

REVIEW ARTICLE

**PLEUROSCOPY: AN IMPORTANT DIAGNOSTIC TOOL FOR A
PULMONOLOGIST**

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Abstract

Pleural diseases are common problems in pulmonary practice. About 20% of pleural effusions remain undiagnosed despite repeated thoracentesis and close needle biopsy. When these patients were subjected to diagnostic pleuroscopy its diagnostic yield was found to be 95% for malignancies and 100% for benign diseases. Pleuroscopy today is primarily a diagnostic procedure, but it can also be applied for therapeutic purposes. Contraindications to pleuroscopy are uncommon and rarely absolute. Pleuroscopy is a safe and effective treatment modality in the diagnosis and treatment of several pleuropulmonary diseases, if standard criteria are fulfilled. Authors have recently completed a study on comparison of pleuroscopy with Abram's biopsy in the diagnosis of exudative pleural effusion at Jinnah Post Graduate and Medical Center. In that study the yield of pleuroscopy was 97% whereas that of Abram's biopsy was 70%.

BACKGROUND

Pleural diseases (e.g. pleural effusions, pleural based masses, and pneumothoraces) are common problems in pulmonary practice. Approximately a million patients worldwide develop pleural effusion each year¹. The frequency of various causes of pleural effusion depends on the incidence of tuberculosis in the region. In an area with a high incidence of tuberculosis the commonest cause of pleural effusion include tuberculosis (25%) neoplasm (22.9%) congestive cardiac failure (17.9%) and pneumonia (14%)². If a pleural biopsy specimen is needed, a physician must usually choose between a blind pleural biopsy and a surgical procedure. 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 disease³ and around 75% in patients with tuberculosis⁴. 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 6% and 18.4% respectively⁵. About 20% of pleural effusions remain undiagnosed despite repeated thoracentesis and close needle biopsy. When these patients were subjected to diagnostic pleuroscopy its diagnostic yield was found to be 95% for malignancies and 100% for benign diseases⁶.

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Introduction

H.C. Jacobeus, the Swedish internist, was the first to perform pleuroscopy in 1910, as a diagnostic procedure for exudative pleuritis. H.C. Jacobeus published the first series of pleuroscopy cases in 1921, describing the value of pleuroscopy in the diagnosis of tuberculous and malignant effusions. Around 1990, instruments such as endoscopic stapler devices, scissors, grasping and biopsy forceps were developed for surgical interventions by means of pleuroscopy in the thorax. The development of endoscopic video systems and instrumentation lead to the widespread use, by (thoracic) surgeons, of therapeutic pleuroscopy for a wide variety of major thoracic procedures (video-assisted thoracic surgery; VATS). This article does not deal with VATS, but with the thoracoscopic procedure that was performed by pulmonologists for many decades and subsequently became referred to as "medical thoracoscopy"⁷. Medical thoracoscopy is generally characterized as pleuroscopy performed under local anesthesia in the endoscopy suite with the use of nondisposable instruments, and is generally for diagnostic purposes. In contrast, VATS is described as a keyhole surgical procedure in the operating room, under general anesthesia with one-lung ventilation using disposable instruments, generally for therapeutic purposes. Pulmonologists may perform thoracoscopy for diagnostic as well as therapeutic goals under local anesthesia^{8, 9, 10}.

Indications:

Pleuroscopy today is primarily a diagnostic procedure, but it can also be applied for therapeutic purposes.^{6, 11, 12 13} Pleuroscopy is mainly indicated for diagnosis of pleural effusions of unknown etiology, for staging of lung cancer or diffuse malignant mesothelioma and for treatment by talc pleurodesis of malignant or other recurrent effusions. Pleuroscopy is also useful for evaluation of spontaneous pneumothorax and empyema.

Equipment

Sterile equipment for visualization, exposure, manipulation, and biopsy is required⁷. The standard equipment for thoracoscopy consists of:

- Trocar
- Obturator
- Optical telescope
- Light source
- Biopsy forceps

The optimal diameter of the thoracoscope (trocar and telescope) is 7 mm. Larger telescopes (diameter 10–12 mm) are often used by surgeons. These sizes would require careful and extensive application of local anaesthetics, and would therefore be less suitable for thoracoscopy under local anaesthesia, because manipulation of a telescope of this size in the intercostal space is painful. There may be a place for equipment with a smaller diameter, the so-called minithoracoscopy (see the Alternative equipment section). The 5-mm optical biopsy forceps provide large adequate biopsies; diagnostic superiority compared with the 3-mm forceps has not yet been proven⁷. Rigid instruments are still in use, as they were from the beginning as flexible instruments have several disadvantages compared to rigid thoracoscope, mainly less adequate orientation within the pleural cavity, and small and frequently inadequate biopsy specimens.¹⁴ A recently developed modification with a semiflexible tip may become an acceptable alternative.⁸ As mentioned, single entry site technique is usually done with a 9mm diameter trocar and a cannula with a valve. Optical devices exist with various fields of view (0, 30, 90 degree). Trocars are also available with diameters of 5 & 3.75 mm for performing thoracoscopy in children. Biopsy forceps with straight optical devices as well as accessory instruments such as puncture needle, cautery electrode, probe, combined suction and cautery cannula with valves and various biopsy forceps and scissors are available. For talc pleurodesis, a talc atomizer is used.¹⁵ A semirigid pleuroscope was developed recently. The design including the handle is similar to a standard flexible bronchoscope, the proximal part being stiff (22 cm) with a bendable distal end (5 cm, with angulation of 100 and 130 degrees). The outer diameter of the shaft is 7mm. A working channel with a diameter of 2.8mm allows the use of standard instruments that are available for flexible bronchoscope. The semirigid pleuroscope has the advantage that the skills involved in operating the instrument are already familiar to the practicing bronchoscopist, and that it is compatible with the existing video processors and light sources, so that little additional equipment must be added to the endoscopy suite. Its disadvantages compared to the rigid thoracoscopic instruments are the smaller biopsy specimens. However the flexible tip allows very homogenous distribution of talc on all pleural surfaces.



Fig 1: Olympus Pleuroscope

Pre op preparation

The pre-operative evaluation of the patient includes spirometry, electrocardiogram (ECG), blood gas analysis and routine blood chemistry analysis.

Pre-operative preparation may involve chest physiotherapy, bronchodilators, antibiotics and corticosteroids to optimize pulmonary function in patients with obstructive lung disease. Current medications should generally be continued. Benzodiazepines are commonly used to produce anxiolysis and sedation. The role of pre-operative medication has not been subjected to randomized study; some authors routinely administer 0.4–0.8 mg of atropine s.c. prior to the procedure, to prevent vasovagal reactions either with or without midazolam (5 mg). Sedation during the procedure is performed using incremental dosages of a narcotic (morphine or fentanyl) and a benzodiazepine. Agents to antagonise both morphine and benzodiazepine should be available⁷. Patients should have an intravenous cannula. Basic monitoring includes ECG and pulse oximetry, and supplementary oxygen should be provided to the patient to maintain oxygen saturation >90%. International normalized ratio (INR) should be <2.0 to ensure a biopsy is taken safely in patients using anticoagulant medication. Use of aspirin may prolong bleeding time, but is not an absolute contraindication to taking biopsies⁷.

Technique

After adequate sedation is achieved, the patient is placed in the full lateral decubitus position with the involved hemi thorax up, padded comfortably, and secured to the table. The site for pleuroscope entry into the pleural space is determined by surface anatomy landmarks, preoperative imaging studies, and physical examination to maximize visualization of the

expected pathology. Standard sterile skin preparation and draping to create an adequate field are performed while the skin is anesthetized with local infiltration anesthesia. After ensuring adequate sedation, the hemi thorax is entered bluntly with a clamp passed over the rib and through the pleura. With an adequate access space created, the pleural space immediately subjacent to the entry site is digitally inspected to ensure an adequate pleural space to safely insert the pleuroscope. The pleuroscope is inserted under direct vision into the pleural space. Once the surveillance panoramic examination is completed, the specific purpose of the procedure (*e.g.* evacuation of pleural fluid, pleural biopsy, or pleurodesis) is addressed. Fluid is evacuated using suction catheters passed through the working channel under direct vision. Parietal pleural biopsy is performed with biopsy forceps passed through the working channel under direct vision. Once the examination and procedure are completed, the pleuroscope is withdrawn, a chest drain is placed, and the pneumothorax is evacuated⁷.



Fig II: Doctor performing pleuroscopy in the dept of chest medicine JPMC

Talc pleurodesis

Thoracoscopic talc pleurodesis can be easily performed under local anaesthesia with some additional pain medication, if necessary. In cases of pleural effusion, the main prerequisite for successful pleurodesis is the removal of all pleural fluid before spraying with talc. Complete collapse of the lung is desirable as it permits wide and uniform distribution of the talc. Following distribution of talc, a complete lung expansion is necessary for successful pleurodesis.^{16,17} The optimal dose of talc poudrage is not

known, but usually a dose of about 5g (8-12 ml) is recommended for malignant or recurrent effusions, whereas for pneumothorax patients 2 gm is usually sufficient. This is done using a pneumatic atomizer introduced through the working channel of the thoracoscope.^{15, 18} After talc poudrage a 24-30 F chest tube should be inserted.

Post pleuroscopic management

Following pleuroscopy, a chest tube should be introduced into the pleural space via the cannula which can be used to determine its direction. The tube is fixed in place by a skin suture. The tube is removed when there is no further air leakage or when the fluid production is less than 100ml/day.

Contraindications

Contraindications to pleuroscopy are uncommon and rarely absolute. The main limitation is the size of the pleural space, which must be at least 10 cm in depth.¹³ If extensive adhesions are present thoracoscopy can be carried out without creating a pneumothorax, but this requires special skills and should not be undertaken without special training.¹⁹ Several factors that make it necessary to delay pleuroscopy but are rarely prohibitive include a persistent cough, hypoxemia, hypercoagulability and cardiac abnormalities. Great care should be taken in presence of hypercarbia. Depending on its severity; respiratory failure proves to be an absolute contra-indication, except in patients with a tension pneumothorax or massive pleural effusion, in whom pleuroscopy may provide a therapeutic benefit. In such conditions, premedication should be given judiciously. Contraindications to biopsy are arteriovenous pulmonary aneurysms, vascular tumours, hydatid cysts and stiff fibrotic lung.²⁰ Relative contraindications include previous systemic steroid or immunosuppressive therapy, as the resulting bronchopleural fistulas may heal poorly.

Complications

Pleuroscopy is a safe and effective treatment modality in the diagnosis and treatment of several pleuropulmonary diseases if standard criteria are fulfilled.^{15,21,22} Most of the series have reported a mortality rate of less than 0.1%.²² The reported complications in various studies were bleeding from a biopsy site, arrhythmias, hypotension, hypoxemia, persistent air leak of over 7 days, subcutaneous emphysema, postoperative fever, empyemas, pulmonary infections and malignant invasion of the scar.^{23, 24, 25} In case of smaller persistent bleeding electrocoagulation may be necessary.

Our Experience

We have been doing pleuroscopy in the department of chest medicine, Jinnah postgraduate and Medical Center since January 2008. We have done 120 pleuroscopies and were able to reach a diagnosis in 116 patients. Our yield of

pleuroscopic biopsy in the diagnosis of exudative pleural effusion is 96.7%. Specific diagnosis through pleuroscopic biopsy have shown 45% cases of tuberculosis 41.7% cases of adenocarcinoma, 8.3% cases of chronic non specific inflammation, 1.7% cases of lymphoma and one case of hemagioendothelioma was also diagnosed. We did not have any major complications.

Conclusion

Various studies have been done in Pakistan to assess the yield of closed percutaneous pleural biopsy in exudative pleural effusion and it was found that in 46 to 50% of patients a definite diagnosis was established^{25, 27} whereas the yield of pleuroscopy was found to be much higher. Medical thoracoscopy is a safe procedure that is easier to learn than flexible bronchoscopy. Based on its high diagnostic and therapeutic efficacy,

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