Fiberoptic bronchoscopy was carried out in 28 patients with an undiagnosed pleural effusion. In four patients, the diagnosis was made by this examination. Three patients had bronchial carcinomas, and one had tuberculosis. None of these four patients had roentgenographic evidence of pulmonary infiltrates, atelectasis, or mass lesions. Pleuroscopic examination was performed in 14 patients with the fiberoptic bronchoscope. The diagnosis was made in three. Prior nondiagnostic blind needle biopsy had been carried out in 11 patients and in all three diagnosed by pleuroscopy. Two patients had metastatic carcinoma of the pleura and one tuberculosis. Of 12 patients with effusions and positive Mantoux tests who had no other evidence of tuberculosis, none had clinical evidence of the disease during the period of follow-up. We conclude that bronchoscopic and pleuroscopic examination is of value in the work-up of patients with undiagnosed pleural effusions without roentgenographic evidence of mass lesion or atelectasis.

Since its introduction in 1966 by Ikeda, the flexible fiberoptic bronchoscope has been widely used in the investigation of pulmonary disease. Recent reviews, although listing an abnormal chest roentgenogram as an indication for bronchoscopy, do not discuss its value in the investigation of pleural effusions. Conversely, articles on perplexing pleural effusions, mention that bronchoscopy may be part of the investigation but give no details about the indications or yield from this procedure. Pleuroscopy was first described by Jacobaeus using a rigid tube. More recently, the flexible bronchoscope has been used for pleuroscopic examinations. In this study, we retrospectively examined the records of 28 patients who were referred to the Respiratory Division of the Department of Medicine for the investigation of pleural effusions and who underwent flexible fiberoptic bronchoscopy as part of their work-up. Fourteen of these patients also had a pleuroscopic examination.

Material and Methods

Patients

The 28 patients were referred from the general medical services after initial investigations had failed to reveal the causes of their pleural effusions. These investigations included at least three sputum examinations for malignant cells and acid-fast bacilli. All patients had undergone a pleural tap showing an exudative effusion according to accepted criteria. Pleural fluid had been examined for malignant cells and acid-fast bacilli. Blind pleural biopsies with the Abrams needle had been done in 20 patients. Patient details are given in Table 1. Details of follow-up are available in 20 patients for periods of up to two years (mean follow-up is ten months).

Method

Bronchoscopic examinations were performed with an Olympus instrument after patients had received general anesthesia. Pleuroscopy was carried out in 14 patients, using a similar bronchoscope and general anesthesia as described previously, but with local anesthesia. Eleven of the 14 patients who underwent the pleuroscopy had previous Abrams needle biopsies, the results of which were negative. We examined chest roentgenograms without reference to the clinical data, specifically looking for features suggestive of atelectasis, mass lesions, or parenchymal infiltrates.

Results

The 28 patients whose pleural fluid had been examined on one or more taps yielded negative

Table 1—Patient Details

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Total No.</td>
<td>28</td>
</tr>
<tr>
<td>Male:female</td>
<td>23:5</td>
</tr>
<tr>
<td>Age, yr</td>
<td>21-83 (mean, 57)</td>
</tr>
<tr>
<td>Smoking history</td>
<td>20</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>5</td>
</tr>
<tr>
<td>5 TU Mantoux test positive</td>
<td>14</td>
</tr>
<tr>
<td>5 TU Mantoux test negative</td>
<td>8</td>
</tr>
</tbody>
</table>

*From the Division of Respirology, St. Michael's Hospital, Toronto, and the Department of Medicine, University of Toronto, Ontario, Canada.
diagnostic results. (In one there were probable but noncharacterizable malignant cells.) Twenty of these had at least one pleural biopsy before being subjected to pleuroscopy. These blind or closed pleural biopsies had given negative results.

Results of bronchoscopic and pleuroscopic examinations are shown in Table 2. The diagnosis was made in four patients by bronchoscopic examination. Three patients had a bronchial carcinoma. In one of these three, prior pleural fluid cytology had identified malignant cells, but it had not been possible to characterize the cell type. Bronchoscopy confirmed this tumor to be a squamous cell carcinoma. Two of these three patients had undergone closed pleural biopsies, with negative results. All three had hemoptysis and were cigarette smokers. However, none had any other symptoms or signs on physical and roentgenographic examination to suggest malignant disease. One patient was found to have tuberculosis on the basis of culture of bronchial washings despite negative findings of pleural biopsy and pleural fluid culture. None of the four patients whose diagnosis was made by bronchoscopy had a pleuroscopic examination. The bronchoscopic examination was negative in one patient, who at postmortem six months later was found to have a large cell undifferentiated carcinoma involving the right apex. This carcinoma was small and had not been visible roentgenographically before death.

Pleuroscopic examination disclosed abnormalities in all 14 patients. A diagnosis was made in three patients by pleuroscopy. Two patients had carcinoma of the pleura and one tuberculosis. In one patient, atypical cells were noted, leading to an open biopsy that confirmed the diagnosis of mesothelioma. In the other ten patients, pleuroscopic biopsy showed nonspecific pleuritis. In one of the patients with nonspecific pleuritis, retrospective analysis of the Abrams needle biopsy specimen revealed scant granulomas compatible with tuberculosis. This patient received antituberculosis therapy and had resolution of the effusion.

Follow-up details are available in eight of the nine patients with a final diagnosis of nonspecific pleuritis. One died six months later in heart failure. No postmortem examination was carried out. In the other patients, there was no evidence of recurrent effusion or the development of malignant or tuberculous disease.

Three patients with diagnosis of tuberculosis had previously received 5 TU Mantoux skin tests, the results of which were positive in two patients. In the third, the reaction of 250 TU was positive. Of the 12 patients with positive Mantoux tests but without other evidence of tuberculosis, none had clinical evidence of the disease during follow-up.

In only six of the 28 roentgenograms examined was there evidence of parenchymal lung disease. Two patients had bilateral basal infiltrates, one had a right upper and one had a left lower lobe infiltrate. There was one with minimal atelectasis and another with an old fibrotic scar in the left upper lobe. None of the four patients whose conditions were diagnosed by bronchoscopy had any apparent abnormality on the chest roentgenogram apart from the effusion. There were no complications from either the bronchoscopic or pleuroscopic examinations.

**Discussion**

Although recent reviews of bronchoscopy\(^1\)\(^-\)\(^3\) mention that an abnormal chest roentgenogram might be an indication for bronchoscopy, its value in the investigation of undiagnosed pleural effusions is not discussed. We found bronchoscopy to be a valuable part of the work-up, being diagnostic in four patients despite a lack of helpful roentgenographic change. In one of these patients, the diagnosis of malignant disease had previously been made by pleural fluid cytology, but it was bronchoscopy that confirmed the primary site. The condition of one patient, who subsequently was found to have an apical carcinoma, was not diagnosed by bronchoscopy.

Tuberculous effusions may be associated with a nidus of tuberculous infection in the subpleural parenchyma. This is frequently small and not visible roentgenographically.\(^9\) It is thus not surprising that bronchoscopic washings were positive on culture in only one of our four patients with tuberculous effusions. Indeed, there is literature to suggest that even in active parenchymal tuberculosis, bron-
Pleuroscopic washings may be an inaccurate method of identifying the organisms. This may, in part, be due to the inhibitory effects of lidocaine topical anesthetic. Similarly, it was unlikely that bronchoscopic examination would be diagnostic in patients with metastatic carcinoma of the pleura or mesothelioma unless there was also parenchymal involvement.

The flexible bronchoscope has been used for direct pleuroscopic examination and for pleural biopsy. Pleuroscopy is indicated when needle aspiration and closed needle biopsy of the pleura have not yielded a positive result on one or more attempts. We were able to diagnose correctly two cases of metastatic pleural carcinoma and one of two cases of tuberculosis, but did not obtain a diagnostic biopsy in a case of mesothelioma. None of the patients with a primary lung carcinoma had a pleuroscopic examination. Follow-up data are available for eight of nine patients who underwent a pleuroscopic examination in whom the final diagnosis was nonspecific pleuritis. None had evidence of recurrent disease. If the one patient with nonspecific pleuritis and no follow-up is excluded, the overall diagnostic accuracy of pleuroscopy in our series is 85 percent (11/13). Gwin et al described pleuroscopic findings in nine patients, all with malignant disease. The diagnostic accuracy in this series was 89 percent (8/9). In the ninth patient, pleuroscopic biopsy was not able to distinguish adenocarcinoma from mesothelioma. Gunnels mentioned pleuroscopic findings in nine patients with perplexing pleural effusions. Her series included patients with malignant disease, tuberculosis, and systemic lupus erythematosus. Her overall pleuroscopic accuracy was 67 percent (6/9). Oldenburg and Newhouse performed thoracoscopic examinations on 41 patients, nine with the flexible instrument and 32 with a rigid instrument. Their diagnostic yield with the flexible instrument was 0/2 for tuberculosis and 1/3 for malignant disease. The comparable diagnostic yield with the rigid instrument was 1/2 and 8/10, respectively. Thus, our results compare favorably with those of previous authors. Like them, we were unable to distinguish reliably nonspecific pleuritis from specific pathology on the pleuroscopic appearance. The diagnostic yields of bronchoscopy and pleuroscopy are compared in Table 3.

<table>
<thead>
<tr>
<th>Final Diagnosis</th>
<th>Diagnostic Yield of Bronchoscopy, no. (%)</th>
<th>Diagnostic Yield of Pleuroscopy, no. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchial carcinoma</td>
<td>3/4 (75)</td>
<td>0/0</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>1/4 (25)</td>
<td>1/2 (50)</td>
</tr>
<tr>
<td>Metastatic carcinoma</td>
<td>0/2</td>
<td>2/2 (100)</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>0/1</td>
<td>0/1</td>
</tr>
<tr>
<td>Rheumatoid effusion</td>
<td>0/1</td>
<td>0/0</td>
</tr>
</tbody>
</table>

In one year, our patient population had a high incidence of positive Mantoux tests (63 percent), but none whose diagnoses were unconfirmed by bronchoscopy or pleuroscopy had tuberculosis within the follow-up period. In a recent series eight similar patients had no evidence of tuberculosis during a follow-up of up to 72 months. It is probable that the incidence of tuberculosis as a cause of pleural effusions is declining in the population.

In our series of patients, bronchoscopy and pleuroscopy were carried out under general anesthesia. Other authors have used local anesthesia for both methods. When multiple transbronchial biopsies are undertaken, we believe that they are more safely performed with an endobronchial tube in place. This would allow easy and rapid ventilation of the patient if there were a pneumothorax or massive hemorrhage. In our unpublished series of a thousand bronchoscopies, there has been only one death following extubation in a person with metastatic malignant disease. The cause of death was unknown. Pleuroscopy can cause moderate chest wall pain, and we believe that general anesthesia may be more comfortable for the patient.

In summary, we suggest the following: (1) that fiberoptic bronchoscopy is an important part of the work-up of an undiagnosed pleural effusion, despite lack of roentgenographic evidence of a mass lesion or parenchymal disease; (2) pleuroscopic examination with a flexible bronchoscope provides additional useful information, particularly in the diagnosis of metastatic malignant disease; (3) pleuroscopy may be unable to provide an adequate pathologic specimen for the diagnosis of mesothelioma; (4) patients with a positive Mantoux test and undiagnosed effusion should be followed-up rather than treated for tuberculosis. Most previous authorities and leading textbooks of medicine still maintain that since tuberculosis may become manifest at a later date, drug therapy for these effusions may be preferred. Further, longer, follow-up of this small series of patients is planned to help resolve some of these difficulties.
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11 Kvale PA, Johnson MC, Wroblewski DA. Diagnosis of tuberculosis: routine cultures of bronchial washings are not indicated. Chest 1979; 76:140-42
14 Kraft JR. Diagnostic problem of primary pleural effusion. Am Rev Tuberc 1949; 59:259

Supercourse VII

Supercourse VII, a clinical course on critical pulmonary care, will be held at the Fairmont Hotel, New Orleans, January 13-16. Sponsors are the American Lung Association of Louisiana and American Thoracic Society of Louisiana. For information, contact: Course Coordinator, American Lung Association of Louisiana, 333 St. Charles Avenue, Suite 500, New Orleans 70130.

Keystone Summit on Allergy, Immunology and Pulmonology

The National Jewish Hospital and Research Center/National Asthma Center at Denver, will present the Keystone Summit on Allergy, Immunology and Pulmonology at Keystone, Colorado, January 17-22. For information, contact Mary Fletcher, NJH/NAC, 3800 East Colfax Avenue, Denver 80206.