THORAX

Editorials

Treatment of empyema thoracis

Infection of the pleural space, empyema thoracis, was recognised and treated with open drainage by Hippocrates. Despite its historical significance and the advancement of medical science, it remains a challenging clinical entity. Response to treatment is directly related to early recognition and timely intervention. The treatment of established empyema is surgical; progression of a parapneumonic effusion or other sterile pleural collection to formal empyema should be considered a failure of medical therapy.

A simple parapneumonic effusion is clear and sterile. It is characterised by low white blood cell count and low lactate dehydrogenase. Glucose and pH are normal. The visceral pleura remains elastic and the dimensions of the thoracic cavity are maintained. There is a transitional phase where the fluid becomes turbid and infected, the white blood cell count increases, and lactate dehydrogenase, glucose, and pH levels decrease. Fibrin deposition occurs on all pleural surfaces. Fibrinous bridges septate the effusion creating multiple loculations within the pleural space.

The organising phase is characterised by frank pus. Both pleural surfaces are grossly thickened. The transition from a diaphanous membrane of mesothelial cells to an opaque sheet of inflammatory tissue with a depth of more than 2 cm is impressive. The fibrin has been replaced by formal granulation tissue (fibroblasts and capillaries) and significant loss of lung volume has occurred, not only because of the space occupying effect of the empyema fluid, but as a result of the inflammatory process itself. There is a generalised contraction of the affected hemithorax, the mediastinum has shifted to the infected side, the diaphragm has moved upwards, and the ribs closer together.

Without wishing to complicate nomenclature further, I would suggest saving the term "complicated empyema" for true complications of the disease such as empyema necessitans, bronchopleural fistula, oesophagopleural fistula, or the formation of metastatic abscesses.

Treatment options

A simple literature review will confirm that a clear consensus of opinion regarding treatment of pleural infection is still outstanding.[1] First principles dictate that the primary objective is to eradicate all infected material. It is facile to suppose that antibiotics alone will sterilise an established pleural infection, so some form of drainage is obligatory. Unlike abscess cavities at other anatomical sites, volume is a critical issue. The nature of the inflammatory process acts to contract the area of injury in order to minimise the burden of healing. This is highly effective for wounds healing by secondary intention, but works against the maintenance of normal respiratory function following the resolution of an empyema. Restoration of normal lung mechanics is an essential secondary goal of treatment. With so many different therapeutic choices, it is incumbent upon the clinician to ensure that the treatment maximises efficacy while morbidity and mortality are kept acceptably low. The cost of treatment and length of hospital stay are important tertiary considerations.

SURGERY

Surgery for empyema is not a simple matter. There are four surgical options: (1) simple tube thoracostomy; (2) rib resection; (3) decortication; and (4) thoracoplasty. These are dictated, not out of surgical preference, but by the condition of the patient and the characteristics of the disease process.

Simple tube thoracostomy

There is no reason to believe that a tube placed under an anaesthetic should be any more effective than one placed under ultrasound or computed tomographic control. The former procedure has largely been abandoned, except for patients in whom manipulation under local anaesthesia is inappropriate.

Rib resection

This procedure allows the surgeon to ensure that all intrapleural loculations are broken down by mechanical means, and that a drain is inserted under direct vision ensuring dependent drainage. The "rib resection" anticipates the need for long term drainage; large bore chest tubes are more comfortably tolerated.

Decortication

In patients with established empyema with thickened pleura and significant loss of volume this is the treatment of choice. The procedure is hard work, time consuming, and progress is begrudgingly slow. Meticulous attention is essential if damage to the underlying lung is to be kept to a minimum. Any compromise in technique is likely to result in retained infected material and recurrence of clinical infection. The reek of anaerobic infections and necrotising lung can, at times, be inspirational! The procedure invariably precipitates a florid bacteraemia. Surgery in a patient debilitated by chronic infection has a high attendant morbidity. Mortality, in the last decade, has been variably reported between 0% and 33%.[2] There were 252 decortications performed in the UK in 1992 with a mortality of only 1·9%.[3]

Thoracoplasty

This was a common procedure in the pre-chemotherapeutic era of pulmonary tuberculosis. It still plays an important but less prominent part in the treatment of tuberculosis and has relevance in non-tuberculous empyema. If, after evacuation of infected material, obliteration

of the space cannot be achieved, some form of thoracoplasty is mandatory. A full thoracoplasty of the Schede type is a labour intensive procedure and can be disfiguring. A modern and more desirable option is to fill the space with viable tissue. This can be effected with several acceptable grafts, and the commonest donor sites are rotated latissimus dorsi and the greater omentum.

Thus, the surgical options are effective but unattractive! Any treatment that will genuinely reduce the number of patients coming to surgery for empyema would be most welcome to patients and surgeons.

STREPTOKINASE

The potential use of streptokinase as a means of effecting intrapleural fibrinolysis was recognised as early as 1949.[4] In the original report 20 000–400 000 units of streptokinase were injected into the pleural space followed in a further 12–18 hours by repeated pleural aspiration. Major haemorrhagic complications have been reported following a dose of 500 000 units instilled for six hours.[5] The modern standard has been set by Bergh *et al*[6] who advocate a dose of 250 000 units diluted to 100 ml with an exposure period of four hours. In this issue of *Thorax* both Bouros *et al*[7] (pp 852–5) and Taylor *et al*[8] (pp 856–9) have taken the trouble to emphasise that better enzyme preparations and shorter patient exposure have been associated with fewer unwanted and less consequential side effects. Success rates of up to 93% have been reported with this technique.[9] It is worth noting that, in this most successful study, patients with non-contiguous loculations or a large empyema cavity were specifically excluded.

The cooperation of an interventional radiologist is of critical importance. Catheters must be placed with painstaking accuracy, and their positions checked and rechecked regularly if a successful outcome is to be systematically achieved. In fact, using entry criteria identical to those used by Taylor *et al*, success rates of 88% have been reported merely by the meticulous placement of catheters (9–12·5 Fr).[10]

A clear understanding of the end points of each study is worth reviewing. Streptokinase does facilitate drainage in patients with loculated, infected pleural effusions and is well tolerated. Resolution of febrile and constitutional symptoms is to be expected. Radiographic improvement occurs long after the patient is discharged from hospital. Objective lung function studies have not been obtained. Both studies see the avoidance of surgery as a treatment success, in and of itself. Neither dares ask the fundamental question: is streptokinase therapy superior to surgery? I am not convinced that responders truly represent those patients who eventually come to surgery. The number of patients in both studies is small. Any conclusions and generalisations drawn from the data presented in these studies should be guarded.

Conclusions

Empyema is a heterogenous condition treated by multiple modalities. The answers are confused still further by comparing different treatment outcomes. It is nearly 50 years since streptokinase was first described for the treatment of pleural infections. Papers such as the two in this issue of *Thorax* which describe the efficacy of streptokinase in a small series of patients are still topical. A controlled trial, including an arm with early surgical intervention, would help to resolve many of the most controversial aspects of this condition and is long, long overdue. Optimising treatment in the pre-empyema phase of the disease is a worthy area of interest.

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1 Strange C, Sahn S. The clinical perspective on parapneumonic effusions and empyema. *Chest* 1993;**103**:259–61.
2 Strange C, Sahn S. Management of parapneumonic pleural effusions and empyema. In: Wallace RJ, ed. *Infectious disease clinics of North America.* Philadelphia: Saunders, 1991:539–59.
3 United Kingdom Thoracic Surgical Register 1992.
4 Tillet WS, Sherry S. The effect in patients of streptococcal fibrinolysin (streptokinase) and streptococcal deoxyribonuclease on fibrinous, purulent and sanguineous pleural exudations. *J Clin Invest* 1949;**28**:173–90.
5 Godley PC, Bell RC. Major haemorrhage following the administration of intrapleural streptokinase. *Chest* 1984;**84**:486–7.
6 Bergh NP, Ekroth R, Larsson S. Intrapleural streptokinase in the treatment of haemothorax and empyema. *Scand J Thorac Cardiovasc Surg* 1977;**11**: 265–8.
7 Bouros D, Schiza S, Panagou P, Drositis J, Siafakas N. Role of streptokinase in the treatment of acute loculated parapneumonic pleural effusions and empyema. *Thorax* 1994;**49**:852–5.
8 Taylor RFH, Rubens MB, Pearson MC, Barnes NC. Intrapleural streptokinase in the management of empyema. *Thorax* 1994;**49**:856–9.
9 Aye RW, Froese DP, Hill LD. Use of purified streptokinase in empyema and haemothorax. *Am J Surg* 1991;**161**:560–2.
10 van Sonneberg F, Nakamoto SK, Mueller PR, Casola G, Neff CL, Friedman PJ, *et al.* CT and ultrasound guided catheter drainage of empyema after chest-tube failure. *Radiology* 1984;**151**:349–53.