Diagnostic Value of Thoracoscopic Biopsy in Undiagnosed Pleural Effusion: An outcome-based retrospective study in a tertiary cancer centre

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Abstract

Background: Pleural biopsy can be performed via needle, thoracoscopy, or open surgery, with thoracoscopic biopsy emerging as a valuable tool for diagnosing pleural diseases. Video-assisted thoracoscopic surgery (VATS) offers direct visual assessment and targeted tissue sampling, with a diagnostic yield comparable to open biopsy while remaining minimally invasive. Despite extensive diagnostic efforts, the etiology of pleural effusion remains unclear in 20–25% of cases, necessitating more definitive diagnostic approaches.

Objectives: This study aims to evaluate the diagnostic yield, accuracy, and clinical outcomes of thoracoscopic biopsy in patients with undiagnosed pleural effusion.

Methods: Our study included patients who had undergone Video assisted thoracoscope biopsy (VATS) for undiagnosed pleural effusion at our center since 2015 to 2024. There was no follow up in our study. Data from 149 patients were taken and entered in Excel and analyzed via Statistical package for the social sciences (SPSS 27).

Results: A total of 149 patients were included. The overall diagnostic yield of thoracoscopic biopsy was 98%, with malignancy being the most common diagnosis i.e.,75.3%. The procedure was well-tolerated, with a complication seen in just 5 patients(3.36%) and no in-hospital mortality .

Conclusion: Thoracoscopic biopsy is safe, highly effective diagnostic modality for undiagnosed pleural effusion. It has an advantage of having high accuracy and being minimally invasive. Thoracoscopic biopsy influence clinical management, leading to targeted treatment strategies.

Keywords

Pleural effusion, Undiagnosed pleural effusion, Thoracoscope, VATS biopsy, pleural disease diagnosis

Introduction

Pleural biopsy can be obtained via needle, thoracoscope and open surgery among which thoracoscopic biopsy has been a valuable tool in diagnosing pleural diseases, offering a direct visual assessment and targeted tissue sampling.[1] It is minimally invasive and has tissue yield similar to open biopsy. The use of thoracoscopy for further pleurodesis can't be underestimated.[2]tetracycline, iodopovidone, etc. Thoracoscopy, another name for Video Assisted Thoracic Surgery (VATS), is a minimally invasive procedure used to diagnose and treat thoracic disorders, first used by Hans Christian Jacobeus in 1910, for closed intrapleural pneumonolysis

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and subsequently for the identification of various pleural illnesses.[3]

Conventional diagnostic methods, including pleural fluid cytology and blind pleural biopsies, have limitations in sensitivity, often necessitating more definitive approaches.[4]by needle biopsy in 123 (43% Video-assisted thoracoscopic surgery (VATS) has demonstrated high diagnostic yield, particularly for malignancies and granulomatous diseases, making it a preferred method in cases of unexplained pleural effusion.[5,6]

Despite extensive diagnostic efforts, the underlying etiology of pleural effusions remains unclear in nearly 20-25% of instances, leaving room for more robust diagnostic tool.[7] Despite its diagnostic utility, there is variability in reported outcomes, including diagnostic accuracy, procedural safety, and clinical impact. [8]the commonest being metastatic adenocarcinoma in 8 (57.1%

This retrospective study aims to evaluate the diagnostic yield, accuracy, and clinical outcomes of thoracoscopic biopsy in patients with undiagnosed pleural effusion in a tertiary hospital, which is crucial for optimizing patient management.

Methods

Patients

This was a retrospective cohort study evaluating records of all the patients who underwent thoracoscopic biopsy for undiagnosed pleural effusion from 2015 to 2024 in the department of surgical oncology (Thoracic unit) of BP Koirala memorial cancer hospital. The study was approved by the review committee, BPKMCH. This being a retrospective study, individual consent was waived

Patients with unexplained pleural effusion despite initial diagnostic workup, including pleural fluid analysis, imaging, and blind pleural biopsy were included in the study. Pleural effusion was divided into mild, moderate and massive as per the amount of fluid, less than 500 was termed mild, 500 to 1500 was termed moderate, more than 1500 ml fluid in thoracic cavity was termed as massive effusion.

Data were reviewed from patients' records, including age sex and medical history. Baseline patient demographics and features, presenting complaints, surgical parameters such biopsy site and position, intraoperative and postoperative problems, length of chest drainage, and final histological analysis are included for study. As with every procedure, informed patient permission was obtained before the procedure.

VATS biopsy procedure

All thoracoscopic procedure are performed in either general anesthesia or total intravenous anesthesia (TIVA) with added local anesthesia or only under local anesthesia in lateral decubitus. The camera port was positioned in the 5th to 7th intercostal space, at midaxillary line based on the targeted lesion, CO2 pneumothorax was established up to 6-8 mm of Hg. The thoracic cavity was examined with a 30-degree rigid telescope (thoracoscope). One or two operational ports (5 mm) were subsequently positioned according to the requirements of the procedure, and adhesions were broken up using monopolar cautery if necessary. A biopsy was obtained from the pleural lesion or mass lesion from lung or from mediastinal nodes.

At the end of the procedure, a 24 French chest tube drain was inserted with an underwater seal. Negative suction was not commonly employed. All patients were removed from intubation before moving to post-operative care. After the procedure, a chest X-ray was performed 24 hours

later. The chest tube was inserted until there was no air leakage and the drainage volume was below 150ml every 24 hours. Pleurodesis was done if there was continuous drainage of >300 ml fluid / day drainage in fully expanded lungs after 5 days.

Statistical analysis

All statistical data were entered in Excel, analyses performed using SPSS version 27. Continuous variables were expressed as mean ± standard deviation (SD), median and range.

Results

A total of 149 patients underwent VATS biopsy procedure for undiagnosed pleural effusion from 2015 - 2024. The common demographic details and status of patients is shown in table 1.

Table 1 : Demographic and clinical details

Variable	Value (mean ± SD)
Mean age (years)	54.37 ± 15.36
Sex	
Male	90(60.4%)
female	59(39.6%)
Symptomatic	146(98%)
Asymptomatic	3(2%)
CT findings	
Lung mass with effusion	53 (35.6%)
Pleural effusion	96 (64.4%)
Mean post operative stay	7.5 days
Bronchoscopy	
Endoluminal mass	4 (2.6%)
External compression	61(40.9%)
Normal	78(52.3%)
Not done	6 (5%)

Ninety-one patients (61.1%) underwent VATS biopsy in the right side, and 58 (38.9%) had undergone in left side. Post operative complications have been shown in Table 2.

In every case presented with effusion, biopsy was taken from pleura and some other sites in case lung nodule or significant mediastinal nodes were visualized in pre-op CT (Table 3). One patient had to be converted to an open thoracotomy for dense adhesion and inadequate visualization. One patient underwent open thoracotomy and decortication in second setting during same hospital stay for empyema and collapsed lung. And one patient had persistent air leak for which chest tube was kept for prolonged period.

Table 2 : Intra and post operative events

Anesthesia	
GA	80 (53.69%)
LA	12 (8.1%)
IVA	57 (38.25%)
Surgery	
Diagnostic VATS with biopsy	139 (93.3%)
VATS biopsy + Decortication	10 (6.6%)
Additional Biopsy Site	
Lung nodule	16 (10.73%)
Mediastinal node	3 (0.2%)
Post-Operative Complications	
Prolonged Fluid drainage	4*
Persistent air leak	1
In-hospital mortality	0

* (Discharged with indwelling catheter)

Ninety three percent of cases didn't undergo prior intercoastal drainage, and majority of case i.e., 44.3% had moderate pleural effusion. Table 3 describes the pre-operative and intra-operative findings.

On histopathology Metastatic adenocarcinoma was found in 76 (53.15%), squamous cell carcinoma in pleural deposits in 25 (17.6%), and tuberculosis in 18 (12.6%) patients (Table 4). Twenty-one cases of purulent pleural effusion were all found as inflammatory etiology. There were some cases with mesothelioma as differential diagnosis which were all ruled out after immunohistochemistry test. One hundred five (70.46%) out of all cases had malignancy in their final histopathological report.

Table 3 : Preoperative and intra operative findings.

ICD	
No ICD	139 (93.28%)
On ICD	3 (2.01%)
History of ICD	7 (4.69%)
Pleural effusion	
Mild pleural effusion	38(25.8%)
Moderate pleural effusion	66(44.3%)
Massive pleural effusion	45 (30.2%)
Pleural effusion type	
Serous	58 (38.8%)
Seropurulent	9 (6.0%)
Purulent	7 (4.7%)
Hemorrhagic	57 (38.3%)
Serosanguineous	18 (12.1%)
Pleural fluid cytology	
Malignancy	2 (1.34%)
Suspicious of carcinoma	8 (5.36%)
Adenocarcinoma	8 (5.36%))
Inconclusive	107 (71.81%)
Inflammatory	21 (14.09%)

Table 4 : Final Histopathological report.

Squamous cell carcinoma	25 (17.6%)
Metastatic adenocarcinoma	76 (53.15%)
Lung Primary	58 (76.31%)
Other sites	18 (23.69%)
Small cell lung cancer	4 (2.7%)
Tuberculosis	18(12.6%)
Inflammatory	19 (13.2%)

Discussion

This was a single center retrospective study, targeted to evaluate the usefulness of thoracoscopy for diagnostic evaluation of undiagnosed pleural effusion, in a tertiary cancer centre. VATS procedure has diagnostic as well as therapeutic indications and they possess little complications. To procure adequate sample VATS biopsy is a good and effective technique, which ultimately helps in establishing the diagnosis. We evaluated the records of 149 patients over a span of 10 years.

Most of the patients of our study population were between 50 to 60 years of age with a mean ± SD of 54.37 ± 15.36 years, which is similar to other studies.5,9 This is associated with the fact that most of the cases we receive are of referred cases of suspicious malignancy, which is prevalent in older age group.

In our study the male female ratio was 1.5:1, which is aligning with the findings of Shrestha et al.8 The majority of cases were female in a study of kharel et. al. which is not aligning with our finding.5

Ninety eight percent of our study population presented with some sort of symptoms , which is associated with the progressing disease, these findings were factual and similar to many literatures.8,9 The mean hospital stay was 7.5 days, which was way lesser than 12 days reported by Rasha et. al. 10 The mean hospital stay in a study by Beheshtirouy et. al. was found to be 5.35 days which corelates with our study. 8,11 This represent the fact that VATS biopsy is indeed a safer procedure.

More than 50% of patients with pleural effusion can't be diagnosed with thoracentesis alone, so VATS biopsy is mandatory.12 In our study, pleural fluid cytological study had 28.7% sensitivity which is lower than what was reported on study of Pairman et al. 13

In our study, biopsy yielded positive for malignancy in 70.46%. of which metastatic adenocarcinoma had highest occurrence i.e., 76 (53.15%), 76.31% of them were originated from lungs while 23.68 % originated from other sites like breast, the findings were similar to that of Rasha et. al.10 However, other study had lower percentage of malignancy as reported by Hucker et. al. 51% , Prabhu et.al 35% .9,14 This may be due to the fact that we present this study from tertiary cancer center, where patients are refereed

with strong suspicion of malignancy.

In the present study, the overall diagnostic yield was 98%, similar results were experienced in multiple other studies across the globe.5,8–10 Some cases where histopathological data were inconclusive were due to absence of good pleural tissue in biopsy. We use rigid thoracoscope and the biopsy forceps accommodated in rigid system is larger which might have resulted in excellent diagnostic yield.

Conclusion

Our experience suggest that VATS biopsy is a low-risk procedure with excellent diagnostic yield. It may also help in therapeutic procedure if needed sometimes. Therefore, thoracoscopic biopsy should be considered for the diagnosis of undiagnosed pleural effusion.

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