Management of parapneumonic effusion and empyema

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Aims: To gather data on the clinical presentation of parapneumonic effusion and empyema and to examine the effect of different management strategies on short term outcomes.

Methods: Retrospective case note review of 48 children admitted to a tertiary unit between January 1998 and March 2001. Effusions were classified into three stages dependent on ultrasound findings.

Results: The stage of effusion was not associated with duration of previous symptoms or length of previous admission. An interventional procedure was performed on median day 2 of admission in 46 children: eight (17%) had an intercostal drain alone, 14 (29%) had an intercostal drain followed by intrapleural fibrinolytic therapy, and 24 (50%) had a thoracotomy. Three children who had an initial intercostal drain alone returned to theatre for thoracotomy, and two children who had intrapleural fibrinolysis returned for thoracotomy. Median length of stay (interquartile range) for each initial procedure was 15 days (6–20) for intercostal drain alone, 8 days (6–12) for fibrinolytic therapy, and 6.5 days (3–9) for thoracotomy. Stay for intercostal drain alone was significantly longer than for thoracotomy.

Conclusion: Early surgical management of empyema is associated with a favourable outcome.
All children had chest radiographs performed and all were abnormal. Chest ultrasound was performed in 46 children (96%). Twenty seven children had chest ultrasound performed at their local hospital, and 19 had this repeated at our unit. If ultrasound had been performed twice, our ultrasound report was used for staging. A stage 1 effusion was seen in 12%, a stage 2 effusion in 38%, and a stage 3 complex empyema in 46%. Loculi were seen in 65%. In two children (4%) the result of the ultrasound was not sufficiently clear to allow staging. Computed tomography was performed in three children (6%). Stage of effusion was not associated with duration of previous symptoms or the length of the previous admission.

An intercostal drain had been inserted in three children at their local hospital but removed before admission. A therapeutic procedure was performed in 46 children (96%) on median day 2 of the admission (range: day 1 to day 8). An intercostal drain alone was placed in 22 (46%), and a thoracotomy was performed in 24 children (50%). A formal decortication was performed in eight (17%). One child had a small pigtail type intercostal drain.

Intrapleural fibrinolytic therapy was used in 15 children (31%), in association with an intercostal drain in 14 and in one after a thoracotomy. Urokinase 40 000 units was diluted in 40 ml of saline and given via the chest drain every 12 hours for a median of 3 days (range 1–5 days). Eight children had an intercostal drain but did not have fibrinolytic therapy. Table 1 shows the therapeutic procedures categorised by the stage of the effusion.

Three of eight (38%) children returned to theatre for a thoracotomy for failure of therapy after an initial intercostal drain alone, and two of 14 (14%) returned after an intercostal drain with fibrinolytic therapy. Four children returned to theatre for a further intercostal drain due to drain displacement, blockage or pneumothorax. Intercostal drains remained in place for a median of 4 days (range 2–12 days).

Cultures were positive in two of the eight pleurocenteses performed before a therapeutic procedure. There was a significant growth of organisms from the following sources: blood in seven children (15%), pleural fluid at the time of drain insertion in seven (15%), and sputum in two (4%). Serology was diagnostic in two children (4%). Overall, organisms were identified in 15 children (31%), as shown in table 2.

**DISCUSSION**

This study provides a retrospective review of the management of a large group of children with parapneumonic effusion or empyema in a tertiary centre in the United Kingdom over a short time interval. It shows a reduction in the length of stay in hospital compared to previous retrospective reviews. Children who had a thoracotomy as an initial procedure recovered quickly and had the shortest length of stay. Intrapleural fibrinolysis was used in 31% of children and this group also appeared to do well.

The strengths of this study lie in its short time interval during which there were no major changes in surgical strategy or imaging techniques. It is however not a randomised trial of different surgical techniques, and therefore one must place limits on the strength of evidence that can be obtained, especially with regard to short term outcomes. The patients studied were a heterogeneous group, with a wide range in duration of preceding symptoms and prior admission. It is important not to over-extrapolate these results into a treatment strategy for an individual. However, these patients probably best represent the more severe end of the spectrum of parapneumonic pleural inflammation, as these were mostly referrals from other hospitals in the area. Patients with small simple effusions were probably not referred. Almost half (48%) had complicated empyemas on ultrasound evaluation, and only 12% were (retrospectively) classified as simple effusions. In addition all but two children had some form of interventional procedure. We also accept that we have not evaluated long term outcome. We considered that this would not be feasible in a retrospective study, and much of the follow up occurred in the local hospital rather than at our centre. Data on lung function, radiological resolution, and cosmetic appearance would be valuable in evaluating long term implications of each strategy.

We used ultrasound as our main imaging technique to guide therapy. This is in contrast to some other surveys that
have advocated chest computed tomography (CT) as the next imaging modality after chest radiographs.1 4 In fact, in one series the number of CT scans per patient was 2.7. Ultrasound in experienced hands can show the presence of septations, loculations, thickened pleura, and the mobility of the underlying lung.6 We avoided CT in all but three children, avoiding cost, radiation burden, and potentially the need for further anaesthesia.

Organisms were identified in 31% of children, which is low but similar to previous surveys.7 8 The most common organism was Streptococcus pneumoniae, but 20% of organisms were Staphylococcus aureus, underlying the need for anti-staphylococcal cover. Only 17% of cultures had prior aspiration of the pleural effusion, and more widespread adoption of early aspiration may aid organism identification. More recent techniques of antigen detection with polymerase chain reaction can increase the diagnostic yield further.9 We found that thrombocytosis was common, which has been previously described,10 but the degree of thrombocytosis was particularly high (greater than 1000) in 13% at some stage of the admission. One child had a significant immunodeficiency diagnosed following his presentation with empyema, and this highlights the importance of further investigation of immune function in some patients, particularly those with repeated significant infections or a family history of immune deficiency.

Properties of pleural fluid such as glucose, lactate dehydrogenase, and pH have been proposed as a guide to dictating treatment in adults,11 but these have not been adequately evaluated in children. In a series of 85 adults with pleural infection, only the absence of purulence of pleural fluid was found to be a useful predictor of success of chest drainage and intrapleural fibrinolysis.12 We found that the duration of preceding symptoms or previous admission was unrelated to the stage of the effusion, which suggests that the rate of progression of pleural inflammation varies between individuals and the organism responsible.

The median length of stay for the whole group was short compared with other surveys.13 There was a clear statistical and clinical difference in the length of stay between those children who had an initial thoracotomy (median 6.5 days) and those who had only a chest drain inserted (median 15 days). Those children who had chest drains alone tended to be those with less complex effusions (table 1), compared to those who had thoracotomies. One might expect that the former might recover more quickly than those children who had more major surgery. This was clearly not the case with discharge at might recover more quickly than those children who had more thoracotomies. One might expect that the former children who had an initial thoracotomy (median 6.5 days) appeared shorter than the intercostal chest drain alone group, but these have not been adequately numbers involved. There have been several small case series of the use of fibrinolysis in paediatric empyema, and there has appeared shorter than the intercostal chest drain alone group, but these have not been adequately series of 85 adults with pleural infection, only the absence of purulence of pleural fluid was found to be a useful predictor of success of chest drainage and intrapleural fibrinolysis.12 We found that the duration of preceding symptoms or previous admission was unrelated to the stage of the effusion, which suggests that the rate of progression of pleural inflammation varies between individuals and the organism responsible.

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Intrapleural fibrinolytic therapy was used in 31% of patients and in all three ultrasound assessed stages. Median length of stay at 8 days was similar to the thoracotomy group and appeared shorter than the intercostal chest drain alone group, although this was not statistically significant for the small numbers involved. There have been several small case series of the use of fibrinolysis in paediatric empyema, and there has been a recent randomised placebo controlled trial of urokinase.11 This reported a 2 day reduction in hospital stay in those children given urokinase (to 7.4 days), with a further reduction if a small percutaneous drain was used. Only five of the 58 children in the trial required thoracotomy, which is a much lower proportion than in our study. The children in this trial may therefore represent a different part of the spectrum of severity, with only 7% having densely echogenic collections and 3% had empyema on ultrasound.

Several retrospective series evaluating the use of video assisted thoracoscopic surgery (VATS) have shown that it is a safe and effective therapy in children, even with advanced disease.12 13 14 It appears to be associated with short lengths of stay, and some centres propose it as a primary procedure15 16 in loculated effusions. However, some children still require thoracotomy after a VATS procedure, and some groups accept its limitations compared to thoracotomy.12 13 For those children who have dense collections and a thickened pleural rind, the ability of either fibrinolytic therapy or VATS to provide clearance of the pleural space must be questioned. In these advanced empyemas our surgeons prefer to perform a thoracotomy with debridement of the pleural space. This study suggests that this approach provides rapid recovery, with little risk of a second surgical procedure being required.

Conclusions

This retrospective review gives an overview of current management of parapneumonic effusion and empyema in a single institution in the United Kingdom. Children who had a thoracotomy recovered quickly and had a better outcome than those who initially had a chest drain alone. This observation supports early and aggressive management of complicated effusions. Those who had fibrinolytic therapy also had a favourable outcome and there is now evidence of its efficacy in children. We believe that a randomised trial is now required to compare the therapeutic options available, including fibrinolysis and VATS.

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