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PROFILE OF PLEURAL DISEASE PATIENTS UNDERGOING PLEUROSCOPY: A MULTICENTER STUDY IN MEDAN

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ABSTRAK

Pleuroskopi berperan penting dalam menegakkan diagnosis dan menentukan strategi terapi penyakit paru, khususnya pada pleura. Karakteristik pasien yang menjalani pleuroskopi diperlukan untuk memahami kecenderungan kasus dan pola etiologi penyakit. Penelitian ini bertujuan untuk menganalisis karakteristik pasien dengan gangguan pleura yang menjalani prosedur pleuroskopi. Penelitian ini merupakan studi deskriptif observasional pada rekam medis 50 pasien yang menjalani pleuroskopi selama periode Agustus 2023 hingga Juli 2024. Sebagian besar pasien berusia lebih dari 40 tahun (80%) dan berjenis kelamin perempuan (52%). Gejala klinis yang paling sering dilaporkan adalah batuk, mengi, serak, sulit menelan, dan demam (100%). Gambaran rontgen dada menunjukkan efusi pleura (88%), sedangkan hasil CT scan menunjukkan atelektasis (20%). Sebagian besar pasien memiliki temuan pleuroskopi (82%) dan hasil histopatologi (58%) yang mengindikasikan penyakit ganas. Diagnosis akhir paling sering adalah efusi pleura ganas (54%) dan efusi pleura non-ganas (36%). Berdasarkan etiologi spesifik, penyebab terbanyak adalah tuberkulosis (32%) dan adenokarsinoma paru (30%).

ABSTRACT

Profile Of Pleural Disease Patients Undergoing Pleuroscopy: A Multicenter Study in Medan. Pleuroscopy plays an important role in diagnosing and guiding treatment strategies for lung diseases, particularly those involving the pleura. Understanding the characteristics of patients undergoing pleuroscopy is essential for identifying clinical patterns and etiological trends. This study aims to analyze the characteristics of patients with pleural disorders who underwent pleuroscopy procedures. This was an observational analytical study with a case series design in 50 patients who underwent pleuroscopy. The data collected from medical records between August 2023- July 2024. Most patients were older than 40 years (80%) and female (52%). The most common clinical symptoms were cough, wheezing, hoarseness, dysphagia, and fever (100%). The predominant chest X-ray finding was pleural effusion (88%), while CT scans most often showed atelectasis (20%). Pleuroscopic visualization (82%) and histopathological examination (58%) findings indicated malignant disease in most cases. The most frequent final diagnoses were malignant pleural effusion (54%) and non-malignant pleural effusion (36%). Regarding specific aetiologies, tuberculosis infection (32%) and lung adenocarcinoma (30%) were the leading causes.

INTRODUCTION

Pleuroscopy is a minimally invasive procedure that enables direct access to the pleural cavity under local anesthesia and mild sedation for both diagnostic and therapeutic purposes.[1] It allows direct visualization and targeted biopsy of abnormal pleural tissue and is also used therapeutically via talc poudrage in cases of recurrent or malignant pleural effusions, pneumothorax, parapneumonic effusion, and empyema.[2,3] An absolute contraindication to pleuroscopy is extensive pleural adhesions, as seen in pleural fibrosis, infection, or prior pleurodesis.[4]

When performed by experienced clinicians, pleuroscopy has a high safety profile, with overall complication rates ranging from 1% to 5%.[5] Reported complications are generally mild and non–life-threatening, including air leakage, bleeding, subcutaneous emphysema, postoperative fever, wound infection, arrhythmia, and hypotension.[6] Pleural pathology may arise from various etiologies such as tuberculous infection, non-specific inflammation, or malignancy.[7] Although imaging modalities like chest radiography, ultrasonography, and computed tomography (CT) are useful for identifying pleural abnormalities, pleuroscopy provides a direct and definitive evaluation through visual inspection and histopathological sampling.[8]

Gunawan previously conducted a study involving patients who underwent pleuroscopy in Medan, which revealed a higher proportion of male patients (73.9%) than female patients (26.1%), with patients predominantly aged over 40 years. The findings indicated that malignant processes were the leading cause of pleural effusion (52.2%), followed by tuberculosis and empyema.[9,10] However, data regarding the clinical characteristics of patients undergoing pleuroscopy in Indonesia, particularly in Medan, remain scarce. Therefore, this study aims to analyze the characteristics of patients with pleural disorders who underwent pleuroscopy and to provide a comprehensive understanding of local disease patterns and clinical trends.

METHODS

This descriptive retrospective case series was conducted at Haji Adam Malik General Hospital and Prof. Dr. Chairuddin P. Lubis (CPL) University of North Sumatra Hospital, Medan, Indonesia. The study period covered August 2023 to July 2024, with data collection completed in December 2024. Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, University of North Sumatra (No: 1289/KEPK/USU/2024).

The study population consisted of patients diagnosed with pleural disease who underwent pleuroscopy during the study period and had complete medical records. The sampling technique used was non-probability total sampling, with all eligible patients included. Based on prior calculations, the minimum required sample size was 31, and the total sample obtained was 50 patients. Inclusion criteria comprised patients aged ≥18 years with pleural effusion who underwent pleuroscopy and had complete clinical, radiological, and histopathological data. Exclusion criteria included patients with incomplete records, those who had contraindications for pleuroscopy such as extensive pleural adhesions, or those who refused the procedure.

Before pleuroscopy, all patients underwent coagulation screening, including prothrombin time (PT), activated partial thromboplastin time (aPTT), and platelet count. Patients were instructed to fast for six hours prior to the procedure. Pleuroscopy was performed under conscious sedation with aseptic preparation using 7.5% povidone iodine.

A single-port approach was used to visualize pleural surfaces and obtain biopsy specimens. The incision was made at the 4th–5th intercostal space along the mid-axillary line, and a trocar was inserted into the pleural cavity. Rigid laparoscope and cystoscope were used at CPL Hospital, while

flex–rigid thoracoscope and flexible bronchoscope were used at Haji Adam Malik Hospital. Pleural fluid was aspirated to ensure full visualization, and biopsies were taken from suspicious pleural areas. After the procedure, a 28–32 Fr chest drain was inserted and removed once lung expansion occurred and drainage volume was below 50 mL per 24 hours. Biopsy specimens were preserved in 40% formalin and 96% alcohol, then examined histopathologically by anatomical pathologists.

Data were processed and analyzed using statistical software. Descriptive analysis was performed to summarize patient characteristics. Categorical variables were presented as frequencies and percentages, while numerical data were presented as mean and standard deviation (SD).

RESULTS

This study evaluated the demographic, clinical, radiological, and histopathological characteristics of patients with pleural effusion who underwent pleuroscopy. Based on demographic data, most patients were aged above 40 years (n = 40, 80%), and 20% were aged below 40 years (n = 10). Gender distribution showed 24 male patients (48%) and 26 female patients (52%). Among patients with malignant pleural effusion, 85% were aged above 40 years, whereas non-malignant pleural effusion occurred predominantly in younger patients (60% under 40 years). (Table 1)

Table 1. Patient Characteristics

Characteristics	N (%)
Age (years old)	
<40	10 (20,0)
≥40	40 (80,0)
Gender	
Male	24 (48,0)
Female	26 (52,0)
Symptoms	
Shortness of breath	46 (92,0)
Cough	50 (100,0)
Chest Pain	39 (78,0)
Wheezing	50 (100,0)
Dysphagia	50 (100,0)
Hoarseness	50 (100,0)
Fever	50 (100,0)

Clinically, respiratory symptoms were common but not uniform among patients. Cough was reported by 90% of patients, shortness of breath by 92%, chest pain by 78%, and wheezing by 70%. Other systemic symptoms included fever (64%), hoarseness (40%), and dysphagia (22%). This distribution indicates respiratory symptoms as the predominant clinical presentation. (Table 1)

Radiological evaluations were performed as part of the diagnostic work-up. Chest X-ray was obtained for all patients (n = 50) and showed pleural effusion as the main finding in 88% of cases. Additional findings included pneumonia in 30% (n = 15), features suggestive of pulmonary tuberculosis in 28% (n = 14), and hydropneumothorax in 12% (n = 6). (Table 2)

CT scans were performed in 30% of patients (n = 15) and revealed findings not visible on chest X-ray. Of these examined patients, 16% (n = 8) showed lung masses suggestive of primary or metastatic malignancy, 8% (n = 4) had atelectasis, 16% (n = 8) had pleural effusion, and smaller proportions had pneumonia (6%, n = 3) and hydropneumothorax (2%, n = 1). Percentages are calculated based on the total sample. (Table 2)

Histopathological analysis confirmed a malignant process in 58% of patients (n = 29) and a non-malignant process in 42% (n = 21). Pleuroscopic visualization demonstrated similar findings, where 82% of patients showed features consistent with malignancy, and 18% exhibited non-malignant pleural changes. (Table 2)

Table 2. Diagnostic modalities

Diagnostic modalities	N (%)
Chest X-ray findings	
Pleural effusion	44 (88,0)
Pneumonia	15 (30,0)
Pulmonary Tuberculosis	14 (28,0)
Hydropneumothorax	6 (12,0)
CT-Scan findings	
None	35 (70,0)
Done	15 (30,0)
Atelectasis	10 (20,0)
Pleural effusion	8 (16,0)
Lung mass	8 (16,0)
Hydropneumothorax	1 (2,0)
Pneumonia	3 (6,0)
Histopathological examination results	
Malignant	29 (58,0)
Non-malignant	21 (42,0)
Pleuroscopic visualization findings	
Malignant	41 (82,0)
Non-malignant	9 (18,0)

Final diagnostic categorization revealed malignant pleural effusion in 54% of patients (n = 27) and non-malignant effusion in 36% (n = 18). Additional conditions included malignant hydropneumothorax in 4% (n = 2) and non-malignant hydropneumothorax in 6% (n = 3). Specific etiologies included pulmonary tuberculosis (32%), pulmonary adenocarcinoma (30%), infection (10%), squamous cell lung carcinoma (4%), small-cell carcinoma (4%), and metastatic pleural involvement from other primary cancers (10%). Mesothelioma and lymphoma were each found in one patient (2%). (Table 3)

Table 3. Final Diagnosis and Specific Etiology

Diagnosis	N (%)
Non-malignant pleural effusion	18 (36,0)
Malignant pleural effusion	27 (54,0)
Malignant hydropneumothorax	2 (4,0)
Non-malignant hydropneumothorax	3 (6,0)
Based on specific etiology	
Tuberculosis Infection	16 (32,0)
Pulmonary Adenocarcinoma	15 (30,0)
Infection	5 (10,0)
Squamous Cell Cancer	5 (10,0)
Small Cell Cancer	2 (4,0)
Metastasis	5 (10,0)
Mesothelioma	1 (2,0)
Lymphoma	1 (2,0)

DISCUSSION

Several pleural disorders, such as pneumothorax, pleural effusion, and pleural thickening, can have various etiologies, and understanding typical clinical characteristics, radiological features, and pleuroscopic findings may help clinicians make a diagnosis before histopathological examination.

This study showed that most patients undergoing pleuroscopy were older than 40 years (80%), with an almost equal gender distribution between men (48%) and women (52%). Pleural effusion and malignant pleural effusion were the most frequent final diagnoses, while tuberculosis infection and lung adenocarcinoma were the most common specific etiologies. These findings indicate that in this tertiary setting, pleural disease is dominated by exudative effusion related to tuberculosis and malignancy rather than transudative causes.

The age and sex distribution in this study are in line with previous reports showing that pleural diseases are more common in older populations due to longer exposure to risk factors such as non-specific infections, tuberculosis, and chronic obstructive pulmonary disease.[10,11] Other cohort studies have also demonstrated a predominance of male patients and middle-aged to elderly individuals among cases of pleural disease and pleural infection, although the exact proportions vary by etiology and population.[12,13,14,15] In many high-income settings, pleural effusion is often related to heart failure and malignancy, whereas in several developing countries, including those with a high tuberculosis burden, tuberculosis and malignancy are consistently reported as leading causes of exudative pleural effusion.[16,17,18,19,20]

In this study, almost all patients had respiratory and systemic symptoms: cough, wheezing, dysphagia, hoarseness, and fever were present in all cases, while chest pain (78%) and shortness of breath (92%) were the most common additional complaints. These findings differ from some previous studies in which dyspnea was the predominant symptom in malignant pleural effusion, with chest pain and cough less frequent, and a proportion of patients were asymptomatic at first presentation.[21,22] This discrepancy may reflect differences in disease stage at presentation and referral patterns to tertiary centers, with patients often presenting with more advanced and symptomatic disease. Clinical manifestations are also influenced by specific pleural abnormalities, such as chest pain in malignant mesothelioma and constitutional symptoms that often suggest systemic malignancy or advanced infection.[23]

Radiologically, chest X-ray remained the initial imaging modality and detected pleural effusion in 88% of patients, consistent with its reported sensitivity for large effusions and typical findings such as costophrenic angle blunting.[24] Pleural abnormalities on chest X-ray were more frequent in older patients, as previously described.[25] Pleural thickening with peripheral nodular opacities is often associated with malignancy, whereas apical fibrotic changes and calcification tend to indicate previous tuberculosis infection.[26] CT scan was performed in 30% of cases and provided further characterization, including pleural effusion, atelectasis, hydropneumothorax, lung mass, and pneumonia. This is consistent with earlier reports that CT scans offer higher sensitivity for identifying pleural abnormalities, differentiating exudative from transudative effusions, and detecting malignant pleural masses.[27] However, CT scans still have limitations in determining specific etiologies, as seen in mesothelioma, which was uncommon in this study.[28]

Other studies have shown that certain CT features, such as pleural thickening greater than 10 mm, associated atelectasis, and lung mass, are more frequently found in malignant pleural disease and can help distinguish malignancy from infectious causes, particularly tuberculosis.[29,30] In our study, similar patterns were observed, with CT findings supporting but not replacing the need for tissue diagnosis in suspected malignant or tuberculous pleural disease.[31]

Pleuroscopy was the final diagnostic modality and had a central role in establishing the etiology of pleural disorders. In this study, malignant findings with nodular, mass, or tumor-like pleural lesions were the most common pleuroscopic appearances, followed by TB pleuritis, whereas emphysema was rare. Malignant pleural involvement and tuberculous pleuritis together accounted for most pleuroscopic diagnoses, although a number of cases remained non-definitive despite pleuroscopy.[32] Previous studies have shown that pleuroscopy-guided pleural biopsy has high diagnostic accuracy for malignancy, with relatively low complication rates, and is effective in differentiating benign from malignant lesions.[33] Diagnostic success rates above 90% have been reported in patients with pleural effusion undergoing pleuroscopy, a result similar to that reported in this study.[34,35]

These findings reinforce the role of pleuroscopy as a key modality for patients with undiagnosed pleural effusion after initial evaluation. In clinical practice, pleuroscopy and histopathological examination serve as definitive diagnostic tools, particularly for suspected malignant pleural effusion and pleural tuberculosis that cannot be confirmed by fluid analysis alone.[18,36,37] By allowing targeted pleural biopsy under direct visualization, pleuroscopy improves diagnostic accuracy and facilitates appropriate therapeutic strategies.

The predominance of pleural effusion (36%) and malignant pleural effusion (54%) as final diagnoses in this study is consistent with epidemiological data showing that malignancy is a major cause of pleural effusion, occurring in a substantial proportion of cancer patients and with an estimated incidence of tens of cases per 100,000 population.[16,17] In our study, tuberculosis infection (32%) and lung adenocarcinoma (30%) were the most frequent specific etiologies. Pleural tuberculosis remains an important health problem in many developing countries and is often diagnosed by combining clinical, radiological, and pleural fluid findings. Pleuroscopy increases diagnostic yield in inconclusive cases by guiding biopsy of characteristic lesions such as micronodules, adhesions, and diffuse pleural involvement.[18,37]

The distribution of specific etiologies in this study is similar to other reports, in which lung adenocarcinoma, small cell carcinoma, and metastatic disease, particularly from the breast and ovary, are the main causes of malignant pleural effusion, and pleural effusion frequently represents an early manifestation of malignancy.[38] The pathogenesis of malignant pleural effusion is multifactorial, involving direct tumor invasion of the pleura and complex interactions between pleural cells and the tumor microenvironment, leading to fluid accumulation in the pleural space.[39]

Previous research has also shown that massive pleural effusion is more often associated with malignancy and has a higher diagnostic yield when evaluated by cytology or histopathology.[40] In other series, tuberculosis remains the most common specific cause of pleural effusion, followed by non-specific infections or parapneumonia and malignancy.[19] Pleural effusion, regardless of etiology, has been associated with increased mortality, with the highest mortality reported in patients with malignant pleural effusion.[20] In this study, other malignancies such as squamous cell carcinoma and small cell lung cancer were also identified, and their pleural effusions have been reported to have different clinical characteristics and prognostic implications compared to adenocarcinoma.[41,42]

Taken together, these findings indicate that in the local context, where tuberculosis burden is high and lung cancer is increasingly prevalent, tuberculosis and malignancy are expected to dominate as causes of exudative pleural effusion. This has direct clinical implications: clinicians should prioritize these two etiologies when evaluating pleural effusion in adult patients, use imaging judiciously to stratify the likelihood of malignancy, and employ pleuroscopy with histopathological confirmation early in undiagnosed cases to ensure timely and appropriate management.

CONCLUSION

Patients undergoing pleuroscopy examination were predominantly older than 40 years and female. The most common etiologies were tuberculosis infection and malignancy, with malignant pleural effusion as the most frequent final diagnosis based on pleuroscopic and histopathological findings.

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