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Full Length Article

Evaluation of different laboratory methods for rapid diagnosis of tuberculous pleurisy ☆

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ABSTRACT

Background/Objective: Tuberculous pleurisy is a diagnostic challenge due to its nonspecific clinical presentation, paucibacillary nature of the effusion together with the inefficiency of conventional laboratory methods motivating the evaluation of variable diagnostic strategies.

Methods: Using thoracoscopy, the pleural cavity of 50 patients with undiagnosed exudative pleural effusion were fully examined and biopsy specimens of affected parietal pleura were taken under direct vision. Pleural fluid and biopsy specimen were subjected to microscopic examination (direct and after cytocentrifugation), culture, PCR, and histopathological examination.

Results: The pleural biopsy specimens proved to have a higher detection rate of tubercle bacilli than pleural fluid. Also, cytocentrifugation improved the sensitivity of microscopic detection for both pleural fluid and biopsy specimens.

Conclusion: The combination of microbiological results and histopathology examination of the pleural biopsy specimens is essential for the diagnosis of tuberculous pleurisy, as microbiological examination of pleural biopsy specimens has proved to have a higher detection rate than pleural fluid examination.

Introduction

According to the World Health Organization, the incidence of tuberculosis (TB) was 9.6 million in 2014 and it is estimated that deaths from TB will increase from 3 million a year to 5 million by the year 2050. Between 2002 and 2020, approximately 1 billion people will be newly infected, 200 million people will get sick, and 36 million will die of TB if proper control measures are not instituted [1,2].

Although the majority of patients with TB have pulmonary TB, extrapulmonary TB affecting mainly the lymph nodes and pleura constitutes the initial presentation in ~25% of adults

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[3]. It was mentioned that among all cases presenting with pleural effusion, 25% are unable to be attributed to a specific diagnosis, even after thoracentesis and closed pleural biopsy (PB) [4]. As many as 50% of the patients in this undiagnosed group will eventually be diagnosed with a malignancy. Other diagnostic possibilities include TB, fungal disease, connective tissue disease-related pleuritis, pulmonary infarction, rib fractures, asbestos-related pleural effusion, and nonspecific pleuritis (NSP) [5].

Still, TB is the main cause of pleural effusions in some countries [6]. It is important to consider the possibility of tuberculous pleurisy in all patients with an undiagnosed pleural effusion. A pleural effusion as an isolated manifestation of TB is self-limited and of little immediate concern, but may lead to serious disease many years later. Tuberculous pleurisy is thought to represent primarily a hypersensitivity reaction to tuberculous protein while the bacillary burden in the pleural space is low [7].

Extrapulmonary tuberculosis usually presents more of a diagnostic problem than pulmonary TB. The combination of small numbers of bacilli and inaccessible sites causes bacteriologic confirmation of diagnosis to be more difficult, and invasive procedures are frequently required to establish a diagnosis [8].

The aim of the current study was to evaluate the different diagnostic methods: (1) direct smears; (2) cytocentrifugation prepared smears; (3) cultures; and (4) polymerase chain reaction (PCR) for detection of *Mycobacterium tuberculosis* in pleural fluid (PF) and PB specimen obtained by thoracoscopy from patients with undiagnosed lymphocytic exudative pleural effusion.

Patients and methods

The present study was conducted on 50 patients who presented to the Chest Diseases Department in Alexandria Main University Hospital, Alexandria, Egypt, with exudative pleural effusion (according to Light's [6] criteria), but of unclear etiology after biochemical, bacteriological, and cytological examination of the PF. All patients were subjected to full history taking including age, sex, smoking status, occupation, residence, and history of other diseases or previous malignancies, thorough clinical examination and routine laboratory investigations including hemoglobin, total and differential white blood cell count, renal and liver function tests, fasting blood glucose level, coagulation profile including prothrombin time and activity, international normalized ratio, and platelet count. Oxygen saturation was detected with a pulse oximeter and an electrocardiogram was performed on all patients. Radiological evaluation in form of a plain chest X-ray in the posteroanterior view to evaluate the amount of pleural effusion, position of mediastinum, and any other abnormality, and contrast enhanced computed tomography to view pleural thickening, pleural nodules, mediastinal pleural involvement, lung masses or consolidation, lymphadenopathy, and any other abnormality was performed on all patients. Also, thoracic ultra sound (Sonos 100 CF, Hewlett Packard, MS, USA) was done to assess loculations, adhesions, and apparent masses, and to determine the most appropriate site of entry. Thoracentesis was performed and PF analysis for total protein and albumin content, lactate dehydrogenase content, total and differential leucocytic count, Ziehl–Neelsen (ZN) stain for acid-fast bacilli (AFB), and cytological examination for malignant cells were performed.

Thoracoscopy was performed in the bronchoscopy suite, with the patient under conscious sedation and local anesthesia lying in the lateral decubitus position. An examination was carried out with a rigid thoracoscope. Patients were monitored regarding blood pressure and pulse rate, an electrocardiograph was attached, a pulse oximeter was used, and supplementary oxygen was provided to maintain oxygen saturation >90%. Equipment used included a rigid thoracoscope (Karl Storz, Tuttlingen, Germany), a straight forward telescope 0° with an angled eyepiece, 10 mm in diameter, working length at 27 cm with a 6-mm working channel, a metallic trocar 11 mm in diameter, cold (xenon) light source, an endoscopic camera attached to the eyepiece, video monitor and recorder, and other accessories commonly available in a chest tube insertion tray. A single port of entry was required in all patients. The patient was positioned in the lateral decubitus position breathing spontaneously, with the normal lung in the dependent position and with the arm raised above the head. The involved side of the chest was disinfected: 15–30 mL of lidocaine 2% was injected at the point of entry, through all layers of chest wall as far as the pleura. Thoracentesis to confirm the presence of PF at the insertion site was performed. A single puncture, which involved a 1-cm incision in the midaxillary line between the fourth and seventh intercostal space of the chest wall was done, and a track was created by blunt dissection. A trocar was inserted and the pleural cavity was opened to atmospheric pressure. Any remaining PF was then aspirated [9]. A full examination of the pleural cavity was then made and biopsy specimens of parietal pleura were taken as appropriate under direct vision. Multiple (5–7) biopsy samples were taken. At the end of the procedure, a chest tube was inserted and lung expansion was radiographically confirmed before removal of the tube. A chest radiograph was taken within 24 h and patients were put under close observation postthoracoscopy. Both PF samples and PBs were sent to the TB lab in the Department of Medical Microbiology and Immunology, Faculty of Medicine, University of Alexandria, as well as undergoing pathological examination. The specimen sent for microbiology was put separately in normal saline. The study was approved by the Alexandria Faculty of Medicine Ethical Committee and informed consent was obtained from patients before sampling.

Specimen processing

Specimens were delivered aseptically to the TB lab in the Department of Medical Microbiology and Immunology, Faculty of Medicine, University of Alexandria.

With regards to the PF samples, they were divided into three parts: (1) one part (20 mL) was centrifuged at 1200 × g for 15 min and the sediment was used for ZN smear and Lowenstein–Jensen (LJ) culture [10]; (2) another part (10 mL) of the sample was centrifuged at 1200 × g for 15 min and the deposit was used to detect AFB after cytocentrifugation

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