

The Role of Thoracoscopy in the Diagnosis of Pleural Effusion of Unknown Origin

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ABSTRACT

BACKGROUND AND OBJECTIVE: Video-assisted thoracoscopic surgery is preferred over conventional methods, such as pleural biopsy, in the diagnosis and treatment of patients with pleural effusion. Considering that Imam Khomeini Hospital is facing a large volume of patients with pleural effusion of unknown origin referred from other centers, the present study was conducted to investigate the role of thoracoscopy in the diagnosis of pleural effusion of unknown origin.

METHODS: In this prospective study, 31 patients with pleural effusion of unknown origin, whose disease was not diagnosed using conventional methods such as imaging, thoracentesis or pleural biopsy, were treated with video-assisted thoracoscopic surgery (VATS) at Imam Khomeini Hospital in Urmia.

FINDINGS: The most common symptoms were dyspnea in 18 patients followed by chest pain in 8 patients and cough in 5 patients. Histological findings reported cancer in 19 patients, pleuritic in 10 patients and tuberculosis in 2 patients. Among the patients with malignant pleural effusion, the most common causes were metastatic carcinoma (42.1%) adenocarcinoma (26.3%) and mesothelioma (7.5%). In general, VATS was unable to definitively diagnose the disease in 5 patients. The diagnostic function of VATS was 83.9% in patients with pleural effusion of unknown origin (CI-95%= 71–96.8).

CONCLUSION: The results showed that thoracoscopy along with imaging can be helpful in detecting pleural effusion with unknown origin.

KEY WORDS: Video-Assisted Thoracoscopic Surgery, Pleural Effusion, Thoracoscopy, VATS.

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Introduction

Pleural effusion or fluid accumulation in the lung's pleural cavity is a common problem that can be caused by several diseases, including malignancies, failure of heart, liver and kidney, pulmonary infections, chest trauma, and so on. In the United States, approximately 1.5 million cases of pleural effusion are detected every year (1), of which 10 to 25% are not detected using common diagnostic methods (imaging, thoracentesis, ultrasound – guided core needle biopsy) (2, 3). Since the introduction of video – assisted thoracoscopic surgery (VATS) in the 1990s, this technique played a significant role in the diagnosis and treatment of pleural effusion (5, 4). Thoracoscopy seems to have better and more secure diagnostic profiles than other common methods, including ultrasound – guided core needle biopsy (6 – 8), and it has less complications, better diagnostic results, less pain caused by the procedure and shorter hospital stay compared to thoracotomy (9 – 11).

Video – assisted thoracoscopic surgery allows a wide range of therapeutic interventions such as fluid drainage, optimal biopsy of parietal pleura and its abnormalities, optimal preparation of effective pleural effusion, and so on (5, 12, 13). In studies conducted in other centers, there was no significant difference in the detection of pleural effusion between thoracoscopy (VATS) and other diagnostic methods, including ultrasound – guided core needle biopsy, and etc. in some centers. Considering the large volume of patients with unknown pleural effusion, this study examined the role of thoracoscopy in the diagnosis of pleural effusion of unknown origin.

Methods

In this prospective study, after approval by the Ethics Committee of Urmia University of Medical Sciences (Ir.umsu.rec.1393.231), all patients with pleural effusion of unknown origin, who were admitted to Imam Khomeini Hospital in 2013 and 2015, and their disease was not diagnosed using conventional methods such as imaging, thoracentesis or biopsy were included in the study. Patients with narrow intercostal space, coagulopathy or bleeding, hemodynamic instability or respiratory failure, and those who were not willing to

provide informed consent for the VATS method were excluded. After obtaining informed consent, all patients underwent VATS under general anesthesia. This task was performed under general anesthesia with single lung ventilation and in a side-lying position with a 10 mm guide for thoracoscope with a zero-degree lens and two 5 mm guides one for biopsy forceps and one for suction or cautery. All of the pleural fluid was suctioned and was analyzed through cytology and culture. In the presence of macroscopic abnormalities, biopsies were taken directly from the pleural lesion and in the absence of a visible pleural disorder, multiple random biopsies were taken from the pleural effusion.

Homeostasis was done using electrocautery devices or other devices. After the process, a 28-32-French chest tube was inserted into the pleural space and connected to a liquid sealing machine with suction. The chest tube was removed when the daily discharge level was ≤ 50 cc and patients were followed up during their hospital stay. Chi-squared and Fisher's exact test were used to evaluate the relationship between the two variables and $p < 0.05$ was considered significant.

Results

In this study, 31 patients were examined, among which 18 (58.1%) were male and 13 (41.9%) were female. The mean age of the patients was 55.64 ± 16.68 years (from 14 to 85 years). The most common symptom was dyspnea in 18 patients (58.1%), then chest pain in 8 (25.8%) and cough in 5 (16.1%) patients. Involvement of right hemithorax (17 patients, 54.8%), followed by left hemithorax (38.7%) and bilateral involvement (6.4%) were the most frequent lateral damages of pleural effusion. Twenty patients (64.5%) had LDH levels above 1000 units per liter (Table 1). All patients underwent VATS for the diagnosis and treatment of pleural effusion of unknown origin, and no patient required thoracotomy.

Histologic reports in 19 patients (61.2%) indicated cancers, in 10 patients (32.2%) indicated pleuritis and in 2 patients (5.6%) indicated pulmonary tuberculosis. In patients who suffered from malignant pleural effusion, the most common cause was metastatic carcinoma (8 patients, 42.1%), followed by adenocarcinoma (5

patients, 26.3%), mesothelioma (3 patients, 15.7%), squamous cell carcinoma (2 patients, 10.5%) and finally chondrosarcoma (1 patient, 2.5%). Of 10 cases of pleuritis reported in the examinations, 1 case was due to rheumatoid arthritis and 4 cases were due to pneumonia, but 5 cases (16.1% of the total subjects) were ultimately left without diagnosis (Fig. 1).

Therefore, the diagnostic function of VATS was 83.9% (95% CI = 71–96.8) in the diagnosis of patients with pleural effusion. Pleural effusion was bloody in 21 patients (67.7%). Of the 20 patients with an average age of less than 60 years, 12 patients (60%) had bloody pleural effusion, compared to 81.8% in subjects 60 years of age or older. There was no significant difference

between age group and bloody and non-bloody secretion of pleural effusion. Eleven out of 18 male patients (61.1%) had bloody pleural effusion and this was higher in female patients (76.9%), but there was no significant difference. There was no significant difference between the affected part and the pleural effusion of patients. Four out of 11 patients (36.4%) in LDH < 1000 U / L group and 17 patients (85%) in LDH $\geq$ 1000 U / L group had pleural effusion, which was statistically significant ($p = 0.009$).

Eighteen patients (85.7%) in malignant pleural effusion group had bloody effusion, while this rate was 14.3% and 0% in pleuritic and tuberculous patients, respectively ($p < 0.001$) (Table 1).

Table 1. Patient characteristics based on the presence and absence of blood in the pleural effusion in the study

Demographic information	All patients (n=31) N(%)	Bloody pleural effusion (n=21) N(%)	Non-bloody pleural effusion (n=10) N(%)	P-value
Age $\geq$ 60 years	11(35.4)	9(42.8)	2(20)	0.2
Male gender	18(58)	11(52.3)	7(70)	0.29
Hemithorax involvement				
Right	17(54.8)	12(57.1)	5(50)	0.1
left	12(38.7)	9(42.9)	3(30)	
bilateral	2(6.4)	0(0)	2(20)	
LDH $\geq$ 1000 u/L	20(64.5)	17(80.9)	3(30)	0.009
Etiology				
Malignancy	19(61.2)	18(85.7)	1(10)	$> \pm 0.001$
Pleuritis	10(32.2)	3(14.2)	7(70)	
Tuberculosis	2(6.4)	0(0)	2(20)	

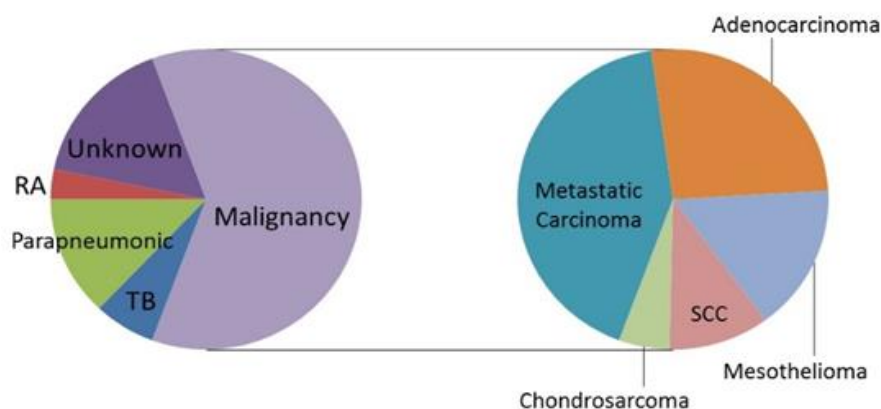


Figure 1. Final diagnoses based on VATS in study patients
RA: Rheumatoid Arthritis; SCC: Squamous cell carcinoma; TB: Tuberculosis

Discussion

The results of this study indicate that in comparison with other diagnostic methods, precise sampling of the target location through thoracoscopy can help reach the diagnosis more quickly due to providing wide view of the pleural and pericardial space. Therefore, the necessary therapeutic measures can be performed for the patient, and frequent hospitalization and high cost of treatment can be prevented, and this method can be introduced as a reliable and safe diagnostic method with the ability to perform therapeutic measures. In this study, a relatively high diagnostic function for video – assisted thoracoscopic surgery (VATS) was used to detect the cause of pleural effusion in people not using conventional methods.

Although thoracentesis is considered as a primary step in the evaluation of pleural effusion in many cases, it has low sensitivity (60% sensitivity for the first attempt, which may increase by 15% after the second procedure) (14, 15). However, it can help to limit differential diagnosis by classifying pleural effusion into exudative and transudative groups based on light's criteria (16), and the pleural needle biopsy shows a lower diagnostic function (~50-60%) (17, 18). Imaging – guided pleural needle biopsy (CT or ultrasound) have a higher diagnostic performance than the mentioned methods, but due to limited therapeutic application, they have lower therapeutic value (20, 19). Hence, over the past two decades, due to the high diagnostic performance, and potential treatment and acceptable safety profiles, the thoracoscopy in general, and the VATS method in particular, have been considered more specifically. In our study, the diagnostic value of VATS was 84% in detecting pleural effusion of unknown origin. However, this rate was lower than the one reported by some studies (21), because they often studied a non-specific group of patients with pleural effusion of unknown origin, while in our study, patients were included by pleural cytology and closed biopsy procedures (~ 25%). In other studies on similar population of patients, negative cytology of pleural

effusion with similar diagnostic results were reported for VATS (70–90%) (3, 4, 22–24). In general, malignancy is the second most common cause of pleural effusion (~ 40%) in patients over 50 years of age (5). Malignant pleural effusion is the main cause of pleural effusion with an uncertain cause in our study.

Similar to our findings, De Groot et al. reported 89% sensitivity and 100% specificity for the diagnosis of malignant pleural effusion using VATS (4), and also showed that VATS is an effective way of detecting and treating patients with malignant pleural effusion (25). The sensitivity and specificity of VATS in the diagnosis of pleural tuberculosis has been reported 100% (4). Only 6.5% of our patients had secondary pleural effusion due to tuberculosis. Cozma et al. reported that 14% of those under the VATS suffer from pleural tuberculosis, which is higher than the rate reported by us (26). Several studies have demonstrated the beneficial effects of using VATS to treat patients with various symptoms (27–30).

However, in this study we focused on the diagnostic function of this method instead of its role in treatment. Some studies have been conducted on patients who spontaneously breathe with epidural anesthesia or under localized and sedative anesthesia (30–32), while in this study, VATS was performed with three-port triangular approach under general anesthesia. Therefore, it should be noted that the findings of this study are not generalizable to other methods of VATS or thoracoscopy. As a result, we found that thoracoscopy by video–assisted thoracoscopic surgery (VATS) has high diagnostic performance in detecting the cause of pleural effusion in people whose disease has not been diagnosed by conventional methods.

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