The value of early CT in complicated childhood pneumonia

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Abstract Objective. To investigate the value of CT in complicated childhood pneumonia and its role in early intervention when chest radiography (CXR) is non-contributory. Materials and methods. Forty-two immunocompetent children, aged 1–11 years, admitted for community-acquired pneumonia from October 1997 to September 1999, had 42 contrast-enhanced CT scans and frontal chest radiographs on the same day, which were assessed independently. CT was performed when the patient remained unwell and the CXR images showed failure of resolution despite 7–10 days of antibiotics and/or drainage with urokinase therapy. Results. Compared to CT, CXR revealed suboptimal accuracy rates of lobar involvement (84%), chest tube placement (73%), fluid loculation (42%), abscess formation (40%) and bronchopleural fistulae (33%). It could not assess parenchymal or pleural complications such as cavitary necrosis, early abscess formation, empyemas or pericardial effusions. On the basis of the CT findings and poor clinical progress, 16 patients underwent surgical intervention with the aid of video-assisted thoroscopic surgery (VATS). The CT features correlated well with surgical findings. Ten cases required pleural decortication while six with destructive or necrotic lung lesions had surgical resection. Debridement was difficult when the pleura had become thick and fibrotic. Streptococcus pneumoniae was the offending organism in 81% of cases. The right side was affected in 67% of cases. Conclusions. In complicated childhood pneumonia, CT is far superior to CXR in revealing pleural and parenchymal complications, which may require early surgical intervention.

Keywords Childhood · Pneumonia · CXR · CT · VATS

Introduction

We have seen a disturbing threefold increase in our hospital admissions for complicated childhood streptococcal (pneumococcal) pneumonia. These patients are initially evaluated with chest radiographs and treated with IV antibiotics. When a significant pleural effusion is present, drainage and urokinase therapy using a simple chest tube is advocated. If the child does not show any improvement after 7–10 days of medical therapy and/or the opacification on chest radiographs does not resolve, it is our experience that a potentially serious underlying parenchymal or pleural disease is present [1]. Chest radiography (CXR) is often unhelpful in detecting these complications and there is no question that CT yields far more information [2] and is accurate in revealing lung abscesses and cavitary necrosis [3, 4]. Sonography has
been used for the detection of pleural effusions, but is less useful in evaluating parenchymal complications or deep-seated loculations.

Recently, video-assisted thoroscopic surgery (VATS) has been used for pleural toilet and decortication of empyemas [5]. Compared with a standard thoracotomy, VATS results in decreased morbidity and hospital stay. However, most published reports agree that early intervention is necessary for VATS to succeed [6]. Once the empyema crosses from the exudative and fibrinous stage to the organizing phase, decortication with VATS may be difficult. When the disease is advanced or when large abscesses have formed, thoracotomy is usually necessary.

We embarked on this study with two aims:

1. To compare the accuracy of CXR with CT in the assessment of pneumonic complications at 7–10 days after parenteral antibiotics and/or chest tube drainage.
2. To evaluate the importance of certain CT features in the decision to intervene surgically.

**Materials and methods**

Forty-two consecutive immunocompetent children, aged 1–11 years, admitted for community-acquired pneumonia from October 1997 to September 1999 were accepted into this prospective series. CT was performed after 7–10 days of admission when the clinical status had not improved (i.e. continuing fever, respiratory symptoms) or there was inadequate resolution of the CXR opacities despite IV antibiotic therapy and/or chest tube drainage. In one patient, CT was performed 10 days after admission on the 7th postoperative day for lobectomy and debridement when he became increasingly dyspnoeic and CXR was non-contributory.

The frontal chest radiograph done on the same day as the CT scan was assessed by a single reviewer who was blinded to the CT findings. CT was performed immediately after the IV administration of non-ionic contrast medium (Omnipaque 240; 2 ml/kg body weight) by hand. Spiral scans with a slice thickness of 5–8 mm were employed, depending on the size of the patient. The CT scans were arranged randomly and reviewed by a single radiologist at a separate session. The features assessed were:

1. **Lung**
   - The segment or lobe consolidated or collapsed
   - Presence of parenchymal suppuration
   - Cavitary necrosis
   - Macroscopic abscesses > 5 mm

2. **Pleura**
   - Presence and distribution of pleural fluid (loculated or free)
   - Pleural thickening and enhancement
   - Viscosity
   - Bronchopleural fistulae
   - Chest tube placement (anterior or posterior)