

**Video-assisted thoracoscopic surgery for patients with undiagnosed exudative pleural effusion****Mohamed Sabry Abdelmotaleb\***

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**Abstract**

**Background:** The most objective of assessment in patients with undiagnosed pleural effusion is to set up early diagnosis and encourage treatment with minimal invasive procedure. Video-assisted thoracoscopic surgery (VATS) is regularly considered as gold standard examination for an undiagnosed pleural effusion with great diagnostic value.

**Objectives:** This study was arranged to assess the role of (VATS) in the diagnosis of unexplained exudative pleural effusion.

**Patients and Methods:** This is a retrospective study included all patients who underwent VATS for undiagnosed exudative pleural effusion patients from 2014 to 2020.

**Results:** Total 105 patients who underwent VATS for undiagnosed pleural effusion in this time period as the diagnostic as well as therapeutic methods were included in the study. The overall mean age was  $46.5 \pm 20.71$  and we had 51 Males (48.57%) and 54 Females (51.43%). There were 48 patients (54.29%) with co-morbidities most of them had diabetes mellitus (DM) in 36 patients (34.29%). The most common radiological findings were right free pleural effusion in 45 patients (42.86%) and pleural thickness in 42 patients (40%). VATS pleural drainage and biopsy (right and left) most common performed procedure in 75 patients (71.43%). Final histopathological diagnosis was nonspecific inflammation in 15 patients (14.29%), pleural TB in 57 patients (54.29%) and malignancy in 33 patients (31.43%).

**Conclusion:** VATS is a good diagnostic and therapeutic method. Therefore, patients had undiagnosed exudative pleural effusions should be underwent VATS after failure of diagnosis by the initial workup as soon as possible to reach clear diagnosis.

**Keywords:** Exudative pleural effusion; Pleural biopsy; pleural TB; video-assisted thoracoscopic surgery.

**DOI:** 10.21608/svuijm.2022.129068.1296

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**Received:** 23 March, 2022.

**Revised:** 21 April, 2022.

**Accepted:** 22 April, 2022.

**Cite this article as:** Mohamed Sabry Abdelmotaleb. (2022). Video-assisted thoracoscopic surgery for patients with undiagnosed exudative pleural effusion. *SVU-International Journal of Medical Sciences*. Vol.5, Issue 2, pp: 228-236.

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## Introduction

Pleural effusion (PE) is an abnormal accumulation of fluid in the pleural cavity. Many different underlying diseases can be manifested by Pleural effusion (**Collins and Sahn, 1987**). Diagnostic thoracentesis is essential to divide pleural effusion into transudate or exudate fluid, according to Light's criteria (**Porcell and Light, 2006**). Failure of diagnosis occurs in 20% PE patients, although different diagnostic methods like repeated thoracentesis and closed pleural biopsy (**Boutin et al., 1981; Arkin et al., 2019**).

The early diagnosis in an undiagnosed pleural effusion with minimal invasive intervention is important to establish effective treatment (**Amandeep et al., 2020**).

Video-assisted thoracoscopic surgery (VATS) is a good tool for visualization of pleural cavity and identification abnormality makes it as gold standard procedure for an undiagnosed pleural effusion with great diagnostic value (**Beheshtirouy et al., 2013**). VATS can explore the pleural cavity and enables taking biopsy for histopathological examinations for proper diagnosis and also enables performing many therapeutic procedures like drainage of encysted pleural effusions, pleurodesis, decortications and chest tube insertion under vision (**Luh et al., 2005**).

In comparison to open thoracotomy, VATS has many advantages such as a small surgical wound, early postoperative recovery, better pain control, less hospital

length of stay, decreased overall morbidity and mortality (**Das and Dey, 2016**).

This study was conducted to assess the role of (VATS) as diagnostic procedure for patients with exudative PE when a specific diagnosis could not be achieved by thoracentesis.

## Patients and methods

We conducted a retrospective study including all patients who underwent VATS for undiagnosed exudative pleural effusion patients from 2014 to 2020.

Undiagnosed exudative pleural effusion defined as failure to reach to diagnosis by simple initial methods like microscopic and biochemical analysis of pleural fluid including protein, sugar, lactate dehydrogenase, Gram stain, acid fast bacilli (AFB) smear and culture, pleural fluid adenosine deaminase (ADA) levels, and pleural fluid cytology negative for malignant cells or other definite causes.

Exudative pleural effusion was characterized as per the Light's criteria. "Light's Criteria Pleural fluid is exudative in case one of the following criteria is display, something else, it is transudate.

- Effusion protein/serum protein ratio is greater than 0.5.
- Effusion Lactate Dehydrogenase (LDH)/serum LDH ratio greater than 0.6.
- Effusion LDH level is greater than two thirds the upper limit of the laboratory's reference range of serum LDH" (**Porcell and Light, 2006**).

The charts for all patients underwent VATS for undiagnosed exudative pleural effusion patients from 2014 to 2020 were reviewed. Gathered information included

demographic characteristics (age and gender), clinical presentation, comorbid diseases, special habits like smoking or alcohol intake, past medical history was taken, all the routine laboratory investigations and computed tomography of the chest duration of the disease and pathology report tissue samples.

#### ***Ethical considerations***

This study was approved by the local Research Ethics Board in our tertiary university institute for reviewing charts for all patients underwent VATS for undiagnosed exudative pleural effusion patients from 2014 to 2020.

#### ***Surgical procedures of VATS***

The patients underwent general anesthesia with double-lumen endotracheal intubation which was affirmed by fiber-optic bronchoscopy within the contralateral decubitus position. Sixth or seventh intercostal space in mid-axillary line was routinely depended upon for trocar secured thoroscopic access to the pleural depth. Consequent intercostal access at 1-2 locales was accomplished beneath the coordinate thoroscopic vision to protect the underlying lung parenchyma from injury. The whole hemithorax was carefully inspected. Any fluid was suctioned and sent for microbiology and cytology study. A thorough inspection of the pleural and lung surface was done and biopsies were taken from suspected regions of pleura or lung

tissue in like manner and were sent for histopathological examination. Too, in case required, at that point VATS helped pericardial window, decortications or wedge resection was done. Chemical pleurodesis with 3-5 grams of talc powder was done agreeing to intra-operative discoveries. Once VATS procedure was complete and total hemostasis accomplished, one or two chest tubes were put through one or more of the intercostal opening sites under the vision to encourage proper drainage. The thoracic cavity was at that point closed in layers and the aseptic dressing was applied.

#### ***Statistical analysis***

Statistical analysis was performed by means of factual bundle for the Social Sciences (SPSS) program version 20. Mean and standard deviation were used as descriptive statistics for numerical variables, and for categorical variables were frequencies and percentages.

#### **Results**

Total 105 patients who underwent VATS for undiagnosed pleural effusion as diagnostic as well as therapeutic methods were included in the study. The overall mean age was  $46.5 \pm 20.71$  years and we had 51 males (48.57%) and 54 females (51.43%), (**Table.1**). Prevalent symptoms have been well reported as there was fever in 27 patients (25.7%), chest pain in 42 patients (40%), Cough in 45 patients (42.86%) and dyspnea in 54 patients (51.43%), (**Table.1**).

**Table 1. Preoperative clinical data**

<b>Variables</b>	<b>Number (%)</b>
<b>Demographic data</b>	
Age (mean $\pm$ SD, years)	46.5 $\pm$ 20.71
Sex	
• Male (%)	51 (48.57)
• Female (%)	54 (51.43)
• Total	105
<b>Clinical presentation</b>	
• Fever	27(25.7)
• Chest pain	42 (40)
• Cough	45 (42.86)
• Dyspnea	54 (51.43)
<b>Co-morbidities</b>	
No co-morbidities	48 (45.71)
Co-morbidities	57 (54.29)
• Diabetes mellitus	36(34.29)
• Dyslipidemia	9 (8.57)
• Rheumatoid arthritis	6 (5.71)
• Bronchial asthma	6 (5.71)
• Hypertension	33 (31.43)
• ESRD	9 (8.57)
• Liver failure	3 (2.86)
• CAD	9 (8.57)
• COPD	6 (5.71)
<b>Radiological findings/CT</b>	
• Right free pleural effusion	45 (42.86)
• Left free pleural effusion	27 (25.71)
• Right loculated pleural effusion	27 (25.71)
• Left loculated pleural effusion	6 (5.71)
• Pleural thickness	42 (40)
• Pleural nodules	9 (8.57)
• Lung nodules	3 (2.86)
• Pericardial effusion	6 (5.71)

There were no co-morbidities in 48 patients (45.71%) however 57 patients (54.29%) had co-morbid diseases in the

form of diabetes mellitus(DM) in 36 patients (34.29%), dyslipidemia (DLP) in 9 patients (8.57%), Rheumatoid arthritis in 6 patients

(5.71%), Bronchial asthma in 6 patients (5.71%), Hypertension (HTN) in 33 patients (31.43%), End stage renal disease (ESRD) in 9 patients (8.57%), Liver failure in 3 patients (2.86%), Coronary artery disease(CAD) in 9 patients (8.57%) and Chronic obstructive pulmonary disease(COPD) in 6 patients (5.71%) , (Table.1).

Regarding radiological finding in chest computed tomography (CT) there were

multiple finding in chest CT in form of right free pleural effusion in 45 patients (42.86%), left free pleural effusion in 27 patients (25.71%), right loculated pleural effusion in 27 patients (25.71%), left loculated pleural effusion in 6 patients (5.71%), pleural thickness in 42 patients (40%), pleural nodules in 9 patients (8.57%), lung nodules in 3 patients (2.86%) and pericardial effusion in 6 patients(5.71%) (Table. 1).

**Table 2. Surgical procedures**

Variables	Number (%)
• Right VATS pleural drainage and biopsy	51 (48.57)
• Left VATS pleural drainage and biopsy	24 (22.86)
• Right VATS pleural drainage and biopsy and decortication	9 (8.57)
• Left VATS pleural drainage and biopsy and decortication	6 (5.71)
• Left VATS pleural biopsy pericardial window and pericardial biopsy	6 (5.71)
• Right VATS pleural drainage, pleural biopsy and lung wedge resection	3 (2.86)
• Right VATS pleural drainage and biopsy and Talc pleurodesis	6 (5.71)
• Total	105(100)

Right VATS pleural drainage and biopsy were done in 51 patients (48.57%), left VATS pleural drainage and biopsy were done in 24 patients (22.86%), right VATS pleural drainage, biopsy and decortication were done in 9 patients (8.57%), left VATS pleural drainage, biopsy and decortication were performed in 6 patients (5.71%), left VATS pleural biopsy, pericardial window

and pericardial biopsy were performed in 6 patients (5.71%), right VATS pleural drainage, pleural biopsy and lung wedge resection were performed in 3 patients (2.86%) and right VATS pleural drainage, pleural biopsy and Talc pleurodesis were performed in 6 patients (5.71%). There were no intraoperative or postoperative complications, (Table. 2).

Final histopathological diagnosis was nonspecific inflammation in 15 patients (14.29%), pleural TB in 57 patients (54.29%), metastatic adenocarcinoma mostly lung in 12 patients (11.43%), metastatic adenocarcinoma mostly breast

primary in 8 patients (7.62%), metastatic carcinoma mostly ovarian primary in 9 patients (8.57%) and malignant mesothelioma in 4 patients (3.80%), (**Table. 3**).

**Table 3. Histopathological diagnoses**

Variables	Number (%)
• Non-specific inflammation	15 (14.29)
• Pleural TB	57 (54.29)
• Metastatic adenocarcinoma mostly lung	12 (11.43)
• Metastatic adenocarcinoma mostly breast primary	8 (7.62)
• Metastatic carcinoma mostly ovarian primary	9 (8.57)
• Malignant mesothelioma	4 (3.80)
• Total	105(100)

### Discussion

Diagnosis of pleural effusion is very important for pulmonologists and thoracic surgeons because of varied clinical picture and a variety of etiology which may be a simple inflammatory reaction or serious diseases like tuberculosis and malignancy (**Amandeep Singh Nar et al.,2020**).

Literatures proved that VATS is a profoundly sensitive and accurate tool in the diagnosis of unexplained exudative PE (**Celik et al., 1998; Caccavale and Lewis, 2000**).

Many studies proved that 95% of PE can be diagnosed by VATS. The ability of VATS to explore the whole pleural space and to target multiple tissue biopsies under vision (**Medford et al., 2008; Soni et al., 2012**).

This study included 105 patients with exudative pleural effusion in whom routine and specific pleural fluid analysis couldn't reach to diagnosis.

In our study, mean age was  $46.5 \pm 20.71$  and 51 Males (48.57%) and 54 Females (51.43%). Dyspnea was the most common symptoms in 54 patients (51.43%). There were 57 patients (54.29%) had comorbidities in the form of diabetes mellitus (DM) in 36 patients (34.29%).

The most common radiological findings were right free pleural effusion in 45 (42.86%) patients and pleural thickness in 42 (40%) patients.

VATS pleural drainage and biopsy (right and left) most common performed procedure in 75 patients (71.43%). Final histopathological diagnosis was pleural TB in 57 patients (54.29%),

malignancy in 33 patients (31.43%) and nonspecific inflammation in 15 patients (14.29%).

**Dadaset al., (2019)** conducted retrospective multicenter study included 263 patients with unexplained non-parapneumonic pleural effusion. The study showed that, dyspnea was most common complaint (66.5%). Regarding the most frequent radiological finding, the simple pleural effusion (66.5%) was the most common. They could reach to definitive diagnosis in 97% of all the patients.

**Amandeep et al., (2020)** conducted prospective study. 54 patients with unexplained pleural effusion who experienced VATS for diagnosis as well as therapeutic tool were included in their study. Diagnostic capacity of VATS in this study was 100%. Parapneumonic effusion was the most frequent diagnosis in 31.5% of the patients then chronic non-specific inflammation and pleural tuberculosis in 25.9% of patients and 4 patients had malignancy.

**Arkin et al. (2019)** conducted retrospective study included 229 patients aged 14-80 years with exudative PE which couldn't be diagnosed by pleural fluid aspiration, pleural biopsy or bronchoscopy who hence experienced VATS for final diagnosis. Their patients were 145 males (63.3%) and 84 females (36.7%). The mean age was  $54.5 \pm 15.1$  years. Regarding to final diagnosis, 84 patients (36.6%) had malignancy, 26 patients (11.4%) diagnosed as tuberculosis and the remaining 119 patients (52%) diagnosed as nonspecific inflammation.

**Özkaya et al., (2018)** conducted retrospective study analyzed 74 patients who underwent uniportal VATS for unexplained pleural effusions. Their patients were 41 males (55.4%) and 33 females (44.5%). Their mean age was 64.12 year. Regarding to affected side, right pleural effusion was in 51 patients and left pleural effusion was in 23 patients. VATS pleural biopsy could reach to diagnosis in 60/74 patients (81.0%).

**Almashtouly et al., (2021)** reviewed 40 cases with unexplained exudative pleural effusion in their research. Their patients were 23 males (57.5%) and 17 females (42.5%). Their mean age was  $52.90 \pm 7.24$  years. Regarding to patients' complaint, 33 patients (57.3%) had dyspnea, and 15 patients (37.5%) had chest pain. 7 patients (17.5%) diagnosed as metastatic effusion, 21 patients (17.5%) as chronic non-specific inflammation, 5 patients (12.5%) as suppurative effusion, 5 patients (12.5%) as tuberculous effusion and 2 patients (5.0%) as primary malignant tumor.

### Conclusions

VATS is a good diagnostic and therapeutic method. Therefore, all patients with undiagnosed or unexplained exudative pleural effusions should be underwent VATS after failure of diagnosis by the initial workup as soon as possible to reach clear diagnosis.

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