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Research Article

Timing and Efficacy of VATS Debridement in the Treatment of Parapneumonic Empyema

Abstract

Objectives: Empyema thoracis is a common thoracic disease seen in both developing and developed countries. Despite modern management techniques, this condition is still associated with significant morbidity and mortality. Video assisted thoracoscopic surgery (VATS) has become an established mode of treatment for this condition; however the first-line approach and timing of surgical intervention remains controversial. The present study was undertaken to assess our experience of VATS debridement in the management of empyema, focusing on the timing of surgical intervention, and the affect this has on outcomes.

Method: Between May 2007 and May 2011, 75 patients underwent VATS debridement of empyema in our institution. Retrospective analysis of clinical notes was performed to collect data regarding length of pre-operative conservative management, operative strategy and post-operative course. The primary outcomes were the need for open thoracotomy, post-operative complications, length of hospital stay and survival.

Results: The mean pre-operative duration of conservative management in this cohort was 15.7 days (range 4-35). A total of 9 patients (12%) required open thoracotomy. Patients who had been managed conservatively for two weeks or more were significantly more likely to require open thoracotomy ($p > 0.05$). Both approaches were well tolerated with minimal post-operative complications. Average length of stay was 8.2 days (range 2-38) with no correlation found between this and pre-operative length of management. There were no in hospital deaths following this procedure.

Conclusions: VATS is now fully established as a safe and effective approach in the management of patients with empyema. The timing of any surgical intervention, however, remains controversial. There appears to be an ongoing trend for delayed referral, with the majority of our patients managed conservatively for over two weeks. The current study supports early surgical involvement, as later referral has been shown to lead to a significant increase in the need for open thoracotomy.

Background

Empyema thoracis is defined as an accumulation of purulent material and fluid within the pleural cavity. The most common cause is as a complication of pneumonia [1]. The natural history of the disease is one of transition and a number of stages have been classified. The early or exudative phase (stage I) is a simple fluid or pus collection. Without treatment this will soon evolve into a loculated, fibrinopurulent effusion (stage II) followed finally by a complex, organised collection with trapping of the underlying lung (stage III).

As the name would suggest, empyema thoracis was first described in Greece by Hippocrates and his followers in 500BC, at which time surgical drainage was proposed as the treatment of choice [2]. Open thoracic drainage remained the only management option until the early 1900s at which time unacceptable mortality rates during the influenza pandemics of 1917 and 1918 forced further investigation into the disease. The novel approach of drainage using a closed chest tube was introduced at this time leading to a dramatic reduction in mortality rates [3].

This approach remains the basis for the current rationale in the management of empyema. It is generally agreed that success is dependent upon appropriate antibiotic therapy combined with drainage of the pleural space, re-expansion of the underlying lung and treatment of co-morbidities such as diabetes and malnutrition. The method of drainage and the timing of any surgical intervention, however, remain controversial. Despite modern management techniques the condition is still associated with significant morbidity, and a mortality rate of 20% in adults [4]. The present study was therefore undertaken to assess our experience of VATS debridement for empyema, focusing on the timing of surgical referral and intervention, and the affect this has on outcomes.

Methods

A review of the thoracic surgical database identified 75 patients who had undergone VATS drainage in the management of post-pneumonic empyema between May 2007 and May 2011. Patients requiring open drainage with rib resection, thoracoplasty or flap reconstruction were excluded from this study. Patients with an underlying thoracic malignancy were also excluded. The most common presenting symptoms were shortness of breath, fever and cough and were reported in 35-40% of cases. Others seen less frequently included chest pain, loss of appetite, loss of weight and haemoptysis. All patients had been resistant to medical treatment which varied from antibiotic therapy only, to pleural aspiration or

drain insertion. The cohort was divided into those patients managed conservatively for less than two weeks prior to surgery (Group I n=34) and those managed for 2 weeks or more (Group II n=41). Diagnosis in both groups was confirmed using CT scan of the chest (Figure 1), with or without analysis of pleural fluid.

VATS empyema debridement was implemented initially in all cases using a standard two port technique, for simple loculated collections, and three ports where more extensive decortication was required. The inferior 10mm port is used for the camera while a larger anterior incision is used as a utility port. Following drainage of any effusion, the lung is mobilised from the chest wall using a combination of blunt dissection and diathermy for dense adhesions. Sponge-holding forceps can then be used via the utility port to remove fibrinous debris (Figure 2). Copious wash-out of the pleural cavity is performed using betadine solution. At the conclusion of the procedure a size 28 French chest drain is inserted to the apex via the utility port, while a size 32 French chest drain can be passed through the camera port to the base. The lung is re-inflated under direct vision prior to closure.

Conversion to open thoracotomy was performed in cases where adequate debridement and lung expansion could not be achieved via the VATS method, or to manage complications. At the time of surgery samples of parietal pleura and purulent matter were sent to histology and microbiology for analysis and all patients were treated with antibiotic therapy as per consultant microbiological advice.

Outcomes compared included operative strategy, in particular the need for conversion to open thoracotomy, post-operative complications, length of stay and survival. The Fisher's exact test and Mann-Whitney test were used for statistical analysis. A p value < 0.05 was considered as statistically significant.

Results

Of the 75 patients who underwent VATS management of empyema, 9 (12%) required conversion to open thoracotomy. In 7 cases this was performed to allow adequate decortication and re-expansion of the underlying lung. The other two reasons identified for thoracotomy were to control bleeding and to manage poor tolerance of single lung ventilation.

The mean pre-operative duration of conservative management in group I was 9.7 days (range 4-13) and in group II was 20.6 days (range 14-35). The patient demographics of these groups are outlined in Table 1. There were no significant differences seen when comparing age, gender and pre-operative co-morbidities. Of the 9 patients requiring conversion to thoracotomy only 1 patient was in group I while the other 8 patients were in group II. This difference in frequency of open surgery was statistically significant ($P = 0.03$).

The procedure was well tolerated by all patients with minimal post-operative complications (Table 2). Although samples from the pleural cavity were sent to microbiology in all cases, only 11 (15%) yielded positive bacterial culture. The most common organisms identified were staphylococcus aureus and Escherichia coli.

Following surgery 58 patients were discharged home while 17 were transferred back to their local hospital for ongoing management

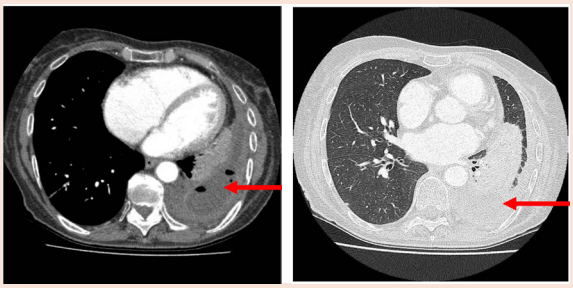

Figure 1: CT chest demonstrating complex left sided empyema (arrow) with a thick cortex surrounding the lower lobe of the left lung.

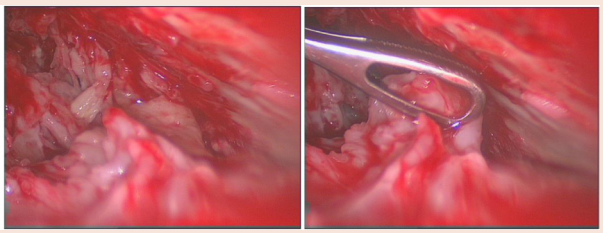

Figure 2: VATS management of a stage II empyema.

Table 1: Patient demographics of groups I and II.

	Group I	Group II	P Value
No. Patients	34	41	
Mean Age (years)	56.7	57.1	0.48
Gender (M:F)	21:13	28:13	0.55
Chronic lung disease	3	3	
Diabetes	3	5	

Table 2: Post-operative complications seen in groups I and II.

	Post-op bleeding	Air leak	Wound infection	Delayed extubation
Group I	2	1	0	1
Group II	1	1	1	2

or rehabilitation. Overall length of stay ranged from 2-29days with a mean of 6.9days. Excluding those patients transferred to other hospitals, the mean length of stay was 7.3days. A total of 27 patients were discharged with a chest drain in situ on a portex bag to manage ongoing drainage from the pleural cavity. In those patients where all chest drains were removed prior to discharge the average length of drainage was 7.2days (range 3-23). The mean length of stay was 7.2days (± 5.9days) in group I and 6.6days (± 5.3days) in group II. There were no in-hospital deaths reported. When comparing length of stay and post-operative complications, no significant difference between the groups was seen.

Conclusions

Empyema thoracis remains a common problem, affecting over 65,000 patients each year in the UK and US [5]. Prior to the advent of VATS the only surgical option for drainage and decortication was via

an open thoracotomy. In view of this, surgical intervention was often perceived as a final option for patients in whom optimum medical management had failed. VATS has now become an established mode of treatment for this condition. A number of papers have reported VATS to be as effective as, if not superior to open thoracotomy [6-10]. This has reopened the debate regarding optimum primary management, with a growing number of advocates for early, aggressive surgical intervention [11-15].

Alternatives to surgical intervention include the use of intrapleural fibrinolytic therapy instilled via a chest tube. Agents such as streptokinase, urokinase and recombinant tissue plasminogen have been used in this setting with variable results. A recent systematic review and meta-analysis included seven randomised controlled trials comparing fibrinolytic therapy with placebo [16]. Outcomes included treatment failure (surgical intervention or death) and length of hospital stay. The results demonstrated that intrapleural therapy was associated with a reduction in treatment failure alone but not for death or length of stay. The authors therefore concluded that fibrinolytic therapy has potential benefits in the management of empyema in adults but that there was not enough evidence to advocate routine use. For this reason the use of such agents is usually reserved for patients who are unfit or high risk for surgical intervention.

VATS provides a number of advantages over simple tube thoracostomy with or without fibrinolytic therapy in the management of empyema. The technique allows inspection of the lung and the opportunity for debridement under direct vision. Specimens can easily be obtained for microbiological analysis allowing more focused antibiotic therapy in the post-operative period, and washout of the pleural cavity can be performed. In this cohort only 15% of cases yielded positive cultures, which may be explained by long pre-operative antibiotic treatment in the majority of cases. Isolation of microbiological agents has been positive in up to 77% in other series [12]. Perhaps one of the most important benefits of VATS is the ability to assess re-expansion of the lung following drainage. Poor expansion increases the risk of fluid re-accumulation and failure of the procedure [13]. Assessment allows the surgeon to decide whether further endoscopic maneuvres may be useful or if an open approach is required. In this study, VATS was well tolerated by all patients with minimal post-operative complications. Resolution was achieved in 97% of cases with a conversion to thoracotomy rate of only 12%.

Despite VATS being widely used and accepted in this patient group, the timing of surgical intervention and optimum first line approach remain controversial [17]. The current BTS guidelines support early discussion with a thoracic surgeon and consideration of surgical treatment in patients with persisting sepsis and pleural collection [18]. Guidance advocates a maximum period of 7 days without resolution. In our cohort the majority of patients had received significantly longer conservative management at the time of surgery (mean 15.7days). We have demonstrated that patients treated for ≥ 2 weeks are significantly more likely to require open thoracotomy than those treated for < 2 weeks. These findings are in keeping with previous studies. Lardinois et al., reported the probability of conversion to thoracotomy for fibrinopurulent empyema increases from 22% to 86% between day 12 and day 16 of presentation [19]. In view of this, and the progressive nature of the disease, timing of any intervention is paramount to achieving success.

To date, there have only been two randomised controlled trials comparing VATS and tube thoracostomy as the primary intervention [11,20]. Both studies reported that patients undergoing VATS as the primary management had fewer treatment failures and shorter length of hospital stay. The sample groups involved were, however, both relative small (n=104 and n=20) and there was no analysis of cost. We did not demonstrate a correlation between length of pre-operative management and length of post-operative hospital stay. This may in part be explained by the fact that 23% of our patients were transferred back to their local hospital, while a further 25% were discharged home with a chest drain in situ.

VATS has now been fully established as a safe and effective approach in the management of patients with both acute and chronic empyema thoracis. The technique allows adequate assessment of the pleural cavity, specimen collection and, in the majority of cases, re-expansion of the lung. The current study is limited in that it is a retrospective analysis; it does however support previous recommendations for early surgical involvement as delayed referral has been shown to lead to a significant increase in the need for open thoracotomy [6-10,19]. The exact timing remains controversial but should be based upon the general condition of the patient, stage of disease at presentation and local considerations (such as ease of access to a thoracic surgery service). Further randomised trials, looking particularly at cost-effectiveness and service provision, are required if we are to advocate VATS as the first-line treatment for empyema. The current evidence, however, supports earlier referral for VATS to circumvent the need for open thoracotomy and prolonged hospital stay.

References

1. Magovern CJ, Rusch VW (1994) Parapneumonic and post-traumatic pleural space infections. Chest Surg Clin N Am 4: 561-582.
2. Francis Adams LL.D (1849) The genuine works of Hippocrates translated from the Greek with a preliminary discourse and annotations. London: Printed for the Sydenham Society.
3. Peters RM (1989) Empyema thoracis: Historical perspective. The Annals of Thoracic Surgery 48: 306-308.
4. Ferguson AD, Prescott RJ, Selkon JB, Watson D, Swinburn CR (1996) The clinical course and management of thoracic empyema. QJM 89: 285-289.
5. Ahmed RA, Marrie TJ, Huang JQ (2006) Thoracic empyema in patients with community-acquired pneumonia. Am J Med 119: 877-883.
6. Striffeler, H., Gugger, M., Im Hof, V., Cerny, A., Furrer, M. and Ris, HB (1998) Video-assisted thoracoscopic surgery for fibrinopurulent pleural empyema in 67 patients. Ann Thorac Surg 56: 319-323.
7. Casali C, Storelli ES, Di Prima E, Morandi U (2009) Long-term functional results after surgical treatment of parapneumonic thoracic empyema. Interact Cardiovasc Thorac Surg 9: 74-78.
8. Chan DT, Sihoe AD, Chan S, Tsang DS, Fang B. et al. (2007) Surgical treatment for empyema thoracis: is video-assisted thoracic surgery 'better' than thoracoctomy? Ann Thorac Surg 84: 225-231.
9. Chambers A, Routledge T, Dunning J, Scarci M (2010) Is video-assisted thoracoscopic surgical decortication superior to open surgery in the management of adults with primary empyema? Interact Cardiovasc Thorac Surg 11: 171-177.

10. Zahid I, Nagendran M, Routledge T, Scarci M (2011) Comparison of video-assisted thoracoscopic surgery and open surgery in the management of primary empyema. Curr Opin Pulm Med 17: 255-259.

11. Wozniak CJ, Paull DE, Moezzi JE, Scott RP, Anstadt MP, et al. (2009) Choice of first intervention is related to outcomes in the management of empyema. Ann Thorac Surg 87: 1525-1530.

12. Bilgin M, Akcali Y, Oguzkaya F (2006) Benefits of early aggressive management of empyema thoracis. ANZ J Surg 76: 120-122.

13. Cassina PC, Hauser M, Hillejan L, Greschuchna D, Stamatis G (1999) Video-assisted thoracoscopy in the treatment of pleural empyema: Stage-based management and outcome. J Thorac Cardiovasc Surg 117: 234-238.

14. Petrakis IE, Kogerakis NE, Drositis IE, Lasithiotakis KG, Bouros D, et al. (2004) Video-assisted thoracoscopic surgery for thoracic empyema: primarily, or after fibrinolytic therapy failure? Am J Surg 187: 471-474.

15. Bouros D, Antoniou KM, Chalkiadakis G, Drositis J, Petrakis I, et al. (2002) The role of video-assisted thoracoscopic surgery in the treatment of parapneumonic empyema after the failure of fibrinolytics. Surg Endosc 16: 151-154.

16. Janda S, Swiston J (2012) Intrapleural fibrinolytic therapy for treatment of adult parapneumonic effusions and empyemas: a systematic review and meta-analysis. Chest 142: 401-411.

17. Petrakis IE, Heffner JE, Klein JS (2010) Surgery should be the first line of treatment for empyema. Respirology 15: 202-207.

18. Davies CW, Gleeson FV, Davies RJ, Pleural Diseases Group, Standards of Care Committee (2003) BTS guidelines for the management of pleural infection. Thorax 58.

19. Lardinois D, Gock M, Pezzetta E, Buchli C, Rousson V, et al. (2005) Delayed referral and gram-negative organisms increase the conversion thoracotomy rate in patients undergoing video-assisted thoracoscopic surgery for empyema. Ann Thorac Surg 79: 1851-1856.

20. Wait MA, Sharma S, Hohn J, Dal Nogare A (1997) A randomized trial of empyema therapy. Chest 111: 1548-1551.

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