Co-existence of Posttraumatic Empyema Thoracis and Lung Abscess in a Child After Blunt Chest Trauma: A Case Report

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Posttraumatic empyema commonly results from blunt or penetrating chest injuries, and its severity is related to morbidity and mortality because of post-pneumonia empyema [1]. Potential causes of posttraumatic empyema thoracis include iatrogenic infection during chest tube insertion, direct infection resulting from penetrating wounds and secondary infection resulting from associated intra-abdominal organ injuries [2]. Although the incidence of posttraumatic empyema thoracis has been reported to range from 1.6% to 2.4% in adult patients suffering from blunt thoracic trauma [2], it is relatively rare in children, particularly in association with lung abscess, compared with adult patients [2]. Here, we report our experience of treating a 15-year-old boy who suffered from posttraumatic empyema thoracis, accompanied with lung abscess after blunt chest trauma. The patient was not initially given any prophylactic antibiotic under the impression of chest contusion. Two weeks later, he was transferred to our hospital because of the development of severe empyema. Chest ultrasound and computed tomography (CT) revealed empyema and abscess. In this report, we describe the case history and treatments, including CT-guided drainage and antibiotics administered, and review the appropriate treatments for complicated empyema thoracis in children after lung contusion.

Key Words: CT-guided catheter drainage, lung abscess, posttraumatic empyema thoracis

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performed at the time showed opacity over the right lower lobe of the lung, compatible with the diagnosis of pulmonary contusion (Figure 1). He was discharged from the local hospital and treated with acetaminophen only. Seven days later, cough with sputum and fever developed, and he was admitted to a local hospital. He was then diagnosed with pneumonia and intravenous cefazolin was given. However, after 7 days of cefazolin treatment, his fever and cough were still persistent. He began to complain of right chest pain on deep respiration. A chest radiograph showed an air-fluid level containing cavity mass-like lesion over the right lower lung field (Figure 2A). Therefore, he was transferred to our hospital because of his worsening condition.

On physical examination, the boy weighed 57 kg and was 167 cm tall. He looked ill and uncomfortable. Chest auscultation revealed decreased breath sounds over the right side. Laboratory studies showed that the white blood cell count was 11,310/mm³ and segmented neutrophils were 72%. Serum C-reactive protein was 30.28 mg/dL (normal range: <5 mg/dL). Chest CT revealed a lung abscess and empyema over the right lower lobe (Figure 2B). Chest ultrasonography revealed a hypoechoic cavity with a thickened wall (Figure 2C). Under CT guidance, an 8-Fr Pigtail catheter (Skater™ Drainage Catheter; Angiotech, Denmark) was unevenly inserted to the abscess cavity through the posterior aspect from the back, and a large amount of pus was drained out. Gram staining of the pus revealed numerous Gram-positive cocci. Aerobic and anaerobic cultures of the drained pus, blood and sputum revealed negative results. After 8 days of cefotaxime administration, the catheter was removed because the drainage became nonproductive and chest radiographs showed that the empyema and lung abscess had markedly regressed (Figure 2D). After 2 weeks of continuous administration of cefotaxime, the patient was discharged with an improved condition. At a follow-up 1 month after discharge, the boy was asymptomatic with normal chest radiography.

**DISCUSSION**

Thoracic infection after trauma is an important issue because it is a common cause of morbidity and late mortality [1]. The incidence of posttraumatic empyema thoracis was reported to range from 1.6% to 2.4% in patients with blunt chest trauma [2]. However, there are few reports of pediatric patients with posttraumatic empyema thoracis and lung abscess. Risk factors for posttraumatic empyema thoracis include retained hemothorax, pulmonary contusion, and multiple chest tube placements [3]. Our patient had suffered from pulmonary contusion and empyema thoracis developed 2 weeks later.

The treatment of children with pulmonary contusion involves the general principles of injury management, together with pulmonary care and supplemental oxygen [4]. In addition, avoiding fluid overload, pain control and appropriate nutritional support are recommended [5]. Corticosteroids do not provide any benefits [6]. The use of prophylactic antibiotics to prevent the development of posttraumatic empyema thoracis remains a controversial issue. The Eastern Association for the Surgery of Trauma practice Management Guidelines Work Group concluded that the evidence is insufficient to recommend the routine use of prophylactic antibiotics for the management of chest trauma [7]. Eren et al suggested using prophylactic antibiotics only in patients with risk factors, such as prolonged duration of tube thoracostomy, prolonged intensive care stay, presence of contusion, retained hemothorax, and exploratory laparotomy [8]. For blunt chest trauma, secondary deterioration within a few days of the injury may indicate complications and should be investigated [4].

The pathophysiology of posttraumatic empyema thoracis is quite different from that of parapneumonic...
empyema thoracis. Hoth et al reported that there was little correlation between preoperative bronchoalveolar lavage and sputum cultures and intraoperative cultures in patients with posttraumatic empyema [9]. *Staphylococcus aureus* was the most common organism identified in cases with posttraumatic empyema, followed by pure or mixed anaerobic bacteria [2,8,9]. The pathophysiology is most likely related to the inoculation of the pleural space by the injury itself [9]. However, in children with parapneumonic empyema thoracis, the most common pathogen isolated from blood and pleural fluid is *Streptococcus pneumoniae* [10]. In our patient, there were numerous Gram-positive cocci based on Gram staining of the pleural fluid, while cultures of sputum, pleural fluid and blood were all negative. Although *S. aureus* is the most likely pathogen, mixed infection or other pathogens should also be considered.

Accordingly, conventional radiographic techniques and clinical histories are not sufficient to delineate between an abscess or empyema and a cavity lesion. A CT scan can help to make the distinction between both lesions [11]. Empyema is diagnosed by the presence of loculated pleural fluid with or without air bubbles or air-fluid levels. In contrast, lung abscess is diagnosed by a relatively thick-walled pulmonary parenchymal cavity with air-fluid levels. A pleuroparenchymal abscess is also diagnosed if there are inflammatory changes adjacent to the pleural fluid [11–13]. In the present case, the CT revealed loculated pleural fluid with air-fluid levels. Meanwhile, a pulmonary parenchymal cavity with a thickened wall

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**Figure 2.** (A) Chest radiograph in the standing position showed a cavity mass lesion with air-fluid level. (B) Chest computed tomography confirmed the loculated fluid-containing lung abscess with a surrounding irregular thick-walled border. (C) Lung sonography showed a hypoechoic cavity with thickened wall. (D) Chest X-ray performed 8 days later revealed dramatic regression of infiltration and fluid collection after insertion of an 8-Fr drainage catheter.
and consolidation was noted, suggesting coexistence of empyema thoracis and lung abscess.

In general, the treatment for posttraumatic empyema thoracis includes continued tube thoracostomy, decortication and image-guided catheter drainage. Except for some cases with complicated empyema requiring decortication, image-guided drainage can provide a safer and more effective therapeutic modality and was recently suggested as first-line treatment in most patients with empyema thoracis [14], or lung abscess [15]. Furthermore, it was reported that image-guided percutaneous drainage improved the success rate when the anechoic or complex non-septated lesions are detectable, rather than a complex septated area, suggesting an empyema on chest ultrasonography [14]. Similarly, in the present case, hypoechoic empyema and a single loculated cavity with fluid accumulation was noted on chest ultrasonography. Therefore, CT-guided percutaneous catheter drainage could provide a satisfactory outcome in such cases.

In conclusion, thoracic infection after trauma is a concern for prevention and treatment. In pediatric patients, the combination of empyema thoracis and lung abscess resulting from a blunt chest trauma has been rarely reported in medical literature. Careful follow-up of posttraumatic lung contusion is essential, although treatment with antibiotics is controversial. Using careful assessment with chest ultrasound, image-guided percutaneous drainage can provide a safer, less invasive, and more effective method for treating posttraumatic patients with both empyema thoracis and lung abscess, instead of direct decortication.

REFERENCES

兒童胸部鈍傷後併發創傷後膿胸併有肺膿瘍：
病例報告

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創傷後膿胸是胸部創傷後少見的併發症，發生率約 1.6–2.4%，在兒童的病例甚為少見。我們報告一位 15 歲的男孩，發生車禍後一開始被診斷為肺挫傷，但卻在 14 天後出現高燒，咳嗽合併膿痰及右胸疼痛的症狀。經診斷為創傷後膿胸合併肺膿瘍，我們成功地以電腦斷層掃描定位引流術及抗生素治療病人。我們強調創傷後膿胸合併肺膿瘍在兒童的病例非常少見，臨床醫師對創傷後產生肺挫傷的病人應提高警覺並小心追蹤。雖然文獻報告大部分出現創傷後膿胸的病人都需要外科治療，我們的經驗提供，影像定位引流術在篩選過的病人可作為第一線輔助治療方法。

關鍵詞：電腦斷層掃描定位引流術，肺膿瘍，創傷後膿胸
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