

Medical thoracoscopy

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Medical thoracoscopy [MT] (pleuroscopy) is a minimally invasive procedure performed by using endoscopic telescope to visualize and evaluate the pleura, pleural space, mediastinum and the lung. Hans Christian Jacobeus (an internist that worked in Stockholm Sweden) is the first one to report the technique in 1910 (on the possibility to use cystoscopy in examination of the serous cavities)¹. However MT is not polarized for the management of malignant and infectious pleural effusion in Europe until 1970s². Surgical thoracoscopy and Visual Assisted Thoracic Surgery (VATS) were developed by surgeon after the excellent success and result of laparoscopic surgery³⁻⁷. MT differ from surgical thoracoscopy and VATS in many ways. MT is performed using the Jacobeus technique under conscious sedation, the ipsilateral lung is passively deflated, via a single or two sites of entry. It is performed by the pulmonary physician in an endoscopy suite or procedure room using non disposable rigid (or semi-rigid) instruments⁷. Surgical thoracoscopy and VATS are performed under general anesthesia with double lumen endotracheal tube with single lung ventilation and need 2-4 sites of entry. They are performed by the surgeon in an operating theatre.

Keywords: pleuroscopy, pleural effusion, chylothorax, talc.

THERE are mainly two indications for MT; diagnostic and therapeutic. By far the most common indication for diagnostic MT is undiagnosed exudative pleural effusions, and for those who are familiar with the procedure MT can be used for biopsies from the lungs, diaphragm, mediastinum and pericardium and for staging of lung cancer or diffuse malignant mesothelioma^{8, 9}. The sensitivity of MT for malignancy is approximately 93%- 95% compared with pleural fluid cytology at 57.6% and close pleural biopsy at 43%¹⁰. The diagnostic yield of MT in pleural tuberculosis is 100% specific and sensitive based on histology and bacteriology compare with 79% with Abram needle biopsy⁹. The markedly improved yield of MT over other modalities is likely owing to the size of specimens and ability to reliably perform a biopsy of abnormal area under direct vision¹¹.

MT can be used for therapeutic purposes. The commonest therapeutic procedure for which MT can be used is pleurodesis with talc

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poudrage for symptomatic recurrent malignant pleural effusion⁷. Recurrent pneumothorax and chylothorax also can be treated in a similar way. In experienced centers empyema is drained and the pleural space lavage through this route¹². Worldwide pleural TB evaluation is one of the commonest indications for MT⁹.

Contraindications:

MT is a minimally invasive procedure and generally well tolerated with minimal sedation. The absolute contraindications include inability to tolerate lateral decubitus position, refractory cardiopulmonary disease, uncorrectable coagulopathy and fused pleural space¹¹. To perform MT the size of the pleural space should be at least 10 cm depth¹³. Respiratory failure is an absolute contraindication except in patients with tension pneumothorax or massive pleural effusion in which thoracoscopy may provide therapeutic benefits¹³. Relative contraindication is multiloculated pleural effusion, persistent cough, hypoxia, hypocoagulability and mild cardiac abnormality¹⁴.

Pre-procedure and preparation

The required investigation before MT includes radiologic evaluation with a postero-anterior and lateral chest radiograph. Ultrasound is helpful for localization of the pleural fluid and for diagnosis of potential adhesions in the pleural space. A CT scan is not mandatory but may be helpful in certain situations such as loculated empyema and localized lesions of chest wall or diaphragm. ECG has to be taken to exclude recent myocardial infarction or significant arrhythmia. Coagulation parameters and complete blood count are essential. Viral screening including hepatitis B, C and HIV are necessary before any surgical intervention. Other laboratory parameters like renal profile, blood glucose, blood group, liver function tests are desirable.

Description of the procedure to the patient including the possible complication and taking an informed consent are mandatory^{11,14}.

Three types of thorascopies are available, rigid, flexible and semiflexible (fig 1a, 1b, 2, 3).



Fig 1a (two ports thoracoscope zero and 30° lenses) others tools needed for thoracoscopy.



Fig 1b (single port thoracoscope, special needle and trocar and needle)

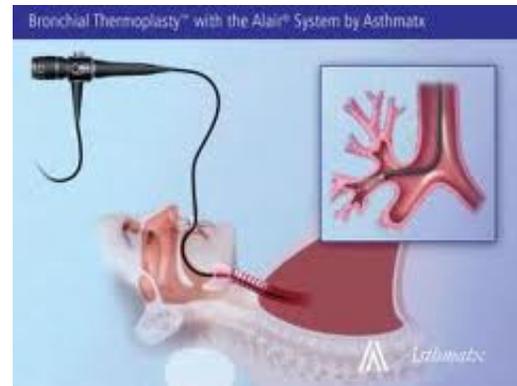


Fig (2) Flexible bronchoscope



Fig (3) semi-flex thoracoscope – the first 22 cm is rigid and the last 5 cm is flexible-

The rigid one is of two types. One type with two ports of entries (one for the telescope and one for the procedure instruments), the other type of the rigid thoracoscope has one port of entry in which the procedure instrument cannal is built within the telescope. Both rigid telescopes have trocars of variable types and sizes (9, 7, 5, 3.75 mm), and optical length with variable field of view, (0, 30, 90 degrees). Other instruments includes biopsy forceps and scissors and accessory instruments like puncture needle, cautery electrode, suction probe and atomizer for pleurodesis¹⁵. Flexible thoracoscope is the same scope used for bronchoscopy. Classical bronchoscope is made flexible to allow entering the bronchial tree easily. It has been used to visualize the pleural space using the same facilities of the bronchoscope i.e. the processor and light source and the screen without additional equipment. The problem with the flexible bronchoscope is the difficulty to direct it up and down in the

pleural space. Recently a semi flexible thoracoscope is introduced with all the feature of the flexible bronchoscope but has a stiff proximal part (22 cm) and a flexible distal part (5 cm) with angulations of 100 and 130 degrees. This characteristic solved the problem of the flexible one. The outer diameter of the shaft of the semi flexible is 7 mm and a working cannal of 2.8 mm allowing the use of the standard instruments used in the flexible bronchoscopy. The advantage of the semi flexible thoracoscope is 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 used for bronchoscopy, so that little additional equipment need to be added to the endoscopy suite. Their disadvantage compared to the rigid thoracoscope is that the biopsy specimen of the semiflexible thoracoscope is small. However the flexible tip allows very homogenous distribution of talc on all pleural surfaces¹⁴.

Other equipment needed include vital signs monitor (pulse, BP, Oxygen saturation and ECG tracing), suction instrument and cardiac resuscitation instruments and drugs.

Personal

One trained chest physician with one assistant. Two nurses one trained in moderate sedation (or anesthesia support), another nurse familiar with the MT instruments to assist the physician.

Technique

Sterile procedure protocol should be followed (include wearing of masks, hats. Shoe covers, sterile gowns and gloves). First position the patient in the lateral decubitus position with abduction and elevation of the ipsilateral arm over the head (fig 4).

Care is taken to avoid nerve injury by placing padding beneath the elbow and between the legs. Placing a role beneath the mid chest will expand the intercostals spaces. Then the patient should be connected to the monitor and oxygen supply.



Fig (4) Patient position for thoracoscopy (left lateral decubitus).

Time monitoring is routinely performed. After checking all equipment, patient identification should be done and then determine the site of entry. For pleural effusion a common selected site is the fifth intercostal space mid or anterior axillary line. This site is considered to be safe and allow manipulation of the instrument especially for biopsy. Then scrubbing of all the involved, skin is cleaned and the patient is draped in sterile fashion.

Patient is sedated with midazolam (1-2 mg), narcotic or both to allow spontaneous breathing. An approximately 2-3 cm long area of skin in the intercostal space just above the margin of the lower rib is anesthetized with 1% lidocaine. Adequate anesthesia is essential for this procedure.

The larger bore needle can be inserted into the thoracic cavity and open up to the air to introduce pneumothorax. Two cm incision is made parallel to the line of the inferior rib. Blunt dissection is performed using Kelly forceps down to the parietal pleura. It is important at this time to avoid injury to the lung and intercostal vessels. Using the finger for dissection will reduce this risk. Through the entry port the trocar and its blunt inner obturator is cautiously advanced into the pleural space in a twisting or screw motion. In the case of large effusion it is very important to place a flexible suction catheter through the trocar to prevent pleural effusion from being forcefully expelled. The thracoscope is placed through the trocar into the thoracic cavity. The cavity is inspected in a structure way (the apex, the diaphragm, the fissures lobes and mediastial structures (fig 5).



Fig (5) Inspection of the pleural cavity

If a second port is required for biopsy or talc then a second small trocar is inserted in the same way under direct visualization.

Biopsy forceps can be passed through both rigid or semi flexible thoracoscope. Parietal pleura specimen is recommended to be taken over the rib to minimize the risk of accidental intercostal vessels injury. Four to five specimens are taken for histology and microbiology tests. Microbiology specimen are to be taken in sterile container moisten with small amount of saline. The pathology specimens are to be kept in formalin.

Talc pleurodesis.

Talc powder can be insufflated into the pleural space to promote inflammatory response leading to symphysis of the parietal pleura and visceral pleura (fig 6 a&b).

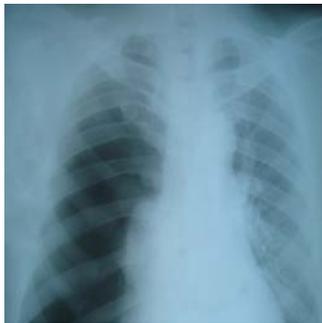


Fig (6 a): CXR (a) showed complete recurrent pneumothorax.



Fig (6 b): CXR (b) 3 months after pleurodesis.

The talc could be insufflated with an atomizer through the treatment port and then by internally rotating the nozzle continuously so that the talc is deposited in the entire surface of both visceral and parietal pleura. Collapse of the lung is desirable to permit uniform distribution of the talc. Complete suction of pleural effusion and after insufflation complete expansion of the lung are essential for successful talc pleurodesis^{16, 17}. Insufflations should be done under direct vision. The goal is to achieve light dusting of powder over all pleural surfaces (see picture). The optimal talc dose is not known but the recommended dose for pleurodesis in malignant and recurrent effusion is five grams¹⁷. Fewer doses are required for pneumothorax (two grams)¹⁸.

On completion of the procedure the scope is removed and a chest tube (24-30 F) is inserted through the second port and directed posteriorly and apically^{12, 14}. The trocar is then removed and the rest of the action is like that for the chest tube.

Post procedure

The chest tube should be connected to suction machine. The suction should be applied and be increased gradually to -20cm H₂O. When there is no more air leak or the drainage is less than 150 ml per 24 hours the tube can be removed. Narcotic analgesia will be required in the first 24 – 48 hours. Patient may be discharge in 2-4 days¹¹. A chest radiograph is performed prior to the outpatient visit to ensure that no fluid accumulates. The microbiology and histology result will be discussed with the patient and the appropriate treatment is planned.

Complications

Pleuroscopy is generally a safe procedure in trained hands. The overall complications are 1- 5%, however most are minor and does not prolong hospital stay¹⁹⁻²⁴. Complications include subcutaneous emphysema (0.6%-5%), infection/empyema (2%-3%), bleeding (0.4% -2%) and re-expansion pulmonary edema¹⁹⁻²⁴. A mortality rate of less than 0.8% has been reported from large center performing thoracoscopy¹⁹⁻²⁴. Other

complications include hypoxia, hypotension, arrhythmia, persistence air leak after 7 days and post-operative fever^{22, 25, 26}.

Potential advantages of MT over conventional techniques include certainty of representative tissue for diagnosis, reduced hospital stays and shorter duration of chest tube drainage compared with thoracotomy.

Training requirements

Physicians performing this procedure should have ample experience, excellent knowledge of pleural and thoracic anatomy, mature judgment in interpreting radiographic images related to pleural disease, and sufficient surgical skill. Trainees should perform at least 20 procedures in a supervised setting to establish basic competency. To maintain competency, dedicated operators should perform at least 10 procedures per year²⁷.

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