Original Article

Video-assisted Thoracoscopic Surgery in Multiloculated Pleural Effusion — The Earlier, The Better

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Abstract :

Background :

Video-assisted thoracoscopic surgery (VATS) is a minimally invasive surgery performed for the treatment as well as the diagnosis of different chest problems, including pleural effusion. Early diagnosis and management using VATS in stage II and early stage III pleural effusions improves the outcome, with delay being the most common factor for conversion to open.

Materials and Methods :

This is a descriptive case series in which 34 patients under went video-assisted thoracoscopy for multiloculated pleural effusion, not responding to conservative management, strictly adhering to the inclusion and exclusion criteria at a tertiary care hospital in Kolkata, West Bengal, India.

Results :

64.7% patients had Stage II pleural effusion while 35.3% patients had Stage III pleural effusion. Patients in Stage II had a shorter surgery time, shorter hospital stay, a shorter ICU stay and ICD duration as compared to those who were operated in Stage III.

Conclusion :

Performing VATS in the early stages of pleural effusion is beneficial and can be done satisfactorily inoculated effusions with good results.

Keywords :

VATS = Video-assisted thoracoscopic surgery, ICD = Inter-costal chest drain, USG = Ultrasonography, CBNAAT = Cartridge based nucleic acid amplification test,

Introduction :

Video-assisted thoracoscopic surgery (VATS) is a minimally invasive surgery performed for the treatment as well as the diagnosis of different chest problems, including pleural effusion. Pleural effusion is a common problem and is divided into either transudate or exudative types, depending on the laboratory characteristics of the fluid. The underlying pathology for exudative effusion is a local process that causes increased capillary permeability, which results in the exudation of fluid, protein, cells, and other serum constituents. There are numerous causes, the most common being tuberculosis (in India), cancer, and viral infection, which cause increased morbidity and prolonged hospitalization[1,2,3]. Pleural effusion can be divided into three phases: stage I is the exudative phase, stage II is the fibrino-purulent phase, and stage III is the organizing stage[4].

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Stage I (Exudative Stage) : thin serous fluid with minimal debris, pH>7.2, LDH1000IU/L, glucose> 60 mg/dl, negative culture, and no loculations[4,5].

Stage II (Fibrino-purulent Stage) : thick fluid and thick fibrin strands; pH7.2; LDH>1000IU/L; glucose 60 mg/dl; positive culture or presence of suppuration; and increased loculations[4,5].

Stage III (Organising Stage) : thick fibrous peel and scarformation[4,5].

Multiloculated pleural effusion in both stages II and III needs antibiotic treatment along with drainage of fluid by ICD placement[1]. This ICD placement is not effective in later stages because fibrin deposition and loculi of fluid restrict lung expansion[1,4,6]. Surgery is needed after the failure of primary treatment. Early diagnosis and treatment are necessary for the patient[7,8]. Previously, all those patients who required surgery were subjected to an open thoracotomy. Gradually, with the advancements in minimal access surgeries, video-assisted thoracoscopic surgery (VATS) facilitates the management, with less post operative discomfort and reduced hospitalization, as compared to those who undergo open thoracotomy as a primary surgical procedure[1,3,4,5,6]. Although VATS is useful in both stage II and stage III effusions, it is technically difficult in stage III, especially if there are thick or calcified septa and dense adhesions.

In this retrospective study, we shall discuss our experience with VATS for effective management of stage II and early stage III pleural effusions.

Case Presentations :

Patients presented with pleuritic chest pain, chest discomfort, dyspnoea, persistent fever, and pleural effusion.

Materials & Methods :

Study Design : This is a descriptive individual case series – a prospective, longitudinal, interventional study.

Study Population : Patients admitted in Ramakrishna Mission Seva Pratishthan Hospital with multiloculated pleural effusion.

Study period : August 2019 to July 2024 (5 years).

Sample Size : 34 cases.

Investigations : To determine the general condition of the patient and to confirm the underlying cause of such condition. USG-guided pleural fluid aspiration was done for bacterial culture or CBNAAT. All patients had preoperative CT scans of the chest for diagnosis, and USG, if necessary, to determine the thickness of the septa.

Inclusion Criteria :

Patients admitted with loculated pleural effusion (etiology being bacterial or tubercular), were planned for surgical intervention (VATS) only when all the alternative treatments were exhausted.

Exclusion Criteria :

1) Patients with decompensated cardiac disease
2) Patients not fit for VATS
3) Patients not willing to participate in the study

Procedure Methodology :

A thorough history taking, clinical examination was done. Informed consent for VATS was taken.

Video-assisted Thoracoscopic Surgery Procedure :

The patients were operated on under general anaesthesia, using a double-lumen endotracheal

tube for selective ventilation. A standard laparoscopic setup is used for the surgery. The position of the patient and surgeon depends upon the site of collections on radiological images. The patient is mostly placed laterally with the affected site upwards. The surgeon and assistant holding the telescope stand facing the patient's anterior chest while the monitor setup is kept behind the patient. The first port (10 mm) is made at the site of collection. If the whole of the pleural place is involved, then the 5th intercostals space near the nipple is used. The nipple in VATS is considered as the landmark of entry point like the umbilicus is in laparoscopy.

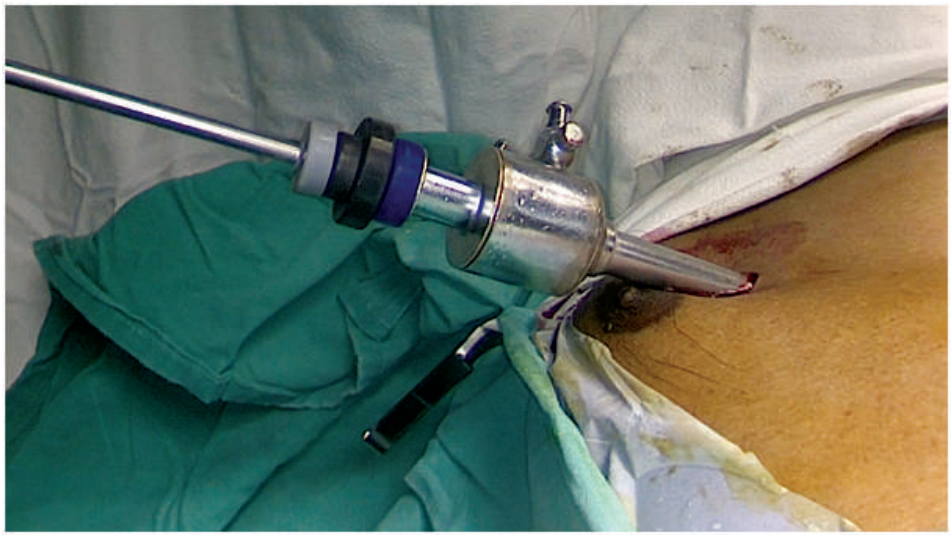

Fig 1: First 10 mm port done just lateral to the nipple in the 5th intercostal space

Fig 2: Aspiration of pleural fluid – sent for diagnostic confirmation.

A second port is done under vision depending upon the location of the effusion. Additional ports are created as needed. We use both 10 mm and 5mm suckers, soft graspers to remove tissues, and ultrasonic devices or electro-cautery whenever needed, especially in stage III.

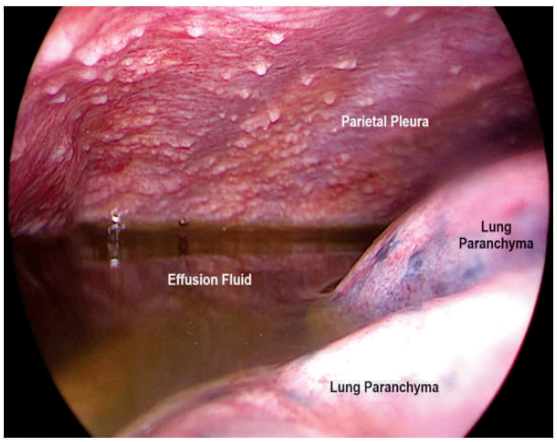

Fig 3 : View of Pleural cavity

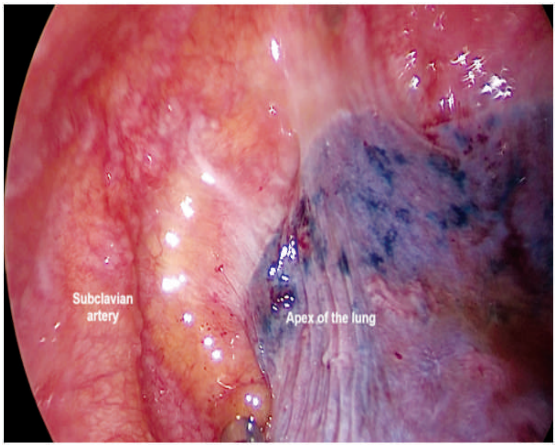

Fig 4: View of upper pleura

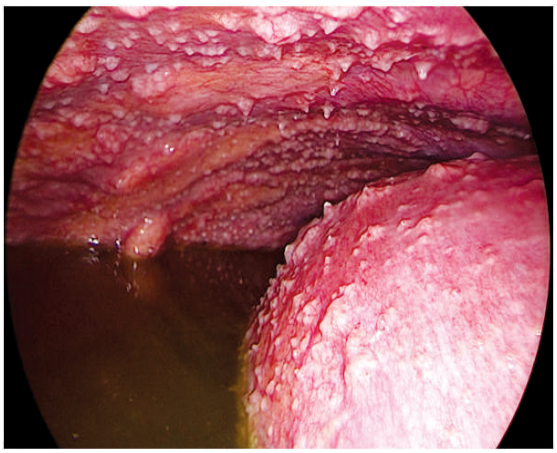

Fig 5 : Small whitish tubercles in parietal pleura as well as pericardium in Tubercular effusion

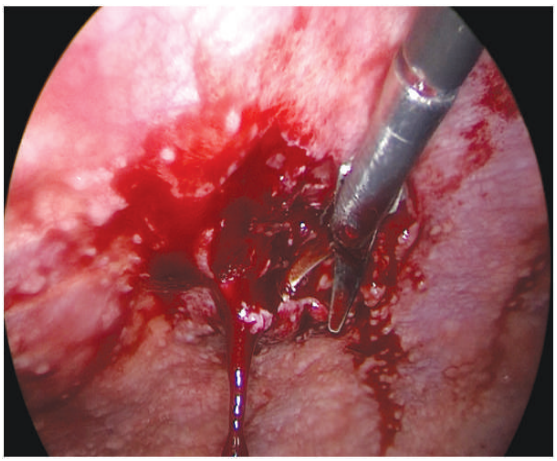

Fig 6 : Procedure of taking Pleural biopsy for diagnosis

Drainage of the pus with breakage of the adhesions means there is no need for visceral or parietal decortication, which allows full lung expansion and obliteration of the empyema cavity.

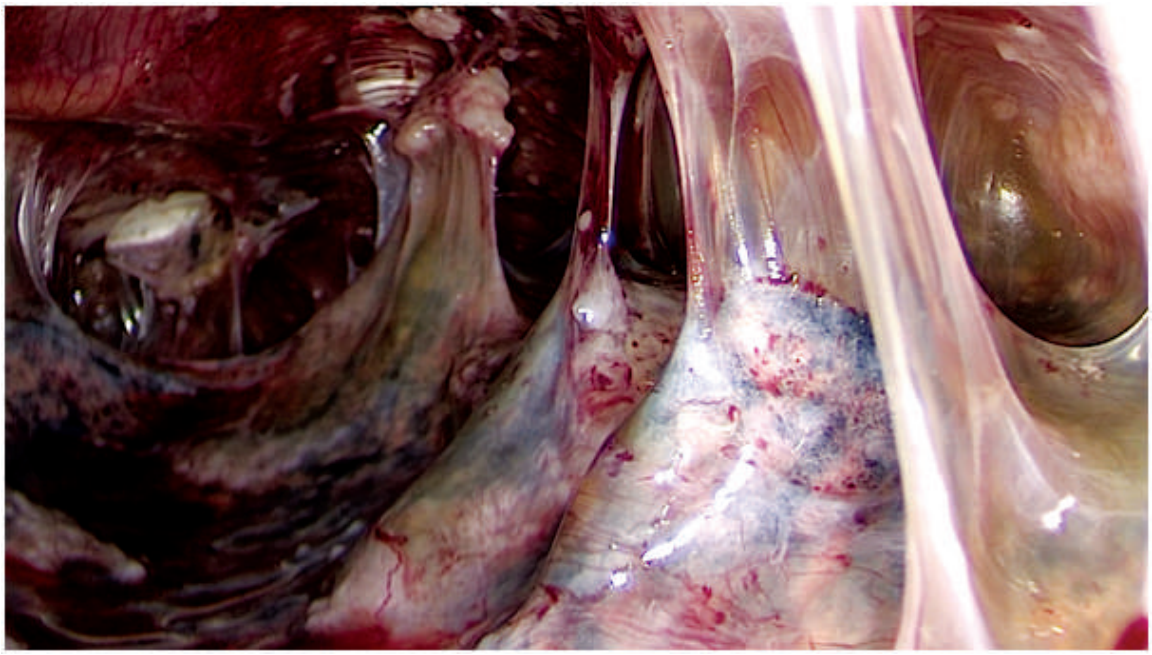

Fig 7 : Stage II loculated pleural effusion – loculations can be seen

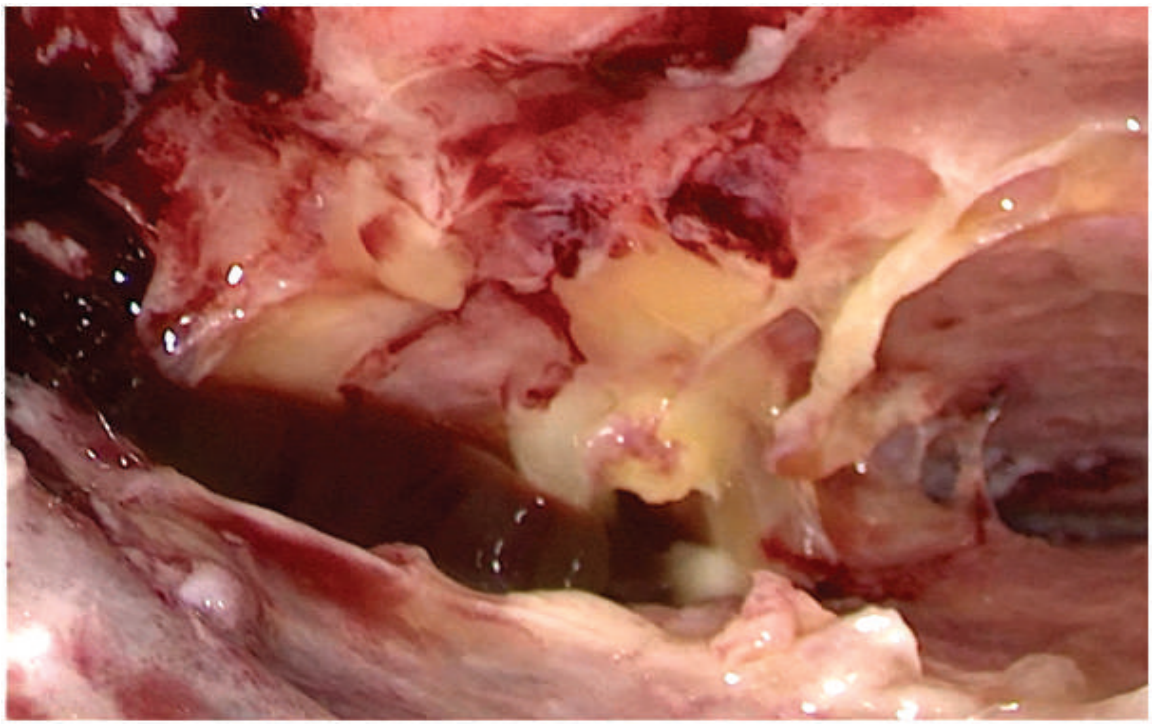

Fig 8 : Stage III loculated pleural effusion – inspissated pus loculations

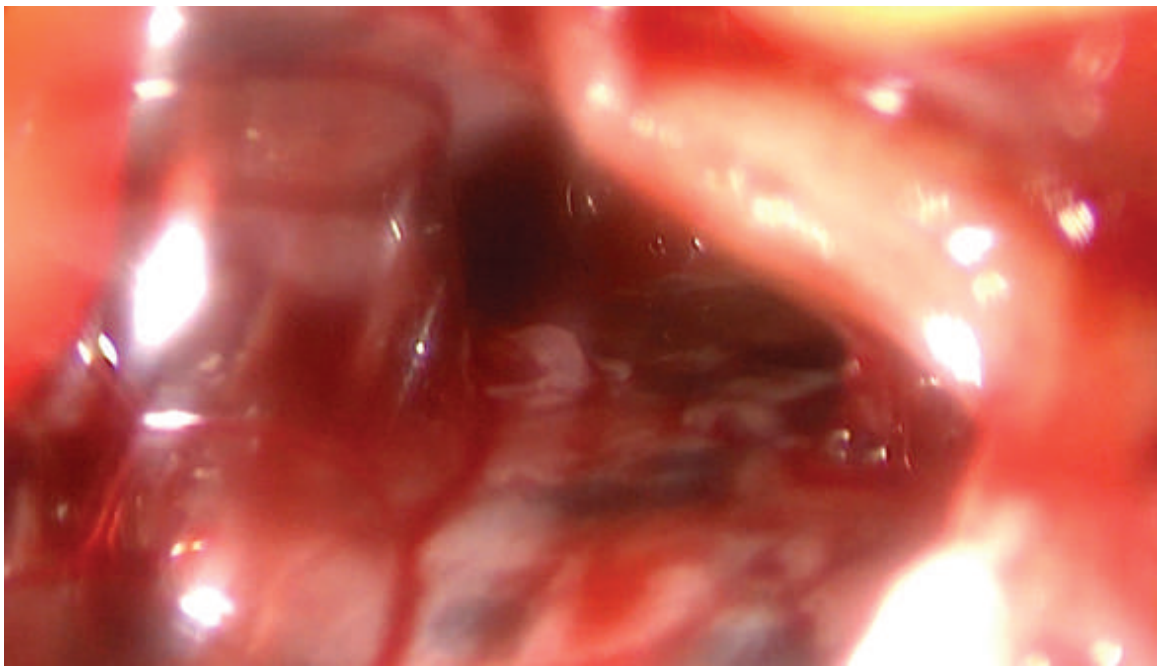

Fig 9 : Stage III loculated pleural effusion – dirty fibrotic loculations

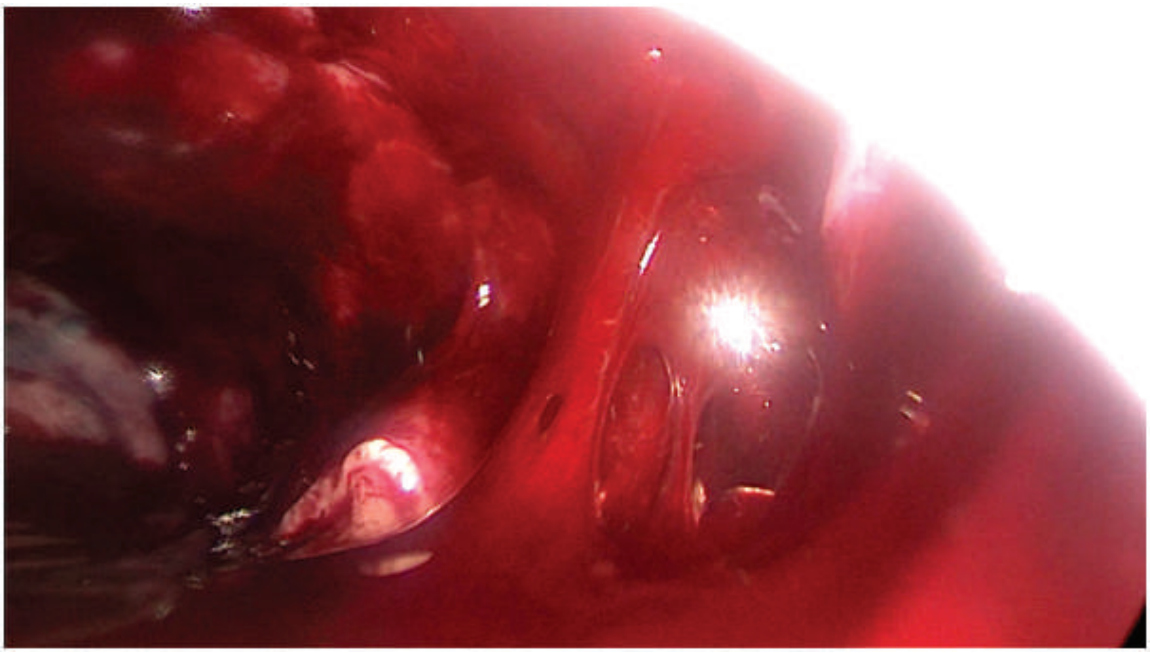

Fig 10 : Stage III loculated pleural effusion – fibrin clotted loculations

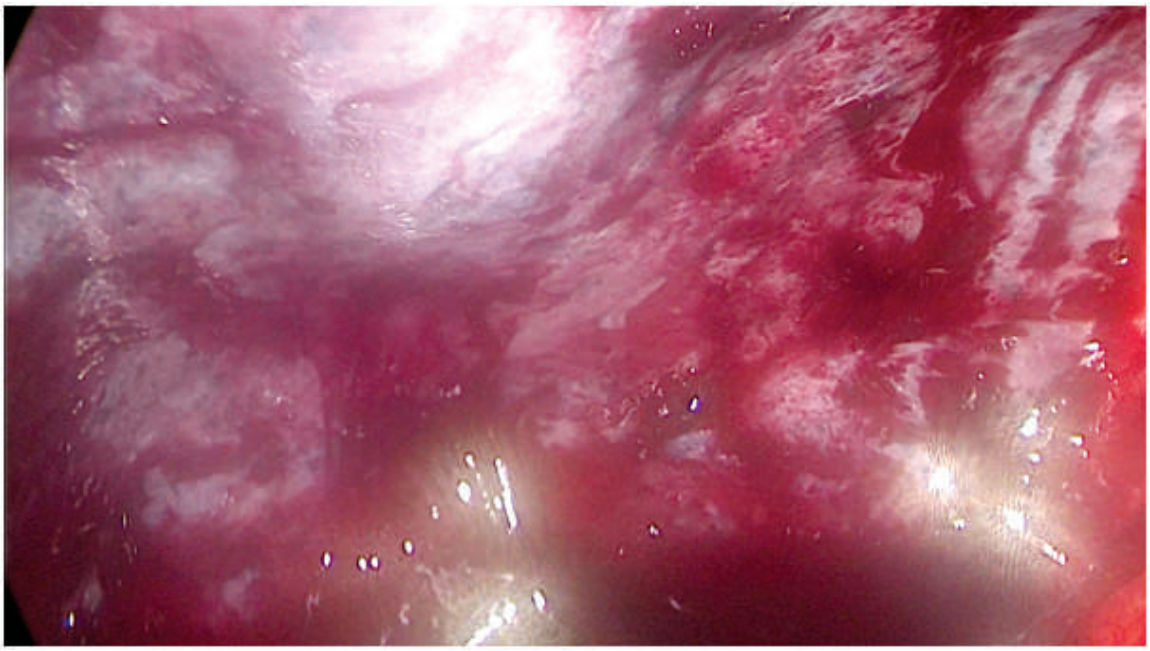

Fig 11 : View after breaking of loculi – parietal pleura cleared of loculations

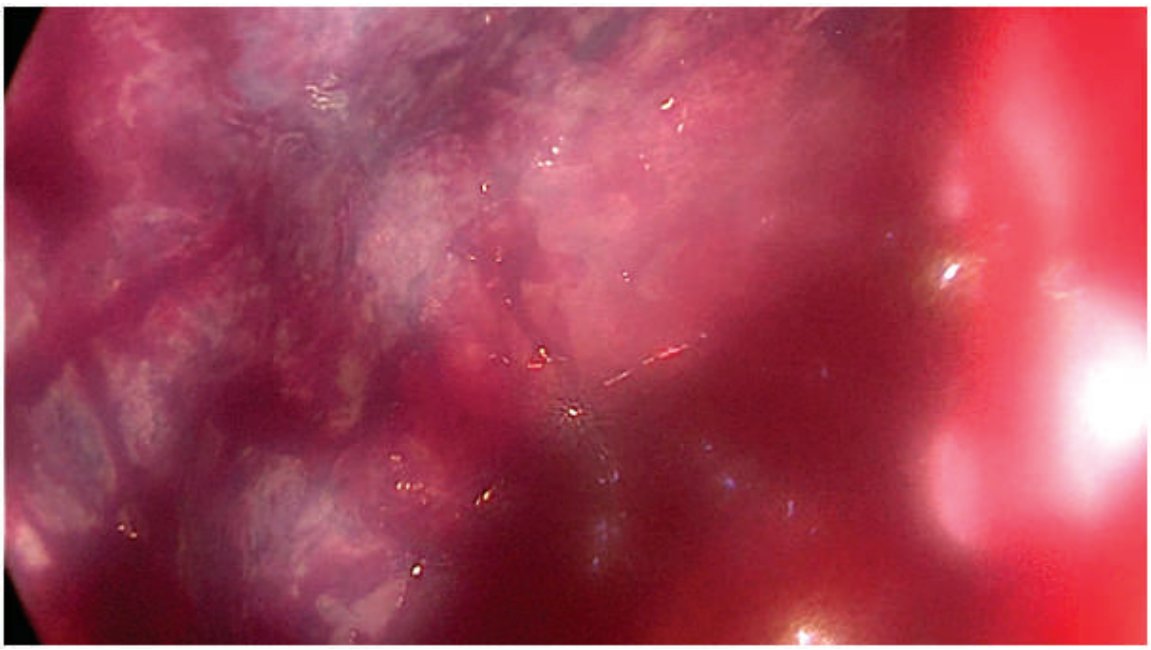

Fig 12 : Condition of pleura after breaking of loculi – oozy

ICDs one or two, depending on the extent of dissection, were always placed under vision.

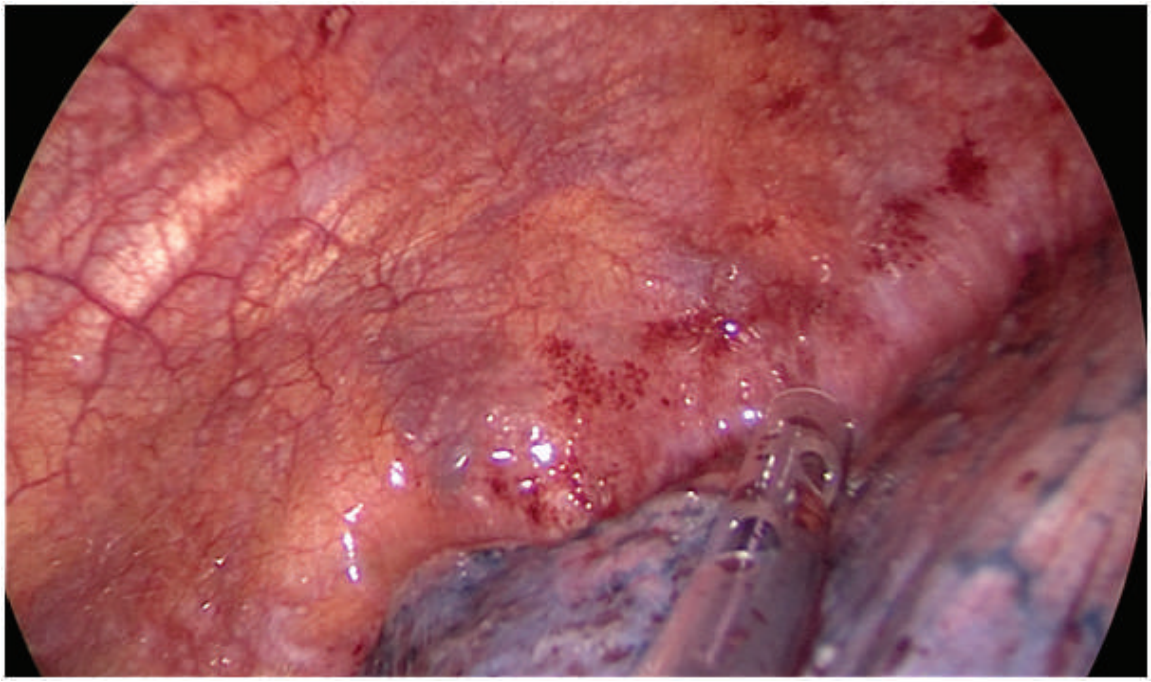

Fig 13 : Chest-drain placement near the lung apex

Post operative management protocol :

Broad spectrum antibiotics followed by culture sensitivity and analgesics for pain control. ICU monitoring is not mandatory; it depends on the anaesthesia team. Physiotherapy and early mobilization are aggressively practiced. Routine ICD care is advised, as is careful monitoring of collection and water column movement. Sanguinous collection in ICD is common which was managed with Injection Tranexamic acid. ICD was removed when the collection was serous and <30 ml for 3 days with no air column movement.

Follow-up :

Patients were followed up at 1 week, 2 weeks, 1 month and 6 months after discharge. Chest radiograph was done in all patients to look for resolution or recurrence.

Statistical analysis :

Analysis was done using SPSS software version 25.0. Pearson's Chi-square Test was used to test the significance between the variables of the two groups.

Results :

Out of 34 patients undergoing VATS, the Mean Age (Years) (Mean ± S.D.) was 49.09 ± 4.358 with a range of 40-56 years.

Predominantly, Males suffered from loculated pleural effusions. There were 67.6% (n=23) Males and 32.4% (n=11) Females.

64.7% (n=22) patients had Stage II pleural effusion while 35.3% (n=12) patients had Stage III pleural effusion.

The Mean Duration of Symptoms (Days) (Mean ± S.D.) before the patient was put for VATS was 18.53 ± 8.251. The Mean Duration of Symptoms (Days)(Mean ± S.D.) in Stage II patients was 12.77 ± 1.660 while in Stage III patients was 29.08 ± 3.343.

The Mean Duration of Surgery (Mins) (Mean ± S.D.) was 111.21 ± 27.365. The Mean Duration of Surgery (Mins) (Mean ± S.D.) in Stage II patients was 92.14 ± 8.615 while in Stage III patients was 146.17 ± 6.645.

The Mean Duration of Post-operative ICU Stay (Days)(Mean ± S.D.) was 2.44 ± 0.746. The Mean Duration of Post-operative ICU Stay (Days)(Mean ± S.D.) in Stage II patients was 2.09 ± 0.610 while in Stage III patients was 3.08 ± 0.515.

The Mean Duration of ICD Placement (Days) (Mean ± S.D.) was 8.56 ± 0.960. The Mean Duration of ICD Placement (Days) (Mean ± S.D.) in Stage II patients was 8.05 ± 0.653 while in Stage III patients was 9.50 ± 0.674.

The Mean Hospital Stay (Days) (Mean ± S.D.) was 10.65 ± 1.070. The Mean Hospital Stay (Days)(Mean ± S.D.) in Stage II patients was 10.05 ± 0.653 while in Stage III patients was 11.75 ± 0.754.

Conversion to thoracotomy was not needed in any of the patients undergoing VATS.

There was no case of recurrence in the 6 months follow-up period.

Discussion :

Pleural effusion is a common problem that thoracic surgeons face and deal with. The mainstay of treatment is source control and preventing recurrent infection, which, if not done, leads to restriction of lung expansion secondary to fibrosis at a later stage. Pleural effusion is managed best through early drainage by chest drain placement. Previously, open decortications and thoracotomy were the main stays of treatment. Still, the management option for the fibrino-purulent stage of pleural effusion is controversial. After a thorough and detailed literature search, it was found that VATS is a superior primary treatment in a few studies[9]. Delay in the management of effusion leads to functional impairment and increases morbidity and mortality. The basic principle of both open and VATS is the same, i.e., taking off the visceral peel and leaving behind the parietal one[10]. Various trials were done, and they too had a similar outcome, i.e., reduced morbidity when VATS was done. The results were comparable to our study. So, still debatable, but the use of VATS must be considered early in the treatment of pleural effusion, even in stage III. Duration is not directly proportionate to diseases everity, but longer duration leads to chronic disease; among chronic cases, duration has limited impact. As for comorbidities, they have no significant impact on our patients. The presence of thick septa in the CT thorax is a poor prognostic marker for VATS, and the chance of conversion is higher, although thick septa (more than 5mm) are not a contraindication to VATS. Etiology has an impact on the outcome; drug-resistant TB and malignancy definitely would not do well as disease processes could not be stopped, and for our cases, they were referred by physicians after all alternative means of treatments were exhausted.

Conclusion :

Video-assisted thoracoscopy facilitates the management of fibrino-purulent, multi-loculated pleural effusions, as well as organized effusions.

Early VATS is better, considering the difficulty and postoperative morbidity, i.e., less postoperative discomfort, reduced hospitalization, and fewer postoperative complications.

Limitation of our study :

Our study was limited by the small number of cases. Further studies, preferably randomised comparative trials with larger study populations, are required to confirm best management practice.

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