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ORIGINAL ARTICLE

MEDICAL THORACOSCOPY: UPDATE, INDICATIONS, METHODOLOGY, AND OUTCOMES

By

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Background: ***Thoracoscopy is the insertion of an endoscope through the chest wall to enable a physician to visualize the inside of the chest cavity. It is the window for the pleural space and intrathoracic structures. The technique was first introduced in 1866 by S Gordon, who observed the thoracic cavity with a binocular instrument in a case of purulent effusion, and refined by Hans Jacobaeus, a Swedish internist who used a cystoscope to evaluate the pleural space. Thoracoscopy continued to be performed by chest physicians throughout continental Europe, primarily for diagnosis and treatment of pleural disorders. It has recently become increasingly popular in the UK and US, and since 1990, more than 300 articles have been published in the English-speaking literature.***

Objectives: ***To review the history, indications, methodology and outcomes of medical thoracoscopy.***

Methods: ***Literature review.***

Results: ***The medical thoracoscopic approach to a variety of diagnostic and therapeutic problems has been shown to be safe and cost effective as compared with more conventional approaches. It is an easy short stay procedure with simple reusable instrumentation. Procedure-related mortality is rare (0.24%, which is comparable to that of bronchoscopic biopsy) in experienced hands. Potential adverse events include bleeding, persistent pneumothorax, intercostal nerve and vessel injury, cardiac arrythmias, complications related to anesthesia, respiratory failure, wound infections, and malignant seeding of the chest wall. Potential advantages of thoracoscopy over more conventional techniques include certainty of representative tissue for diagnosis, reduced requirements for postoperative analgesia, shorter hospital stays, and a shorter duration of chest tube drainage.***

Conclusions: ***Due to its relative simplicity, ease of use, low costs, safety, effectiveness, and high availability, medical thoracoscopy has become increasingly popular among pulmonologists. In many indications thoracoscopy compares favourably with thoracic surgery techniques.***

Keywords: ***Medical Thoracoscopy, Pleural diseases, Diagnostic Therapeutic.***

INTRODUCTION

Medical thoracoscopy was first introduced introduced in 1866 by S Gordon who observed the thoracic cavity with a binocular instrument in a case of purulent effusion. Gordon was followed by Hans Jacobaeus, a Swedish internist in 1910.(1) Between 1915–1955 thoracoscopy was almost exclusively used therapeutically in the

pneumothorax treatment of tuberculosis. In the early 1960s, thoracoscopy was used, mainly by pneumologists in Europe, on a much broader basis for the diagnosis of many pleuropulmonary diseases.[2] Due to technical improvements, thoracoscopy was rediscovered by thoracic surgeons at the beginning of this decade, and renamed "surgical" thoracoscopy, better known as video-assisted thoracic surgery (VATS), requiring general anaesthesia with selective endobronchial intubation, disposable equipment, and at least three points of entry.[3-4]

Medical thoracoscopy is a minimally invasive procedure performed by the pneumologist in an endoscopy suite, is much less invasive requiring only local anaesthesia with conscious sedation and only one or two points of entry. It also allows for basic diagnostic (undiagnosed pleural fluid or pleural thickening) and therapeutic procedures (pleurodesis) to be performed safely and distinct from video-assisted thoracoscopic surgery, an invasive procedure that uses sophisticated access platform and multiple ports for separate viewing and working instruments.[5] In Europe, thoracoscopy is intrinsic in the training programme of pneumology.[6] In the USA, according to a national survey in 1994, only 5% of all pulmonologists were applying medical thoracoscopy.[2]

There exists a grey zone between “purely medical thoracoscopy” (e.g. for inspection and biopsy of the parietal pleura under local anaesthesia in the outpatient setting) and “pure VATS” (e.g. for lobectomy). Experienced pulmonologists perform “medical thoracoscopical” interventions at the sympathetic chain, pericardium, mediastinum using “medical thoracoscopical” equipment and deep sedation or general anaesthesia using single lumen introduction.[3-5]

The main indications of medical thoracoscopy are the diagnosis and treatment of pleural effusions and pneumothorax. In pleural effusions medical thoracoscopy provides the proof or exclusion of malignancy and tuberculosis with an accuracy approaching 100%. As a staging procedure it helps determine the aetiology and extent, and possibly, prognosis of malignant effusions as well as treatment strategies. The insufflation of talc powder during thoracoscopy is the best conservative method of pleurodesis in malignant and recurrent benign effusions, including chylothorax. Medical thoracoscopy has proved also to be successful in the management of empyema and of spontaneous pneumothorax. In the future, it may become even more popular once more respiratory physicians are trained in the procedure.[2]

The aim of this report is:

1. To review the indications, advantages, technique, and outcomes of medical thoracoscopy.
2. Review the different diagnostic options and therapeutic tools of medical thoracoscopy.
3. Provide a framework for future directions in research and guideline management.

Definition: Thoracosocpy is the endoscopic examination of the pleural spaces and its contents. However, the term thoracoscopy is used to describe both surgical and medical thoracoscopy. Weissberg has proposed that pleuroscopy should be accepted term instead of medical throacosopy.[7] Medical thoracoscopy, generally describes the evaluation of the pleural space in a nonintubated patient under conscious sedation. 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.[8]

Indications: Indications for medical thoracoscopy are either diagnostic or therapeutic:

A. Diagnostic indications:

1- Pleural Effusions:

The 2000 American Thoracic Society statement on management of malignant pleural effusions states that indications for performing thoracoscopy include "the evaluation of exudative effusions of unknown cause," among others, and that "in cases of undiagnosed exudative effusions with a high clinical suspicion for malignancy, some clinicians may proceed directly to thoracoscopy if the facilities for medical thoracoscopy are available".[12] The differential diagnosis of pleural disease is often a lengthy process fraught with pitfalls. In pleural malignancies, the diagnostic yield of closed pleural biopsy (CBP) is only 50 to 60% overall, and 20% in malignant mesothelioma (MM).

Contrary to thoracocentesis and percutaneous CPB, thoracoscopy permits biopsy with direct visualization.[9]

Several studies[10,11] suggest that medical thoracoscopy increases the diagnostic yield in patients with benign and malignant pleural disease when thoracocentesis and CPB are nondiagnostic. In a retrospective study of patients having undergone at least one medical thoracoscopy over a 6-year period in a general hospital, Blanc et al, analyzed the diagnostic efficiency of thoracoscopy, together with its complications and limitations, in the management of pleural disease by chest physicians.[9]

In this retrospective study, medical thoracoscopy modified 43 of 96 of the prior CPB-based diagnoses (44.8%). The overall diagnostic efficiency was 93.3%, and the procedure appeared to be relatively safe, despite one thoracoscopy-related death (0.6%).[9]

The diagnostic value of medical thoracoscopy should be considered in two situations, namely when thoracocentesis and CPB have failed to yield a diagnosis, and when these procedures have established a diagnosis of pleural malignancy. The first situation occurs in about 8 to 20% of cases and is known as "chronic pleural effusion" or "pleural effusion of unknown etiology." In Blanc study, 24 of 120 CPB procedures were nondiagnostic, and 66 of 120 CPB procedures diagnosed only nonspecific inflammation. Among these 66 cases of nonspecific inflammation, medical thoracoscopy revealed a malignancy in 29 cases and pleural tuberculosis in 3 cases. It should be noted that all 34 remaining patients were considered to have benign effusion after careful visual examination of the pleura and multiple negative biopsies.[9]

Weissberg and colleagues[13] performed medical thoracoscopy in 45 patients with lung cancer and a pleural effusion, and found pleural invasion in 37, mediastinal disease in 3, and no metastatic disease in 5 (11%) and, therefore, no contraindication to resection.[13] Cantó and coworkers[14] found no thoracoscopic evidence of pleural involvement in 8 of 44 patients; 6 proceeded to resection with no pleural involvement found. Another study by Cantó and associates demonstrated that diagnostic sensitivity of malignancy was associated with the size of the effusion.[15]

Ferrer and colleagues[16] demonstrated that thoracoscopy has 94% sensitivity and 100% specificity in the diagnosis of pleural malignancy. Variables, which in a multivariate model are associated with pleural malignancy, include a symptomatic period > 1 month, absence of fever, blood-tinged pleural fluid, and chest CT scan findings suggestive of malignancy. Receiver operating characteristic analysis showed that the use of these four criteria offered adequate classification in 95% of patients.

Twenty-eight patients had all four criteria, and all had malignancy; 21 patients had at most one criterion, and none had malignancy.[16] In that study 51 of the 54 patients with malignant pleural disease received a diagnosis by thoracoscopy, which represents 94.3% diagnostic sensitivity and 90.9% in the case of malignant mesothelioma (Fig. 1). Specificity for both groups was 100%, with a positive predictive value of 100% and negative predictive value of 93% for malignancy in general, and 97.3% for mesothelioma. No patients with paramalignant pleural effusion presented evidence of pleural malignancy during follow-up.[16]

A further advantage of medical thoracoscopy in metastatic pleural disease is that biopsies of the visceral and diaphragmatic pleura are possible under direct observation. The thorascopic biopsies can provide easier identification of primary tumour, including hormone receptors in breast cancer, and improved morphological classification in lymphomas.[17]

Tuberculous (TB) pleurisy also can present a diagnostic challenge. A high regional incidence for TB often correlates with poor financial resources necessitating a cost-effective diagnostic strategy.

Pleural fluid staining for acid fast bacilli (AFB) and culture of M. tuberculosis has a poor yield and sputum or bronchial sampling via bronchoscopy can diagnose only a minority of cases with additional open lung tuberculosis.[18] In exudative pleural effusions due to tuberculosis, the diagnostic yield of a closed needle biopsy is 60–80% for TB pleurisy.[18,19]

Adenosine deaminase level (ADA) with lymphocyte/neutrophil ratio (L/N) ³0.75 comes close to an ideal test for TB pleurisy because its low cost, non invasive, high accuracy and gives swiftly available results. However, the ideal test should also deliver a reasonable proportion of positive cultures enabling sensitivity testing, which is not the case when pleural fluid only is available for culture. The value of a combined strategy of pleural fluid biochemistry (ADA, L/N) and closed needle biopsy (histology with AFB stain and mycobacterial culture) was clearly the next best diagnostic test to medical thoracoscopy, with a sensitivity and specificity of 93% and 100%, respectively. However, the yield in mycobacterial cultures of 48% was significantly lower than with thoracoscopy (76%, $p<0.01$, paired sign test), which is of importance for regions with high antibiotic resistance.

Loddenkemper reported for pleural tuberculosis a diagnostic yield of 93% (30 of 32 patients) based on histology and/or culture with thoracosocpy alone and 97% (31 of 32 patients) with pleural fluid analysis plus thoracoscopy compared to 84% (27 of 32 patients) with pleural fluid analysis plus closed-needle pleural biopsy.[20] The diagnostic accuracy of thoracoscopy is greater, because the pathologist is provided with multiple, selected biopsies and because the cultural proof of tubercle bacilli growth is more frequently positive. In a prospective intrapatient comparison by Loddenkemper et al,[21] the immediate diagnosis in 100 TB cases was established histologically by thoracoscopy in 94%, compared to needle biopsy (Trucut) with only 38% positive results. This may be of clinical importance, because antituberculous chemotherapy can be started without delay.

The combined yield of histology, and bacteriological culture was for medical thoracoscopy 99% and for needle biopsy 51% and when culture results from effusions were added 61%.[21]

In conclusion for patients with a typical clinical presentation for tuberculous pleurisy, combined pleural fluid adenosine deaminase level and

lymphocyte/neutrophil ratio is an accurate first step. If this test is negative despite a high clinical suspicion of tuberculous pleurisy, if antibiotic resistance is of concern or if other possible diagnoses are considered, medical thoracoscopy is the method of choice.[18] The 'gold standard' for diagnosis of exudative pleural effusion is thoracoscopy because it allows direct vision of the pleural surface, biopsy of areas which look abnormal and effective pleurodesis in one sitting.[22] If thoracoscopy is not available, closed needle biopsy should be performed in combination with pleural fluid analysis for adenosine deaminase and the lymphocyte/neutrophil ratio. This approach provides a high diagnostic yield with affordable, minimally invasive methods that can be performed in outpatient settings.[18]

After thoracoscopy, <10% of effusions remain undiagnosed; whereas with pleural fluid analysis and closed needle biopsy, more than 20% remained undiagnosed. Recently, Venekamp et al[23] studied patients who underwent diagnostic thoracoscopy because of an unexplained exudative pleural effusion, and even after a complete work-up including thoracoscopic biopsies, a significant number of patients with pleural exudates are diagnosed histologically as 'non-specific pleuritis', and no specific diagnosis can be made. The natural evolution of these patients is poorly understood. They studied the natural evolution of patients with non-specific pleuritis diagnosed after thoracoscopy and evaluated whether the histological diagnosis of non-specific pleuritis corresponds with the clinical diagnosis of 'idiopathic pleuritis'. They retrospectively studied the evolution of 75 patients between 1992 and 2002 (49 men and 26 women), mean (+/- SD) age 63.4 (+/- 13.3) years, who underwent diagnostic thoracoscopy in whom the histological diagnosis of non-specific pleuritis was made. Follow-up data were obtained through medical files and/or telephone contacts with general practitioners. Of these 75 patients, 8.3% eventually developed a malignancy during the follow-up period. In the remaining patients (91.7%), the clinical evolution followed a benign course.

Ultimately, a probable cause was established on clinical grounds in 40 patients. True idiopathic pleuritis was finally observed in 25% of patients with the histological diagnosis of non-specific pleuritis. Recurrence of the effusion occurred in 10 out of 60 (16.7%) patients, after a mean period of 26.2 months. The majority of non-specific pleuritis patients (91.7%) followed a benign course, with a spontaneous resolution of the effusion in 81.8% of cases. In the majority of patients, a probable cause of the pleuritis was identified. True 'idiopathic benign pleuritis' hence occurs in only a minority (25%) of patients.[17] In the few cases in which thoracoscopy is not possible (or diagnosis remains elusive even after thoracoscopy), VATS or exploratory thoracotomy may be indicated.[17]

2- Recurrent Pneumothorax:

In recurrent pneumothorax thoracoscopy allows lung inspection and treatment at the same time.

Thoracoscopic findings in patients with spontaneous pneumothorax (Fig. 2) include normal appearance, pleural adhesions, small blebs (< 2 cm) on the visceral pleural surface, and large bullae (> 2 cm).[19] The exact site of air leakage in a patient with primary spontaneous pneumothorax is difficult to determine and locate. In particular, the role of rupture of emphysema-like changes (blebs and bullae) versus that of enhanced porosity of lung parenchyma in the pathophysiology of primary spontaneous pneumothorax remains unclear. Noppen et al;[24] was the first who descriped of a patient with recurrent primary spontaneous pneumothorax in whom inhalation of aerosolized fluorescein followed by autofluorescence thoracoscopy allowed in vivo localization of various lung areas of extensive subpleural fluorescein accumulation suggesting substantial areas of parenchymal abnormality that remain unnoticed by white light thoracoscopic inspection of the parenchymal surface. This technique could prove useful in clinical practice in determining the sites of surgical staple resection whenever this treatment modality is considered.[24]

In a consensus guidelines for management of repneumothorax,[25] the panel stated that: except for patients with persistent air leaks, procedures to prevent the recurrence of a primary spontaneous pneumothorax should be reserved for the second pneumothorax occurrence (85% of panel members). Fifteen percent of panel members, however, would offer patients an intervention to prevent a recurrence after the first pneumothorax. Patients' preferences and interests in continuing activities that would place them at high risk if a pneumothorax reoccurred (eg, scuba diving or flying) should be considered in deciding the timing of the intervention. Thoracoscopy is the preferred intervention for preventing pneumothorax recurrence (very good consensus). The instillation of sclerosing agents through a chest tube is an acceptable approach for pneumothorax prevention in patients who wish to avoid surgery and for patients who present increased surgical risk (eg, bleeding diathesis) (good consensus). Success rates with chemical pleurodesis, however, are only 78 to 91% compared to success rates of 95 to 100% with surgical interventions.[25]

Patients selected for surgical prevention of pneumothorax recurrence should be managed by thoracoscopy (very good consensus). The panel could not agree on the utility of limited (axillary) thoracotomy in recurrence prevention. The panel noted that clinical trials that include patients with primary spontaneous pneumothorax do not demonstrate the superiority of thoracoscopy vs limited thoracotomy in pneumothorax prevention; the panel's

preference for thoracoscopy was based on practice preferences.[25]

3- Lung and Mediastinal Diseases:

Thoracoscopy can be also useful for staging both lung and esophageal cancer because it may complement cervical mediastinoscopy and allows staging of mediastinal lymphadenopathy.[26]

Also, lung inspection and biopsy can be performed with thoracosocopy. Despite encouraging reports in the literature from the 1980 for medical thoracoscopy with lung biopsy (MTLB) in the diagnosis of interstitial lung disease in the nonimmunocompromised patient,[27,28] this technique gained little popularity amongst pulmonologists.[29] In comparison with VATS, there was no significant difference in the specimen volume obtained, complication rate, length of pleural drainage and duration of hospital stay were noted, although the VATS approach proved to be more expensive in one study.[30] In many cases, patients can be discharged from the hospital in < 3 days with little morbidity. In one prospective study, morbidity rates were only 1.5, 2.1, and 9.8%, respectively, in the elderly, patients with poor lung function, and patients with depressed performance status.[31]

4- Other diagnostic indications:

Nakamura et al;[32] used medical thoracoscopy in hepatic hydrothorax and revealed an intrathoracic influx of ascitic fluid via a bleb and two defects located in the tendinous portion of the right hemidiaphragm and confirmed the existence of transdiaphragmatic peritoneal-pleural communication.

Brazinsky and Colt;[32] described a patient with right pleuritic chest pain and an enlarging exudative pleural effusion four months after laparoscopic cholecystectomy. Several radiographic imaging procedures and thoracenteses were nondiagnostic. Thoracoscopy, however, revealed bilious concretions in the parietal pleura. Thoracoscopic drainage, lysis of adhesions, and antibiotic treatment of a Klebsiella pneumoniae pleuritis resulted in relief of symptoms.

Flum et al;[34] studied the role of thoracosopy in acquired immunodeficiency diseases in twenty patients with AIDS and they found that the use of thoracoscopy for the treatment of empyema and intractable pneumothorax is effective, can be performed with little operative morbidity and mortality, and is associated with acceptable long-term survival.[34]

B. Therapeutic indications:

1. Talc Pleurodesis:

Bethune[35] in 1935 first introduced talc in the pleural space to produce pleural adhesions preliminary to lobectomy. Subsequently, Chambers[36] in 1958 suggested that intrapleural talc could be used for the palliative treatment of malignant pleural effusions. Since then, many authors[37-39] have reported their results with this agent and have concluded that it is one of the most effective, simplest, and cheapest methods to produce pleurodesis. Various chemicals have been used in an attempt to produce pleurodesis. Adequate assessment of the efficacy of specific chemical agents has been problematic because reported trials have evaluated small numbers of patients, employed different techniques, used conflicting success criteria, and/or monitored subjects for varying periods of time. Progression of disease is variable, and death has sometimes occurred during the first month after pleurodesis. Not all chemical agents have undergone direct comparison under similar conditions in the same patient population. In some studies, adverse effects have been addressed casually, making comparisons difficult.[17]

Walker-Renard et al,[40] reviewed all published articles in the English language from 1966–1992 describing patients with recurrent, symptomatic malignant pleural effusions who were treated with chemical pleurodesis. A total of 1,168 such patients were analysed for complete success of pleurodesis (defined as nonrecurrence of the effusion, as determined by clinical examination or chest radiograph) and 1,140 patients assessed for drug toxicity. Chemical pleurodesis produced a complete response in 752 (64%) of the 1,168 patients.

The complete success rate with fibrosing agents (nonantineoplastic drugs) was 75% (557 of 770), compared with a complete success rate of only 44% (175 of 398) for antineoplastic agents. Talc (2.5–10 g) was the most effective agent, with a complete success rate of 93% (153 of 165 patients).[40] The efficacy of talc in the control of malignant pleural effusions has been found to be superior to that of bleomycin and tetracycline.[41-43] If the patient undergoing pleurodesis is receiving corticosteroid therapy, the drug should be stopped or the dose reduced if possible because of concerns of decreased efficacy of pleurodesis.[44]

Other indications for talc pleurodesis include recurrent spontaneous pneumothorax,[45,46] chylothorax,[47] and other bengin causes of recurrent pleural effusions.[48] Patients selected for pleurodesis should have significant symptoms that are relieved when pleural fluid is evacuated.

There should be evidence of complete re-expansion of the lung without evidence of bronchial obstruction or fibrotic trapped lung.[17]

Milanez de Campos et al;[49] studied 614 consecutive patients who underwent thoracoscopy with talc poudrage from August 1983 to May 1999. Of these, 457 patients had

malignant pleural effusions, 108 patients had benign pleural effusions, and 49 patients had spontaneous pneumothorax. The overall success rate of the 393 patients with malignant pleural effusions was 93.4%, while the overall success for the 108 patients with benign effusions was 97%, although 7 patients (7%) with benign effusions required a second thoracoscopy. The success rate with pneumothorax was 100%. Major morbidity included empyema in 4%, reexpansion pulmonary edema in 2.2%, and respiratory failure 1.3%.[49]

Kolschmann et al;[38] reported a consecutive series of 102 patients who underwent medical thoracoscopy and TTP for recurrent MPE between 1999 and 2001. For pleurodesis, an average of 8 g of sterile talc powder was used. At the end of the primary observation period of 180 days, 38 of 46 surviving patients (82.6%) had a successful pleurodesis.

Recurrent chylothorax as a complication of lymphoma has had unsatisfactory outcomes. Serial thoracentesis, tube thoracostomy, and pleurodesis via chest tube have been ineffective and compromise the nutritional and immune status of the patient. Medical thoracoscopic talc pleurodesis has been safe and effective in the treatment of some other varieties of recurrent pleural effusions.[47]

Predictors for successful pleurodesis is best correlated with pleural glucose and pH.[17] However, a meta-analysis of >400 patients found a poor predictive value for success of pleurodesis.[50] The patient's general health status and tumour type should be considered in deciding appropriateness for pleurodesis. Because pleural fluid glucose is usually more sensitive to fluctuations in serum than pH, the predictive value of glucose is lower than that of pH. In one prospective study, measurement of the elastance of the pleural space was associated with pleurodesis outcome.[51]

There are many technical differences in thoracoscopic talc pleurodesis but the outcomes usually the same. One method is adopted for pneumothorax by Tschopp et al,[52] where thoracoscopy was carried out in the lateral decubitus position under local anaesthesia with 1% lignocaine. A 7-mm trocar was inserted into the fourth or fifth intercostal space in midaxillary line. A 0° optical telescope was inserted and connected to a video camera and monitor. The visceral pleura were carefully inspected using supplemental air insufflation where necessary. No electrocoagulation, stapling or ligation of any parenchymal lesions was carried out. Sterile asbestos-free talc (2 g) was insufflated particularly to the apex. At the end of the procedure a drain (24–28 French gauge) was inserted through the sixth intercostal space in the midaxillary line and connected to underwater seal suction with a negative pressure of 20 cmH2O for 2 days or until air leakage stopped. When an air leak persisted for >7 days, another procedure was perfomed and the case was considered as an immediate failure. The authors waited 1 week before proposing a second intervention in order to optimise the chances of success in both groups and to avoid overtreating failed cases of conservative treatment.[52]

Kolschmann et al,[38] used medical thoracoscopy by a pulmonary physician in an endoscopy suite assisted by two trained nurses for pleurodesis in MPE. Patients were placed in the lateral decubitus position. The patient's BP, pulse rate, and oxygen saturation were monitored continuously.

Supplemental oxygen was given to the patients to maintain oxygen saturation. Lidocaine 2% was used for local anesthesia, and sedation was achieved by a combination of midazolam and fentanyl.

They used a 6.5-mm thoracoscope (0° and 30°; Karl Storz; Tuttlingen, Germany) with a single 7-mm trocar. After complete aspiration of all of the remaining fluid, a thorough inspection of the pleural surface was made. The adhesions were taken down with the biopsy forceps, if possible.

Biopsy specimens were made for histopathologic examination, if necessary. Under visual control, an average of 8 g of sterile asbestos-free talc (Steritalc; Novatech; France) were distributed onto the pleural surface. After removal of the thoracoscope, a thoracostomy tube (24 Charrière) was inserted.

Suction (–20 cm H2O) was started after 1 h, and the chest tube was left in place until < 100 mL of fluid was drained in 24 h. Chest radiography was performed the same day after the procedure and before discharge.[38]

Despite the safety of talc pleurodesis still some reported side effects has to be mentioned. Fever up to 102.4° F after talc pleurodesis has been reported to occur in 16–69% of patients. Fever characteristically occurs 4–12 h after talc instillation and may last for 72 h. Empyema has been reported with talc slurry in 0–11% of procedures, whereas talc poudrage is associated with an incidence rate of 0–3% of patients. Local site infection is uncommon, and the degree of pain associated with talc has reportedly ranged from nonexistent to severe. Cardiovascular complications such as arrhythmias, cardiac arrest, chest pain, myocardial infarction, or hypotension have been noted; whether these complications result from the procedures or are related to talc per se has not been determined. Acute respiratory distress syndrome (ARDS), acute pneumonitis, and respiratory failure have also been reported to occur after both talc poudrage and slurry.[44]

Milanez de Campos et al,[49] reported empyema in 4%, reexpansion pulmonary edema in 2.2%, and respiratory

failure 1.3% in talc pleurosesis. Kolschmann et al;[38] studied survival curves after 180 days after talc pleurodesis in MPE and showed significant differences, with best survival in mesothelioma and shortest life expectancy in lung cancer (p = 0.005). Adverse effects included empyema in one case and malignant invasion of the scar. No episode of talc-induced ARDS was observed. Mares et al,[47] studied talc pleurodesis in recurrent chylothorax and the complications included medication reactions in two patients (8.3%) and ARDS in one patient (4.1%).

2. Empyema

Pleural empyema (Fig. 5) has a significant morbidity and an overall mortality of 2 to 30%. It is defined as a collection of pus in the pleural space and is usually classified as simple empyema without pleural loculations and complex empyema, ie, multiloculated empyema.[53,54]

Recently, Brutschethe et al[55] studied the safety and outcome of medical thoracoscopy in the treatment of multiloculated empyema. They studied retrospectively a series of 127 patients with thoracic empyema treated with medical thoracoscopy from 1989 to 2003 in three hospitals in Switzerland and Italy. All patients had multiloculated empyema as identified by chest ultrasonography. In the absence of multiloculation, or in case of fibrothorax, simple chest tube drainage or surgical VATS/thoracotomy were performed, respectively. In 47%, a microbiological diagnosis was made. Complications occurred in 9% of patients (subcutaneous emphysema, n = 3; air leak of 3 to 7 days, n=9). No mortality was observed. Forty-nine percent of patients received postinterventional intrapleural fibrinolysis. Medical thoracoscopy was primarily successful in 91% of cases. In four patients, the insertion of an additional chest tube or a second medical thoracoscopy was required. Finally, 94% of patients were cured by nonsurgical means. Six percent of patients required surgical pleurectomy, mostly through thoracotomy.[55]

3. Thoracosocpic Sympathectomy

Partial pulmonary sympathetic denervation by means of bilateral upper dorsal thoracoscopic D2-D3 sympathicolysis (TS) is an accepted treatment in severe essential hyperhidrosis (EH). Thoracic sympathectomy (TS) is defined as the anatomical interruption of thoracic sympathetic chain. The level of interruption (e.g.T2, T3) depends upon the indication for TS and desired therapeutic effects (e.g. treatment of essential hyperhidrosis, treatment of chronic pancreatic pain). Thoracoscopic TS (TTS), which combines superior visualization of the upper thoracic ganglia with minimal postoperative morbidity and dysfunction, is now the technique of choice. Other indications for medical thoracoscopic TS is causalgia and reflex sympathetic dystrophy, Raynaud's phenomenon, Buerger's disease, long QT syndrome refractory to medical treatment, and pancreatic pain.[53] The effects of this intervention on BHR are unknown. Noppen et al;[52] evaluated the effect of partial pulmonary sympathetic denervation by means of TS on BHR. No patient developed asthma symptoms after TS.[52]

Technique:

For each patient, one should analyze the following:

(1) detailed medical history, including smoking habits, exposure to asbestos, and the personal history of cancer; (2) chest radiographs and CTs, in order to assess pleural effusion when existing; and (3) the results of available closed pleural biopsies (CPBs). Also, bleeding and clotting profile should done preoperative.

The medical thoracoscopy (Fig. 3) usually is performed by a pulmonary physician and an assistant in an endoscopy suite with one or two trained nurses and an anathesiologist. Patients are placed in the lateral decubitus position for the most unilateral interventions (Fig. 4). The patient's BP, pulse rate, and oxygen saturation to be monitored continuously. Supplemental oxygen often given to the patients to maintain oxygen saturation.[47] In our hospital, patients can choose between local anaethesia and conscious sedation and general anaethesia, the latter being the technique preferred by the majority. The procedure is performed with single lumen endotracheal intubation with the patient anaesthetised using propofol, alfentanil, and atracurium. Ventilated and oxygenation are given with HFJV delivered to both lungs via a small catheter into the endotracheal tube.[54]

Although we found that there are minor differences in the technique used for medical thoracoscopy in different hospitals due to physicians' training differences we believe that does not change the aim for having a minimally invasive technique for medical thoracosocpy. Here, we will review most of those techniques used for medical thoracoscopy.

An absolute prerequisite for thoracoscopy is the presence of an adequate pleural space. If not present as in thoracosopic sympathectomy, a pneumothorax is induced, immediately or the day before thoracoscopy under fluoroscopic (or radiographic/sonographic) control. If extensive pleuropulmonary adhesions are present, "extended" thoracoscopy without creating a pneumothorax can be carried out, but this requires special skills and should not be undertaken without special training.[56]

One method which essentially used local anaethesia and one opening for the scope and instrument.

This method was described by Kolschmann et al,[47] who used Lidocaine 2% for local anesthesia, and sedation was achieved by a combination of midazolam and fentanyl.

They used a 6.5-mm thoracoscope (0° and 30°; Karl Storz; Tuttlingen, Germany) with a single 7-mm trocar. After complete aspiration of all of the remaining fluid, a thorough inspection of the pleural surface was 20 made. The adhesions were taken down with the biopsy forceps, if possible. Biopsy specimens were made for histopathologic examination, if necessary. Under visual control, an average of 8 g of sterile asbestos-free talc (Steritalc; Novatech; France) were distributed onto the pleural surface for pleurodesis. After removal of the thoracoscope, a thoracostomy tube (24 Charrière) was inserted.

Suction (–20 cm H_2O) was started after 1 h, and the chest tube was left in place until < 100 mL of fluid was drained in 24 h. Chest radiography was performed the same day after the procedure and before discharge.[47]

Another method which is used by Noppen and his interventional group favours two entries, one with a 7 mm trocar for the examination telescope and the other with a 5 mm trocar for accessory instruments including the biopsy forceps and neurolept (or general) anaesthesia with the patient jet ventilated during the procedure However, the experienced thoracoscopist will certainly use a combination of these techniques, depending upon the individual needs and the facilities available.

After skin sterilization, we usually do two incisions about 1 cm parallel to the upper border of the lower rib in the chosen intercostal spaces which is usually the 3rd and 5th intercostal spaces depending on the diagnosis and site of the lesion along the midaxillary line blunt dissection used to enter the pleural space. The lower incision (Fig. 5) is used for the 7 mm trocar (Fig. 6) that will allow the telescope (Fig. 7) to examine the pleural space and the lungs.[57] Visualization of the contents of the pleural cavity is facilitated by a videocamera that is attached to the eyepiece of the rigid telescope (Fig. 8). The size and quality of these cameras has considerably improved in recent years, and the addition of video makes viewing, documentation, and assisting during procedures far easier than in the days of direct visualization. Newer telescopes magnify the subject being visualized (usually about 4x for a 7-mm rigid telescope), and the increased availability of couplers of varying sizes allow greater depth of field and increased field of vision without distortion to enhance visibility. Image size on the video monitor is affected by the aperture of the telescope, coupler size, and camera sensor size. The larger the coupler, the greater the magnification of the image.

Unfortunately, this also decreases the amount of light being transmitted into the already large and relatively dark pleural cavity. Light sources today, however, are able to autoregulate the amount of light being transmitted through fiberoptic light cables, although many operators prefer to manually adjust these light controls.[20] During the procedure, cardiorespiratory functions should be monitored by electrocardiography (ECG), measurement of blood pressure and continuous oximetry.[2]

The upper incision is used for the 5 mm trocar for accessory instruments like the electrocautery or forceps biopsy. Also, we used the upper incision for the sterile asbestos-free talc pleurodesis using two grams (Fig. 9) in pneumothorax and four grams for malignant effusions (Fig. 10). After the procedure the upper incision is closed first and then the lower one after suction of the induced pneumothorax and intercostals tube placed. Negative suction of -5 cm water then applied in the operating room and patient kept on under water seal only in the ward. Others used for pleurodesis of effusions 8–10 mL of sterile, dry asbestos-free talc is insufflated through a rigid or flexible suction catheter with a pneumatic atomizer. Additional pain medication should be given as necessary. In pneumothorax patients 2–3 mL of talc issufficient. Immediate suction through the chest-tube is always applied following the procedure. Chest radiographs were routinely obtained with a portable unit, immediately after the procedure and daily thereafter until chest tube removal.[2,57]

Flexible bronchoscopes have also been used, which in comparison with rigid thoracoscopes have several disadvantages, in particular the less adequate orientation within the pleural cavity and the smaller biopsies.[58] Most authors use flexible instruments only because rigid instruments are not available or appear dangerous: some authors believe that local anaesthesia is not adequate.[59]

Ernst et al;[60] described their 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. The instrument used was a prototype semirigid pleuroscope 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.[60] The most common indications were for pleurodesis of a malignant pleural effusion (53%) or for evaluation of an exudative effusion of unknown etiology (44%). 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. Pleural biopsies were performed in 13 patients, and talc pleurodesis procedures were performed in 25 patients. Mean duration of chest tube drainage was 2.9 ± 1.8 days

postprocedure. There were no complications.[60]

Tassi et al;[61] evaluated minithoracoscopy using 3-mm instrumentation for diagnosis of pleural effusions. The basic components for minithoracoscopy are two 3.8-mm trocars, one 3.3-mm telescope, and one 3.0-mm biopsy forceps. The key instrument is the telescope (Karl Storz Endoskope; Karl Storz; Tuttlingen, Germany), which is 25 mm in length and has viewing angles of 0° and 45°. Indication was later extended to larger nonloculated effusions that could have been examined using conventional thoracoscopy. A total of 30 patients were studied, including 12 patients with nonloculated effusions of undetermined etiology, 17 patients with loculated effusions, and 1 patient with bilateral effusion. In two patients with mesothelioma, lung biopsy samples obtained by minithoracoscopy allowed diagnosis of invasion from the visceral pleura. In the remaining patient, the sample was not interpretable due to coagulation-related artifacts.[61]

Minithorascopy provided high diagnostic yield (93.4%). Visualization using minithoracoscopy instrumentation was equal to that obtained using conventional thoracoscopy instrumentation.

Tolerance and cosmetic results were good. Minithoracoscopy is safe and effective for routine diagnostic applications.[61]

Outcomes and Complications:

Medical thoracoscopy is a safe and easy procedure in trained hands. Procedure-related mortality is rare (0.24%, which is comparable to that of bronchoscopic biopsy) in experienced hands.[58]

Potential adverse events include bleeding, persistent pneumothorax, intercostal nerve and vessel injury, cardiac disturbances, complications related to anesthesia, respiratory failure, wound infections, and malignant seeding of the chest wall.[59]

The most serious complication of pneumothorax induction is air or gas embolism, which occurs very rarely (<0.1%), as long as necessary precautionary measures are observed. Even several litres of fluid can be completely removed during thoracoscopy with little risk of pulmonary oedema, because immediate equilibration of pressures is provided by direct entrance of air through the cannula into the pleural space.[2] Following lung biopsy, a bronchopleural fistula may result. This may require longer than the usual suction periods of 3–5 days, particularly in cases with stiff lungs.[2] Thoracoscopy performed under sedation-assisted local anesthesia is associated with significant hypoventilation. Combined measurement of SpO2 and PcCO2 during thoracoscopy is a novel approach in the monitoring of ventilation, enhancing patient safety, and might allow to guide the administration of sedation in a better way.[60]

An obliterated pleural space is an absolute contra-indication. Relative contra-indications include bleeding disorders, hypoxaemia and an unstable cardiovascular status and persistent uncontrollable cough. Complications such as benign cardiac arrhythmias, low-grade fever, possible hypertension or hypoxaemia can be prevented almost completely by administration of oxygen.[2,61,62] The most serious, but fortunately least frequent, complication is severe haemorrhage due to blood vessel injury during the procedure. However, this, and also pulmonary perforations, can be avoided by using safe points of entry and a cautious biopsy technique. In the case of smaller persistent bleedings, electrocoagulation may become necessary.[2]

Potential advantages of thoracoscopy over more conventional techniques include certainty of representative tissue for diagnosis, reduced requirements for postoperative analgesia, shorter hospital stays, and a shorter duration of chest tube drainage compared with thoracotomy.[63] Also, it was studied to decrease procedure-related costs by employing reusable instruments. Additional studies are necessary to determine ideal settings for thoracoscopic intervention and to evaluate current perceptions regarding thoracoscopic practice.[64]

Conclusions and Recommendations:

It is a safe, easy, and less expensive than VATS, and thoracotomy in many diagnostic and therapeutic indications. The instruments needed are so simple and re-usable. The outcome is safe and results are satisfactory and conclusive. We had very good experience with thoracoscopic sympathecotomy and recently used thoracoscopic pericardiectomy for massive undiagnosed pericardial effusion. The future advances and extension for pulmonary medicine is the use of thoracoscopy in many pulmonary diseases. The future for medical thoracoscopy is promising.

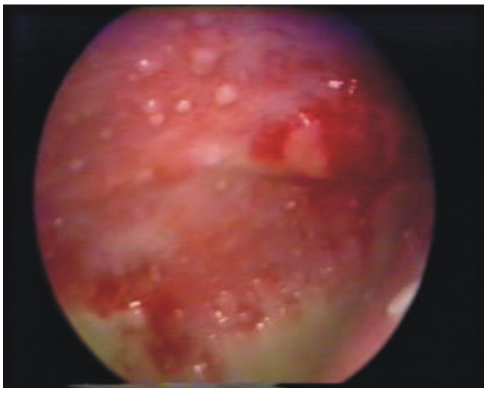

Fig 1. Thoracoscopic view showing diffuse infiltrations and whitish laques of mesothelioma.

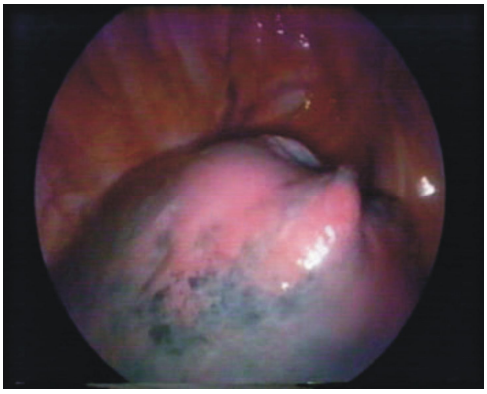

Fig 2. Pneumothorax.

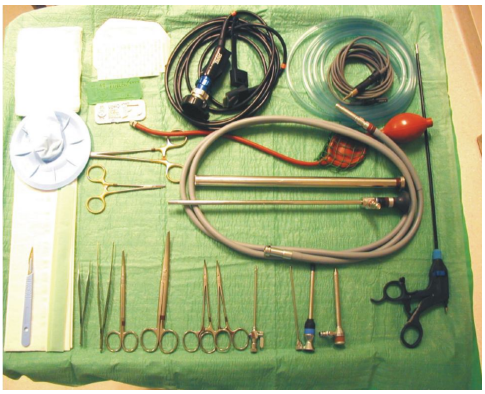

Fig 3. Thoracoscopic Equipment.

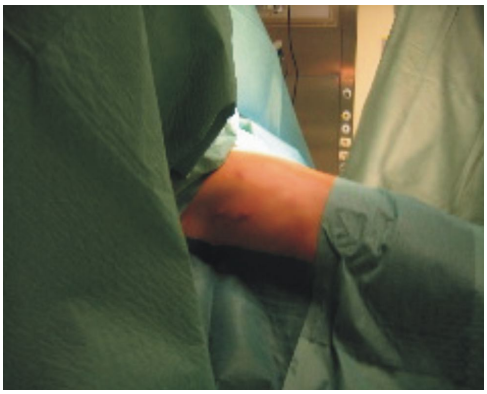

Fig 4. Positioning of the Patient.

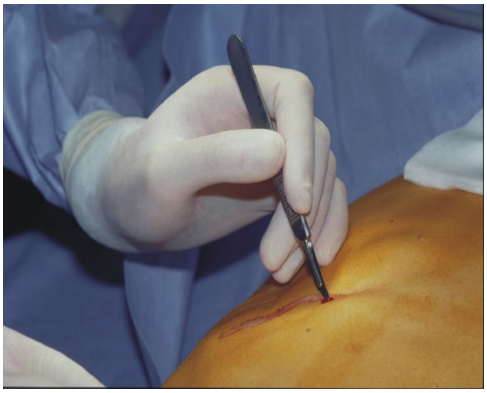

Fig 5. Thoracoscopic Incision.

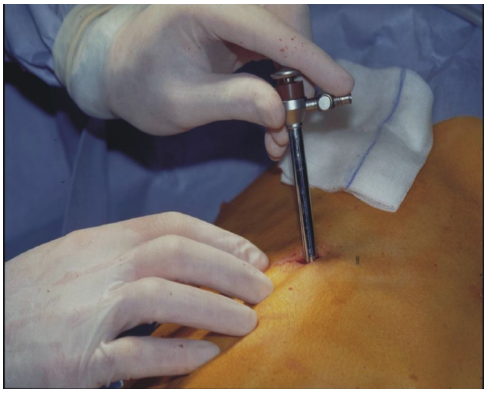

Fig 6. Introduction of 7 mm Trocar.

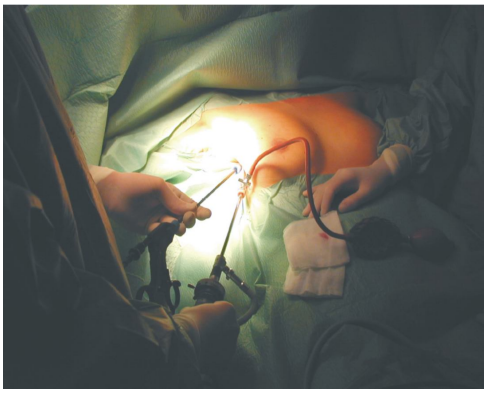

Fig 7. Two Entry Points With Telescope and Forceps.

Fig 8. Monitoring Thoracoscopy Procedure by Videocamera.

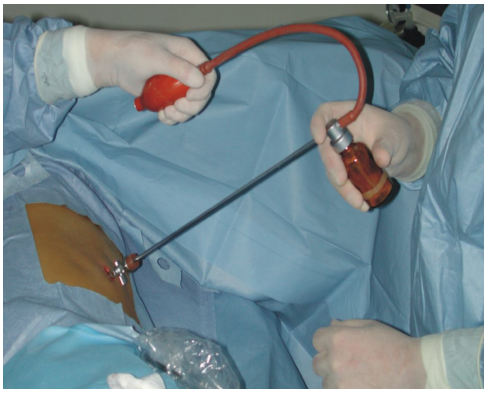

Fig 9. Talc Pleurodesis.

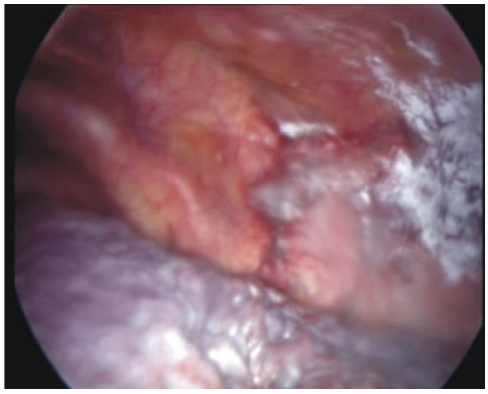

Fig 10. Post Talc Pleurodesis.

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