Usefulness of fiberoptic pleuroscopy and brushing in patients with unknown pleural effusion

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Abstract Background and Objective: Pleural fluid cytology (PFC) and closed pleural biopsy (CPB) are the two most commonly employed diagnostic tests for malignant pleural effusions. The aim of this study was to determine the benefit and safety of the fiberoptic pleuroscopy and brushing for the diagnosis of unknown pleural effusion.

Patients and methods: Twenty patients with suspected malignant pleural effusion and negative cytology for malignancy underwent pleuroscopy with brushing using a 32 Fr chest tube and a flexible fiberoptic bronchoscope for the diagnosis, inspection, and management of patients. All the samples were sent for bacteriological and cytological studies. Patients had a mean follow-up period of 4.37 ± 1.86 months.

Results: Sixteen cases were finally documented to have malignancy, (12 men and 4 women) aged 62.8 ± 5.8 years, while pleuroscopic biopsy provided diagnosis in 12 (75%) of 16 cases. Pleural brushing was diagnostic in 10 (62.5%) of 16 cases. In 2 of these 10 cases, pleuroscopic biopsy was negative. When all procedures were used in combination, the yield increased to 87.5%. When pleural brushing (PBR) was used in addition to pleural biopsy by fiberoptic bronchoscopy, the yield of the diagnosis increased more than 10%. No major complications were encountered with this method. There was no mortality due to these interventions.

Conclusion: Fiberoptic pleuroscopy and brushing utilizing fiberoptic bronchoscopy through a chest tube is a relatively safe, simple and well-tolerated technique with a high diagnostic yield for patients with malignant pleural effusion.

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Introduction

Pleural effusion is a frequent complication of malignant diseases [1,2]. A prudent approach to such cases is to obtain a pleural biopsy if the pleural fluid cytology is nondiagnostic [3,4]. The diagnostic yield of the latter procedure, however, is not always satisfactory and has been variably reported to be...
as low as 30% and occasionally as high as 80% [5,6], depending on the type of the tumour [7] and the degree of pleural involvement [8].

Closed pleural biopsy is not a perfect diagnostic test either because of its blind nature and inability to always obtain tissue samples from the affected sites of the parietal pleura [6,9]. In addition, the visceral pleura is out of its diagnostic reach [9].

The use of a flexible fiberoptic instrument to examine the pleural space was reported in the 1970s in the United States [10] and compared with rigid thoracoscopy as recently as 1988 in the United Kingdom [11]. Although apparently allowing for limited pleural space visualization with a minimum of discomfort and risk, we are unaware of the routine use of the flexible instrument currently to attempt to establish a diagnosis in patients with exudative pleural effusions suspicious for malignancy that remain unexplained despite standard evaluation.

We hypothesized that a video-assisted flexible fiberoptic bronchoscope introduced into the pleural space through a chest tube would allow adequate visualization and access to the pleural space and increase the diagnostic yield in malignant pleural effusions without adding substantially to patient discomfort or risk. Therefore, we performed diagnostic flexible fiberoptic pleuroscopy on 20 patients with exudative pleural effusions suspicious for malignancy that remained undiagnosed despite history, physical examination and diagnostic thoracentesis.

Patients and methods

Twenty patients who were suspected of having malignant pleural effusion with initial negative pleural fluid cytology for malignancy were hospitalized and enrolled in this study. Informed written consent was obtained from all patients. The patients were collected from, Dallah Hospital, Riyadh, Saudi Arabia, during the period between January, 2009 and June, 2012.

Patients were enrolled in this study only if there was clinical, radiological, routine laboratory suspicion of malignant effusion; and if one or more of the following criteria were present:

→ Old age (>60 years old);
→ history of smoking;
→ progressive dyspnea,
→ dull chest pain and hemoptysis;
→ lesions other than effusion on the chest X-ray;
→ any known cancer history;
→ exclusion of tuberculosis, pulmonary embolism, transudative effusions, parapneumonic effusion, and other nonmalignant effusions by clinical, radiological and laboratory evaluation of pleural fluid obtained at the first thoracentesis.

All patients were subjected to the following:
A 32 Fr chest tube and a 6 mm outside diameter flexible fiberoptic bronchoscope, Olympus PF1T260 (Olympus Optical Co. Ltd., Tokyo, Japan) were used. The premedication dose was 5 mg of midazolam and 0.5 mg of atoropine (atoropin was also administered if necessary). The examination was performed in an endoscopy room. The patient was placed in the lateral decubitus position with the pleural effusion upside. Ultrasonography was performed to determine the entry point.

After disinfection with povidone iodine and local anesthesia with lidocaine, an approximately 2 cm chest incision was made. A 32 Fr chest tube was inserted into the pleural space. Once in place, the tube was connected to thoracic drainage device to drain the pleural fluid. After drainage of the fluid, fiberoptic bronchoscope was introduced through the firm wide bore chest tube into the pleural space. Suction of the remaining part of the pleural fluid was done through the suction channel in the bronchoscope. Pneumothorax was induced by repeat insufflation of 50-mL aliquots of room air through the working channel of the bronchoscope to avoid re-expansion pulmonary edema and because visualization of the pleural surfaces was found to be impossible through pleural fluid. Once visualization was adequate, the visceral and parietal pleura were examined by manipulation of the fiberoptic device. Biopsy and Cytologic brushing using standard (bronchoscopic) instruments was then performed. This method requires only one trocar entry point for the fiberscope and for biopsy forceps because the biopsy forceps is used through the channel of the flexible fiberoptic bronchoscope which is done in the same manner as for the manipulation during bronchofiberscopy. The biopsies were then sent for histopathological diagnosis. During this procedure, the blood pressure, pulse rate, electrocardiogram and continuous oximetry were all monitored. At the end of the procedure, the chest tube was connected to the suction tube of the drainage device and fixed in position to the skin of the chest wall using zero silk interrupted vertical mattress sutures. Well cared dressing was applied. The dressing was routinely changed and inspected daily. The chest tube remained for few days until pleurodesis was achieved in the case of malignant pleural effusion.

Follow-up

All patients (n = 20) were followed up regularly for a mean period of 4.37 ± 1.86 months.

Statistics

Only patients documented to have definite malignancy by the initial work-ups or during their follow-ups were included. Thus cases with non-specific pleuritis, those who proved to have tuberculous pleurisy and patients whose pleural effusions resolved spontaneously without any evidence of recurrence in their clinical follow-up were excluded from the statistical analysis. In addition, specimens read suspicious for malignancy and those which were subjectively assessed by the pathologist to be inadequate tissue specimens were considered to be non-diagnostic. Statistics were determined using statistical computer software (SigmaStat, version 2.03; SPSS; San Rafael, CA).

Results

From 20 cases who were initially suspected to have a malignant pleural effusion, four patients were excluded because two had tuberculosis, one had histological signs of non-specific pleuritis and one case had spontaneous resolution of pleural effusions. Sixteen cases were finally documented to have malignancy. They consisted of (12 men and 4 women) aged 62.8 ± 5.8 years.
All thoracoscopy procedures were performed safely without any accidents or other serious complications. The procedure was well tolerated and no complications were encountered even with elderly patients. Visualization using this instrumentation was sufficiently accurate to make a diagnosis of pleural lesions. The inspection of the pleura, diaphragm and lung was possible.

Effusion was right sided in 10 patients and left sided in 6 patients. On the PA chest X-ray only pleural effusion was observed in 10 patients (62.5%). In other patients, atelectasis, mass, or parenchymal infiltration was observed in addition to the pleural effusion.

The sources of the malignancy in the 16 cases were as follows: metastatic adenocarcinoma (37.5%), metastatic squamous cell carcinoma (12.5%), mesothelioma (25%) and undifferentiated carcinoma (25%). Pleuroscopic biopsy (PB) provided diagnosis in 12 (75%) of 16 cases. Pleural brushing (PBR) was diagnostic in 10 (62.5%) of 16 cases. In 2 of these 10 cases, pleuroscopic biopsy was negative. When all procedures were used in combination, the yield increased to 87.5%. When pleural brushing (PBR) was used in addition to pleural biopsy by fiberoptic bronchoscopy, the yield of the diagnosis increased more than 10% (Table 1 and Fig. 1). PFC (taken during the procedure after initial negativity) was diagnostic in 5 (31%) cases; all these cases were diagnosed by pleural biopsy and brushing. The two cases in whom diagnosis could not be provided by these three procedures, were proved to have malignancy by a repeat thoracentesis during their clinical follow up. Four cases were diagnosed with only PB while no case was diagnosed by PFC alone. Two cases were diagnosed with PBR alone (Table 1). The diagnosis was obtained by each of the three methods in five cases while the diagnosis was made by both PBR and PB in 14 cases. PBR seemed most effective with metastatic adenocarcinoma and malignant mesothelioma (Table 2).

**Discussion**

Many cases of pleural effusion can remain undiagnosed based on the patient’s medical history, and the findings of physical examinations and thoracentesis. The next diagnostic procedure is a percutaneous closed (CPB) pleural biopsy, using either an Abram biopsy needle or Cope biopsy needle. However, the rate of making a successful diagnosis remains unsatisfactory. After thoracentesis and a closed pleural biopsy, approximately 20–30% of patients with pleural effusion remain undiagnosed [12–14]. Furthermore, sometimes accidents occur during a percutaneous closed pleural biopsy, such as bleeding or a pneumothorax and they can be life-threatening because this examination is performed blind.

This is the main reason that researchers seek less invasive new diagnostic procedures for malignant effusions. We hypothesized that brush the parietal pleura would increase the diagnostic yield in a manner that bronchial brushing improves the diagnostic yield with bronchoscopy. We hypothesized that a wider sampling of cells would be obtained with PBR than with PFC and PB.

Thoracoscopy under local anesthesia using flexible bronchoscopes is a simpler procedure, but they are more difficult to manipulate within the pleural cavity than within the bronchi. Medical thoracoscopy under local anaesthesia using a 32 Fr chest tube and a flexible fiberoptic bronchoscope is useful for patients with undiagnosed exudative pleural effusions that remained undiagnosed or those requiring the management of pleural diseases. Under local anesthesia, we can talk to the patient during the manipulations by asking such questions as: – Do you feel any dyspnea or pain? Even when treating elderly patients, we can constantly check to see if there are any problems or complaints [15].

![Figure 1](image-url)  
Figure 1 The diagnostic yield of PFC, PBR, PB and combined PB with PBR.

<table>
<thead>
<tr>
<th>Table 1 The results of diagnostic procedures used for malignant pleural effusion.</th>
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(+) Diagnostic; (–) Non-diagnostic; MAC, metastatic adenocarcinoma; MSCC, metastatic squamous cell carcinoma; UDC, undifferentiated carcinoma; MM, malignant mesothelioma.

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<th>Table 2 Results of pleural procedures with regard to cell types.</th>
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<td>Total (n = 16)</td>
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When using a 32 Fr chest tube and the flexible fiberoptic bronchoscope does not bend because the chest tube works as a hard sheath and the terminal section is flexible. Furthermore, using a 32 Fr chest tube is safe even when bleeding occurs. If such complications arise during the procedure for thoracoscopy, then the 32 Fr chest tube can be used as a chest drainage tube directly after removing the flexible fiberoptic bronchoscope. When beginning thoracoscopy, it is easy to drain the pleural effusion with a 32 Fr chest tube because it is suitable for drainage. In this method of thoracoscopy, the chest tube was not only placed in one direction. By changing either the direction or length of the inserted chest tube, we can, therefore, inspect and perform the biopsy of the pleura from around the apex to diaphragm. In addition, this procedure can also be performed with instruments that are widely available in most clinical situations [16].

In the present study, the same procedure was safely performed in addition to pleural brushing. Pleuroscopic biopsy (PB) provided diagnosis in 12 (75%) of 16 cases. Pleural brushing (PBR) was diagnostic in 10 (62.5%) of 16 cases. In 2 of these 10 cases, pleuroscopic biopsy was negative. When all procedures were used in combination, the yield increased to 87.5%. When pleural brushing (PBR) was used in addition to pleural biopsy by fiberoptic bronchoscopy, the yield of the diagnosis increased more than 10%. These results are comparable to those reported previously [17–19]. Bejui-Thivolet et al. [20], performed 150 thorascopics for pleural effusions while the results of conventional pleural cytology and biopsy were negative. In 108 cases pleural brushing and biopsy were both performed. In metastatic tumours biopsy was positive in 80% of the cases; pleural brushing in 78% of cases; taken together they allowed the diagnosis in 86% of the cases. In carcinomatous mesotheliomas biopsy was positive in 82.3%, pleural brushing in 78%; taken together they allowed the diagnosis in 89% of the cases. Pleural brushing could be considered as a sensitive diagnostic method, specific and harmless. The sensitivity of the method was 97%. The specificity of the method was 98.6%. El Hoshy and Helal [16], studied 15 patients with undiagnosed pleural effusion with medical thorascopcic pleural biopsy and brushing. All thorascopy procedures were performed safely without any accidents or any other serious complications. Fine as well as rough biopsies were done to all cases before as well as after forceps biopsy. After forceps, the rough biopsy was diagnostic in 80% of cases in comparison to 60% before forceps. As regards the fine brush biopsy, it was diagnostic in 53.3% after forceps in comparison to 26.6% before forceps. This shows that performed together, Forceps biopsy increased the yield of diagnosis by brushing. We therefore consider this new procedure to be safe and effective, and it will continue to become increasingly easier to perform after it has been carried out on a larger number of cases. In conclusion, PBR procedure; performed via fiberoptic bronchoscopy provides an additional diagnostic yield in suspected malignant pleural effusion. It is a safe, simple, and well tolerated procedure.

Since the PBR can provide diagnosis in cases in whom PFC and PB are not diagnostic; we suggest that the combination of PFC examination, PB and PBR should be performed via fiberoptic pleuroscopy and brushing utilizing fiberoptic bronchoscopy through a chest tube before more invasive procedures like surgical thoracoscopy or thoracotomy with open pleural biopsy are undertaken.

Acknowledgments

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