

Role of Video Assisted Thoracic Surgery in the Diagnosis of Pleural Effusion –A Prospective Study in a Tertiary Hospital Of West Bengal

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Abstract: Video assisted thoracic surgery (VATS) is a relatively new modality and often helps in reaching the final diagnosis for pleural effusion when other less invasive procedure fails. This study was undertaken to identify the patients suitable for VATS & test its usefulness as a diagnostic modality in pleural effusion of unknown etiology. A prospective study was carried out in the Department of Cardiothoracic and Vascular Surgery, R. G. Kar Medical College and Hospital. The patients suitable for VATS were selected and the surgical procedure was carried out from April 2011 to March 2015. The patients were followed up to detect anesthetic & surgical complications, morbidity and effectiveness of the procedure. Out of the 60 patients studied, 46.7% were males, mostly belonging to 31-40yrs. No major surgical complications occurred postoperatively. Mean duration of parenteral analgesics administration & ICD was found to be 1.5 and 3.5 days respectively. Examination of pleural fluid revealed acid fast bacilli in 13.33% patients and malignant cells in 10%. Final diagnosis could be reached in 86.7% cases through VATS. Tuberculosis and malignancies are common causes and both are treatable. VATS proved to be an extremely useful and safe diagnostic modality for this subset of Indian patients.

Keywords: Pleural effusion, Tuberculosis, VATS

I. Introduction

Pleural effusion is a common presentation of many regional and systemic illnesses particularly in India where incidence of both pulmonary tuberculosis and lung cancer are very high. Many a times the etiology of pleural effusion cannot be established by routine hematological tests, examination of pleural fluid and common imaging modalities like X-ray or CT scan. These cases are usually treated by repeated aspirations, intercostal tube drainage and empirically administered antibiotics or anti tubercular drugs. In today's era of evidence based medicine all efforts must be made for searching the cause of the disease instead of going for empiric treatment strategies. Video assisted thoracic surgery (VATS) is a relatively new modality which is only sparingly used till now. It provides an excellent visualization of the pleural cavity, lungs and other thoracic structures. Moreover, tissues can be obtained for histopathological studies from pleura, lungs, lymph nodes and any abnormal lesion, if found during the procedure. Video-assisted thoracic surgery (VATS) is often considered as the gold standard investigation of an unexplained pleural effusion, with high diagnostic yield.[1] However, its use is still limited. This study was undertaken to test the usefulness of VATS as a diagnostic modality in cases of pleural effusion of unknown etiology with the following specific objectives:

- To identify the patients suitable to undergo VATS.
- To assess the anesthetic and surgical complications in the intra and post-operative period.
- To assess the overall morbidity from the procedure of VATS
- To assess the overall efficacy of the procedure.

II. Materials And Methods

The prospective study was performed at the department of Cardiothoracic and Vascular Surgery, R. G. Kar Medical College and Hospital, catering to patients from various parts of West Bengal. Patients more than 10 years of age and of either sex presenting with pleural effusion of unknown etiology were included in the study unless some contraindication was there – for example bleeding disorder or severe co-morbidities like ischemic heart disease, chronic renal failure etc. The study period was 48 months spanning from April 2011 to March 2015 and 60 patients were finally included in the study.

Patients presenting with pleural effusion were initially examined clinically and subjected to routine hematological tests and chest X-ray. Pleural fluid was aspirated either blindly or under USG guidance and sent for the routine biochemical, microbiological and cytological examinations. CT scan was reserved for selected cases. The patients in whom no definite cause could be determined by these tests were prepared for VATS. Preoperative investigations included routine blood tests, chest x-ray, ECG and pulmonary function test.

The procedure was performed under general anesthesia with selective one-lung ventilation using a double-lumen endobronchial tube. On one occasion the patient had severe restrictive lung disease and single lung ventilation was not tolerated. Following fixation of the endobronchial tube the patients were put in lateral position like the routine thoracotomy position. After antiseptic dressing and draping the first port was made with blunt 10 mm trochar usually at the mid-axillary line on the 5th intercostal space. A zero degree 10 mm telescope was introduced into the pleural space after draining the pleural fluid. A thorough inspection of the various structures like pleura, lungs, mediastinal contents and any abnormal lesion, if present was done. Additional one or two ports were made as per requirement in suitable sites. At the end an intercostal tube drain was placed through one of the ports. In selected cases two drains were also given. Rest of the ports were closed with 1-0 polyglactin sutures. The specimens collected routinely during the procedure were –

a. Pleural fluid for

- Cytopathological tests like cell type, cell count, malignant and other abnormal cells,
- Biochemical tests like estimation of the protein, sugar, chloride
- Microbiological tests like Gram staining, AFB staining, culture and antibiotic sensitivity testing

b. Biopsies were taken routinely from the pleura and lungs.

c. If any obvious abnormal lesion was found like a nodule or a mass or enlarged hilar lymph nodes then biopsy was taken from that lesion as well.

Morbidity from VATS was assessed with variables like pain, duration of chest drain or any other complication prolonging the hospital stay in the post-operative period. Efficacy of the procedure was studied in terms of obtaining adequate and appropriate materials for biopsy or other laboratory tests – so that the etiology of the pleural effusion may be made out. After obtaining the reports finally appropriate treatment was initiated according to the etiology. Data were collected using a pre-designed & pretested proforma. The data were analyzed using Microsoft Excel and proportions and mean were used to represent the results.

III. Results And Analysis

Of the 60 patients who underwent VATS, 28 (46.7%) were males and 32(53.3%) were females. Majority of the patients belonged to the age group of 21 to 60 years. The mean age (SD) was found to be 35.7(12.5) and 38.6 (12.8) in males and females respectively.(Fig:1)

Common complications of VATS are either anesthesia related like anesthetic drug related complications, respiratory insufficiency following ipsilateral lung collapse, pulmonary edema following sudden drainage of pleural fluid etc or surgical like injury to lung, pericardium, the diaphragm, great vessels etc during making the ports and subsequent procedures causing major bleeding, postoperative pain, persistent drainage of pleural fluid through ICD , persistent air leak etc.

In our study one patient had severe restrictive lung disease and single lung ventilation was found to be inadequate as the patient desaturated even with 100% oxygen - the procedure had to be completed with both lung ventilation. One patient, a 27 year old male with massive right sided pleural effusion developed acute pulmonary edema after drainage of the pleural cavity followed by re-expansion of the collapsed lung. There was, however, no major surgical complication.

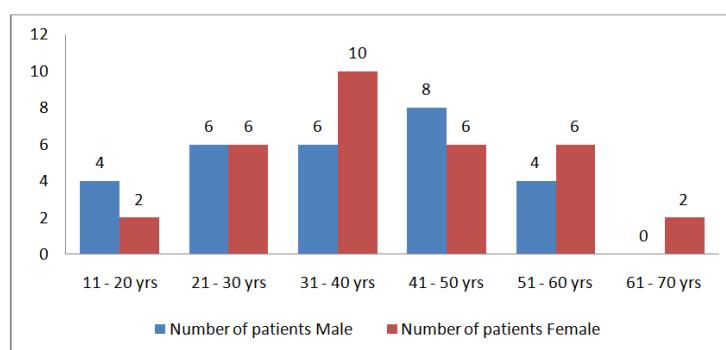


Fig 1: Distribution of patients according to age & sex

On post-operative day 0, all patients were routinely administered parenteral analgesics (Diclofenac or Paracetamol). From the next day patients were put on oral analgesics. 26 patients required parenteral analgesics beyond 1 day (Fig 2).Mean duration of parenteral analgesics administration was found to be 1.5 days. The intercostal drain was removed in majority of the patients (70 %) within 3 days of surgery after checking that the lung had fully expanded and there was no air leak or much drainage. Causes for delayed removal of ICD were air leak and/or persistent drainage of the effusion fluid. Air leak, although minor, usually subsided spontaneously (Fig 3). ICD was continued among the patients for a mean duration of 3.5 days.

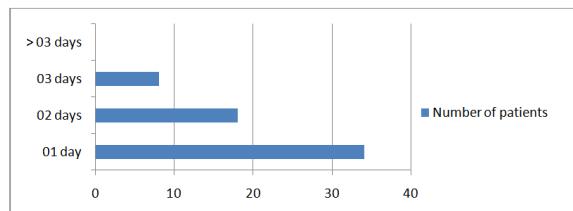


Fig 2: Requirement of parenteral analgesics (in number of days)

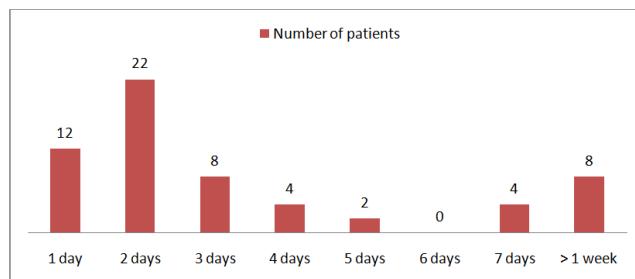


Fig 3: Duration of intercostal drain (in number of days)

During the procedure pleural fluid, pleural tissue and lung tissues were routinely collected for examination. Apart from these, biopsy was taken from mediastinal/ hilar lymph nodes in 8 patients and from pleural based tumor in 4 patients.

Microbiological study of the pleural fluid demonstrated presence of acid fast bacilli in 8 (**13.33%**) patients. Gram stain showed Klebsiella in 4 patients and Pneumococcus in 2 patients – they were regarded as cases of parapneumonic effusion and specific antibiotic was started in them as per the sensitivity report. 4 samples on culture showed growth of mixed flora – probably due to contamination. 42 samples did not yield any growth after 48 hours of incubation. Cytological study of the pleural fluid demonstrated presence of malignant cells in 6 out of 60 (**10%**) samples.

Histopathological study of the pleural tissue showed normal mesothelial cells in nearly half of the patients (28 out of 60 patients). But among the remaining patients the pleural biopsy clinched the diagnosis clearly in 24 cases. In 16 patients there was granulomatous inflammation with presence of tubercles, in 8 patients malignancy was detected (6 of them had mesothelioma and 2 patients had adenocarcinoma of lung) and non specific inflammatory changes were seen in 8 patients with presence of mononuclear cell and lymphocytic infiltration. (Fig:4)

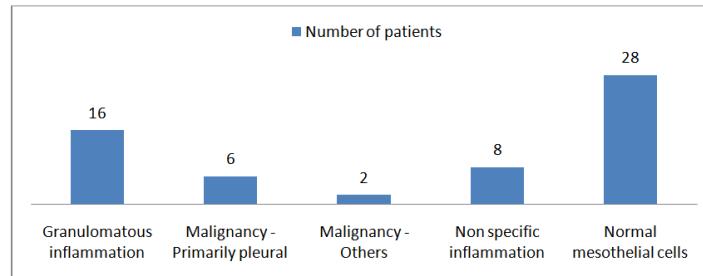


Fig 4: Distribution of patients according to histopathological finding of pleural tissue

Lung tissue was routinely taken for histopathology. In 20 patients features were consistent with tuberculosis. In 6 patients lung cancer was diagnosed – 4 of them had adenocarcinoma while 2 had small cell carcinoma. Normal lung histology was seen in 26 patients. (Fig:5)

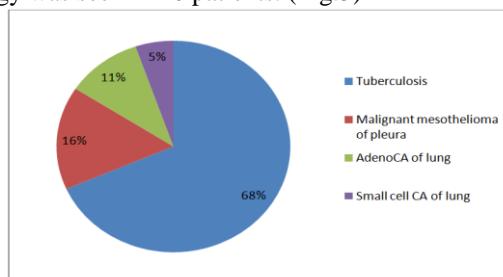


Fig 5: Distribution of patients according to lung tissue histopathology

During the procedure, mediastinal and/ or hilar lymphadenopathy was seen in 8 patients. Biopsy was taken from the lymph nodes and sent for histopathological study. 6 cases were found to have tuberculous lymphadenopathy and 2 patients had deposits of adenocarcinomatous cells. In 4 patients we found presence of pleural based tumor during thoracoscopy, biopsy was taken from them under direct vision. All of them on histopathology confirmed the diagnosis of mesothelioma.

After analyzing the various samples and specimens cause of the pleural effusion could be determined in 52 out of the 60 (86.7%) patients. However, no diagnosis could be made regarding the cause of pleural effusion in 8 patients. The following pie chart summarizes the cause of pleural effusion in the patients studied.

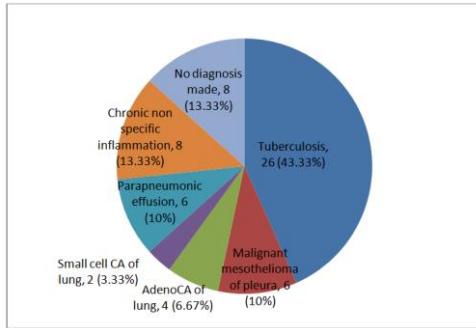


Fig 6:Etiology of pleural effusion as diagnosed by VATS

IV. Discussion

Video assisted thoracic surgery (VATS) was carried out in 60 patients to determine the etiology of pleural effusion. In our study double lumen endotracheal tube was routinely used in all the patients undergoing VATS except for one patient with severe restrictive lung disease. Robert James Cerfolio, Ayesha S. Bryant et al [2] in a study on 376 patients at the University of Alabama at Birmingham concluded that VATS using single lumen endotracheal tube and only one incision is possible, and it affords excellent visualization of the pleural space, allowing pleural biopsies and talc insufflations. It avoids the risks, time, and cost associated with a double lumen ET tube.

Pain after thoracotomy is very severe, probably the most severe pain experienced after any surgical procedure. It is because of multiple factors like long incision involving muscles of different layers, retraction and sometimes resection of ribs and injuries to ribs, costo-vertebral and costochondral joints and intercostal nerves. This pain has several implications, including respiratory failure due to splinting; inability to clear secretions by effective coughing, resulting in atelectasis; and often the development of incapacitating chronic pain: the post-thoracotomy pain syndrome. Management of this pain often requires use of intercostal nerve blocks, paravertebral blocks, epidural analgesia etc. apart from oral and parenteral NSAIDs and narcotics.[3] Ziser A, Messick JM, Schroeder DR et al. at the Mayo Clinic, Rochester MN, USA, found that 98.7% of the patients undergoing VATS required parenteral analgesics (ketorolac or opioids or both) during the stay in PACU and/ or for another 24 hrs[4]. More than 86% patients in our study (52 out of 60) required parenteral analgesics for 48 hrs only following the surgery and no patient required any parenteral analgesic beyond 3 days.

Duration of intercostal drain following any thoracic surgery depends on several factors like the amount of daily drainage, presence of air leak and expansion of the underlying lungs. It is well recognized that adequate pain relief following the surgery is the most important factor as that allows the patient to perform deep breathing exercise, incentive spirometry and coughing out secretions effectively which in turn help in early expansion of lungs and reduction of the daily drainage and air leak. As the postoperative pain is less in VATS than that in conventional thoracotomy, average duration of ICD should also be less in patients undergoing thoracoscopic surgery. In our study the chest drain could be removed by the 3rd postoperative day in 70% patients (42 out of 60). In 8 patients the ICD could not be removed even after 1 week due to persistent drainage of the pleural fluid.

Malignant cells were seen during cytological examination of the pleural fluid in 6 patients in our study. Considering the final diagnosis it may be noted that the diagnostic yield of the pleural fluid cytology is 50% as 12 patients in our study had malignant disease (malignant mesothelioma and carcinoma lung). This result is consistent with the result obtained by K C Ong, V Indumathi et al in their study on malignant pleural effusion [5] where the initial pleural fluid cytology was positive for malignancy in 48.5% of patients. Pleural biopsy demonstrated presence of tuberculous granulomatous inflammation in 16 patients out of 26 cases of tuberculosis (i.e. 61.5%). Pleural biopsy was diagnostic for malignancy in 8 cases out of 6 (66.67%). Lung biopsy was performed in all the patients in our study. On histological study 20 patients were found to have tuberculosis and 6 patients had carcinoma – 4 cases of adenocarcinoma and 2 cases with small cell carcinoma. Though the British Thoracic Society does not clearly include the cases of undiagnosed pleural effusion in the list of the

recommended indications for radiologically guided lung biopsy we find that the histological study of lung tissue can clinch the diagnosis in many such patients[6].

Tuberculosis was found to be the single most important etiologic factor for the undiagnosed cases of pleural effusion (26 out of 60) in our study. The next important group was malignant diseases of which mesothelioma was diagnosed in 6 patients and 6 patients had carcinoma lung. Parapneumonic effusion was diagnosed in 6 patients. In 8 patients chronic non specific inflammatory process was diagnosed as the cause of pleural effusion. But in 8 patients we failed to determine the cause of the pleural effusion. In a similar study performed by Mohammad Behgam Shadmehr, Mehrdad Arab et al. at the Department of Thoracic Surgery, Shaheed Beheshti University of Medical Sciences and Health Services, Tehran-Iran, on the role of VATS in pleural effusion with unknown etiology[7], it was seen that malignant diseases (metastatic adenocarcinoma, malignant mesothelioma, metastatic choriocarcinoma etc.) were responsible in 32 out of 59 cases (44.06%). Tuberculosis was the diagnosis in 5 patients (8.47%) and chronic non specific inflammatory disease was diagnosed in 10 patients. They, in fact, divided the patients into two groups; one group of patients underwent limited thoracotomy while the other group of patients was subjected to VATS. On comparing the results and outcomes of the two groups they concluded that VATS was a safe diagnostic procedure replacing limited thoracotomy.

V. Conclusion

There was no case of death, neither there was any major complication related to the surgical or anesthetic procedure. VATS as a diagnostic procedure carries minimal risks and postoperative morbidity is also less. During the procedure, pleural fluid, pleural tissue and lung tissues may be taken routinely in all the patients and sent for various tests. In 8 patients mediastinal or hilar lymphadenopathy was noticed and they were biopsied. Similarly, pleural based mass lesion was noted in 4 patients and biopsy was taken from them. It is, therefore, an excellent approach by which adequate and appropriate tissues and pleural fluid can be obtained safely under direct vision for histopathologic evaluation and other tests. In our study we could determine the cause of the pleural effusion in 52 out of 60 patients (i.e. 86.67%) in whom standard imaging studies and pleural fluid analyses failed to determine the etiology. Tuberculosis and malignancies are noted to be the most common causes and both of these are treatable. Video assisted thoracic surgery may be an extremely useful and safe diagnostic modality for this subset of patients in Indian context.

Medical thoracoscopy is being increasingly used at many centers nowadays by the chest physicians which is usually done under local anesthesia and sedation[8,9]. The major advantages of diagnostic VATS that we had performed were visualization was much better because of complete lung collapse that can be achieved by the double lumen endobronchial tube and more amount of representative tissues can be taken using appropriate surgical instruments and techniques. In many cases of multiloculated pleural effusion the loculi were broken during the procedure and thereby facilitating the drainage of the entire fluid through the ICD placed. With appropriate antimicrobial agent (antitubercular in majority of cases) and IC drainage most of these patients were fully cured. These patients would have otherwise required formal thoracotomy and decortication which is an extensive procedure. The main drawback was of course the cost – operation theatre charges, cost of anesthetic drugs and double lumen endobronchial tube etc. But that can be justified as the patients of undiagnosed pleural effusion often have to undergo repeated imaging – CT scan, USG etc, repeated aspirations and are administered costly antibiotics for long duration empirically.

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