

Empyema thoracis: Controversies and technical hints

ABSTRACT

This communication is the summary of Internet discussions held by members of the Indian Association of Pediatric Surgeons (IAPS) in June 2005. It reflects the opinion and practice of Indian pediatric surgeons on the treatment of childhood empyema thoracis (ET). Despite the availability of broad-spectrum antibiotics, a large number of ET in advanced stages is still seen in India. The management of ET appears to depend on the stage of pathology, the status of underlying lung and proper usage of antibiotic adjuncts. Intercostal tube drainage of pleural space is sufficient for stage 1 empyema. Thoracoscopic decortication reduces the treatment cost and morbidity of stage 2 disease. However, stage 3 lesions with very thick pleural peels require open decortication. Pros and cons of these three modalities of treatment are discussed. The members also describe the various innovative techniques, that they found useful in the surgical management of ET.

KEY WORDS: Empyema thoracis, Pleural decortication, Surgery of lung, Thoracoscopy

With the advent of antibiotics empyema thoracis (ET) has become a rarity in the West. However, disturbingly large number of children with this disease is still seen in India.^[1] It is alleged that one Government hospital at New Delhi encounters two to three fresh patients of ET every day.^[2] In contrast to this, ET is rare in the state of Kerala.^[3] Although a majority of ET is of the pyogenic bacterial origin, 3% of it is due to tuberculosis.^[2] Management of tubercular ET cannot be compared with that of pyogenic ET because the former requires specific antitubercular drugs and these patients fare worse with decortication.^[2] Therefore, tubercular ET is excluded from the discussion.

The spectrum of ET seen in the Western countries is usually the milder form of the disease.^[2] In the West, patients are seen much early in the course of the disease so that the pleural thickening seldom exceeds 1–2 mm.^[2] In contrast, Indian patients are seen in the advanced stage of the disease so that the pleural thickening may reach even 2–3 cm.^[2] Hence the Western practice to estimate pH and enzymes in pleural fluid to determine the treatment modality is not applicable to Indian patients.^[4] Therefore, Indian experience on ET must be recorded as distinct from that of the West.^[2]

Intercostal tube drainage vs decortication

It is generally accepted that antibiotics alone or its combination with repeated needle aspiration are highly unsatisfactory in the management of ET.^[4] Intercostal tube drainage (ICD) is unquestionably the choice of management in early stages of ET.^{[5],[6]} At one center in spite of registering as many as 168 cases in 15 years, only three cases required decortication.^[5] The remaining 165 were

cured by ICD alone. This is probably because the patients were seen early and none beyond 2 weeks after the onset of illness.^[5] When inserted in early stages of ET, ICD need not be kept for more than 5–6 days.^[6]

Causes of ICD failure are: diagnostic delay,^[4] postponement of ICD insertion,^[4] improper positioning of tube,^[4] improper selection of tube size,^[4] underutilization of vacuum suction,^[4] inadequate physiotherapy,^[4] inappropriate or inadequate antibiotics,^[6] presence of BPF,^[6] loculation of pus (pleural honeycombs),^[4] and unscientific usage of corticosteroids.^[6] Nonexpansion of the lung within 72 h of ICD indicates underlying pleural thickening.^[4]

The controversy surfaced when ICD is recommended for even advanced stages of the disease.^{[5],[6]} Approximately 10% of ET requires more than one ICD in order to drain multiple loculi.^[6] One pediatric surgeon^[3] is reported to have inserted four ICDs at one time to drain different loculi. Such ICD need to be kept for varying duration of 3 weeks^[3] to 2 months.^[5] Most Indian pediatric surgeons believe that early surgical intervention reduces the morbidity of prolonged ICD and hospitalization.^{[2],[7]–[15]}

The ICD may not be able to drain flakes of pus even when a large tube is used.^[15] Even if ICD helps in the drainage of pus and reduces the inflammatory reaction, it is unlikely to affect the pleural thickening that occurs in advanced stages of ET.^[14] This pleural thickening is akin to scar formation after any inflammation. This is evidenced by the change in the nature of collagen in the subpleural connective tissue and replacement of mesothelial cells of pleura by the fibrin deposits.^[14] Thickened

parietal pleura restricts chest wall movement, while thickened visceral pleura immobilizes the lung and prevents it from expanding. It is unimaginable that, in the absence of documented proof, this thick pleural scar will melt away in due course with ICD.^[2] It is contended that although ICD may provide symptomatic relief in advanced stages of ET, such patients will silently suffer restrictive lung disease and abnormal spirometry.^[12] One is not justified to postpone surgery on the pretext that the patient is asymptomatic because the encasement of lung is paradoxically more severe in patients with fewer symptoms and in those who appear less sick.^[12] The lung continues to grow even after postnatal life up to the age of 7 years. The lung encased in thickened pleura cannot be expected to grow normally. Although this is not quantifiable, the logic of this argument is irrefutable.^[8] This could be the strong basis for recommending early decortication in ET.^{[8],[12]}

Because underlying lung suppuration is usually the cause of ET, it is likely to get scarred as healing proceeds. Hence, even after adequate decortication, the lung function test (spirometry) will remain abnormal for a long time^[4] and perhaps they may never revert back to premorbid status.^[14] This makes the case for early decortication weak. Undeniably, decortication is indicated in encased lung,^[12] lung adherent in twisted positions,^[12] crowding of ribs,^{[2],[10]} scoliosis,^[10] and pneumothorax is indicated in radiographs sans column movement in ICD indicating rigid immobile collapsed lung.^[5]

Thoracoscopy vs open decortication

When decortication is clearly indicated, the next controversy that emerged is the technical modality of doing it. The conventional open thoracotomy is increasingly being replaced by thoracoscopic procedures. Before any comparison is made between the two modalities, one must appreciate that there are two distinct thoracoscopic procedures, namely thoracoscopic debridement and thoracoscopic decortication.^[16] In the former, only the loculi are broken using a thoracoscope and no attempt is made to peel away the thickened pleura.^[16] It would be illogical to compare thoracoscopic debridement (simple procedure) with open decortication (aggressive procedure). Obviously, debridement alone is inadequate in very late stages where the encasing thick pleura need to be removed.^[16]

Enthusiasts of thoracoscopy (TS) claim that it is simple, less painful, allows early physiotherapy, and shortens hospitalization.^[14] Approximately 90% of TS patients can be discharged within 5–7 days and all of them by 3 weeks.^[16]

On the other hand, opponents of TS point out that it is time consuming,^{[3],[13],[16]} and bleeding (which is not unusual during decortication) obscures endoscopic vision.^[13] In the absence of tactile feedback, inadvertent lung injuries are more likely and the incidental air leak causes serious disturbances in vision.^[17] It is also maintained that TS is not suitable for very thick pleura of stage 3.^[2] However, one surgeon^[11] reported to have done more than ten decortications by TS in which the duration of illness was more than 3 weeks and the pleural thickness was more than 1 cm. In TS, it is ergonomically near impossible to dissect in-between the two working ports.^[17] This would mean sub-optimal decortication of parietal pleura in TS.^[13] Apprehension is also expressed whether TS is favored purely for technical novelty or ulterior motives.^{[2],[6]} Enthusiasts of TS annulled the argument that TS is costly. They pointed out that TS works out to be cost effective than any other treatment modality, if the cost of hospitalization, loss of parental earning due to absence from work, and the cost of treating complications and morbidity are taken into account.^[11]

The general agreement is that although there is nothing wrong in trying TS decortication, the surgeon must be ready for conversion if it is technically found to be difficult. One surgeon who managed 180 ET claimed that he performed 50 TS decortications out of which only one needed conversion.^[16]

Broncho pleural fistula

Broncho pleural fistula (BPF) is a troublesome complication of ET and it delays discharge from hospital.^{[14],[16]} The BPF prevents expansion of lung by creating positive intrapleural pressure^[14] and in turn, rigid encased and splinted lung around the fistulous opening prevents spontaneous closure of BPF.^{[4],[12]} To break this vicious cycle decortication is essential. Most of the BPF will spontaneously close within 48 h of satisfactory lung expansion.^[12] Formal suturing of BPF will often fail due to the friability of the underlying diseased lung.^[11] The usual options are either to fire a stapler more medial to BPF or to resect the affected lung segment.^[11] Vascularised latissimus dorsi flap is a viable option for closing BPF.^[10] Hence, pediatric surgeons should avoid damage to this muscle during open thoracotomy.^[10] Some surgeons claim that BPF will most often close by conservative ICD. According to one surgeon only one out of five BPF require thoracoscopic intervention.^[11] Although PTFE is used to suture BPF in adults, it is not known whether it has ever been used in pediatric cases.^[15] The BPF should not be confused with postdecortication air leaks, as the latter will settle spontaneously within 10 days.^[3]

Technical considerations

Although it is theoretically ideal to peel-off every bit of thickened pleura, over zealous decortication may be dangerous.^{[10],[11],[14]} When the pleura resists peeling or if there is profuse bleeding, Gird-like full thickness cuts can be made in the thickened pleura to free the lung from bondage.^[8] It is generally held^{[10],[11]} that thickened pleura at the apex of lung (behind the clavicle), hilum of lung, and on the diaphragmatic surface may be left undisturbed for fear of injuring vital nerves and major vessels. Such omission does not appear to affect the function in the long run.

During video-assisted thoracoscopic surgery (VATS) decortication for very thick pleural peels, one must be careful to protect the costly equipments.^[17] Instruments stronger than the pleural peels are recommended.^[11] Monopolar diathermy hooks (2–3 mm) are durable^[11] but have the disadvantage of causing too much tissue charring.^[3] Charred tissue obscures tissue planes and thus increases the risk of lung injury.^[3] Also one has to constantly keep on changing instruments for dissection and cauterization.^[3] These disadvantages are circumvented when a bipolar scissors is used.^[3] However, cutting tough tissue with bipolar scissor without applying diathermy current (analogous to harmonic scalpel) will quickly blunt the instrument.^[3]

Preoperative CT scan will help to assess the location and thickness of pleural peels.^[11] This will enable to site thoracoscopic ports more effectively.^[11] Be it VATS or open decortication, stripping the parietal pleura is technically difficult.^{[10],[13]} This is best done and is technically easier to do by extrapleural dissection^[10] before opening the pleural cavity.

Usually the lung should expand within 72 h of ICD.^[4] If it fails to do so, it may be due to mucous plug blocking the bronchus. Hence, a bronchoscopic suction is worth trying.^[4] Nonimprovement even after bronchoscopic suctioning and absence of aeration in the ipsilateral lung in CT scan are said to be the signs of autopleuronecrosis and any further surgery is considered unnecessary.^[4]

One is often distressed to see a patient who requires redecortication due to inadequate surgery.^[2] In such situations, it is better to go through the bed of the third rib by excising it. Although this approach leaves two big unsightly scars, it provides best access to those leftover areas during first decortication.^[2] In a few patients (2 out of 60) even after adequate decortication, the lung would not expand.^[2] The BPF and necrosis of the underlying

lung are the causes of this. In the latter case, resection of the affected lung segment will be prudent.^[2]

If thorascopes are not available, a cystoscope with its sheath may be used for thoracoscopic-assisted debridement or decortication.^{[12],[16]} As inflation of gas and maintenance of positive pressure are not required for thoracoscopy, ordinary surgical instruments can be used through additional ports in conjunction with the cystoscope.

Except a very few,^[9] most Indian pediatric surgeons do not have experience with streptokinase therapy for ET. The BPF, bleeding diathesis, and hypersensitivity to streptokinase are contraindications to this form of therapy.^[9] At least in one Indian case, streptokinase failed and open decortication was needed.^[9] Quoting the Cochrane reviews it was opined that there was insufficient evidence for the use of streptokinase in ET and it has been soundly discarded by several papers.^[4]

CONCLUSIONS

The management of ET appears to depend upon the stage of pathology.^{[2],[4]} The success of any intervention depends upon the status of the underlying lung and proper usage of antibiotic adjuncts.^[4]

It is true that properly sited ICD at the early stage of pathology avoids surgery. The TS appears to be a via media when ICD is clearly not sufficient and thoracotomy is to be avoided.^[16] Therefore the rule of thumb could be^[2]

For stage 1	ICD
For stage 2	VATS decortication
For stage 3	Open decortication

However, as the stages overlap so also does the treatment options.^[5]

It is suggested that pediatricians must be convinced about the benefits of early surgical intervention and they must be encouraged to refer patients early.^{[13],[18]}

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