

Thoracoscopy: Role in Non-Resolving Pleural Effusion

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Introduction: A minimal pleural fluid works as a lubricant in the a potential space between parietal and visceral pleural. The excess PLEF commonly encountered with the thoracic and other systemic diseases is due to imbalance between its formation and re-absorption. The pleural collection could be in the form of clear transudate, exudative and turbid to frank pus, hemorrhagic and rarely chylous to even a urinothorax etc and can easily be diagnosed with routine clinical, pathological and imaging modalities. However around 15% cases remained undiagnosed or have recurrent effusion may require directly visualize the space with preferably a semi-rigid pleuroscope.

Results: The diagnosis of PLEF could not be established in 14.2% cases with routine evaluation and among them in 40 undiagnosed cases pleuroscopy was performed. The mean age was 49 years with male predominance of 70%, low BMI 65% and 50% among all were smoker. Final diagnosis was Tuberculosis (50%), malignancy (40%) and remaining 10% as parapneumonic/inflammatory pathology. Among the malignancy the adenocarcinoma (69%) remained the most common followed by squamous (19%) and small cell (13%). An associated most common co morbidity was COPD (50%) and DM in 10% case.

Discussion: The medical thoracoscopy preferably with semirigid scope under analgesedation enable direct visualization of pleural space and is a gold standard for undiagnosed or recurrent PLEF. In Indian context TB followed by malignancy and infection/inflammation are the main etiological factors. A small and smooth nodular lesions are usually tubercular while the bigger and non smooth prone to be malignant. The adenocarcinoma due to its peripheral location followed by metastatic and mesothelioma are the common pleural tumors.

Conclusion: MT is becoming popular because it is less invasive and can be performed easily under local or moderate sedation with biopsy under direct visualization and simultaneously pleurodesis or ICD placement. There is an urgent need to improve both quantitative and qualitative respiratory specialist/intensivist services with availability of equipment and training at least in all the medical colleges.

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Introduction

Pleural effusion (PLEF) is a pathological condition with the collection of body fluid between the parietal and visceral pleural space within the thorax. A minimal pleural fluid is essential to lubricate this potential space to minimize the friction produced by a continued movement of lungs. The excess PLEF commonly encountered with the thoracic and other systemic diseases is due to imbalance between its formation and re-absorption.¹ The factors leading to fluid accumulation in the space encompass increased pulmonary capillary pressure, diminished plasma oncotic pressure, heightened permeability of the pleural membrane, mediastinal involvement hindering

pleural lymphatic drainage, bronchial obstruction causing elevated negative intrapleural pressure, and a disparity between the production and absorption of pleural fluid. Light's criteria provide the principal approach for differentiating exudates from transudates: (i) Pleural fluid protein to serum protein ratio above 0.5; (ii) pleural fluid lactate dehydrogenase (LDH) to serum LDH ratio surpassing 0.6; and (iii) Pleural fluid LDH exceeding two-thirds of the upper normal limit for serum LDH. Transudates do not satisfy any of these characteristics, while exudates fulfill one or more.² The other variant of accumulated fluid includes pyothorax (turbid to frank pus), chylothorax, hemothorax, and hemorrhagic fluid (or serosanguineous), urinothorax

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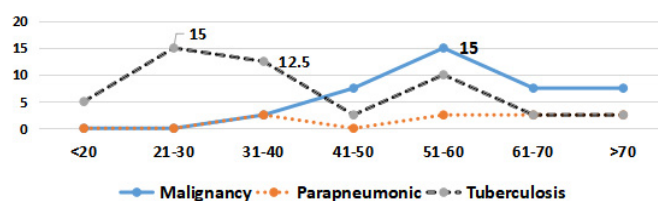


Figure 1: Age & percent-wise diagnosed cases N = 40

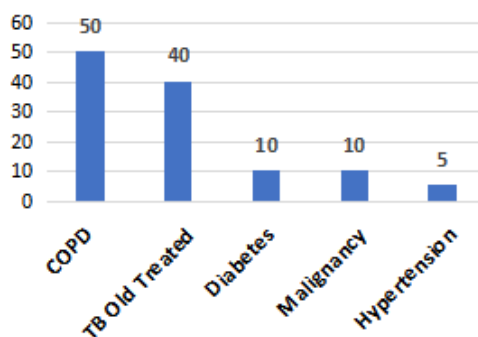


Figure 2: % Comorbidity

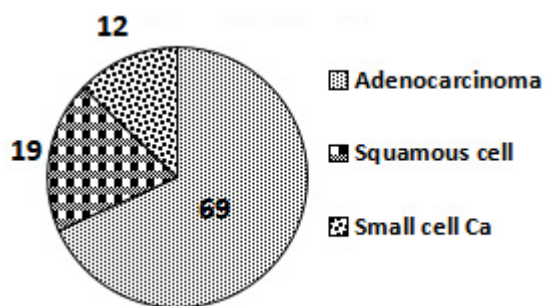


Figure 3: Percentage of malignancy typing N = 16

etc however the underlying infection/inflammation and neoplastic are the main etiologic factors.

In Western nations, 90% of pleural effusion instances are ascribed to five principal diseases: congestive heart failure, pneumonia, malignancy, pulmonary embolism, and viral infections.³ In Indian context tuberculous PLEF is more frequent and affecting around 5% of all TB patients and ranking second to lymph node as extra-pulmonary TB.^{4,5} The diagnosis and management depends up on the type of fluid, cytology, biochemical, gram staining, ADA, CBNAAT, culture with sensitivity and the bio-markers relevant to cancer and connective tissue disorders. The presence of systemic diseases (e.g. cardiogenic edema/CHF, renal or hepatic etc) as causative factor and associated comorbidities are not uncommon to alter management scenario. The recurrent PLEF, non expanded lung, pleural fibrosis, loculations/septations and broncho-pleural fistula are other challenges that may require intervention. Nevertheless 15 to 20% of the

cases still remained undiagnosed, that required direct visualization of pleural space to perform diagnostic or therapeutic pleuroscopy/thoracoscopy. The present study is carried out at a rural based medical college situated near to the pilgrim city of Mahakal, Ujjain, MP, India.

Methodology

This study is prospective and observational among the admitted cases. A meticulously taken history, clinical, radiological examination (Chest X-ray USG thorax and abdomen) and routine PLEF aspirate examination for cytology, biochemical, CBNAAT, ADA were carried out for etiological factor. The medical thoracoscopy (also called pleuroscopy) with semirigid scope was performed for undiagnosed or recurrent cases of PLEF in the bronchoscopy suite under local anaesthesia.

Results

The total 345 pleurocentesis were performed during July 2023 to June 2024 and the diagnosis could not be confirmed in 14.2% (49/345) of cases and among these undiagnosed cases only 40 cases, who full filled the criteria including the final out comes were included for the analysis in the present study. Among them 50% were smoker with 40% never smoked, and the mean age (Figure 1) was 49.4 years. (16–85 range), with a male predominance 2.3 times. Most of the patients were underweight (65%) and only 5% had BMI >25. In all the cases the chest movements were reduced with a dull percussion node on the affected site. The tracheal shift to opposite side was observed except in 12.5% where it had moved towards the same side (usually happens with collapse-consolidation or in chronic cases with underlying fibrosis). The most common symptom were SOB, chest pain and cough in 90, 80 and 75% of cases respectively however 30% were without fever (Figures 2-6). USG examination (Photo A) revealed loculation (in 90%) and septations in 80% of cases which is more common due to high proteinous and fibrinogens content and can best seen on pleuroscopy. Multiple fibrous adhesion (90%), septations/loculation (80%) and nodular lesions (Photo B & C) were present in 12 (30%) along with BP fistula in 4 (10%) cases (Figure 7). The biopsy were taken under direct visualization with semi rigid pleuroscope in 24 (60%) of the total undiagnosed PLEF cases and sent for the histopathological examination which revealed malignancy and granuloma in 48.8 and 33.3%, respectively and rest were inflammatory. No major complication occurred during para or post procedure except few minor complication with nil mortality (Figure 6).

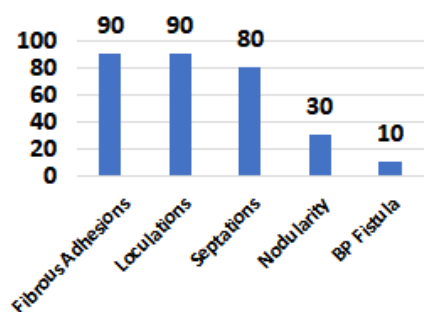


Figure 4: Pleuroscopic findings

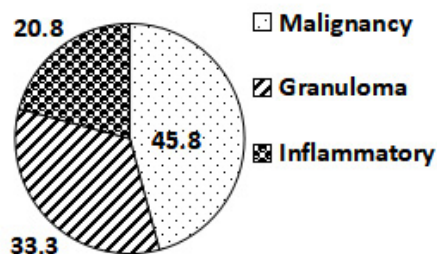


Figure 5: Histopathology of biopsy N=24

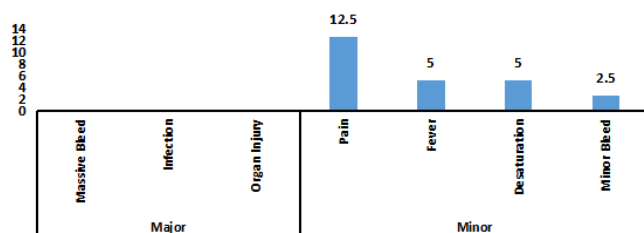


Figure 6: Post-procedure % Complications N=40

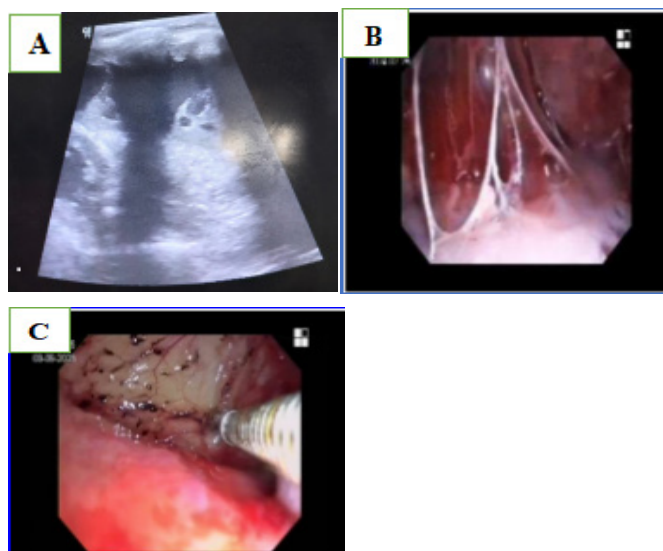


Figure 7: (A) Loculation (in 90%) and septations in 80% of cases; (B & C) Multiple fibrous adhesion (90%), septations/ loculation (80%) and nodular were present in 12 (30%) along with BP fistula in 4 (10%) cases

Discussion

The TB, Malignancy and inflammatory/infective are the most common etiological causes of the PLEF. At the primary or secondary health services these diseases can usually and easily be diagnosed by thoracentesis followed by routinely available biochemical, cytological, Gene Xpert, ADA and imaging modalities including CXR, USG etc.⁶ Unfortunately a significant number of cases remained undiagnosed. Nevertheless an additional use of closed pleural biopsy (Abrams needle or CT guided) and fiber-optic bronchoscopy, about 15 to 20% cases still remained undiagnosed or had recurrent collection. These cases required the biopsy under direct vision with the help of minimally invasive flexible pleuroscope. In Indian context the diagnosis of TB is more during the age 25 to 45 years and malignancy more common beyond this age (>45) with male sex predominance is unanimously agreed by most the authors including us as an etiology of PLEF (Figure 1). Our study observed a mean age of 49.4 years with a male predominance of 2.3 times and finally diagnosed as TB (50%), malignancy in 40% and parapneumonic infection in 10% of cases. Sanwalka N. *et al.*⁷ reported TB 53%, CA 15%, pulmonary infection 22% and similarly Parikh *et al.*⁶ TB 62%, carcinoma 18%, and pulmonary infection 15%. In the western countries with low prevalence TB an over all ratio/percentage of malignancy is likely to increase. However Hemant kumar *et al.*⁸ from North Indian Medical college, KS SC *et al.*⁹ from Mangaluru, Karnataka, India and Periwal P *et al.*¹⁰ from Metro Hospital, Noida, Delhi India reported a higher proportion of malignancy detection than TB, e.g., 75, 61 and 55% respectively as an underlying cause of PLEF in undiagnosed patient, that could be due to the particular referral or patient flow within the institute. A higher proportion of adenocarcinoma was reported^{7,9,11} among the cancer patients including our study also observed adeno 69%, squamous 19% and small cell in 12% out of the 16 malignant cases. The comparative peripheral location of adenocarcinoma (e.g. nearer to pleura) could be the cause of PLEF. KC SC *et al.*⁹ and Chilamakuru Raghavendra *et al.*¹¹ reported mesothelioma in 18% and 12% cases among the malignancy, and metastatic cancer (in 86%) and mesothelioma were also reported by a Rui-Lin Chen *et al.*¹² while none of these malignancies were observed in our study.

An over all success rate of Medical thoracoscopy (MT) for UPE were encouraging 90 to 95%.^{1,7,12,14} Hemant Kumar *et al.*,⁸ reported minimal number of cases with minor complications in 11.8 and 12.5% was observed in our study without any mortality (Figure 6). The

present study observed inter-pleural loculations and fibrous adhesions (90%) septations (80%), and nodularity (30%) as usual finding among the long standing UPE or recurrent PLEF and these were easily removed/broken or biopsied during the process of MT. Naik G P *et al.*,¹³ stated that adhesion are common with TB and nodularity in malignancy, similarly Perwal P *et al.*¹⁰ had mentioned that a smaller and smooth nodules are tubercular while irregular and bigger one are usually of malignant origin.

Hemant kumar *et al.*⁸ studied 160 cases of UPE and mentioned that the diagnostic yield of CBNAAT and culture is very low for the detection of mycobacterium and histo-pathological results with closed pleural biopsy also remained unsatisfactory. They further mentioned that a few cases with ADA value more than 40 were finally came out as malignancy. Similarly Ali M S *et al* had insisted that in non specific pleuritis with a follow up after 1-year may eventually diagnose malignancies in 10-15% of cases.¹⁴ A longstanding undiagnosed or non responding to therapy cases should be reevaluated after performing a supportive PET-CT followed by a through examination of a fresh fluid sample and repeat medical thoracoscopy/brochoscopy or EBUS to improve histopathological yield.

Rakesh *et al.* had performed medical thoracoscopy with flexi-rigid/semi-rigid thoracoscope safely under conscious sedation with a combination of midazolam and fentanyl.¹⁵ They have conducted an "Indian Thoracoscopy survey" under the aegis of Indian Chest Society and mentioned that MT is gaining popularity among respiratory specialist especially for undiagnosed and recurrent PLEF. Allocca V *et al.* conducted a retrospective control trial of video assisted thoracoscopic surgery (VATS) performed by thoracic surgeon under GA with endotracheal intubation and compare with the medical thoracoscopy (MT) performed under analgesedation by respiratory specialist and found all most similarity in diagnostic yield and complication rate.¹⁶

Ethical Approval

Ethical approval was taken from the institutional ethical review board IEC-RDGM (IEC Ref no. PG/OTO-RHINO-LARYNGOLOGY/56).

Conclusion

Medical thoracoscopy with semirigid scope under local anaesthesia with mild sedation is a potent diagnostic tool which is minimally invasive and a safe procedure for undiagnosed or recurrent PLEF. A repeat thorough examination for the left out cases of UPE should be reinvestigated in due course of time with PET-CT, EBUS

and fiberoptic bronchoscopy with MT or VATS. There is an urgent need to enhance intensivist training opportunities and at least all the upcoming medical colleges should be equipped accordingly and organized with the facility of MT in the department of respiratory medicine, looking to the large number of cases of nonresolving pleural effusion presenting to our hospital.

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