Calicut Medical Journal

Calicut Medical Journal 2009; 7(1): e4

Review Article:

Medical Thoracoscopy – Minimally invasive diagnostic tool for a trained Pulmonologist

Dhanya T S, Ravindran C

Institute of Chest Diseases Medical College, Calicut

Abstract

Even after extensive diagnostic evaluation of a patient with pleural effusion, the etiology often remains unclear. Pleural fluid studies and blind pleural biopsy have their own limitations. It is in this context that pleuroscopy or thoracoscopy becomes an important investigation so that the pleural surface can be visualized and representative sample can easily be picked. The concept of medical thoracoscopy is a simplification of VATS, as it is done under conscious sedation through a single port by the chest physicians. Here we report our experience with Medical Thoracoscopy at Institute of Chest Diseases, Calicut with review of literature.

Key words: Medical thoracoscopy,…..

Introduction

Recent significant advances in endoscopic technology have provided sophisticated endoscopic instruments and endoscopic telescopes with extremely high optical resolution and small diameters. Thoracoscopy was introduced together with laparoscopy in 1910 by Hans-Christian Jacobeus, who at that time worked as an internist in Stockholm, Sweden. He published his first experiences in a paper entitled *"on the possibility to use cystoscopy in the examination of serous cavities"* [1]

Jacobeus himself initiated the therapeutic application of thoracoscopy for the lysis of pleural adhesions by means of thoracocautery to facilitate pneumothorax treatment of tuberculosis(*Jacobeus operation*) [2] Between 1950 and 1960, a generation of chest physicians already familiar with the therapeutic application of thoracoscopy began to use the technique on a much broader basis in pleuropulmonary biopsy even for localized and diffuse pulmonary diseases. [3]

The excellent results of laparoscopic surgery and the tremendous advances in endoscopic technology stimulated many thoracic surgeons to develop minimally invasive techniques which were termed therapeutic [4,5] or surgical thoracoscopy [6,7] as well as video-assisted thoracoscopic surgery.(VATS).[8-13] To clarify the difference between two methods the term medical thoracoscopy was introduced.[14] This is performed using the Jacobeus technique under conscious sedation ,via a single or two sites of entry, by the pulmonary physician in an endoscopy suite using non disposable rigid instruments . [15]

To further clarify the difference and to avoid confusion in future, it has been suggested that the old term "pleuroscopy", as used in 1923[17] should be favoured over thoracoscopy.

Techniques

Pleuroscopy(Thoracoscopy) is an invasive technique that should be used only when other simpler methods do not provide the diagnosis. Appropriate training is mandatory. The technique is actually very similar to chest tube insertion by means of a trocar, the difference being that ,with pleuroscopy ,the pleural cavity can be visualized and biopsies can be taken from all areas of pleural cavity including the chest wall, diaphragm, mediastinum and lungs.

There are two different techniques of diagnostic and therapeutic pleuroscopy as performed by the pulmonary physician. [15,16]

The first method is very similar to the technique described by Jacobeous for diagnostic purposes. It uses a single entry site usually with a 9mm trocar for a thoracoscope with working channel for accessory instruments and optical biopsy forceps that is employed under local anaesthesia. [18]

In the other technique ,as used by Jacobeus for lysis of adhesions ,two entry sites are used one with a 7mm trocar for the examination telescope and the other with a 5mm trocar for accessory instruments ,including the biopsy forceps. For this technique ,neuroleptic or general anaesthesia is preferred.[19]

Equipment

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.[20-22]A recently developed modification with a semiflexible tip may become an acceptable alternative.[23] 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 (0,30,90degree). 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 . [19] As mentioned earlier, a semirigid pleuroscope was developed recently. [23] 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.

Indications

Pleuroscopy today is primarily a diagnostic procedure, but it can also be applied for therapeutic purposes.(Table)[14,15] **(***table given below references)* .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.[24] Pleuroscopy is also useful for evaluation of spontaneous pneumothorax and empyema. For those familiar with the technique, pleuroscopy is also indicated for diagnostic biopsies from the lungs, diaphragm, mediastinum and pericardium.

Patient preparation

Before pleuroscopy radiologic evaluation should routinely include a posteroanterior and lateral chest radiograph. Ultrasound for localization of the pleural fluid and for diagnosis of potential adhesions in the pleural space is helpful. 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.

Evaluation of the patient's respiratory status requires at a minimum an ABG analysis. An ECG has to be taken to exclude recent myocardial infarction or significant arrhythmia. Other laboratory parameters include coagulation parameters, serum electrolytes, blood glucose, blood group, platelet count, liver function tests, and serum creatinine. Informed consent must be obtained from the patient.

Access to the pleural space

It is generally recommended that the operator introduces a pneumothorax before introducing the trocar. The pneumothorax is generally induced under fluoroscopic control with the patient in lateral decubitus position and the hemithorax to be studied facing upward. [3] A pneumothorax apparatus is not required in the case of a large pleural effusion or a pneumothorax.

Anaesthesia

Pleuroscopy by the single entry technique is done under local anaesthesia with premedication using an anxiolytic , a narcotic or both. If necessary additional pain medication may be given during the procedure as required. An excellent alternative today is sedation by propofol with or without premedication. Monitoring devices such as cardiac monitor, pulse oximeter, and BP cuff automatic monitor are applied. In addition an intravenous line is introduced.

Pleuroscopic technique

The site of introduction of the thoracoscope depends on the location of the presumed abnormalities detected radiographically; the induction site must also avoid potentially hazardous areas such as that of the internal mammary artery,the axillary region with the lateral thoracic artery and the infraclavicular region with the subclavian artery. The trocar is generally introduced in the lateral thoracic region between the mid and anterior axillary line in the fourth to seventh intercostal space : for pleural effusions ,more often in the seventh intercostal space ,and for pneumothorax more often in the fourth intercostal space.

The pleural space can be directly inspected through the thoracoscope or indirectly through a video monitor. Anatomic relationships and intrathoracic structures can be well recognized during thoracoscopy. Biopsies of the pleura and if needed, of the lungs can be taken easily and safely by means of a lung biopsy forceps. In the presence of pleural effusions, biopsies should be taken at least from the anterior chest wall, the diaphragm, and the posterior chest wall for histologic examination and mycobacterial culture. If no macroscopic abnormalities are visible ,several biopsies should be taken from different sites of the parietal pleura. Biopsies from the lungs are not taken routinely to avoid creation of a bronchopleural fistula, but may be necessary when the abnormalities are seen on the lung surface. Fibrinous membranes or adhesions can be severed using a blunt probe forceps or by a cutting cautery.

Although a single site entry is generally sufficient, a second site may be useful to perform biopsies or to perform coagulation. [19] The position of the second entry is determined by viewing through a 50 degree scope, while depressing the possible entry site with an index finger. It is sometimes helpful to introduce a needle through the same site while viewing its precise location through the thoracoscope. A 5mm incision is made and a 5mm trocar is inserted directly.

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. [25, 26]

The optimal dose of talc pouldrage is not known ,but usually a dose of about 5g (8-12 ml) is recommended for malignant or recurrent effusions. [26] whereas for pneumothorax patients 2 gm is usually sufficient.[27] This is done using a pneumatic atomizer introduced through the working channel of the thoracoscope. [19,27] After talc pouldrage a 24-30 F chest tube should be inserted. The chest tube can be removed when the daily amount of fluid production is less than 100 ml or when an air leak associated with the pneumothorax has stopped.

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. [3, 19]

Contraindications

Contraindications to pleuroscopy are uncommon and rarely absolute. The main limitation is the size of the pleural space, which must be atleast 10 cm in depth. [14] 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. [28] Several factors that make it necessary to delay pleuroscopy but are rarely prohibitive include a persistent cough, hypoxemia, hypocoagulability 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 pulmonary biopsy are arteriovenous pulmonary aneurysms, vascular tumours, hydatid cysts and stiff fibrotic lung. [29] 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. [3, 19, 30] Most of the series have reported a mortality rate of less than 0.1%. [31,32] The reported complications in various studies were bleeding from a biopsy site,

arrhythmias, hypotension, hypoxemias, persistent air leak of over 7 days, subcutaneous emphysema, postoperative fever, empyemas, pulmonary infections and malignant invasion of the scar.[33,34,35] In case of smaller persistent bleeding, electrocoagulation may be necessary.

Results

Thoracoscopy was performed on 42 patients over a period of 2years from June 2005 to May, 2007, in the Institute of Chest diseases, Medical College, Calicut. Mean age of the patients was 50.2 years (range 28 to 74) and 12 of them were females. Thoracoscopy was done on 29 patients (69.05%) for diagnostic purposes and on 13 (30.95%) for therapeutic purposes. Diagnostic thoracoscopy for pleural abnormality was carried out only after pleural fluid examinations and in many cases additional closed pleural biopsy also was performed. In the diagnostic group histopathological specimen was taken in all, out of which 15 were proved to be malignant, caseating granuloma was reported in 3 cases, Hydatid disease in one and non specific inflammatory changes in 10 cases. Sensitivity of pleuroscopy is similar for all types of malignant pleural effusions. The overall yield in 287 cases was 67% for cytology and 95% for pleuroscopy, the yields for cytology and pleuroscopy did not vary greatly between lung carcinomas, extrathoracic primaries and diffuse malignant mesotheliomas. [15]. In our series nearly 30% of undiagnosed pleural effusions are found to be due to malignancy after thoracoscopy

In lung cancer patients pleuroscopy can help to determine whether the effusion is malignant or paramalignant . [29] In malignant pleural effusions, success rates of more

Several studies have tried to determine the diagnostic accuracy of thoracoscopy in the setting of undiagnosed pleural effusions, but the results vary widely with a range of about 60 to 90%. [34, 36 , 37, 38] Because of its high diagnostic accuracy, diagnostic pleuroscopy is an excellent option in exudates in which the etiology remains undetermined after pleural fluid analysis. The diagnostic than 90% have been achieved by talc pleurodesis in several series. [26] Although there is a lack of comparative controlled studies, talc pleurodesis seems to be the most efficient pleurodesis method. Diacon and colleagues in a prospective randomized trial compared pleuroscopic talc pouldrage under local anaesthesia to bleomycin instillation. [39] In 36 patients they found less reccurence rates of effusions after talc pouldrage. A cost estimation also favoured talc pouldrage, both for initial hospitalizations and for reccurences. There are no studies comparing talc pleurodesis by pleuroscopic pouldrage with instillation of talc slurry.Potential disadvantages of slurry include a lack of uniform distribution and accumulation in dependent areas of the pleural space. [26]

In tuberculous pleural effusions, the diagnostic accuracy of pleuroscopy is almost 100% because the pathologist is provided with multiple selected biopsies and because cultural proof of tubercle bacilli growth is more frequent. [40] In a prospective intrapatient comparison, an immediate diagnosis of TB infection in 100 cases was established histologically by pleuroscopy in 94%, compared to only 38% with needle biopsy. [40]

Pleuroscopy can be used in the management of early empyema. In multiple loculations it is possible to open these spaces, create a single cavity and this can be drained and irrigated. However prospective studies on the role of

pleuroscopy in the treatment of empyema have not been done.

In spontaneous pneumothorax, pleuroscopy has got a diagnostic and therapeutic role. Underlying blebs, bullae and fistulas can be visualized. Pleuroscopy offers the possibility of combining chest wall drainage with electrocautery of blebs and bullae, as well as pleurodesis by talc pouldrage. Talc pouldrage achieves excellent results with reccurence rates of below 10%. [27] No long term sequelae were observed 22 to 35 years after talc pouldrage except for a minimally reduced total lung capacity .(total lung capacity averaged 89% of predicted value in 46 patients,whereas it was 97% of the predicted value in 29 patients treated with tube thoracostomy alone. [41]

Conclusion

Medical thoracoscopy is a safe procedure that is easier to learn than flexible bronchoscopy. Based on its high diagnostic and therapeutic efficacy, thoracoscopy should be applied increasingly in the management of the aforementioned pleuro-pulmonarydiseases.

Table-I: Indications for Medical Thoracoscopy		
Medical Thoracoscopy	42	100%
Diagnostic	29	69.05%
Therapeutic	13	30.95%

Table-II: Diagnostic Thoracoscopy		
Total	29	100%
Malignancy	15	51.72%
Tuberculosis	3	10.35%
Hydatid Disease	1	3.45%
Non specific Inflammation	10	34.48%

Table-III : Therapeutic Thoracoscopy					
	Total	*Adhesiolysis done*	*Adhesiolysis+ Pleurodesis*	*Success*	Failure
Pneumothorax	*9*	*9*	*3*	*9*	0
Empyema	*4*	*4*	*0*	*2*	2

References

1. Jacobaeus HC:Uber die Moglichkeit, die Zystoskopie bie Untersuchung seroser Hohlungen anzuwenden.Munch Med Wochenschr 57:2090-2092,1910
2. Jacobaeus HC: The cauterization of adhesions in artificial Pneumothorax therapy of tuberculosis.Am Rev Tuberc 6:871,1922.
3. Brandt HJ, Loddenkemper R,Mai J:Atlas of Diagnostic Thoracoscopy :Indications - Technique.Newyork:Thieme,1985
4. Inderbitzi R,Althaus U :Therapeutic thoracoscopy,a new surgical technique (abstract). Thorac Cardiovasc Surg39(suppl):89,1991
5. Miller JI Jr:Therapeutic thoracoscopy:New horizons for an established procedure (editorial).Ann Thorac Surg52:1036-1037,1991
6. Kaiser LR,Daniel TM (eds):Thoracoscopic Surgery.Bosten:Little,Brown,1993
7. Inderbitzi R:Chirurgische Thorakoskopie.Berlin:Springer,1993
8. Miller DL,Allen MS,Deschamps C,et al:Video-assisted thoracic surgical procedure:Management of a Solitary pulmonary nodule.Mayo Clin Proc67:462-464,1992.
9. Landreneau RI,Mack MI,Hazelrigg SR,et al:Video assisted thoracic surgery:Basic technical concepts and intercostal approach strategies.Ann Thorac Surg 54:800-807,1992.
10. Lewis RJ,Caccavale RJ,Sisler GE,et al:One hundred consecutive patients undergoing video-assisted thoracic operations.Ann Thorac Surg 54:421-426,1992.
11. Bensard DD,McIntyre RC,Waring BI,et al:Comparison of videothoracoscopic lung biopsy to open lung biopsy in the diagnosis of interstitial lung disease.Chest103:765-770,1993.
12. McKenna RJ: Lobectomy by video assisted thoracic surgery with mediastinal node sampling for lung cancer.J Thorac Cardiovasc surg 107: 879-887,1994
13. Lo Cicero J:Minimally invasive thoracic surgery and thoracoscopy(editorial).Chest 102:330-331,1992
14. Mathur PN, Boutin C, Loddenkemper R : “Medical thoracoscopy” :Technique and indications in pulmonary medicine.J Bronchol 1:228-239,1994.
15. Loddenkemper R:Thoracoscopy-state of art.Eur Respir J 11:213-221,1998.
16. Buchanan DR, Neville E: Thoracoscopy for physicians :A practical guide.London:Arnold,2004.
17. Piquet A ,Giraud A:La pleuroscopie et la section des adherencesintrapleural au cours du Pneumothorax therapeutique.Presse Med 23,1923.
18. Seijo LM, Sterman DH: Interventional pulmonology. N Engl J Med 344:740-749,2001.
19. Boutin C,Viallat JR,Aelony Y:Practical thoracoscopy.New York:Thieme,1985.
20. Gwin E, Pierce G, Boggan M et al : Pleuroscopy and pleural biopsy with the flexible fibre optic

bronchoscope.Chest 67:527-531,1975

21. Oldenburg FA Jr, Newhouse MT:Thoracoscopy: A safe ,accurate diagnostic procedure using the rigid thoracoscope and local anaesthesia.Chest 75:45-50,1979.
22. Davidson AC,George RJ,Sheldon Cd et al:Thoracoscopy:Assessment of a physician service and comparison of a flexible bronchoscope used as a thoracoscope with a rigid thoracoscope.Thorax43:327-332,1988.
23. Ernst A, Hersch CP, Herth F,et al: A novel instrument for the evaluation of the pleural space:An experience in 34 patients.Chest 122:1530-1534,2002.
24. Loddenkemper R:Medical thoracscopy .*In* Light RW,Lee YCG(eds):Text book of pleural diseases.London:Arnold, 2003, pp 498-512.
25. Rodriguez-panadero F,Antony VB:Pleurodesis:State of the art.Eur Respir J 10:1648-1654,1997.
26. Antony VB, Loddenkemper R, Astoul P et al:Management of malignant pleural effusions(ATS/ERS statement)Am J Respir Crit Care Med 162:1987-2001,2000.
27. Boutin C,Astoul P,Rey F,et al: Thoracoscopy in the diagnosis and treatment of spontaneous Pneumothorax.Clin Chest Med 16:497-503,1995.
28. Janssen JP,Boutin C: Extended thoracoscopy: A biopsy method to be used in case of pleural adhesions.Eur Respir J 5:763-766,1992.
29. Loddenkemper R,Boutin C:Thoracoscopy: Present diagnostic and therapeutic indications.Eur Respir J 6:1544-1545,1993.
30. Colt HG:Thoracoscopy:A prospective study of safety and out come.Chest 108:324-329,1995.
31. Viskum K, Enk B: Complications of thoracoscopy .Poumon Coeur 37:25-28,1981.
32. Boutin C,Viallat JR,Cargnino P,et al :La thoracoscopie en 1980:Revue generale.Poumon Coeur 37:11-19,1981.
33. Boutin C,Viallat JR,Cargnino P,et al:Thoracoscopy.*In* Chretien J,Bignon J,Hirsch A (eds):Lung Biology in Health and Disease .Vol 30:The Pleura in Health and Disease.New York:Marcel Dekker,1985,pp587-622.
34. Menzies R,Charbonneau M:Thoracoscopy for the diagnosis of pleural disease.Ann Intern Med 114:271-276,1991.
35. Viallat JR,Rey F,Astoul P,et al:Thoracoscopic talc pouldrage.Pleurodesis for malignant effusions:A review of 360 cases.Chest 110:1387-1393,1996.
36. Boutin C,Viallat JR,Cargnino C, et al: Thoracoscopy in malignant pleural effusions,Am Rev Respir Dis 124:588-592,1981.
37. Jamssen JP,Ramlal S,Mravumac:The long term follow up of exudative pleural effusion after non diagnostic thoracoscopy.J Bronchol 11:169-174,2004.
38. Ryan CJ,Rodgers RF,Uni UK,et al: The outcome of patients with pleural effusion of indeterminate cause at thoracotomy.Mayo Clin Proc 56:145-149,1981.

39. Diacon AH,Wyser C,Bolliger CT,et al:Prospective randomized comparison of thoracoscopic talc poudrage under local anaesthesia versus bleomycin instillation for pleurodesis in malignant pleural effusions .Am J Respir Crit Care Med 162:1445-1449,2000.
40. Loddenkemper R, Grosser H, Mai J et al :Diagnostik des tuberkulosen Pleuraergusses:Prospektiver Vergleich laborchemischer, bakteriologischer, Zytologischer und histologischer Untersuchungsergebnisse.Prax Klin Pneumol 37:1153-1156,1983
41. Lange P,Mortensen J,Groth S:Lung function 22-25 years after treatment of idiopathic spontaneous Pneumothorax with talc pouldrage or simple drainage.Thorax 43:559-561,1988.

Corresponding author:

Dr. Ravindran C,

Professor & Head

Institute of Chest Diseases

Medical College, Calicut

ravindranc@calicutmedicalcollege.ac.in