Rigid Thoracoscopy

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The first written report on exploration of the pleural cavity using optical instruments was published by Dr. Samuel Gordon referring to a case presentation of an 11-year-old girl with empyema in Dublin, Ireland (1). However, and in spite of this, Jacobaeus still deserves the honor to be considered as the father of thoracoscopy, because he overcame the problems related with collapsing the lung to obtain an appropriate view of the pleural cavity. In order to achieve this, he induced pneumothorax by cutting adhesions by galvanocautery (the Jacobaeus operation), and -in addition-he standardized the use of thoracoscopy for both diagnostic and therapeutic purposes (2).

Medical thoracoscopy (or "pleuroscopy") is mainly used for diagnostic purposes (especially in pleural effusions) and for talc pleurodesis ("poudrage") to prevent recurrence of persistent pleural effusions or pneumothorax, and it is mostly performed by pulmonologists in the endoscopy suite under local anesthesia and with intravenous conscious sedation/analgesia.

Jacobaeus demonstrated that pleuroscopy could be performed simply with an optical instrument (cystoscope) inserted into the pleural cavity through a trocar. With the technical improvement achieved in the instruments and video cameras for endoscopy, the quality of the vision has been greatly enhanced, and the safety of the procedure increased. The standard equipment for thoracoscopy consists of a trocar with an obturator, an optical telescope, a light source and biopsy forceps. There are a few recommendations that should be followed;

Trocar: Obviously, a large trocar would permit insertion of a large telescope too, thus enhancing the quality of the exploration, but -especially when working in local anesthesia- we need a com-

promise between the size of the instruments and the width of the intercostal spaces. I have done most of my thoracoscopies with a 10 mm thoracoscope in local anesthesia plus intravenous analgesia (mepivacaine), but I would agree in that a 7 mm -or even 5 mm- thoracoscope is the best choice for medical thoracoscopy, especially if it has a working channel that allows taking biopsies through a single port of entry. The shape of the tip of the trocar is important, and the conical one is much preferred to the others, in order to prevent damage to the intercostal vessels or nerves during insertion of the trocar in the pleural cavity (3).

Telescopes: There are both rigid and semi-rigid instruments available for thoracoscopy, and each type has some advantages over the others (see Table 1). The rigid thoracoscope provides excellent vision, provides large biopsy samples using a single port of entry (in most of the versions available), facilitates the orientation inside the pleural cavity, and also is of great help when biopsies have to be taken from hard lesions (or located over the ribs). On the other hand, the semi-rigid thoracoscope is a little more familial to pulmonologists who use the flexible bronchoscope every day; in addition, it allows for lateral vision very easily (we would need a telescope with oblique view for that purpose when using the rigid ones), or even retro-visualization of the point of entry. However, it is more expensive and fragile than the rigid thoracoscope, the working channel is smaller, and biopsies can be difficult when we need to push the forceps against the ribs to sample lesions located laterally to the axis of the thoracoscope.

The light source: For the thoracoscope has to be of good quality, and the ones with xenon lamps are strongly recommended. Make sure that the connecting cables between the source and the thoracoscope are correctly attached.

One or two ports of entry for Medical Thoracoscopy?: Though it is clear that several entries are needed for VATS (video-assisted thoracoscopic surgery), and some of the best centers doing medical thoracoscopy do use two ports of entry, I much prefer using one single entry for diagnosis and treatment of pleural effusions (talc poudrage), and have needed two ports in very few occasions. They are necessary when there is no thoracoscope with working channel available, when electrocautery has to be used, whenever a hardly accessible area of the pleural cavity needs to be explored, and when very small telescopes are needed for pediatric patients or other selected cases ("Mini-thoracoscopy"). Tassi and Marchetti used a 3 mm thoracoscope for diagnostic thoracoscopy under local anesthesia (4), and the diagnostic yield was 93 %in their study. Janssen et al compared minithoracoscopy -using a 3 mm set and a 2 mm set- to standard thoracoscopy using the 7 mm set. The diagnostic yield of the 3 mm set was 100%, the same as for the 7 mm set, while the yield of diagnostic biopsies with the 2 mm set was only 40% (5). A second port of entry is always necessary with minithoracoscopy, in contrast to the standard equipment.

Endoscopy room: Whenever available, a well-equipped operating room is excellent for every invasive procedure, including thoracoscopy (both rigid and semi-rigid), but this is not the case in most centers, where operating rooms are very busy with other major procedures or operations. Instead, medical thoracoscopy can be performed safely in the respiratory endoscopy suite, provided that a sterile setting can be prepared, the electrical installation and patient monitorization is adequate, and the mandatory resuscitation equipment is available.

Thoracoscopy procedure: Patients should have an intravenous cannula. Basic monitoring includes ECG and pulse oximetry. Supplementary oxygen should be provided to the patient to maintain oxygen saturation above 90%.

The patient is positioned in lateral decubitus position, with healthy lung in the dependent side.

	Pros	Cons
RIGID THORACOSCOPE	Better vision for pleural exploration and foto/video documentation.	Supplementary optics with lateral view needed.
	Larger biopsies.	Lateral biopsies unfeasible, unless double-entry is used.
	Better biopsies from hard lesions	CAREFUL TRAINING NEEDED!! (Long-learning curve)
	Durability and relatively low cost.	
	Same light source than for bronchoscopy can be used.	
	Availaible in several sizes	
SEMI-RIGID THORACOSCOPE	More familial to pulmonologists (rather similar to flexible bronchoscopy).	Training and perfect knowledge of the the Anatomy needed (as with the rigid instrument).
	One single port of entry is sufficient.	Pain similar to the rigid scope, unless a flexible trocar is used.
	Lateral lesions (or those close to the port of entry) can be explored and sampled more easily.	Biopsies from lateral lesions can be difficult (due to lack of steady support at the working end).
	Flexibility to reach hidden lesions	Vulnerability and high cost.

Keeping the arm ipsilateral to the exploration above the head helps to make the intercostal spaces a little wider, thus allowing for an easier introduction of the trocar. The optimal point of entry depends upon the disease to be investigated: thus, a higher entry is preferred for pneumothorax, in order to explore more easily the upper part of the pleural cavity, where most of the bullae are located; on the other hand, the mid-axillary line of the 5^{th} or 6^{th} intercostal spaces is the best option to explore patients with pleural effusions.

Local anaesthesia: Has to be applied generously and carefully around the chosen point of entry. A common mistake with beginners is the application of large amounts of anaesthetics in the subcutaneous tissue, while the deep tissue and intercostals muscles are neglected. This would provoke acute pain when the trocar (with the thoracoscope inserted) compresses the intercostals nerves during the exploration of the pleural cavity.

Alternative Equipment for Thoracoscopy

From the times of Jacobaeus, several alternative instruments have been used for thoracoscopy, including a flexible bronchoscope (6,7) and, more recently, a dedicated semi-rigid thoracoscope was developed (8,9). Compared with rigid instruments, the control of the working end of the semi-rigid thoracoscope is limited due to its flexibility. The biopsy size is small (2 mm), which may limit the diagnostic yield, especially in difficult cases of mesothelioma and lymphoma. The size of the trocar is the same as for rigid equipment, which means that the discomfort for the patient during the

procedure is not reduced. The use of flexible and semi-rigid equipment has the disadvantage of flexible instruments, including reduced maneuverability, high costs, vulnerability, more problematic sterilization, and small size of the biopsies.

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