Original Article

Medical Thoracoscopy: A Rapidly Evolving Diagnostic Modality in Undiagnosed Effusion

Gopal Purohit, Shameel Ahammed KK, Sunil Vyas, Hemant Borana, Sandeep Vernaker and Aswathy TA

Department of Pulmonary Medicine, Kamla Nehru TB and Chest Hospital, Dr S.N. Medical College, Jodhpur (Rajasthan), India

Abstract

Background. The diagnostic focus for exudative pleural effusion is to recognise the aetiology of intra-pleural disease. We describe our experience in the outcome and analysis of medical thoracoscopy in undiagnosed pleural effusion.

Methods. A prospective, cross-sectional study was conducted from April 2016 to March 2017 using Olympus (LTF-160) semi-rigid thoracoscope.

Results. Forty-eight patients with undiagnosed pleural effusion underwent medical thoracoscopy; out of whom 36 patients (75%) were males. The diagnostic yield of medical thoracoscopy in our study was 89.6%. Malignancy was the most common histological diagnosis in 54.2% of cases, 35.4% were diagnosed with tuberculosis and 10.4% with non-specific pleuritis. There were no major complications.

Conclusions. Medical thoracoscopy is an extremely useful diagnostic modality that can often contribute crucially to accurate clinical decision making in patients with undiagnosed pleural effusion. The greatest advantage is the ease in handling the semi-rigid thoracoscope by bronchoscopist which is essentially similar to the use of flexible bronchoscope. **[Indian J Chest Dis Allied Sci 2018;60:77-80]**

Key words: Medical thoracoscopy, Tuberculosis, Undiagnosed pleural effusion, Pleural biopsy.

Introduction

The initial step in the evaluation of a pleural effusion is a detailed history and physical examination.[1] The next step is sampling of the pleural fluid, i.e thoracocentesis followed by microbiology, biochemistry and cytological examinations of the pleural fluid.[2] The diagnostic focus for exudative effusions is to recognise the aetiology of the pleural disease.

It has been observed that in day-to-day clinical practice, 20% to 25% of cases of pleural effusion are undiagnosed after simple diagnostic pleural aspiration, which requires further investigations.[3,4] 'Blind' pleural biopsy is less sensitive in the diagnosis of malignant pleural disease than computed tomography (CT)-guided pleural biopsy or local anaesthetic thoracoscopy/pleuroscopy.[5,6] Direct visualisation of the pleura in malignancy often reveals patchy abnormalities with disease affecting the more dependent part of the pleura near the diaphragmatic surface.

The use of thoracoscopy for the diagnosis of pleural effusions was first described in 1910 by an internist from Stockholm called Hans-Christian Jacobaeus.[7] In 1925, Jacobaeus then reported the use of rigid urology forceps to diagnose pleural tumour[8,9]; since then, over a period of 100 years, this technique has evolved and improved after advances in optics, laparoscopic techniques and video technology along with studies conducted across the globe for diagnosing and treating pleura-related diseases.[10] The procedure evolved into video-assisted thoracoscopic surgery as is being currently performed by the thoracic surgeons.

This study was palnned to study the outcome of medical thoracoscopy in undiagnosed pleural effusions. Further, it was also proposed to compare visual thoracosopic appearance and histopathology and to evaluate complication rate in medical thoracoscopy.

Material and Methods

A prospective, cross-sectional study was undertaken from April 2016 to March 2017 at our hospital in Rajasthan state in India. The patients with moderate to massive pleural effusions were enrolled for the study where diagnosis was not confirmed by pleural fluid analysis (biochemical, microbiological, cytological analysis with adenosine deaminase activity). The patients with age less than 15 years, obliterated pleural space, minimal pleural effusion, refractory cough, hypoxia, coagulopathy/bleeding

[Received: May 11, 2017; accepted: August 23, 2017]

Correspondence and reprint requests: Dr Shameel Ahammed, Department of Pulmonary Medicine, Kamla Nehru TB and Chest Hospital, Pal Link Road, Jodhpur-342 008 (Rajasthan), India; E-mail: shameel.ahammed@yahoo.com

diathesis, thrombocytopaenia and unstable cardiovascular status were not included in the study. Written informed consent was taken from all the patients and the study was approved by the Institute's Ethical Committee.

After informed consent from the patients and explaining the procedure, probable complications during and after procedure, medical thoracoscopy was performed under conscious sedation. Patients were kept fasting for minimum of four hours prior to the procedure. Vascular access was achieved in the upper limb opposite to the side of thoracoscopy. Patients were positioned in the lateral decubitus with the diseased side up and arms were positioned above the patients head. Patient's vital parameters were monitored. The port of entry was at the mid-axillary line between fourth and sixth intercostal spaces, assessed with ultrasound chest to mark the site. Local anesthesia was administered to the skin, subcutaneous tissue, muscle, and parietal pleura in the same order. A 1-2 cm skin incision was made with a scalpel, followed by a blunt dissection of intercostal muscles using curved artery forceps until the pleural space is reached. Once pleural space was entered a disposable flexible trocar with cannula of an inner diameter of 8mm was inserted through the chest wall. This was followed by the insertion of the semi-rigid thoracoscope (Olympus Medical System Corporation, Japan, LTF-160, CV-150) through the cannula after removing trocar. Pleural fluid was suctioned to enable clear visualisation of entire pleural surface. Thoracoscope was maneuvered judiciously. After selecting suitable site on parietal pleura for biopsy, biopsy forceps were introduced through working channel of the thoracoscope. Pleural biopsy samples were obtained from the parietal pleura. After obtaining satisfactory biopsy specimens, pleuroscope was removed, followed by trocar. A chest tube (24F) was introduced through the same space and connected to the underwater seal. Chest radiograph was taken immediately after post-operative period. The chest tube was removed the next day, if there was good lung expansion and fluid drainage was minimal (less than 50 mL/24 hours).

Statistical Analysis

Data were entered using Microsoft Excel 2007 and analysed using Statistical Package for the Social Sciences (SPSS, Version 24). Statistical analysis was done by using Chi square test and a p value <0.05 was considered as significant.

Results

During the study, 48 patients with undiagnosed pleural effusion underwent medical thoracoscopy; out of whom 36 patients (75%) were males. Twenty-four patients were more than 60 years of age (Table 1). Half of the patients were smokers, that included current (33.3%) and reformed (16.7%) smokers. Duration of smoking (pack years) was given in table 1.

The most common respiratory symptom was breathlessness in 42 (87.5%) patients, followed by chest pain in 34 (70.8%) and haemoptysis in 27% of cases. There was a statistical correlation between the presence of haemoptysis, chest pain and absence of fever with malignancy (Table 1).

Table 1. Comparison of clinical and demographic characteristics of the cases

Variables	Malignant (n=26)	Non-malignant (n = 22)		p value
		TB	NSP	
Age (in years) (mean)	69.4	31	43.8	
≤20	0	1	0	
21 to 40	0	13	1	<0.0001
41 to 60	5	1	3	
>60	21	2	1	
Gender				
Male	19	15	2	= 0.086
Female	7	2	3	
Duration of symptoms (mean, days)	38.2	12.5	19	
Occupation				
Farmers	5	6	0	
Labourer	7	5	1	= 0.59
Government service	2	0	0	
Housewife	7	4	3	
Others	5	2	0	
Symptoms				
Shortness of breath	25	13	4	0.1403
Cough	14	9	1	0.3656
Fever	0	8	2	0.0007
Haemoptysis	12	1	0	0.0052
Chest pain	23	7	4	0.0034
Smoking				
Smoker (n=24)	19	3	2	0.0016
Non-smoker (n=24)	7	14	3	
Smoking (pack years)				
<20	0	1	0	0.0008
20-40	3	1	2	
>40	16	1	0	
Co-morbidity				
COPD	8	1	0	
Diabetes mellitus	2	0	1	
Liver disease	1	0	0	0.0988
Renal diseases	0	1	0	
Cardiac diseases	0	1	1	
Malignancy	3	0	2	
Duration of Illness				
<1m	0	0	0	0.0068
>1m	26	17	5	
Duration of ICTD (mean, days)	6.4	4.9	5.1	

Definitions of abbreviations: TB=Tuberculosis; NSP=Non-specific pneumonia; COPD=Chronic obstructive pulmonary diseases;

All the patients had lymphocyte predominant picture in pleural fluid analysis. On gross examination, 40% of the patients had straw-coloured fluid and 60% had haemorrhagic fluid (Table 2). Nodular lesions (50%) were commonest thoracoscopic finding followed by sago grain appearance (31%) and whitish patches (13%). Malignancy was diagnosed in 26 (54.2%) patients, tuberculosis in 17 (35.4%) patients and 5 (10.4%) patients had non-specific pleuritis (Table 3). Mesothelioma (primary pleural malignancy) was diagnosed in 11 cases (Table 4).

Table 2. Pleural fluid analysis findings of study population

Pleural Fluid Features	Undiagnosed Effusion		
	Malignant	Non-malignant	
		TB	NSP
Side of effusion			
Right (62.5%)	16	10	4
Left (37.5%)	10	7	1
Appearance			
Haemorrhagic (60.4%)	24	7	1
Straw coloured	2	13	4
pH#	7.288±0.03258	7.288±0.06966	7.400±0.0000
Protein# (g/dL)	4.312±0.6244	4.582±0.5365	4.600±0.8972
Glucose# (mg/dL)	66.423±8.5799	51.412±6.9468	86.000±6.8920
Neutrophils# (%)	19.500±7.2457	19.059±6.9863	36.000±3.1623
Lymphocytes# (%)	59.500±6.4946	79.765±5.7612	63.000±3.1623
Mesothelial cells# (%)	20.615±8.9981	1.176±3.3955	1.000±2.2361
Positive MGG stain	9	0	0
Aminideaminae assay (Mean±2SD)	16.600±7.5557	47.000±6.8007	24.200±9.5499
<40	26	1	5
≥40	0	16	0

#=Values are expressed as mean±standard derivation

Definition of abbreviations: TB=Tuberculosis; NSP=Non-specific pneumonia; MGG=May-Grunwald Giemsa

Table 4. Histopathological types of malignant cases of the study population

Histopathological Findings	Number (%)
Primary	
Mesothelioma	11 (42.3)
Metastatic	
Adenocarcinoma	8 (30.7)
Squamous cell carcinoma	2 (7.73)
Small cell carcinoma	2 (7.73)
Breast carcinoma	2 (7.73)
Prostate carcinoma	1 (3.8)
Total	26 (100)

The diagnostic yield of medical thoracoscopy in the present study was 89.6% (43/48) and without any major complications. However, few minor complications, like subcutaneous emphysema (2.1%), infection and minimal bleeding (4.2%) were seen.

Discussion

The present study was performerd to analyse the diagnostic yield of medical thoracoscopy in undiagnosed pleural effusions and to assess the complication rate in a resource-limited setting, like India.

The diagnostic yield of medical thoracoscopy in our study (89.6%) was almost similar to that reported in other studies (85.3% - 95.3%).[11,12]

A study showed higher the age group, more the chances of malignancy,[9] as 81% of the malignant cases were diagnosed in patients with age more that 60 years. Smoking (>40 pack years) and longer duration of illness (>1 month) are significant risk factors for the pleural malignancy, similar to as reported in a study by Zay Soe *et al*.[13]

Majority of patients enrolled in the study were males (75%). Mean age of our study population was 52.6 years, similar to as reported by Patil *et al*.[12] Smoking and longer duration of illness (>1 month) are statistically significant risk factors for the pleural malignancy. Correlation between final diagnosis and gender of the study population was not statistically significant in our study. There was no statistically significant correlation between final diagnosis and the patient's occupation.

Table 3. Comparison of thoracoscopic findings with histopathological diagnosis

Thorascopic Findings	Number of Patients	Malignant (n=26)	Non-malignant (n=22)		p value
			TB	NSP	
Normal	3 (6%)	0	0	3	0.001
Nodules	24 (50%)	23	0	1	
Sago grain appearance	15 (31%)	0	15	0	
Whitish patches without adhesions	6 (13%)	3	2	1	
Total	48	26 (54.2%)	17 (35.4%)	5 (10.4%)	48 (100%)

Definitions of abbreviations: TB=Tuberculosis; NSP=Non-specific pneumonia

The majority of exudative effusion cases were diagnosed as tuberculosis (68.4%) and majority of haemorrhagic effusions were diagnosed as malignant (55%). Mesothelial cells were significantly higher in patients with malignancy as compared to tuberculosis in our study, similar to as reported also by Kushwaha *et al*[14] in their study.

Nodular lesions were the major thoracoscopic findings followed by sago grain appearance and whitish patches in our study. In other studies this varied from 35.2% to 59%.[11,12,15-18]

Among the malignant cases, mesothelioma (primary pleural malignancy) was diagnosed commonly in the present study, whereas another study reported a prevalence of 53.6%.[19] Among the metastatic malignancies, adenocarcinoma was seen more, followed by squamous cell carcinoma, small cell carcinoma and breast and prostate carcinoma, in contrast with the results of Nathusamy *et al*.[15]

Among the non-malignant cases, tuberculosis was found in nearly 36% cases. However, results of other studies varied from 24% to 36%.[12,20] Non-specific pleuritis was reported in 10.4% patients, whereas other studies reported this entity in 5% to 12.6% of cases.[19,21]

All the cases with sago grain lesions were diagnosed as tuberculosis in the present study, which is in contrast with other studies from various regions of the world.[16,19]

The complication rate in our study was low, as there were no major complications and no procedure-related mortality. However, few minor complications, like subcutaneous emphysema, infection and minimal bleeding were observed in our patients; which is similar to the complication rate reported in other studies.[12,16]

The limitations of our study were that immunohistochemistry of the biopsy samples was not done. We also could not perform cultures for *Mycobacterium tuberculosis* and acid-fast bacilli test for biopsy samples.

Conclusions

Medical thoracoscopy is an extremely useful diagnostic modality that can often contribute crucially to accurate clinical decision making in patients with undiagnosed pleural effusion. It is highly useful in cases of lymphocytic exudative pleural effusions with a diagnostic dilemma between malignancy and tuberculosis, especially in countries like India where prevalence of both the diseases is high. The advantage of the procedure is the ease of adoption of the semi rigid thoracoscope by the bronchoscopist.

References

1. Mayse ML. Non-malignant pleural effusions. In: Fishman AP, Elias JA, Fishman JA, Grippi MA, Senior RM, Pack AI, editors *Fishman's Pulmonary Diseases and Disorders*; 4th Edition. New York, USA: Mcgraw-Hill; 2008; pp1487–1504.
2. Sahn S. Pleural fluid analysis: narrowing the differential diagnosis. *Semin Respir Med* 1987;9:22–9.
3. Light RW. Pleural effusion. *N Engl J Med* 2002;346:1971–7.
4. Shaheen MMAM, Shaaban AY, Mahmoud MI, Shaaban AA, Sweeda RA. The diagnostic role of thoracoscope in undiagnosed pleural effusion: rigid versus flexible. *Egyptian J Chest Dis Tubercu* 2014;63:635–42.
5. Poe RH, Israel RH, Utell MJ, Hall WJ, Greenblatt DW, Kallay MC. Sensitivity, specificity, and predictive values of closed pleural biopsy. *Arch Intern Med* 1984;144:325–8.
6. Maskell NA, Gleeson FV, Davies RJO. Standard pleural biopsy versus CT-guided cutting-needle biopsy for the diagnosis of pleural malignancy in pleural effusions: a randomised controlled trial. *Lancet* 2003;361:1326–30.
7. Jacobaeus H. About the possibility of applying the cystoscopy in the examination of serous cavities. *Münch Med Wschr* 1910;40:2090–2.
8. Jacobaeus H. The thoracoscopy and its practical significance. *Ergebn Ges Med* 1925;7:112–66.
9. Brims FJH, Arif M, Chauhan AJ. Outcomes and complications following medical thoracoscopy. *Clin Respir J* 2012;6:144–9.
10. Ernst A, Silvestri GA, Johnstone D. American College of Chest Physicians. Interventional pulmonary procedures: guidelines from the American College of Chest Physicians. *Chest* 2003;123:1693–1717
11. Dhanya TS, Ravindran C. Medical thoracoscopy: minimally invasive diagnostic tool for a trained pulmonologist. *Calicut Med J* 2009;7:e4.
12. Patil CB, Dixit R, Gupta R, Gupta N, Indushekar V. Thoracoscopic evaluation of pleural effusion. *Lung India* 2016;33:502–6.
13. Soe Z, Aung Z, Tun KD. A clinical study on malignant pleural effusion. *Int J Collab Res Internal Med Public Health* 2012;4:761-79.
14. Kushwaha R, Shashikala P, Hiremath S, Basavaraj HG. Cells in pleural fluid and their value in differential fluid diagnosis. *J Cytol* 2008;25:138–43.
15. Nattusamy L, Madan K, Mohan A, Hadda V, Jain D, Madan NK, *et al*. Utility of semi-rigid thoracoscopy in undiagnosed exudative pleural effusion. *Lung India* 2015;32:119–26.
16. Prabhu VG, Narasimhan R. The role of pleuroscopy in undiagnosed exudative pleural effusion. *Lung India* 2012;29:128–30.
17. Hucker J, Bhatnagar NK, al-Jilaihawi AN, Forrester-Wood CP. Thoracoscopy in the diagnosis and management of recurrent pleural effusions. *Ann Thorac Surg* 1991;52:1145–47.
18. Mootha VK, Agarwal R, Singh N, Aggarwal AN, Gupta D, Jindal SK. Medical thoracoscopy for undiagnosed pleural effusions: experience from a tertiary care hospital in north India. *Indian J Chest Dis Allied Sci* 2011;53:21–4.
19. Helala LA, El-Assal GM, Farghally AA, Abd El Rady MM. Diagnostic yield of medical thoracoscopy in cases of undiagnosed pleural effusion in Kobri El-Kobba Military Hospital. *Egyptian J Chest Dis Tubercu* 2014;63:629–34.
20. Huang GH, Cheng YX, Su J, Liu AH, Yu WW, Wu YX, *et al*. Application of flexirigid thoracoscopy in the diagnosis of pleural disease with unknown etiology. *Nan Fang Yi Ke Da Xue Xue Bao* 2011;31:669–73.
21. Eldaboosy SAM, El-shamly M, Halima KM, Shaarawy AT, Alwakil I, Osamab M. Medical video assisted thoracoscopy: minimally invasive diagnostic tool for diagnosis of undiagnosed pleural effusion. *Egyptian J Chest Dis Tubercu* 2013;62:121–26.