Respiratory Medicine xxx (2015) 1–5

Contents lists available at ScienceDirect

Respiratory Medicine

journal homepage: www.elsevier.com/locate/rmed

Diagnostic value and safety of medical thoracoscopy in tuberculous pleural effusion

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ARTICLE INFO

Article history:
Received 4 March 2015
Received in revised form
12 May 2015
Accepted 15 June 2015
Available online xxx

Keywords:
Medical thoracoscopy
Pleural biopsy
Tuberculous pleural effusion

ABSTRACT

Background: Differentiating tuberculous pleural effusion from other lymphocytic pleural effusions is often challenging. This retrospective study aimed to assess the efficacy and safety of medical thoracoscopy in patients with suspected tuberculous pleural effusion.

Methods: Between July 2005 and June 2014, patients with pleural effusions of unknown etiologies underwent medical thoracoscopy in our institute after less invasive means of diagnosis had failed. Demographic, radiographic, procedural, and histological data of patients with tuberculous pleural effusion were analyzed.

Results: During this 9-year study, 333 of 833 patients with pleural effusion were confirmed to have tuberculous pleurisy. Under thoracoscopy, we observed pleural nodules in 69.4%, pleural adhesion in 66.7%, hyperemia in 60.7%, plaque-like lesions in 6.0%, ulceration in 1.5% of patients with tuberculous pleurisy. Pleural biopsy revealed the presence of *Mycobacterium tuberculosis* in the pleural tissue or/and demonstration of caseating granulomas in 330 (99.1%) patients. No serious adverse events were recorded, and the most common minor complication was transient chest pain (43.2%) from the indwelling chest tube.

Conclusions: Our data showed that medical thoracoscopy is a simple procedure with high diagnostic yield and excellent safety for the diagnosis of tuberculous pleural effusion.

1. Introduction

Tuberculosis accounts for millions of active disease cases and deaths in both developed and developing countries. Pulmonary infection with *Mycobacterium tuberculosis* is the most common form of tuberculosis, tuberculous pleural effusion (TPE) remains a frequent form of extrapulmonary tuberculosis [1,2]. In addition, tuberculosis is the most common cause of exudative effusions in areas with a high prevalence of tuberculosis [2,3].

TPE can develop from either a primary *M. tuberculosis* infection or disease reactivation [2,4]. TPE is curable, therefore, making an accurate diagnosis as early as possible becomes essential. However, differentiating TPE from the many other causes of lymphocytic pleural effusions is often challenging. Diagnosis of TPE depends on the demonstration of *M. tuberculosis* in pleural fluid or pleura tissue, or demonstration of epithelioid cell granulomas and/or caseating granulomas in the pleura [1,5]. Sensitivity of pleural fluid smear for acid-fast bacilli is very low (0–1%) [5–7], while mycobacterial culture of pleural fluid and/or pleural biopsy specimens is relatively sensitive (24–58%) [6–9], but is time consuming and requires standardized laboratories. Even with advanced culture techniques, the diagnostic yield is 63% for effusion culture [10]. Medical thoracoscopy (MT) refers to the examination of the pleural space in a nonintubated patient under local anesthesia, and this procedure has been well documented to be highly sensitive and safe for diagnosing exudative pleural effusions [11–13]. To our

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http://dx.doi.org/10.1016/j.rmed.2015.06.008
0954-6111/

knowledge, this study is the first to evaluate usage and safety of MT in the diagnosis of TPE.

2. Methods

2.1. Study population

The study protocol was approved by the Institutional Review Boards for human studies of Beijing Chaoyang Hospital, China. The detailed medical history, clinical presentation, laboratory examination results, and image data of all patients with undiagnosed exudative pleural effusions who underwent MT in our institute between July 2005 and June 2014 were recorded, and only those data of patients with definite diagnosis of TPE were included in the current study. Before MT, all patients underwent the initial diagnostic workup, which includes measurement of a pleural fluid marker for tuberculosis, including adenosine deaminase, and their pleural effusions remain undiagnosed. The characteristics of the study population are presented in Table 1.

All patients have had a thoracic computed tomography (CT) scan within 24 h before undergoing MT. According to the techniques described by Moy and colleagues, the size of a pleural effusion was estimated as small, moderate, or large according to CT imaging with anteroposterior quartile and maximum anteroposterior depth measured at the midclavicular line [14]: first anteroposterior-quartile effusions are small, second anteroposterior-quartile effusions are moderate, and third or fourth anteroposterior-quartile effusions are large.

2.2. Thoracoscopic procedures

MT was performed by chest physicians in our pulmonary procedural suite. After written informed consent was obtained, the patient was positioned with the affected side up in the lateral decubitus position. The patient breathed spontaneously with supplemental oxygen via nasal cannula as needed. The patient was connected to blood pressure, cardiac, and pulse oximetry monitors. Aloka ultrasound system (Aloka Co. Ltd, Tokyo, Japan) was used to confirm effusion presence and evaluate the best trocar entry site, generally located at the mid-to anterior axillary line, between the sixth to eighth intercostal space.

Under moderate sedation using fentanyl and midazolam, the skin, subcutaneous tissue, adjacent ribs, and parietal pleura were anesthetized with 1% lidocaine (15–30 mL), and a small incision was made at the planned site of entry. The 8-mm disposable trocar was then inserted, and a semi-rigid pleuroscope (Olympus LTF-240, Tokyo, Japan) was introduced into the pleural space right after all fluid was drained completely. A detailed inspection of the pleural cavity was then performed, with documentation of any abnormalities by photographic and/or video recordings. Biopsies were performed with flexible forceps under direct visual control in all suspect areas, systematically in several parts of the parietal pleura for mycobacterial, cytological, and histological examination. In addition, biopsy of the parietal pleura was performed over a rib to avoid the neurovascular bundle.

At the end of the procedure, a 24F chest drain was inserted for drainage. Chest radiographs were routinely obtained after the procedure and re-check until the removal of the chest tube.

2.3. Diagnostic criteria for TPE

The diagnosis of TPE was established by the presence of *M. tuberculosis* in biopsy specimen, or by demonstration of caseating granulomas or epithelioid cell granulomas in pleural tissue with no evidence of other granulomatous diseases.

2.4. Statistical analysis

Data are presented as mean ± standard deviation (SD) or number with percentage. Descriptive statistical methods were used for data analysis.

3. Results

Between July 2005 and June 2014, 833 patients with undiagnosed pleural effusions successfully underwent MT, and pleural biopsy samples were obtained for diagnostic evaluation. Eventually, TPE was the final diagnosis in 333 (40.0%) patients with lymphocytic exudates; the mean age of TPE patients was 51.8 ± 18.5 years.

As shown in Table 1, the most common symptoms of TPE were cough (64.6%), breathlessness (60.7%), fever (48.1%), chest pain (35.7%), expectoration (32.4%), and weight loss (18.3%).

In 127 (38.1%) TPE patients, pleural fluid occurred only on the left side, in 161 (48.4%) only on the right, and in 45 (13.5%) both sides were affected (Table 2). In either unilateral or bilateral effusion, the percentages of small, moderate, and large size of pleural effusions were 20.4%, 19.2%, and 60.4%, respectively. Overall, in

Table 1
Characteristics of the study population (n = 333).

Variables	Values
Age, yr, mean ± SD	51.8 ± 18.5
Sex, male, n (%)	216 (64.9)
Smoking status, n (%)	
Current or ex-smoker	121 (36.3)
Never smoker	148 (44.4)
Unknown smoking status	64 (19.2)
History of tuberculosis	22 (6.6)
Symptoms, n (%)	
Cough	215(64.6)
Breathlessness	202 (60.7)
Fever	160 (48.1)
Chest pain	119 (35.7)
Expectoration	108 (32.4)
Weight loss	61 (18.3)
Fatigue	34 (10.2)
Night sweat	22 (6.6)
Hemoptysis	4 (1.2)

Table 2
Characteristics of CT findings and pleural effusions (n = 333).

Characteristics	n (%)
CT imaging	
Pulmonary consolidation or infiltration	178 (53.5)
Pulmonary atelectasis	145 (43.5)
Mediastinal lymphopathy	137 (41.1)
Pleural thickening	111 (33.3)
Pulmonary mass or nodules	73 (21.9)
Pleural nodularity	13 (3.9)
Side of effusion	
Right	161 (48.4)
Left	127 (38.1)
Bilateral	45 (13.5)
Size of effusion	
Small	68 (20.4)
Moderate	64 (19.2)
Large	201 (60.4)
Effusion appearance	
Yellow	281 (84.4)
Blood-stained	51 (15.3)
Chylous	1 (0.3)

Please cite this article in press as: Z. Wang, et al., Diagnostic value and safety of medical thoracoscopy in tuberculous pleural effusion, Respiratory Medicine (2015), http://dx.doi.org/10.1016/j.rmed.2015.06.008