CASE REPORTS

Empyema Necessitatis Due to Methicillin-Resistant Staphylococcus aureus: Case Report and Review of the Literature

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Empyema necessitatis is a rare complication of empyema in which the pleural infection spreads outside of the pleural space to involve the soft tissues of the chest wall. Most cases of empyema necessitatis are related to Mycobacterium tuberculosis and, less commonly, to Actinomyces spp. and Streptococcus spp. Staphylococcus aureus has rarely been reported as the causative agent of empyema necessitatis, with the majority of S. aureus isolates being methicillin sensitive. Only two cases of empyema necessitatis due to methicillin-resistant S. aureus (MRSA) have been reported in the medical literature. We report the case of a 59-year-old Caucasian male who presented to our institution with complaints of pain in and swelling of his left upper chest of 2-months duration. A computed tomography scan of the chest showed an 8.1- by 6.5-cm lesion which extended from the left upper lobe of the lung into the extrathoracic soft tissues beneath the left upper pectoralis muscle. A wedge resection of the left upper lung lobe revealed lung tissue with an organized pneumonia-like pattern associated with marked acute pleuritis. Blood and urine cultures and cultures of the left chest soft tissue mass grew MRSA. The patient was successfully treated with vancomycin followed by a 10-day outpatient course of ciprofloxacin and trimethoprim-sulfamethoxazole. This case represents an extremely rare manifestation of an increasingly dangerous bacterial pathogen.

CASE REPORT

A 59-year-old Caucasian male presented to our institution with complaints of progressive pain in and swelling of his left upper chest of 2-months duration. He had a significant past medical history of hypertension, insulin-dependent diabetes mellitus, chronic renal failure, cirrhosis, and bleeding esophageal varices requiring esophageal banding. He also had a history of heavy alcohol and tobacco use. On physical examination, his temperature was 98.1°F, his pulse was 71 beats per minute, his respiratory rate was 18 breaths per minute, his blood pressure was 142/84 mmHg, and his oxygen saturation was 97% on room air. His white blood cell count at the time of admission was 14.6. The patient's left upper chest wall was erythematous and tender to palpation. A computed tomography scan of the chest showed an 8.1- by 6.5-cm lesion which extended from the left upper lobe of the lung into the extrathoracic soft tissues beneath the left upper pectoralis muscle (Fig. 1). The central portion of the lesion showed fluid accumulation and air within the fluid-filled cavity. Erosion and bony destruction of the left lateral portion of the sternum and the distal end of the first rib were identified. Bilateral pleural effusions were present, and thrombosis of the left subclavian vein was seen. The radiographic differential diagnosis included abscess versus neoplasm. Blood cultures were drawn at the time of admission, and a subsequent Gram stain revealed Gram-positive cocci in clusters.

The patient was started on empirical vancomycin therapy. Urine culture and susceptibility studies were performed the next hospital day, and both the blood and urine cultures eventually yielded methicillin-resistant Staphylococcus aureus (MRSA). Antimicrobial susceptibility patterns were determined, using MicroScan panels (pos MIC panel type 20A; Siemens Dade Behring, West Sacramento, CA). In an attempt to further classify the patient's chest wall lesion, an ultrasound-guided fine-needle aspiration of the chest wall mass was performed on hospital day 4. After several attempts at aspiration, a scant amount of thick, tan fluid was obtained. MRSA was again isolated by culture. Despite 9 days of vancomycin therapy, the patient's lung lesion persisted, and a wedge resection of the left upper lung lobe with tube thoracostomy drainage of the left pleural space was performed. Histologic examination of the lung revealed an organized pneumonia pattern and associated marked acute pleuritis (Fig. 2). A repeat blood culture again showed MRSA. The patient's vancomycin therapy was continued for a total of 25 days, followed by a 10-day outpatient course of ciprofloxacin and trimethoprim-sulfamethoxazole.

Discussion. Empyema is a subtype of parapneumonic effusion characterized by the accumulation of purulent fluid and fibrin in the pleural space. There are two stages of parapneumonic pleural effusions, each having different fluid qualities and drastically different treatments (2). The first is the exudative stage, in which the fluid is usually clear and straw colored. The pH and glucose concentration are normal, and the concentration of lactate dehydrogenase is less than 500 U/liter. The exudative parapneumonic effusion does not require drain-
age and is easily treated with antibiotics. The fluid in the second stage is no longer clear because of an increase in bacteria, leukocytes, debris, and fibrin. When the fluid turns to pus, an empyema has developed. The fluid in this stage has a pH of less than 7.2, a glucose concentration of less than 40 mg/dl, and a lactate dehydrogenase concentration greater than 1,000 U/liter. The treatment of empyema is more complicated, including not only antibiotics, but also drainage. In severe cases, surgery may also be necessary.

A rare complication of empyema in which the pleural infection spreads outside of the pleural space to involve the soft tissues of the chest wall is known as empyema necessitatis. The most common location of an extension is the anterior chest wall between the midedcavicular and anterior axillary lines (3). Other reported locations of extensions include the abdominal wall, paravertebral space, vertebrae, esophagus, bronchus, mediastinum, diaphragm, pericardium, flank, breast, and retroperitoneum (5, 7).

First described in the medical literature by Gullan De Baillon in 1640, empyema necessitatis is an uncommon complication of empyema in which inflammation associated with an underlying pulmonary bacterial infection bridges the pleural space and involves the thoracic wall. The first modern review of this entity was a description of 115 cases by Sindel in 1940, but due to the advent of antibiotic therapy since that time, the incidence of empyema necessitatis has declined significantly (6). The majority of empyema necessitatis cases are caused by Mycobacterium tuberculosis, although many other organisms have also been implicated, including S. aureus. Only two previous cases of MRSA empyema necessitatis have been reported in the medical literature.

Empyema necessitatis may be asymptomatic but can also present vaguely as pleuritic chest pain and a nonproductive cough. Most commonly, an enlarging soft tissue mass is present on the chest wall (5). As in the current case, computerized tomography is necessary to make the diagnosis. A computerized tomography scan demonstrates a pleural effusion connected to the chest wall mass, which is pathognomonic for empyema necessitatis (5).

For the clinician, the differential diagnosis of an empyema with chest wall extension includes lymphomas, primary pulmonary neoplasms such as bronchogenic carcinoma and mesothelioma, sarcomas, and, finally, infective endocarditis with septic embolization (8). The clinical presentation can be helpful in making the diagnosis of empyema necessitatis. Neoplasms typically have a more indolent presentation and generalized symptoms. Lymphadenopathy is usually present in patients with lymphomas.

The median age at diagnosis of empyema necessitatis is 44.5 years, with a range of 3 months to 81 years (1, 3). It is extremely rare in pediatric patients. The first pediatric case was reported by Laennec in a 12-year-old male (3). The youngest patient reported in the medical literature was a 3-month-old female with empyema necessitatis caused by MRSA.

Since the introduction of antibiotics, the number of cases of empyema necessitatis has decreased significantly (8). M. tuberculosis remains the most common etiologic agent, but Actinomyces species have replaced Streptococcus pneumoniae as the second most common cause (7, 8). Less common etiologic agents include S. aureus, Streptococcus milleri, Fusobacterium nucleatum, Mycobacterium avium, Mycobacterium intracellulare, Burkholderia cepacia, and Blastomyces spp. (7). Interestingly, Pseudomonas cepacia has been reported as a cause of empyema necessitatis in patients with cystic fibrosis following lung transplantation (4).

Only rare cases of empyema necessitatis due to MRSA have been reported in the medical literature. In 2005, the first reported case of MRSA-related empyema necessitatis was diagnosed in an 8-month-old male (7). The patient was treated with surgical drainage and a 10-day course of vancomycin followed by oral trimethoprim-sulfamethoxazole to complete a 21-day course. A second case of MRSA-related empyema necessitatis, in a 3-month-old female, was reported in 2006 (3). The patient was treated with thoracotomy with decortication and tube thoracotomy and a 14-day course of vancomycin followed by oral linezolid for 7 days. To our knowledge, our case represents the third reported case of MRSA-related empyema necessitatis occurring in an adult.

The treatment of empyema necessitatis includes surgical drainage and antimicrobial therapy (2). The overall mortality rate in the preantibiotic era was 66%, with a mortality rate of 87% in cases of M. tuberculosis-related empyema necessitatis and 28% in cases of S. pneumoniae-related empyema necessitatis (1). Since the advent of antimicrobial therapy, no fatalities have been documented. In the treatment of empyema necessitatis, prophylactic antibiotic coverage for possible pathogens

FIG. 1. Computed tomography scan of the chest showing an 8.1- by 6.5-cm lesion which extends from the left upper lobe of the lung into the extrathoracic soft tissues beneath the left upper pectoralis muscle.
should begin immediately after diagnosis, and antimicrobial therapy can subsequently be altered when the susceptibility patterns of the cultured organism are available. Empyema necessitatis caused by M. tuberculosis has a cure rate of 99% when treated with 9 to 12 months of isoniazid and rifampin (5). Antimicrobial agents that have been reported as efficacious in the treatment of the rare cases of documented MRSA-related empyema necessitatis include vancomycin, linezolid, trimethoprim-sulfamethoxazole, and rifampin (3).

In summary, our case represents an extremely rare manifestation of an increasingly dangerous bacterial pathogen. Empyema necessitatis should be suspected in any patient with pulmonary symptoms presenting with a chest wall mass as well as in patients with known skin and soft tissue infections of the chest wall. Imaging studies and sampling of the lesions by aspiration or biopsy are the mainstays of diagnosis. Appropriate antimicrobial therapy and surgical drainage of the empyema are the mainstays to a successful outcome in cases of empyema necessitatis.

REFERENCES