A Novel Instrument for the Evaluation of the Pleural Space*

An Experience in 34 Patients

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Study objectives: To test a novel semirigid pleuroscope to be used by pulmonologists for the diagnosis and treatment of pleural diseases.

Design: Prospective study.

Setting: Three tertiary referral centers for pulmonary diseases.

Patients: Thirty-four patients who were referred for medical thoracoscopy between September 2000 and April 2001.

Measurements and results: Thirty-six procedures were performed. The most common indications were for pleurodesis of a malignant pleural effusion (53%) or for evaluation of an exudative effusion of unknown etiology (44%). All operators found the instrument easy to use. In all but one case, the images were thought to be adequate, despite the presence of adhesions in 12 patients and loculations in 8 patients. Pleural biopsies were performed in 13 patients, and talc pleurodesis procedures were performed in 25 patients. Mean (± SD) duration of chest tube drainage was 2.9 ± 1.8 days postprocedure. There were no complications.

Conclusions: The prototype semirigid pleuroscope is a useful instrument in the diagnosis and management of pleural diseases. It is similar in design to a standard flexible bronchoscope, so the skills involved in operating the instrument should already be familiar to the practicing pulmonologist. It is compatible with existing video processors and light sources, so little additional equipment must be added to the endoscopy suite. The semirigid pleuroscope may allow for an increase in the performance of medical thoracoscopy by pulmonologists.

(CHEST 2002; 122:1530–1534)

Key words: pleural diseases; pleural effusion; thoracoscopy

Pleuroscopy, also referred to as medical thoracoscopy, generally describes the evaluation of the pleural space in a nonintubated patient under conscious sedation.1 A visual inspection of the pleural space, drainage of a pleural effusion, performance of pleural biopsies, and pleurodesis are commonly performed procedures during pleuroscopy. This type of endoscopy is usually performed by a pulmonologist with special training. This is in contrast to video-assisted thoracic surgery, performed by a thoracic surgeon in the operating room.

In experienced hands, medical thoracoscopy is very well-tolerated. The patient does not have to undergo general anesthesia and endotracheal intubation.2 Since there is no need for an operating room and anesthesia time, there may be significant cost advantages compared to conventional thoracoscopy. Despite these well-known facts, pleuroscopy is not frequently performed by pulmonologists in the United States. There are few practitioners with expertise in the procedure.3 In the past, it has required the use of specialized rigid endoscopic instruments with appropriate camera equipment, as well as a dedicated processor and light source. Besides the expense of this additional equipment, the rigid thoroscope is an unfamiliar tool for most pulmonologists.

We describe our experience with the use of a novel...
endoscope that is similar in design to a commonly used bronchoscope. This pleuroscope interfaces with existing processors and light sources that are routinely employed for flexible bronchoscopy and, therefore, are available in most endoscopy units.

Materials and Methods

Consecutive patients referred for diagnostic or therapeutic pleuroscopy at three institutions over a 6-month period were included in this study. Informed consent was obtained from all subjects.

In all three institutions, pleuroscopy was performed by experienced chest physicians. The instrument used was a prototype semirigid pleuroscope (model XLTF-240; Olympus; Tokyo, Japan) [Fig 1]. The instrument consists of a handle similar to a standard flexible bronchoscope. The outer diameter of the shaft is 7.0 mm. The length of the insertion portion is 27 cm, which consists of a proximal rigid portion (22 cm) and a bendable distal end (5 cm). The tip is movable in one plane with the help of a lever on the handle, which is similar to a conventional flexible bronchoscope. A 2.8-mm single working channel accommodates the biopsy forceps and other instruments. Angulation is 100° and 130°. The instrument connects to a standard video processor and light source (models CLV-U40 and CV-240, respectively; Olympus), and images are viewed on a screen.

Pleuroscopy Technique

The procedures were performed using a single-puncture technique. Patients were placed in the lateral decubitus position, with the affected side up. Some patients (ie, those from Indiana University and Lahey Clinic Medical Center) had small pneumothoraces induced preprocedurally, but the majority did not (ie, those from Beth Israel Deaconess Medical Center). Most patients received IV conscious sedation using midazolam and fentanyl, with appropriate monitoring. After local anesthesia was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. A somewhat larger sized trocar was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. After local anesthesia was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. A somewhat larger sized trocar was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. A somewhat larger sized trocar was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. A somewhat larger sized trocar was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. A somewhat larger sized trocar was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. A somewhat larger sized trocar was placed, a small incision was made in the mid-axillary line and an 11-mm trocar was introduced. After all fluid was suctioned, the pleuroscope was introduced into the pleural cavity, and the lung, diaphragm, and pleural surfaces were inspected. Parietal pleural biopsy specimens were obtained when indicated, and the procedure was followed by talc poudrage (with 5 g sterilized talc) when indicated. Rigid instruments (Karl Storz Endoscopy-America; Culver City, CA) were available, if the examination with the semirigid pleuroscope was deemed unsatisfactory. The procedure was followed by the placement of a 24F standard chest tube through the trocar. A chest radiograph was obtained postprocedure.

Operators recorded the presence or absence of loculations and adhesions, the subjective quality of the images, the ability to obtain satisfactory biopsy specimens, the need for conversion to rigid equipment, the duration of postprocedure chest tube drainage, and complications, if any. Differences between durations of chest tube drainage in patients with and without pleurodesis were compared using the Student t test, and p ≤ 0.05 was considered to be significant.

Results

From September 2000 to April 2001, 36 pleuroscopies were performed on 34 patients (Table 1). Twenty-four patients were men, and 10 patients were women, with a mean (± SD) age of 63.2 ± 13.5 years. Eighteen procedures were performed on the right pleural space, and 18 were performed on the right pleural space. Two patients underwent bilateral procedures, which were separated by 1 to 2 days. The most common indications were for the evaluation of an exudative effusion of unknown etiology (including the patient with the hepatic failure) or for pleurodesis of a malignant pleural effusion. Thirty-two patients received conscious sedation in the endoscopy suite, and 4 patients underwent general endotracheal anesthesia in the operating room, as per their individual preference (Table 2).

All examiners found the pleuroscope to be easy to handle. In all but one instance, the image quality was perceived to be good. Fluid was easily suctioned through the instrument (Fig 2, top right). No cases

Table 1—Characteristics of the 34 Patients Undergoing Pleuroscopy

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Data</th>
</tr>
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<tbody>
<tr>
<td>Age, yr</td>
<td>63.2 ± 13.5</td>
</tr>
<tr>
<td>Male gender</td>
<td>24 (71)</td>
</tr>
<tr>
<td>Side of procedure†</td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>18 (50)</td>
</tr>
<tr>
<td>Right</td>
<td>18 (50)</td>
</tr>
<tr>
<td>Preoperative diagnosis</td>
<td></td>
</tr>
<tr>
<td>Malignant pleural effusion</td>
<td>18 (53)</td>
</tr>
<tr>
<td>Unknown exudative effusion</td>
<td>15 (44)</td>
</tr>
<tr>
<td>Hepatic hydrothorax</td>
<td>1 (3)</td>
</tr>
</tbody>
</table>

*Values given as mean ± SD or No. (%).
†Two patients underwent bilateral procedures, separated by 1 to 2 days.

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Figure 1. The semirigid pleuroscope is shown. The design, especially of the handle, is similar to that of a flexible bronchoscope. The proximal portion is stiff, with a flexible distal tip. A working channel allows for the usage of the standard instruments that are used with the flexible bronchoscope. A biopsy forceps is shown.
required replacement of the semirigid pleuroscope with the conventional rigid thoracoscope in order to complete the procedure.

Pleural biopsy specimens were obtained in 13 cases, and all specimens were deemed to be of satisfactory quality. A definitive histologic diagnosis was made in 4 of the 14 patients who underwent pleuroscopy for evaluation of an unexplained exudative effusion, and malignancy was discovered in all 4 (Fig 2, middle).

Adhesions were found in 12 patients, and loculations were found in 8 patients. However, the flexible tip of the pleuroscope allowed for the exploration of areas that had been obscured by adhesions, as the instrument could be maneuvered with the flexible tip to look around the adhesions (Fig 4, bottom left and bottom right).

In 25 patients, talc poudrage was performed through the trocar. Uniform distribution was assured endoscopically.

All patients tolerated the procedure well. There were no complications, no significant desaturations, and no deaths. Chest tube drainage was continued for a mean duration of 2.9 ± 1.8 days following the procedure, and no patient required a chest tube for >7 days. In patients who did not undergo pleurodesis, chest tubes were continued for 1.5 ± 1.9 days. The duration of chest tube drainage was 3.6 ± 1.4 days in patients who were treated with talc poudrage.

**Discussion**

Pleural diseases (eg, pleural effusions, pleural based masses, and pneumothoraces) are common problems in pulmonary practice. If a pleural biopsy specimen is needed, a physician must usually choose between a blind pleural biopsy and a surgical procedure. No procedure is without problems. The latter requires general anesthesia in the operating room and is expensive, and the former is positive in only 40 to 60% of patients with malignant pleural disease. Pleuroscopy performed on patients under conscious sedation is a viable alternative. The procedure has a low rate of complications, with one study reporting major and minor complication rates of 1.9% and 5.5%, respectively.

However, pleuroscopy is currently not a widely utilized procedure among pulmonologists in the United States. In a 1995 survey, only 5% reported performing the procedure as part of their practices. Most pulmonologists are not familiar with the use of the rigid thoracoscope, due to a lack of training in most pulmonary fellowships. Additionally, this instrument requires a dedicated light source and camera equipment, which greatly increases the start-up expenses for a practice.

The use of fiberoptic bronchoscopes in the pleural space has been reported previously. It was found to be feasible, but the flexibility of the instrument made maneuvering and steering within the pleural cavity difficult.

The semirigid pleuroscope used in this study offers a solution to some of these problems. The design of the instrument is similar to commonly used bronchoscopes, making it more familiar to many pulmonologists. The rigid body allows for easy steering within the pleural cavity. It has a working channel that is similar to a conventional bronchoscope, allowing the use of standard flexible biopsy forceps. It also connects to the processor and light source that are found in most bronchoscopy suites, minimizing the additional equipment that must be purchased.

The semirigid pleuroscope allows for the visualization of abnormal areas and for directed biopsy. This prevents a common problem with blind pleural biopsies, which are often nondiagnostic, and thus have been abandoned in many hospitals. The single incision into the chest that is needed for placement of the pleuroscope is not much larger than that made for the insertion of the Cope or Abrams needle, and a visually guided biopsy of abnormal areas should provide a higher diagnostic yield. In addition, the pleuroscope affords a view of the entire pleural cavity, allowing the physician to effectively rule out malignant or granulomatous disease by obtaining visually directed biopsy specimens. It needs to be emphasized that this study was not designed to show superior diagnostic yield over a closed pleural biopsy.

All remaining pleural fluid can be suctioned while visualization continues, and talc poudrage can be performed through the already-placed trocar. Even the distribution of the talc can be assured with endoscopic assessment. In many ways, pleuroscopy mirrors the placement of a simple tube thoracoscopc...
tomy, and it can be performed easily in the endoscopy suite, saving the significant expense of an operating room.

However, only a properly trained operator should perform these procedures, and patients need to be appropriate for this minimally invasive approach to the evaluation and treatment of pleural abnormalities. In this study, the physicians who used the

Figure 2. Top left: view of the pleural cavity with pleural fluid. Top right: view of the pleural cavity after fluid has been suctioned through the working channel. Middle: view of the parietal pleura with nodular abnormalities. Testing of a biopsy revealed mesothelioma. Bottom left: pleural space with the presence of significant adhesions. Bottom right: the flexible distal tip allows the operator to maneuver around the adhesions, improving visualization.
semirigid pleuroscope were already highly experienced in performing pleuroscopy with conventional rigid equipment. However, we believe that the ease of use of this new instrument and its compatibility with existing bronchoscopy equipment will open the door for pleuroscopy to become a more commonly utilized procedure in pulmonology practices.

REFERENCES