Use of intrapleural urokinase in an infant with empyema thoracis

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Abstract

We reported an infant who was given intrapleural fibrinolytics as part to the management of empyema thoracis. The 6-month-old boy was admitted for fever, cough, and shortness of breath for three days. Chest X-ray showed opacification of right chest with mediastinal shift to the left. Bedside ultrasound thorax showed significant pleural effusion measuring 3 cm with fibrinous tissue inside the fluid. In face of the respiratory distress, the boy was intubated and put on mechanical ventilation. A 12-gauge pigtail chest drain was inserted, yielding 60 ml of thick pus-like fluid within the first hour. The patient was empirically treated with intravenous cefotaxime and penicillin combined with oral klacid after admission. Both blood culture and pleural fluid yielded Haemophilus influenzae type A which was sensitive to ampicillin. Antibiotics was switched to intravenous ampicillin of 200 mg/kg/day. Because of significant pleural effusion with poor chest drain output, intrapleural fibrinolytic was started on day 3 of admission. The drain was removed on day 12 and a total of 6-week course of intravenous ampicillin was given. Empyema responded well to conservative treatment. Our report has illustrated the efficacy and safety of intrapleural fibrinolytics in infant with empyema.

Keywords: Empyema thoracis; infants; urokinase

Introduction

Bacterial pneumonia is a common paediatric problem and the incidence of empyema thoracis is increasing. There have been increasing reports of use of intrapleural fibrinolytics in empyema thoracis in children.† However, use of intrapleural fibrinolytics in infants were much less reported. In this series, we reported a 6-month-old boy with empyema thoracis treated with intrapleural urokinase.

Case report

PP was a 6-month-old boy admitted for fever, cough, and shortness of breath for three days. He had history of cytomegalovirus pneumonitis at 3 months of age requiring intensive care with total hospital stay for one month. For the current admission, the child was pale and lethargic. On initial physical examination, there was mild dehydration with dry mucosa and mildly depressed anterior fontanelle. He was in significant respiratory distress with respiratory rate of 80 per minute and diminished breath sound bilaterally. He had tachycardia with heart rate of 180 per minute but cardiovascular examination was otherwise normal. Abdominal examination revealed hepatomegaly of 4 cm below the costal margin. Initial SpO₂ was 80% in room air. Chest X-ray showed opacification of right chest with mediastinal pushed to the left. Bedside ultrasound thorax showed significant pleural effusion measuring 3 cm with fibrinous tissue inside the fluid. Initial investigation showed raised white blood cell of 20.9 × 10⁹/L, neutrophil of 17 × 10⁹/L and C-reactive protein of 177. The first arterial blood gases showed mixed respiratory and metabolic acidosis with pH 7.24, pCO₂ of 5.3, HCO₃ of 16.7 and base excess of -10.

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In face of the respiratory distress, the boy was intubated and put on mechanical ventilation. A 12-gauge pig-tail chest drain was inserted, yielding 60 ml of thick pus-like fluid within the first hour. The patient was empirically treated with intravenous cefotaxime and penicillin combined with oral klacid after admission. Repeated arterial blood gases after mechanical ventilator improved with pH 7.43, pCO\textsubscript{2} of 4.4, HCO\textsubscript{3} of 21.5 and base excess of -1.9. Liver and renal function was normal except for mildly raised ALT and AST of 65. Pleural fluid for protein was 52 g/L, glucose was 0.3 mmol/L, pH was 6.8, lactate dehydrogenase (LDH) was 17,170 IU/L. Fluid for culture yielded *Haemophilus influenzae* type A. Serum for mycoplasm titre was <10 and cold agglutinin was <64. Nasopharyngeal aspirate for immunofluorescence was negative.

As the child was active with better respiratory effort after chest drain insertion and initial stabilisation, he was extubated to continuous positive airway pressure (CPAP) few hours after admission. Both blood culture and pleural fluid yielded *Haemophilus influenzae* type A which was sensitive to ampicillin. Antibiotics was switched to intravenous ampicillin of 200 mg/kg/day. Daily chest drain output was charted (Figure 1). Because of significant pleural effusion with poor chest drain output, intrapleural fibrinolytic was started on day 3 of admission. Urokinase of 4,000 units in 4 ml NS was administered through the chest drain every 12-hourly for 3 days. After administration, the chest drain was clamped for 4 hours. There was increase in chest drain output after urokinase (Figure 1).

Computer tomography of the thorax on day 6 of admission and on completion of the course of urokinase showed focal fluid collection at the right paracardiac region suggestive of loculated pleural effusion. There was segmental collapse of the right lower lobe with mild

![Figure 1. Daily chest drain output decreased on day 2-3 with persistent pleural effusion; drain output significantly increased after introduction of intrapleural fibrinolytics (↑); chest drain was clamped on day 9 (↓) when pleural fluid dropped below 10 ml per day for three consecutive days.](image-url)
right pleural effusion. Chest drain was clamped on day 9 of admission as chest drain output fell to less than 10 ml/day for more than three consecutive days. The drain was removed on day 12 with no reaccumulation of pleural effusion. Fever subsided 1 day after admission. C-reactive protein and WBC gradually normalised. Repeated CT thorax 6 weeks after admission showed resolved right paracardiac loculated effusion and right lower lobe collapse. A total of 6-week course of intravenous ampicillin was given. He remained well at follow-up 6 months later.

**Discussion**

There was an increase in incidence of empyemas in children in recent studies. The current paper reported an infant with empyema thoracis that did not respond to treatment with antibiotics and thoracocentesis alone. The management of empyema is controversial with no clear guideline on indication of each modality of treatment, including conservative management with antibiotics, thoracocentesis, chest tube drainage, instillation of intrapleural fibrinolytic, and surgery. While most would take a stepwise approach, some studies advocate the use of early video-assisted thoracic surgery (VATS) or decortication as the primary treatment. A larger and more recent trial involving the use of intrapleural streptokinase in more than 200 adult patients failed to show decrease in mortality and need for surgical intervention. There was so far only one multicentre randomised double-blind controlled trial of intrapleural urokinase in children. The study demonstrated a reduction of hospital stay from 9.5 to 7.4 days (p=0.027) with the use of urokinase during the first 4 days of illness. The group also studied the effect of size of the percutaneous drain on the duration of stay, with reduction from 9.4 to 7.2 days (p=0.017) by using a small-bore drain. With the combination of two measures – urokinase and small percutaneous drain – the hospital stay was shortest. In this study, however, there was no significant difference in number of patients requiring surgical intervention. A meta-analysis in children showed that the overall successful outcome without surgery is about 90% with primary fibrinolytic therapy, when compared to 76% with chest tube and antibiotics alone.

There was even fewer experiences on the use of intrapleural urokinase use in infants. The youngest children included in the randomised controlled trial is 5 months old. For the current case, no complication was encountered. As urokinase was the only one studied in randomised controlled trial, urokinase was recommended for children. The dosage used in the randomised trial was recommended, i.e. urokinase twice daily for 3 days (6 doses in total) using 40,000 units in 40 ml 0.9% saline for children weighing 10 kg or above, and 10,000 units in 10 ml 0.9% saline for children weighing under 10 kg. In conclusion, the current case supported the use of intrapleural urokinase in infants with empyema.

**References**