

Therapeutic Management of Empyema

In 1920, Carl A. Hedblom from Mayo Clinic, Rochester, Minnesota published a review 'The treatment of chronic empyema' based on a study of literature and 150 cases managed in the Mayo Clinic.¹ He arrived at a total of 20 tentative strategies and conclusions related to the management of chronic empyema. These conclusions emphasise the fact that the management of this complex condition has progressively evolved over the last Century and it remains a disease with multiple surgical options. A major surgical procedure is indicated only if non-operative interventions or less extensive surgical treatments are considered to be reasonably less effective. The ultimate aims of the management are to control the infection and achieve a fully expanded lung and dry chest wall with no sinuses. If the lung fails to expand completely, then collapse of the chest wall was suggested to obliterate the persisting space. Hedblom differentiated between tuberculous and non-tuberculous empyema and observed that the efforts to obtain a fully expanded lung were likely to be successful in non-tuberculous cases and thoracoplasty was likely to be needed in tuberculous cases. Advances in surgery notwithstanding most of the conclusions derived by him remain valid even today.

This distressing entity is quite prevalent in India and is a cause of significant and prolonged morbidity. Wrong management often adds to the misery of the patient.

The triphasic nature of thoracic empyema (stages I, II, and III) needs to be understood, acknowledged and addressed. Early exudative stage may be treated with antibiotics alone with repeated pleural aspiration. Penicillin and cephalosporins remain the cornerstones of therapy, while metronidazole or clindamycin are added whenever anaerobic infections are suspected to be present. The duration of chemotherapy should be adequate and it should be reviewed after sputum, blood culture, or pleural fluid culture results. Tuberculous empyemas require standard anti-tubercular chemotherapy.

Various interventions, from very simple to highly elaborate are employed depending upon the stage and severity. The appropriate selection is the most significant as well as controversial aspect of this complex entity with a wide range of available options as follows:

Needle Aspiration. It is generally done for the diagnosis and may be the only treatment necessary if the pus is very thin (e.g., streptococcal infections).

Tube Thoracostomy. Also called intercostal chest tube insertion, remains the most important intervention in the management of empyema. Proper timing, correct technique, positioning and duration

are important points in the management. A lot of morbidity and suffering results from improper technique of chest tube insertion.² It should be inserted as early as possible, although even late cases can be treated with good chest tube drainage, if there is a single loculation. It should be planned for adequate duration. The tube should be fixed well to ensure patient comfort and its patency should be always maintained with frequent changes as blockages are common.

Intra-pleural Fibrinolytic Agents. Intra-pleural fibrinolytic agents, such as, streptokinase and urokinase have been commonly used. These are quite expensive and cause high fever and allergic reactions. These are most effective when used early and before significant collagen is laid down. In a meta-analysis done by Tokuda and Colleagues,³ it was concluded that routine use of fibrinolytic therapy is not indicated for all patients who require chest tube drainage for empyema or complicated parapneumonic effusions. Selected patients might benefit from the treatment.

Rib Resection. Chinese, Indians, Egyptians of ancient times as well as Hippocrates are known to have advocated rib resection for empyema management. It may be resorted to whenever the pus is thick. It also provides an opportunity for good pleural toilet under supervision and a pleural biopsy can also be taken simultaneously. Rib crowding occurs quite early in the course of empyema, especially tuberculous empyema. Rib resection affords a window to put in an adequately sized tube with better and more comfortable drainage.

For acute empyema (empyema in stages I and II), early surgical intervention, such as video-assisted thoracoscopic debridement, is recommended when conventional chest tube drainage has failed. Video-assisted thoracoscopic (VATS) approach has high success rate in early stages and conversion to open thoracotomy should be resorted to in cases developing chronicity.

Radical treatments of chronic empyema (empyema in stage III) include:

Removal of the empyema space (decortication with or without lung resection);

Obliteration of the pleural space with muscle flaps or omentum flaps, and thoracoplasty;

Decortication is the procedure of choice for patients with re-expandable underlying lung; and

When broncho-pleural fistula exists in the underlying lung, the fistula needs to be securely closed.

For those patients whose underlying lung cannot be expected to re-expand, the procedure of choice is either a concomitant removal of the affected lung with the empyema space or obliteration of the pleural space. Post-operative broncho-pleural fistula develops quite frequently after pneumonectomy in an infected space, and hence, there is a role of muscle transfer procedures to fill the pleural space and to support the bronchial stump. However, these are drastic surgeries and often not likely to be tolerated by such patients who have concomitant poor nutritional status.

For patients who are not eligible for the above-mentioned radical treatment, an open-window thoracostomy may be considered. This procedure is not only performed as a definitive treatment of empyema but also as a preparatory treatment for radical procedures. Radical procedures can be performed later when patients are fit.

Choosing the most suitable operation based on the stages of empyema, the conditions of the underlying lung, and the condition of a patient holds the key to success.

The operation of thoracoplasty is still required fairly often at least in the Indian scenario. As thoracoplasty is somewhat mutilating, it is always carried out as a last resort. If the lung cannot be brought to the chest wall (which is the objective of tube thoracostomy, rib resection and decortication), the chest wall must be brought to the lung (or the mediastinum if no lung exists).^{4,5} In 1985, Hopkins and Co-workers⁵ reviewed their experience with thoracoplasty and included in their indications for the procedure attempts to close persistent pleural spaces with and without infection and bronchial fistulae, both post-resection and in association with post-pneumonic pleural suppuration. While such indications are uncommon in developed countries, a large proportion of patients in India are not suitable for decortication and may benefit from thoracoplasty.

Today, thoracoplasty as an operation for the management of chronic pleural empyema is accomplished in one stage,⁶ because paradoxical chest wall motion is not a problem in this clinical setting. By the time the patient is taken up for surgery, the mediastinum and chest wall are fixed, and hence, the problem of flail chest does not arise in the post-operative period.

In the procedure of thoracoplasty, complete posterior resection including resection of transverse processes of the adjoining vertebrae has always been stressed. However, in some cases chronic pleural thickening and the resultant obliteration of the paravertebral gutter obviates the need to resect the transverse processes of the vertebrae.⁷

Eloesser⁸ described a procedure to establish long-term open drainage of chronic empyema cavities in 1935. The procedure involves creating an open

window thoracostomy in the chest wall for facilitating long-term open drainage without the need for an indwelling catheter. Various modifications of the procedure have been developed and described in the literature. It is an excellent though simple procedure and quite useful. Kohli and Colleagues⁹ described complete expansion of lung in 56% of 50 patients treated with open window thoracostomy over a period of 3 to 24 months after creating the flap. In patients with chronic empyema, in whom the lung has not expanded after an adequate period of closed chest tube drainage and who are judged to be not suitable for decortication because of the diseased underlying lung can be managed with this procedure with excellent results. Graham *et al*¹⁰ described the mechanism of lung re-expansion in patients with open drainage for bacterial empyema treated during the influenza pandemic of 1918. They attributed this re-expansion to the "gradual pull of adhesions between the lung and the chest wall". Such has not been the experience with tuberculous empyema, where lack of expansion has led to decortication, lung resection, and thoracoplasty. With modern anti-tuberculous drug therapy, the pulmonary and bronchial components are controlled and the lung becomes capable of re-expansion.¹¹

Recently, an extensive review of literature was carried out by Molner.¹² The roles of surgical drainage, lavage techniques, debridement via VATS, decortication, thoracoplasty and open window thoracostomy were examined in the light of the triphasic nature of empyema thoracis. The randomised, controlled trials came up with conflicting results. With two exceptions all of the papers reviewed provided weak evidences. The lack of a single ideal treatment modality or strategy reflects the complexity of the diagnosis and staging of this heterogeneous disease. While all the above modalities are well-established technically, neither a universally acceptable primary modality nor a gold standard of their sequence is available. Drainage remains to be the initial treatment modality in Phase I disease. Debridement via VATS is a safe, reliable and efficient method in the fibrinopurulent phase. Organised pleural callus requires formal decortication. Open window thoracostomy is a simple and safe procedure for high-risk patients and results in quick detoxication. Thoracoplasty had its final role in pleural space management. Acute post-operative bronchial stump insufficiency requires immediate surgery. Evacuation of toxic material is mandatory. No single-stage procedure offers a solution. An optimised aggressive treatment modality should be tailored to the condition of the patient and to the potential of the persisting cavity. Decision-making involves a triad consisting of the aetiology of empyema (i.e., primary *versus* secondary), general condition of the patient and stage of disease, while

considering the triphasic nature of development of thoracic empyema. The current attitudes show that the present concepts are based mainly on expert opinion. No exclusive sequence of procedures yields uniformly predictable successful outcomes. Individualised approaches can be recommended based on institutional practice and local protocols. Thoracic empyema in general seems to remain resilient to fit completely into the categories of evidence-based medical approach.¹²

Ravindra K. Dewan

Member, Editorial Board
and

Thoracic Surgeon

LRS Institute of TB and Respiratory Diseases

Sri Aurobindo Marg

New Delhi-110 030

E-mail: ravindrakdewan@rediffmail.com

REFERENCES

1. Hedblom CA. The treatment of chronic empyema. *Ann Surg* 1920;72:288-326.
2. Kumar R, Dutta R, Jindal T, Biswas B, Dewan R. Safe insertion of a chest tube. *National Med J India* 2009;22:192-8.
3. Tokuda Y, Matsushima D, Stein GH, Miyagi S. Intrapleural fibrinolytic agents for empyema and complicated parapneumonic effusions: a meta-analysis. *Chest* 2006;129:783-90.
4. Alexander J. *The Collapse Therapy of Pulmonary Tuberculosis*. Springfield, III: Charles C. Thomas;1937.
5. Hopkins RA, Ungerleider RM, Staub EW, Young WG Jr. The modern use of thoracoplasty. *Ann Thorac Surg* 1985;40:181-7.
6. Barker WL. Thoracoplasty. *Chest Surg Clin North Am* 1994;4:593-615.
7. Dewan RK, Singh S, Kumar A, Meena BS. Thoracoplasty: an obsolete procedure? *Indian J Chest Dis Allied Sci* 1999;41:83-8.
8. Eloesser L. An operation for tuberculous empyema. *Surg Gynecol Obstet* 1935;60:1096-7.
9. Kohli A, Singh G, Vig Anita, Dubey KR, Singh R. Pleurocutaneous flap: how useful it is in management of chronic empyema. *Indian J Chest Dis Allied Sci* 2006;48:257-9.
10. Graham E, Singer J, Ballon H. *Surgical Diseases of the Chest*. Philadelphia: Lea & Febiger; 1935:pp118-81.
11. Ali SM, Siddiqui AA, McLaughlin JS. Open drainage of massive tuberculous empyema with progressive reexpansion of the lung: an old concept revisited. *Ann Thorac Surg* 1996;62:218-23.
12. Molnar TF. Current surgical treatment of thoracic empyema in adults. *Eur J Cardiothorac Surg* 2007;32:422-30.

