pleurisy, two had chronic inflammation secondary to autoimmune disease and in two cases the procedure was indeterminate.

Conclusion. Fiberoptic bronchoscopy can be used for pleural biopsy instead of a semi-rigid pleuroscope/rigid thoracoscope in resource-limited settings. **[Indian J Chest Dis Allied Sci 2017;59:173-176]**

Key words: Pleural effusion, Pleuroscopy, Fibreroptic bronchopy.

Introduction

Pleural effusions often present diagnostic and therapeutic challenges in respiratory medicine. Despite thoracentesis and closed pleural biopsy, 25%-40% of effusions remain undiagnosed.[1,2] In resource-rich environments, the next diagnostic step might be medical pleuroscopy done with a semi-rigid pleuroscope or rigid thoracoscope. Such a procedure has high diagnostic yield but poses specific health care utilisation demands that are not universally available. Not only is the rigid thoracoscope equipment unavailable in many resource-poor countries but the procedure is typically done under general anesthesia requiring the services of an anesthetist and longer hospital stay. The availability of this modality is limited in many developing nations and even in places where this intervention is available, high costs limit its access.

We undertook the following study to determine if pleuroscopy could be performed safely and with useful diagnostic yield using equipment already available in most respiratory environments. Using conscious sedation and introducing a flexible fiberoptic bronchoscope through a chest tube, we performed diagnostic pleuroscopy in patients whose pleural effusions remained undiagnosed after at least one diagnostic thoracocentesis. In a subset of patients whose diagnosis was malignant pleural effusion, we used the same approach to perform tetracycline pleurodesis.

Material and Methods

Hospitalised in-patients and ambulatory outpatients of a tertiary care multi-speciality referral hospital in South India (Narayana Health Hospital, Bengaluru, India), were eligible for the study if they were 18 years of age or older, had a radiographically confirmed pleural effusion of more than seven days duration that remained undiagnosed after at least one thoracocentesis yielding fluid for cell count, cytologic examination and microbiologic study. The patient consent for inclusion in the study was taken for all. Patients were excluded if they had any hemodynamic compromise requiring intensive unit care with ventilator support, if they were febrile with a temperature of more than 38 °C, or hypoxic with a saturation <90% on 2 litres of oxygen per minute, or if they were unable to provide informed consent

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because of their illness or were unwilling to go through any intervention. In addition, patients with co-morbidities, like coronary artery disease, renal failure, liver disorders, empyema, and bleeding disorders or on anti-coagulation therapy were also excluded.

The approval of Internal Review Board (IRB) or committee was not required for this study. This is because both the procedures, flexible fiberoptic bronchoscopy (FOB) and insertion of the chest drain (ICD) are routine procedures done in the hospital. We have just used the already available instruments, in a novel fashion to cater to our needs. That is why IRB statement was not needed, and hence, not included.

A flexible fiberoptic bronchoscope with 6 mm outside diametre and a 2 mm working channel and an intercostal chest tube 32 Fr was used. We cut the tip of the chest tube around 2cm to 3cm to facilitate the introduction of the flexible bronchoscope through it. Thus, the modified chest tube was used as a sheath to guide and protect the bronchoscope through the chest wall. The procedure was done in the bronchoscopy suite. The patient was placed in the lateral decubitus position with the side of pleural effusion facing upwards. An ultrasonography of the chest was performed to determine the port of entry for the procedure, to assess the pleura for the presence of any loculations, adhesions and pleural thickening. The premedication used were 2 mg of midazolam and 50 mg of fentanyl along with 40% oxygen via face mask. Under local anesthesia with lidocaine, and conscious sedation, the modified intercostal chest drain (ICD) 32F was introduced into the intercostal space. The pleural fluid was drained and an artificial pneumothorax was created. The FOB was inserted through the ICD, and the entire parietal pleura, lung surface and diaphragm was visualised.

Multiple parietal pleural biopsies were taken with the help of bronchoscope biopsy forceps. A double port technique with a rigid forceps was used in certain occasions, particularly for the hard pleural nodules not yielding to a good sample with the standard bronchoscope biopsy forceps alone, in order to improve the quality of the sample. This double port technique with the rigid forceps also helped us to perform limited adhesiolysis, thus improving the drainage of the pleural fluid post procedure. We also improvised our procedure by using the cryoprobe to get better pleural biopsies in a subset of patients instead of the double port technique, for whom the FOB biopsy did not yield adequate pleural tissue.

For a subset of patients where malignancy was confirmed on histopathology of the pleural biopsy, FOB pleuroscopy was repeated for pleurodesis. Oxytetracycline was instilled over the entire pleural surface using a protected sample sheath through the working channel of the bronchoscope.

Average procedure time was for 30 to 45 minutes. During the entire procedure, the blood pressure, pulse rate, electrocardiogram and oxygen saturation were monitored. At the end of the procedure, the FOB was removed and the chest tube was left behind in the pleural cavity for all patients. The chest tube was connected to the suction tube of the drainage device and fixed in position to the skin of the chest wall using silk sutures. The dressing was applied, inspected daily and routinely changed. The chest tube remained for 48 hours post procedure and a few days longer in malignant cases until pleurodesis was achieved. The duration of stay in the hospital after the procedure was approximately for 48 hours.

All patients were followed up for three months after the procedure.

Results

There were 60 patients (35 females) who met the study criteria. The age of the patients was between 20 years to 65 years. The aetiology of the pleural effusion as confirmed on the pleural biopsy by the FOB pleuroscopy revealed 29 (48.3%) patients with malignancy, 27 (45%) with tuberculosis, 2 (3.3%) with autoimmune disease systemic lupus erythematosus and 2 (3.3%) with indeterminate diagnosis. Out of the patients with indeterminate aetiology, one had a decortication and the histopathology revealed tuberculosis; the second patient had a computed tomography (CT)-guided biopsy of a lung mass which confirmed the diagnosis of adenocarcinoma.

The overall diagnostic yield of this procedure was 97%. A confirmatory diagnosis was possible in 40 cases with the standard bronchoscope biopsy forceps (69%), 8 cases with a cryo forceps (14%) and in 10 cases with a double port technique (17%). The double port technique with rigid forceps was used when the pleural nodules were hard and could not be pinched by the standard bronchoscope biopsy forceps alone.

The detailed comparison of the pleural fluid analysis, the gross appearance of the pleura and the confirmatory histopathological diagnosis are described in the table. We found that 26 out of 27 patients had a pleural tissue positive for *Mycobacterium tuberculosis*, whereas their pleural fluid mycobacterial culture did not reveal growth of the organism. One patient had pleural tissue and pleural fluid growing non-tuberculous mycobacteria (NTM). The pleural fluid adenosine deaminase has been <40 in 25 patients of biopsy proven pleural tuberculosis. Secondly, pleural fluid cytology was positive for adenocarcinoma only in one patient. The procedure was well-tolerated with no deaths during the

Table. Clinical and histopathological profile of the patients undergoing procedure.

Final Diagnosis	Histopathology	Pleural Fluid Analysis	Gross Appearance of Pleura
Malignancy (29)	Adenocarcinoma (27)	All exudative ADA <30= all Cytology + adenocarcinoma=1	Adenocarcinoma: studded with nodules, bleeding on touch (23) Normal appearance (4)
	Mesothelioma (01)		Mesothelioma: Macro nodules interspersed with normal pleura
	Breast cancer (01)		Breast cancer: cluster of grapes
Tuberculosis (27)	Caseating granulomata (27)	Lymphocyte predominant (27)	Proteinaceous exudative pleural coat (24)
	Culture positive for *Mycobacterium tuberculosis* (26)	ADA <30 = 12 ADA 30-40 = 13 ADA >40 + 2	Pleural nodule: (3)
	Culture positive for NTM (1)	Culture positive for NTM: (1)	
Autoimmune (2) Both patients had SLE	Chronic inflammation with no granuloma	ADA <30 Neutrophil predominant	Normal
Indeterminate (2)	One patient had decortication; histopathology revealed tuberculosis	ADA <30 = 2 Cytology negative	Pleural nodules interspersed with normal pleura (1)
	Second patient had a CT-guided biopsy of lung mass: adenocarcinoma		

Definitions of abbreviations: ADA=Adenosine deaminase; NTM=Non-tuberculous mycobacteria; SLE=Systemic lupus erythematosus; CT=Computed tomography

procedure or on three months follow-up. One patient had re-expansion pulmonary oedema that resolved with conservative measures. The images of the pleura during FOB pleuroscopy are shown in figures 1(A,B) and 2 (A,B,C).

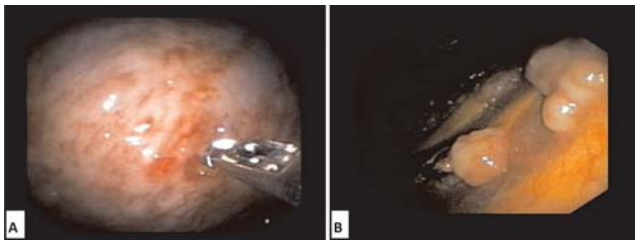

Figure 1. Photograph of the pleura during fibreoptic bronchoscopy pleuroscopy in a patient (A) with adenocarcinoma and (B) with mesothelioma.

Discussion

Our data confirm that simplified pleuroscopy using a flexible bronchoscope introduced through a chest tube can be done under local anesthesia with high diagnostic yield in resource-poor environments.

Previous studies revealed that for malignant effusion the diagnostic yield of the pleural fluid cytology can be as low as 30% and sometimes as high as 80%,[1-5] depending on the type of the tumour[6] and the degree of pleural involvement.[7] The standard closed pleural biopsy, done with the help of Abram's or Cope's needle has a diagnostic yield of only 50%-60% for combined tuberculosis and malignancy.[8,9] This is because of its blind nature and inability to always

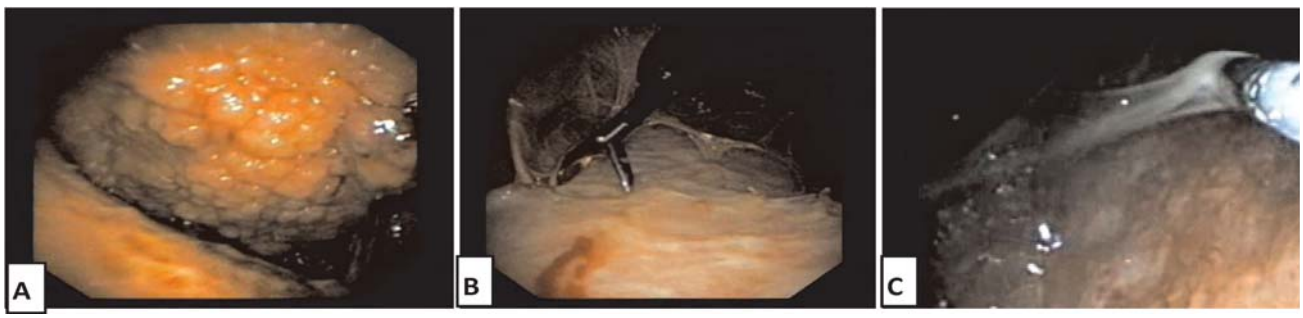

Figure 2. Photograph of the pleura during fibreoptic bronchoscopy pleuroscopy in a patient with (A) breast carcinoma metastasis, (B) tuberculosis undergoing adhesiolysis with double port technique and (C) adenocarcinoma undergoing biopsy with cryoprobe.

obtain tissue samples from the affected sites of the parietal pleura.[10,11] Hence, when compared to pleural fluid cytology and closed pleural biopsy, FOB pleuroscopy had much more diagnostic accuracy.

As the microscopy of the pleural fluid for acid-fast bacilli (AFB) is positive in less than 5% of tuberculosis pleuritis cases, due to the paucibacillary nature of the disease[12,13] and the mycobacterial culture of pleural fluid also has a low sensitivity of 24%-58%,[13] this AFB culture and drug sensitivity from the pleural tissue itself is surely an additional advantage in developing countries, like India, where factors such as human immunodeficiency virus (HIV) infection, malnutrition and homelessness conspire together such that pleural TB is responsible for 30%–80% of all pleural effusions.[14-17]

With the double port technique, adhesiolysis with rigid forceps could be done. This in turn increased the pleural fluid drainage in these patients post procedure. So, in this subset of patients along with a diagnostic procedure, this technique also had a therapeutic benefit.

The procedure has been very cost effective. The cost of rigid thoracoscopy is 20,000 Indian rupees (INR)/ procedure and this procedure costs 4000 INR/ procedure. There was no operation theatre charges required for these cases because the procedure was done in the bronchoscopy suite. The charges were inclusive of the investigations, like cytology, histopathology, and microbiology with Gene-expert test. The cost of medical pleuroscope with a semi-rigid bronchoscope was similar to that of FOB pleuroscope. However, in centres where semi-rigid pleuroscope is not available, FOB pleuroscope remains an affordable and feasible alternative.

The limitation with FOB used for pleuroscopy, that the operator is likely to face, is that the bronchoscope after entry into the pleural cavity will tend to fall down, as it is flexible and there is no support to hold it straight inside the pleural cavity, and thus, maneuverability is difficult. This is probably the reason that the semi-rigid thoracoscope was provided with a rigid shaft for easy operability. We did overcome this limitation by manually supporting the ICD with the FOB throughout the procedure. The ICD itself acted like a rigid shaft for easy operability.

There are previous case reports and small case series from different centers of this technique,[18-22] but this is the first reported case series of this procedure being done in a hospital from the Indian sub-continent.

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