



## Video Assisted Rigid Thoracoscopy in the Diagnosis of Unexplained Exudative Pleural Effusion

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### ARTICLE INFO

#### Article Type:

Original Article

#### Article History:

Received: 21 June 2013

Accepted: 2 September 2013

#### Keywords:

Thoracoscopy  
Pleural Effusion  
Tuberculosis  
Malignancy

### ABSTRACT

**Introduction:** An undiagnosed exudative pleural effusion is often a difficult diagnostic dilemma that needs further histological study for a definitive etiological diagnosis. Video assisted rigid thoracoscopy is a minimally invasive procedure with a minor morbidity and mortality risk that could resolve this problem.

**Methods:** Between January 2010 and December 2011, we performed thoracoscopy in 26 patients for diagnosis of undiagnosed exudative pleural effusion. Clinical and paraclinical data of patients were collected prospectively and analyzed.

**Results:** Sole pleural effusion was the most common CT scan finding seen in 17 (65.4%) patients. Thoracoscopy was diagnostic in 24 patients (92.3%). The pathologic findings were carcinoma (46.2%), tuberculosis (30.8%) and chronic inflammation without a definitive microbiologic culture (15.4%). Surprisingly mean ADA level in the tuberculosis group was in normal range. No mortality or complication related to our operation was observed.

**Conclusion:** Video assisted thoracoscopy is a minimally invasive procedure with a high definitive diagnostic accuracy in the evaluation of tuberculosis and malignant pleural effusions. Pulmonologist should refer these patients sooner to decrease the waiting period of diagnosis and treatment of such conditions.

### Introduction

Diagnosis and treatment of the diseases has always been a major concern throughout the medicine history.<sup>1</sup> An undiagnosed exudative pleural effusion is often a difficult diagnostic dilemma that needs further histological study for a definitive etiological diagnosis. Approximately 20% of exudative pleural effusions remain without an established etiology even after simple pleural aspiration and percutaneous biopsy.<sup>2</sup> Complicated situations could alter the definite diagnosis in the diseases affecting thoracic cavity.<sup>3,4</sup> When conditions such as neoplasia, tuberculosis or other granulomatous disorders are suspected, thoracoscopy should be considered; as this procedure provides larger biopsy specimens and more accurate sampling of abnormal pleura under direct vision.<sup>5</sup> Numerous invasive and non-invasive methods have been introduced for diagnosis of the thoracic diseases.<sup>6</sup> Video assisted rigid thoracoscopy is a minimally invasive procedure with a minor morbidity and mortality risk for the evaluation of the pleural space by direct vision through small incisions. Direct visual inspection of the pleural space, drainage of pleural fluid, and taking a large amount of pleural tissue for pathologic evaluation are the

commonly performed procedures during video assisted thoracoscopy which may be performed under general or even local anesthesia in special situations. At the same time pleurodesis and decortications may be done during this procedure for preventing recurrence of the pleural effusion and palliation of dyspnea.<sup>7</sup>

### Material and Methods

In a prospective study conducted in the department of general thoracic surgery, Imam Reza hospital, Tabriz University of medical sciences, Tabriz, Iran between January 2010 and December 2011, we performed thoracoscopy for diagnosis of undiagnosed exudative pleural effusions referred to our institute by pulmonologists. Undiagnosed exudative pleural effusion was defined as failure to achieve an etiologic diagnosis by initial pleural fluid microscopic and biochemical analysis including sugar, protein, triglyceride (TG), lactate dehydrogenase (LDH), cell count, cytology, Gram stain, Acid fast bacilli (AFB) smear and culture, pleural fluid adenosine deaminase (ADA) levels and at least two pleural percutaneous needle biopsies negative for malignancy or other definite causes. All patients underwent detailed

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clinical evaluation with history and clinical examination. Computed tomography (CT) of the chest was performed to assess feasibility of thoracoscopy. Patients unable to tolerate general anesthesia and one lung ventilation were excluded from study. Other exclusion criteria were: patients with excess rib crowding with narrow intercostal space, loculated pleural effusion, bleeding diathesis, hemodynamic instability and dysrhythmias.

All the patients underwent general anesthesia and intubated by a suitable double lumen endotracheal tube. The patients were first placed in the lateral decubitus position with the affected side up. First a ten-millimeter port was placed in the fifth intercostal space at the mid-axillary line. The second port was placed in the fourth intercostal space at the anterior axillary line.

Keeping the lung deflated and allowing adequate visualization of the pleural surfaces, all of the pleural fluid was aspirated and sent for cytology and culture. Biopsies were taken from the parietal pleura where macroscopic abnormalities were obvious. Hemostasis was controlled by electrocautery or other devices. After the procedure was completed, thoracoscope and the other port(s) were removed and a 28 to 32 Fr chest tube was inserted through the same incision. Chest drain was connected to water-sealed drainage bottle.

Chest X-ray was taken the next day. Once the lung had expanded and drain output decreased to less than 50mL per 24 hours, chest drain was removed.

## Results

During this period, 26 patients who underwent thoracoscopy for diagnosis of undiagnosed pleural effusion were included in this study. There were 11 (42.3%) males and 15 (57.7%) females, with a mean age of  $51.96 \pm 19.79$  years (range, 18 to 85 years). The most common chief complaint was chest pain in 8 (30.8%) patients. Other complaints include dyspnea in 6 (23.1%) patients, cough in 5 (19.2%) patients, cough and dyspnea in 3 (11.5%) patients, chest pain and dyspnea in 3 (11.5%) patients and incidental finding in 1 (3.8%) patient. The mean time prior to the patient referral for thoracoscopy was 4.85 months (range: 0-16 months). Eleven patients had a history of medical illness (Table 1). Only 4 patients had history of smoking.

**Table 1.** Underlying co-morbidities of the patients

Past medical history	No.	Percent
Hypertension	5	19.2
Previous cancer history	2	7.7
Previous tuberculosis	1	3.8
Ischemic heart disease + hypertension + diabetes mellitus	1	3.8
Diabetes mellitus + hypertension	2	7.7
Negative	15	57.7

Mean LDH level of pleural fluid was 831 (range: 160-4018). Mean ADA level was 29.43 (range: 1-123). The most common CT scan finding was sole pleural effusion that was observed in 17 (65.4%) patients (Table 2). Five of the patients had a distinct pleural or pulmonary lesion amenable to CT or ultrasound guided pleural biopsy; however, the biopsy specimen was not enough for accurate diagnosis. All of the patients had previously undergone percutaneous blunt pleural biopsy but in all of them the reported pathologic diagnosis was nonspecific inflammation without any accurate diagnosis.

**Table 2.** CT scan findings of the patients

CT finding	No.	Percent
Pleural effusion	17	65.4
Pleural effusion +lung mass	2	7.7
Massive pleural effusion	4	15.4
Pleural effusion +pleural mass	3	11.5

Right hemi-thorax was the most common affected side by pleural effusion (61.5%). Mean hospital stay was 5.35 days (range: 2-17). No mortality or complication related to our operation was observed.

Thoracoscopy was diagnostic in 24 patients (92.3%). The most common pathologic finding was carcinoma [12 (46.2%) patients]. Tuberculosis was the second common pathologic finding seen in 8 (30.8%) patients. Surprisingly, mean ADA level in these group was in normal range ( $25.00 \pm 11.16$ ) except for 1 case (123). Chronic inflammation was seen in four (15.4%) patients without a definitive microbiologic culture. In these 4 patients, pathologic evaluation was highly suggestive of TB diagnosis. PCR for tuberculosis was positive in 2 of them and their pleural effusion was resolved by a 6 month period of treatment by Anti-TB drugs. In the next 2 patients, the pleural effusion was treated by only broad spectrum antibiotics for 2 weeks. Two of the patients with cancer pathology had a previous history of treated breast cancer and treated ovarian cancer. We performed removal of loculated pleural effusion in 15 cases, decortication in 14 patients, and chemical pleurodesis in 11 patients in conjunction with pleural biopsy during thoracoscopic evaluation of them.

## Discussion

One of the most common chest problems in terms of diagnosis and effective management is pleural effusion. There is a long list of differential diagnosis and treatment options, and in general, its management largely relies on effective therapy of the underlying cause. The differential diagnosis can be narrowed based on dividing the effusion in exudative or transudative effusion based on the Light's criteria.<sup>5</sup> If one or more of Light's criteria are met, the patient has an exudative effusion. Evaluation of

Light's criteria demonstrates 97.5% sensitivity and 80% specificity for identifying pleural exudates.<sup>8</sup>

Based on the patients' presentation, there are many algorithms for investigation of patients presented by pleural effusion that include thoracentesis (aspirate for pH, protein, amylase, lactate dehydrogenase, glucose, Gram stain and culture, and acid-fast bacilli stains and culture, cell count and differential, cytopathologic studies and other specific tests as suggested by the clinical condition—lipids, fungal culture, viral culture, immunoglobulins), imaging modalities and percutaneous biopsy, open biopsy by thoracoscopy or thoracotomy. Collins and Sahn estimated that up to 75% of diseases presenting with pleural effusion can be diagnosed by analyzing the fluid tapped by simple thoracentesis, if used in conjunction with the patient presentation.<sup>9</sup> It has been suggested that a positive diagnosis is more likely with diseases such as parapneumonic effusions, empyema thoracis, chylothoraces, and hemothoraces which do not require a precise cytologic diagnosis. However, for diseases that require cytopathologic for diagnosis, such as malignant pleural disease, the results are much lower. Positive cytologic diagnosis rates from thoracentesis of 45% to 80%, with rates for malignant mesothelioma as low as 20%.<sup>10</sup> In these cases other diagnostic modalities should be tried.

Traditional (non-CT or ultrasound guided) percutaneous pleural biopsy using an Abrams needle has a positive diagnosis rates of only 38% to 67% for malignant diseases.<sup>11,12</sup> Adding CT scan or ultrasonography for localizing the lesions improve the accuracy of sampling and reduce its complications but again the sample is a small tissue fragment.<sup>13</sup> Tomlinson and Sahn, reported only 54% to 75% positive diagnosis rates for tuberculosis<sup>14</sup> but others using combination of histology (80% percent sensitivity) and culture (56% sensitivity) of pleural biopsy tissue establishes the diagnosis of tuberculosis in up to 90% of patients.<sup>15</sup> Real time PCR or adenosine deaminase evaluation will increase the accuracy of this technique in diagnosis of tuberculosis.<sup>16,17</sup> In our 7 from 8 cases of tuberculosis-induced pleural effusion ADA level was in normal range. The cause of this difference is not known but this finding suggests that we could not rely on ADA level in the diagnosis of TB pleural effusion in our patients and again thoracoscopy would be the main diagnostic tool in such cases.

The problem, therefore, is that at least 15% to 25% of pleural effusions may remain undiagnosed using the aforementioned nonsurgical techniques. Boutin and coworkers reported that 215 in a series of 1,000 pleural effusions remained undiagnosed. However, in the same 215 patients, thoracoscopy gave 96% diagnostic accuracy, suggesting that thoracoscopy and VATS may indeed be the ideal investigative tools for such situations.<sup>18</sup> In our study thoracoscopy was diagnostic in 92.3% of the cases. Janssen, in a review of efficacy of three different methods

of pleural biopsy (old technique using Abrams needle closed pleural biopsy, thoroscopic biopsy, computed tomography-guided biopsy and ultrasound-guided biopsy), showed that thoracoscopy was of a sensitivity of 90-95% compared with other methods (40% to 85%). They commented that although thoracoscopy is a more invasive procedure compared with image-guided pleural biopsy, the major advantage of thoracoscopy is its possibility to perform a simultaneous therapeutic intervention.<sup>19</sup> The possible therapeutic procedures during thoracoscopy are: 1) removal of (septated) pleural effusions; 2) talc instillation (under visual control if preferred) 3) pulmonary decortication (if needed); and 4) drain positioning under visual control. In our study, this additional procedure was performed in all of the patients (as indicated) including: removal of loculated pleural effusion (58%), decortication (54%), and chemical pleurodesis (42%). Thoracoscopy is the preferred procedure if no clear target lesion is visible on the CT scan, and in patients with large or recurrent effusions in whom drainage and pleurodesis is indicated.<sup>19</sup> The 2000 American Thoracic Society statement on management of malignant pleural effusions states that indications for performing thoracoscopy include “the evaluation of exudative effusions of unknown cause,” among others, and that “in cases of undiagnosed exudative effusions with a high clinical suspicion for malignancy, some clinicians may proceed directly to thoracoscopy”.<sup>20</sup> As in our study, thoracoscopy is a safe method with a very low risk of mortality and mortality and in suspected cases it is more appropriate to directly refer such patients for video-assisted thoracoscopy. This would decrease the delay in diagnosis; it also, by its therapeutic effects, could decrease the patients' morbidity. For more critical patients unable to tolerate general anesthesia this procedure can be performed by local or regional anesthesia or even by a single port.<sup>21</sup>

**Ethical issues:** The study was approved by the ethics committee of the University.

**Competing interests:** The authors had no competing interests to declare in relation to this article.

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