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Original Research Article

Diagnostic Value of Medical Thoracoscopy in Patients with Undiagnosed Exudative Pleural Effusion: A Descriptive Observational Study

Deepti Xalxo[1], R. K. Panda[2], Roshan Singh Rathore[3]

[1]Post Graduate Student, Department of Respiratory Medicine, Pt. J. N. M. Medical College and Dr. B.R.A.M. Hospital, Raipur

[2]Professor and HOD, Department of Respiratory Medicine, Pt. J. N. M. Medical College and Dr. B.R.A.M. Hospital, Raipur

[3]Associate Professor, Department of Respiratory Medicine, Pt. J. N. M. Medical College and Dr. B.R.A.M. Hospital, Raipur

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Corresponding Author: Dr. Deepti Xalxo

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Abstract:

Pleural effusion, characterized by the abnormal accumulation of fluid in the pleural space, presents a diagnostic challenge due to its diverse etiology. This study aims to evaluate the diagnostic value of rigid thoracoscopy in patients with undiagnosed exudative pleuraleffusion. The research was conducted at the Department of Respiratory Medicine, Pt. JNM Medical College and Dr. BRAMH Raipur (C.G.), over a period from January 2023 to February 2024. The study involved 70 patients who underwent medical thoracoscopy after inconclusive initial investigations. The findings revealed a diagnostic yield of 91.4%, with tuberculosis being the most common etiology, followed by malignancy. This study underscores the importance of thoracoscopy in the diagnostic workup of pleural effusion and highlights its efficacy in determining the underlying cause in cases where lessinvasive methods fail.

Keywords: Pleural effusion, adenosine deaminase (ADA), Thoracoscopy, Post-thoracoscopic complications.

Introduction

Pleural effusion is a common clinical problem with over 50 known causes, ranging from localized diseases in the pleura or lungs to systemic diseases, organ failure, and adverse drug reactions [1]. The condition arises due to an imbalance between fluid production and absorption in the pleural space. The differential diagnosis of unilateral pleural effusion is broad, necessitating a structured approach to investigation.

The global burden of pleural diseases is significant, with an estimated annual incidence of 350-360 cases per 100,000 people. The major causes include heart failure, cancer, pneumonia, and tuberculosis [2]. Patients typically present with dyspnea, dry cough, and pleuritic chest pain. Initial assessments, including history and physical examination, are crucial in determining whether the pleural effusion is transudative or exudative, which guides further diagnostic steps.

Imaging techniques such as chest X-ray, ultrasonography, and computed tomography (CT) are vital in detecting and quantifying pleural effusion [3-5]. Thoracocentesis is the primary procedure for evaluating pleural fluid, with subsequent chemical, microbiological, and cytological analyses offering insights into the underlying cause [6]. Despite comprehensive evaluations, about 20% of pleural effusion cases remain undiagnosed, necessitating more invasive procedures such as thoracoscopy [7].

Thoracoscopy allows for direct visualization of the pleura and the collection of biopsy samples for histopathological examination.

This study aimed to assess the diagnostic yield of thoracoscopy in patients with undiagnosed exudative pleural effusion, explore the association of adenosine deaminase (ADA) levels with different etiologies, and document the gross appearance of pleura and post-operative complications.

Materials and Methods

Study Design and Setting: This descriptive, observational study was conducted in the Department of Respiratory Medicine at Pt. JNM Medical College and Dr. BRAMH Raipur (C.G.). The study period extended from January 2023 to February 2024.

Study Population: The study included patients aged 14 years and older who presented with undiagnosed exudative pleural effusion, as determined by Light's criteria, and who consented to participate. Patients with transudative pleural effusion, those with positive cytology for malignancy, or positive acid-fast bacilli (AFB) and cartridge-based nucleic acid amplification test (CBNAAT) for tuberculosis were excluded.

Sample Size: The sample size was determined based on a diagnostic yield of 74.3% for thoracoscopic pleural biopsy in undiagnosed pleural effusion, with a 95% confidence interval and a 14% margin of error. [8]

Procedure

Patients underwent initial diagnostic thoracocentesis, and pleural fluid was analyzed for cell type, count, protein, sugar, ADA, AFB/CBNAAT, and malignant cell cytology. Those with exudative effusion and undiagnosed etiology were considered for thoracoscopy. During the procedure, the pleura was visualized, and biopsy samples were taken from representative areas for histopathological examination. Post-operative complications were monitored.

Outcome Measures

The primary outcome was the diagnostic yield of thoracoscopy based on histopathological examination.

Secondary outcomes included the distribution of different etiologies, pleural fluid ADA values, gross appearance of the pleura, and post-thoracoscopic complications.

Results

The study involved 70 patients with undiagnosed exudative pleural effusion.

The majority of patients were male (75.7%), with a mean age of 47.6 years. Most patients were in the 40-60 age group and were primarily farmers or labourers.

Table 1: Socio-demographic distribution of the study participants.

Variables (N = 70)	No. Of Participants	Percentage
Age Groups		
< 40 Years	21	30.00%
40 - 60 Years	30	42.90%
≥ 60 Years	19	27.10%
Age (Mean ± St. Dev)	47.6 ± 15.9 Years	
Gender		
Male	53	75.70%
Female	17	24.30%
Occupation		
Farmer	28	40.00%
Labourers	15	21.40%
Housewife	13	18.60%
Student	5	7.10%
Others	9	12.90%

The most common presenting symptoms were dry cough (91.4%), dyspnea on exertion (84.3%), and chest pain (71.4%). Co-morbidities included hypertension (12.9%), past history of pulmonary tuberculosis (7.1%), and diabetes (4.3%). Alcohol consumption was the most prevalent addiction (38.6%).

Table 2: Distribution of Presenting Complaints and Co-morbidities of the study participants

Variables (N = 70)	No. Of Participants	Percentage
Complaints		
Cough	64	91.40%
Dyspnoea or exertion	59	84.30%
Chest Pain	50	71.40%
Fever	37	52.90%
Expectoration	15	21.40%

Variables (N = 70)	No. Of Participants	Percentage
Decreased Appetite	14	20.00%
Generalized Weakness	11	15.70%
Weight Loss	9	12.90%
Others	7	10.00%
Co-Morbidities		

Hypertension	9	12.90%
H/O PTB	5	7.10%
Diabetes	3	4.30%
Others	8	11.40%

Pleural fluid ADA values were below 40 IU/L in 61.4% of patients, with a significant proportion of these cases being diagnosed with malignancy. ADA values above 40 IU/L were more commonly associated with tuberculosis. The diagnostic yield of rigid thoracoscopy was 91.4%, with tuberculosis being the most common diagnosis (45.7%), followed by malignancy (38.6%).

Table 3: Histopathological Findings of parietal pleural biopsy among study participants.

HPE of Pelural Biopsy	No. Of Participants	Percentage
Tuberculosis	32	45.70%
Malignancy	27	38.60%
Inflammation	5	7.10%
Others	6	8.50%

Thoracoscopic findings included nodules (70%), septation (41.4%), and mass lesions (10%). Post-operative complications were noted in 34.3% of patients, with pain at the intercostal drain site being the most common (57.1%).

Table 4: Thoracoscopic findings of the study participants (Gross appearance of parietal pleura)

Findings	No. Of Participants	Percentage
Nodules	49	70.00%
Septation	29	41.40%

Findings	No. Of Participants	Percentage
Hyperemic Mucosa	14	20.00%
Mass Lesions	7	10.00%
Normal	1	0.01%

Discussion

The diagnostic yield of thoracoscopy in this study was 91.4%, aligning with other studies that report yields ranging from 85% to 95% [8-10]. Tuberculosis was the most common etiology, consistent with findings from studies conducted in regions with high TB prevalence [9,11]. Malignancy was the second most common diagnosis, highlighting the importance of thoracoscopy in identifying pleural malignancies.

The ADA threshold of 40 IU/L demonstrated moderate sensitivity and specificity for diagnosing tuberculosis. However, a significant number of TB cases had ADA levels below this threshold, suggesting that reliance on ADA alone may lead to missed diagnoses. Thoracoscopic biopsy remains crucial in such cases. The most common thoracoscopic finding was nodules, seen in both tuberculosis and malignancy cases. Septation was more frequent in tuberculosis, while mass lesions were exclusive to malignancy. These findings are consistent with previous studies that emphasize the role of thoracoscopy in differentiating between these conditions [11,12].

Post-thoracoscopic complications were generally mild, with no significant morbidity or mortality, supporting the safety of the procedure [12,13].

Conclusion

Rigid thoracoscopy is a valuable diagnostic tool for patients with undiagnosed exudative pleural effusion, offering a high diagnostic yield and facilitating the identification of underlying etiologies such as tuberculosis and malignancy. The procedure is safe, with minimal complications, and should be considered when initial, less invasive investigations are inconclusive. Further research is needed to optimize the use of ADA levels in the diagnostic workup of pleural effusion.

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