Empyema Necessitans in the Setting of Methicillin-Susceptible Staphylococcus aureus Causing Pneumonia and Bacteremia

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1. Introduction

Empyema is a collection of pus in the pleural space. It is commonly caused by certain bacterial pathogens and requires drainage in addition to appropriate antibiotics for definitive therapy. Empyema necessitans (EN) is a rare entity that refers to an insidious extension of the empyema through parietal pleura and dissection into the subcutaneous tissue. EN typically occurs in the setting of long-standing parapneumonic effusions, especially those that are tuberculous in nature. It rarely presents secondary to an acute bacterial infection. We report a rare case of EN due to MSSA occurring acutely in a patient with intravenous drug use (IDU).

2. Case Report

We describe a case of a 29-year-old man with a history of IDU who presented to the hospital with fever and chills a few days after an inadvertent needle stick while injecting heroin. Avoiding medical care at first, he eventually came to the Emergency Department when he developed swelling around the punctured skin over the inferior aspect of the left cubital fossa. Upon initial evaluation, he had a temperature of 37.3°C, heart rate of 104 per minute, and respiratory rate of 38 per minute. The inferior aspect of the left cubital fossa was warm, erythematous, and with a 3.5 cm × 3.5 cm well-circumscribed area of fluctuance and induration. Laboratory evaluation revealed a hemoglobin of 10.9 gm/dl and white blood cell count of 10.6 k/cumm with a neutrophilic predominance but no immature granulocytes. His absolute neutrophil count was 9.1 k/cumm (normal 1.5–6.5 k/cumm). The comprehensive metabolic panel showed normal renal function and transaminases but elevated total bilirubin (4.5 mg/dl). His chest radiograph showed patchy infiltrates throughout the mid and upper right lung field with possible small right pleural effusion. Blood and sputum cultures were ordered, and he was started on broad-spectrum antibiotics consisting of vancomycin 1.5 gm IV every 8 hours.
(~15 mg/kg), piperacillin-tazobactam 4.5 gm IV every 8 hours given as an extended infusion, and levofloxacin 750 mg IV once daily. He underwent incision and drainage of the cubital abscess. His antibiotics were tailored to oxacillin 2 gm IV every 4 hours as blood and sputum cultures revealed growth of methicillin-susceptible Staphylococcus aureus. On hospital day 6, his condition rapidly deteriorated due to sepsis (persistent fevers, tachycardia, and hypotension with rising white blood cell count), and a new 4 cm × 3 cm area of fluctuance was noticed on the left superior pectoralis region. He was transferred to the intensive care unit. A transesophageal echocardiogram (TEE) revealed a multilobed lesion on the superior and septal leaflets of the tricuspid valve, with lesion dimension approximating 3 cm on the superior cusp. CT of the chest with intravenous contrast demonstrated extensive bilateral cavitary lung lesions likely reflecting septic emboli, reactive mediastinal and hilar lymphadenopathy, and a large left-sided pleural effusion. A loculated component along the left upper lung insinuated through the chest wall into the left pectoralis muscle, raising the possibility of empyema necessitans (Figures 1 and 2).

Incision and drainage was performed with subsequent indwelling catheter placement for drainage of pectoralis major EN. For the left-sided pleural effusion, a chest tube was placed and it drained serosanguinous fluid. The cardiothoracic surgery service evaluated the patient and recommended ongoing antibiotic therapy with close clinical and radiographic surveillance. CT of the chest, when repeated, showed no interval change in multiple bilateral cavitary lesions, and a surveillance TEE done two weeks later identified persistent tricuspid vegetations with minimal regurgitation. As the CT of the chest was stable and the patient was clinically improving, surgery to replace the tricuspid valve was deferred with plans to treat the patient with six weeks of oxacillin.

The patient completed six weeks of intravenous oxacillin and was later started on suppressive antibiotic therapy with oral dicloxacillin 500 mg twice daily given the fact that he had high disease burden and had not undergone surgical intervention. Follow-up transesophageal echocardiogram (TEE) done soon after completing six weeks of antibiotic treatment showed that the tricuspid valve lesions had stabilized, if not minimally regressed in size, but tricuspid insufficiency had progressed to a moderate range. Magnetic resonance (MR) cardiac imaging reconfirmed sclerosis/thickening of the tricuspid valve leaflets, with moderate-to-severe tricuspid valve regurgitation. Surveillance radiography with CT of the chest showed that the cavitary lesions throughout the lungs had resolved. Unfortunately, at this point, the patient was lost to follow-up.

3. Discussion

Empyema necessitans (EN) refers to extension of a pleural infection out of the thorax and into the surrounding soft tissue of the chest wall and other neighboring structures. The exact pathophysiology is unclear. It may either occur in the setting of previous thoracic surgery (e.g., thoracotomy) or trauma or result from inadequate treatment of an empyema, typically occurring after a necrotizing pneumonia or pulmonary abscess [1].

The current literature notes that Mycobacterium tuberculosis accounts for approximately 70% of cases of EN [2]. Actinomyces is considered the second most common cause [3, 4]. Cases of EN due to fungal pathogens such as Blastomyces, Aspergillus species, and Mucormycosis have been described less frequently. EN due to MSSA in an immunocompetent host resulting from IDU has not previously been reported, although there have been published reports of EN due to other bacteria including MRSA, Fusobacterium, and Nocardia [5, 6].

Sharma and Blyth [7] reported an unusual case of ruptured lung abscess, complicated by a persistent air leak and EN caused by Bacteroides species. However, Bacteroides is a common cause of intrapulmonary abscess and pleural infection. Yauba et al. [8] described a pediatric case of EN due to Proteus species and discussed challenges in diagnosis and management as it was difficult to differentiate between tuberculous and nontuberculous effusions.

Staphylococcus aureus (S. aureus) is the most common cause of infective endocarditis (IE) in much of the developed world.
| Study                | Age of the patient | Isolate/organism                          | Risk factors                                                                 | Invasive procedures                                                                 | Treatment                                                                 | Outcomes and complications                                                                 |
|---------------------|--------------------|--------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Stallworth et al. [14] | 8 months           | MRSA (blood and pleural fluid)             | None                                                                         | Chest tube placement                                                                | IV vancomycin for a total of 10 days, followed by oral trimethoprim-sulfamethoxazole to complete a 21-day course of antibiotics | Discharged home and on follow-up 3 weeks after discharge, the patient was afebrile and asymptomatic |
| Moore et al. [15]   | 3 months           | MRSA (intraoperative cultures from the right chest wall) | None                                                                         | Thoracotomy with decortication and tube thoracostomy, as well as wide drainage of the subscapular collection | IV vancomycin for a total of 14 days followed by oral linezolid for 7 days | Discharged home in stable condition. No long-term complications were reported            |
| Mizell et al. [13]  | 59 years           | MRSA (blood, urine, and left chest soft tissue mass) | Insulin-dependent DM, cirrhosis, heavy alcohol use, and chronic renal failure | Wedge resection of the left upper lung lobe with tube thoracostomy drainage of the left pleural space | IV vancomycin was continued for a total of 25 days, followed by a 10-day outpatient course of oral ciprofloxacin and trimethoprim-sulfamethoxazole Vancomycin and gentamycin were given for two weeks, followed by vancomycin alone for a total of 36 days, followed by oral clindamycin to complete treatment for osteomyelitis | No long-term complications were reported                                      |
| Contreras et al. [16] | 19 months          | MRSA (blood, pleural, and chest wall fluid) | None                                                                         | Left thoracoscopic decortication and removal of fibrin-purulent exudates               |                                                                           | Right distal femur osteomyelitis. Discharged home and at follow-up, the patient exhibited no further signs of infection |
| Rosebush et al. [17] | 4 weeks            | MRSA (right chest mass)                    | Exposure to a maternal breast abscess via breast-feeding                     | Percutaneous drainage of right posterolateral chest abscess with pigtail catheter placement | 4 weeks of IV clindamycin followed by 4 weeks of oral clindamycin          | Osseous involvement of the right posterolateral 9th, 10th, and 11th ribs. Discharged home. No long-term complications were reported |
| Edriss and Berdine [5] | 60 years           | MRSA in sputum and MSSA of the left hip joint aspirate | Remote history of alcohol abuse and left total hip arthroplasty               | Wedge resection of the left upper lobe and treatment with IV vancomycin. For MSSA hip septic arthritis, the patient underwent total hip arthroplasty with hardware removal and antibiotic spacer implantation | Started on IV vancomycin and meropenem and discharged on 6–8 weeks of IV antibiotics | Discharged home in stable condition. No long-term complications were reported |
In conclusion, EN due to *S. aureus* is an uncommon infection in healthy adults without comorbidities. EN has been associated with complications of thoracotomy, immunosuppressed status, or trauma, none of which applied to our patient. Although there have been rare reports of MRSA as a cause of EN in pediatric and adult populations, MSSA has not, to our knowledge, been reported in the literature. It is difficult to ascertain the exact reason why the pathogen in our case was MSSA as opposed to MRSA. We consider this case to have a rare presentation of EN resulting from an acute complication of MSSA pneumonia resulting from septic emboli in an immunocompetent host.

**Conflicts of Interest**

The authors declare that there are no conflicts of interest regarding the publication of this article.

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