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CASE REPORT OPEN ACCESS

Polymicrobial necrotizing pneumonia leading to posterior reversible encephalopathy syndrome in an asthmatic patient

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Abstract

Necrotizing pneumonia is a rare and severe complication of community-acquired pneumonia, characterized by parenchymal necrosis and multiple cavitations. It is most commonly associated with virulent organisms such as Methicillin-resistant *Staphylococcus aureus* (MRSA) and Pseudomonas aeruginosa. Posterior Reversible Encephalopathy Syndrome (PRES) is a neurotoxic condition that presents with seizures, altered consciousness, and visual disturbances, often associated with sepsis, hypertension, or renal dysfunction. The co-occurrence of necrotizing pneumonia and PRES is extremely rare and not well documented in the literature. We report a case of necrotizing pneumonia in a patient with uncontrolled bronchial asthma, who improved with appropriate antibiotic therapy. However, severe bronchospasm necessitated cautious use of corticosteroids in the setting of necrotizing pneumonia and sepsis, ultimately leading to the development of PRES. A multidisciplinary approach involving pulmonologists, critical care specialists, and neurologists contributed to a successful outcome in this patient.

Keywords: necrotizing pneumonia; uncontrolled asthma; sepsis; respiratory failure; PRES

Introduction

This is a case report of polymicrobial necrotizing pneumonia in a patient with uncontrolled asthma, leading to Posterior Reversible Encephalopathy Syndrome (PRES). The patient had a concerning combination of poorly managed bronchial asthma, indiscriminate over-the-counter (OTC) use of corticosteroids, and inappropriate antibiotic use, which contributed to disease severity.

Necrotizing pneumonia, often a complication of community-acquired pneumonia (CAP), is characterized by consolidation, parenchymal necrosis, and the formation of multiple small cavities. While cavitary lesions are not typically seen in all cases of CAP, they may develop when bacterial lung infections progress to necrosis despite optimal medical therapy. The exact pathogenesis remains unclear, but it is believed to involve tissue destruction resulting from a heightened inflammatory response and toxins produced by virulent pathogens [1].

In this case, the isolated organisms were Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Pseudomonas aeruginosa*. MRSA is a significant drug-resistant pathogen responsible for a wide spectrum of infections, ranging from minor skin conditions to severe, life-threatening invasive diseases [2]. *Pseudomonas aeruginosa* is a Gram-negative bacterium commonly implicated in serious respiratory infections, particularly in immunocompromised individuals or those on mechanical ventilation [3].

PRES is a neurological condition caused by cerebral autoregulatory failure, resulting in vasogenic

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edema—predominantly in the posterior cerebral regions. Although PRES is frequently associated with hypertensive crises and renal failure, its occurrence in the setting of severe pulmonary infections and sepsis is rare. Recognizing this uncommon association is critical for prompt diagnosis and management.

Case Report

A 40-year-old obese woman, a known case of bronchial asthma, presented with shortness of breath for 20 days, along with a cough producing yellowish expectoration and intermittent fever for the past one month. She reported over-the-counter use of inappropriate antibiotics and indiscriminate self-administration of corticosteroids.

On clinical examination, the patient had a heart rate of 120 beats per minute and an oxygen saturation (SpO_2) of 87% on room air. Auscultation of the lungs revealed bilateral air entry with coarse crepitations and prominent bilateral rhonchi. Laboratory investigations showed a total leukocyte count (TLC) of 25,440 cells/cumm with neutrophilic predominance, suggesting an ongoing bacterial infection.

Sputum Gram stain revealed Gram-positive cocci arranged in clusters, suggestive of Staphylococcus species. The initial computed tomography (CT) scan of the chest showed multifocal dense consolidations (Figure 1). A repeat CT chest scan demonstrated bilateral dense areas of consolidation with central cavitation. Most of the lesions showed progression in cavitation compared to the initial scan, indicative of necrotizing pneumonia (Figures 2 and 3).

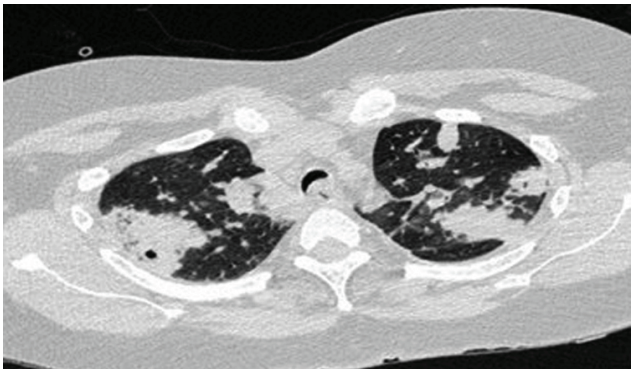

Figure 1: CT Chest showing multifocal dense consolidations.

Magnetic resonance imaging (MRI) of the brain revealed bilateral symmetrical cortical and subcortical white matter hyperintensities on T2-weighted and FLAIR sequences, involving the bilateral precuneus, superior frontal, and precentral gyri. These findings were suggestive of PRES (Figure 4).

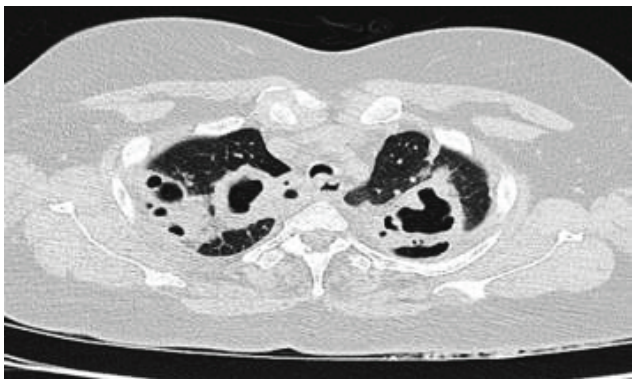

Figure 2: Computed tomography scan showing multiple cavitation in dense consolidation in bilateral upper lobes.

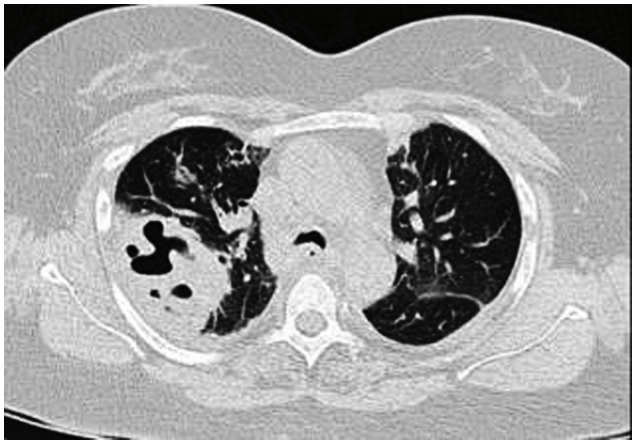

Figure 3: Computed tomography showing cavity in a dense consolidation involving right upper lobe.

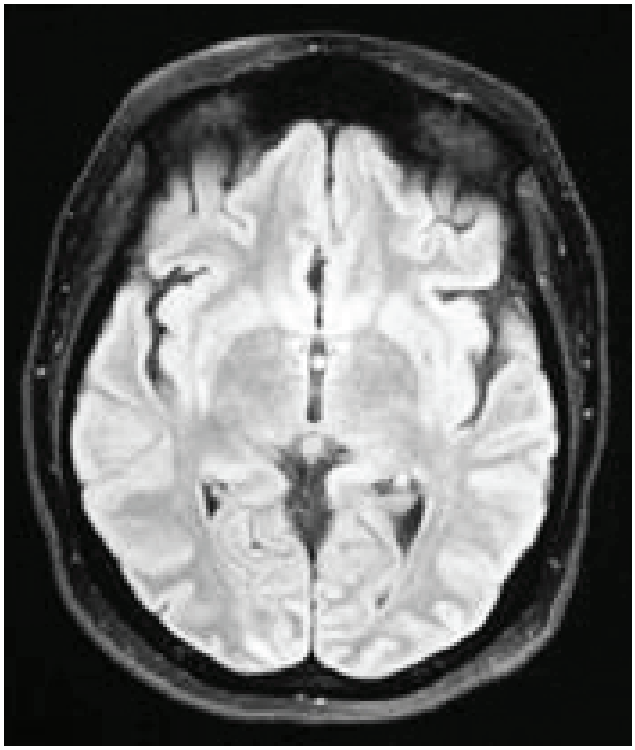

Figure 4: Bilateral symmetrical cortical – subcortical white matter T2 and FLAIR hyperintensities noted involving bilateral precuneus, superior frontal and precentral gyri.

The patient was initially started on bronchodilators and oxygen supplementation. Broad-spectrum intravenous antibiotics, including meropenem and linezolid, were administered. Despite initial therapy, her shortness of breath worsened, accompanied by diffuse wheezing and signs of respiratory distress. She was shifted to the intensive care unit (ICU), where she was stabilized with bronchodilators and low-dose intravenous corticosteroids.

She continued to have fever spikes, and her total leukocyte count increased to 29,620 cells/cumm. Sputum culture revealed growth of MRSA and *Pseudomonas aeruginosa*, both of which were sensitive to the ongoing antibiotic regimen. Due to worsening hypoxia, she required 12 liters per minute of oxygen via a non-rebreather mask (NRBM) and eventually needed non-invasive ventilation (NIV) support. She produced copious amounts of purulent sputum, which was representative of the ongoing lower respiratory tract infection.

The patient was encouraged to expectorate to maintain airway clearance. Although she experienced initial episodes of hemodynamic instability and clinical deterioration, she gradually responded to the combination of appropriate antibiotic therapy, cautious use of steroids, bronchodilators, and NIV support.

While her respiratory symptoms improved, she subsequently developed a seizure episode accompanied by transient right-sided hemiparesis. A CT scan of the brain was normal, and electroencephalography (EEG) showed no epileptiform activity but revealed postictal slowing. Following a second seizure episode, an MRI brain was performed, which revealed findings suggestive of PRES.

The patient showed gradual clinical improvement, allowing for de-escalation of antibiotic therapy. After three weeks of inpatient care, she was discharged with a course of oral antibiotics, minimal oxygen supplementation, and continued bronchodilator therapy.

During her follow-up visit to the outpatient department, she was found to be clinically and symptomatically stable, no longer requiring oxygen support. A follow-up CT scan of the chest performed four months later demonstrated excellent resolution of the previously noted dense consolidations with central cavitations in both lung fields (Figure 5).

Discussion

MRSA, once considered primarily a nosocomial pathogen, has now emerged as a significant community-acquired pathogen [4, 5]. Unlike traditional healthcare-associated MRSA (HA-MRSA), community-acquired MRSA (CA-MRSA) strains possess smaller staphylococcal chromosomal cassette mec (SCCmec) elements—typically type IV or V—and remain susceptible to a broader spectrum of antimicrobial agents, excluding β-lactams [4–7]. Moreover, CA-MRSA strains are more likely to carry the Panton–Valentine leukocidin (PVL) gene, a toxin associated with increased virulence [4, 5, 8, 9].

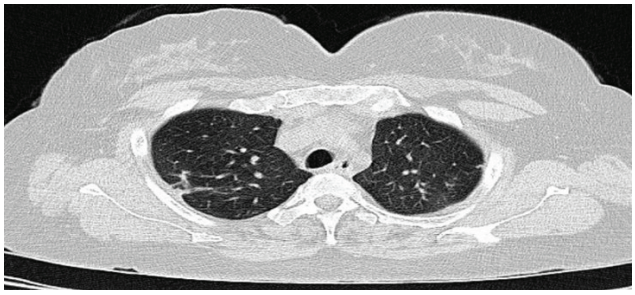

Figure 5: Computed tomography showing resolution of the cavity with dense consolidation in bilateral upper lobes after a span of 4-month interval.

CA-MRSA is capable of causing invasive and severe infections, including necrotizing pneumonia, necrotizing fasciitis, pyomyositis, osteomyelitis, and sepsis [4, 9]. Among these, necrotizing pneumonia is considered one of the most severe complications associated with PVL-producing CA-MRSA strains. This condition has been increasingly reported across various countries and is associated with a high mortality rate of 56–63%.

Clinicians should suspect CA-MRSA as the etiology of pneumonia when specific clinical features are present. These include influenza-like prodromal symptoms, rapidly progressive pneumonia leading to acute respiratory distress syndrome (ARDS), fever, hemoptysis, hypotension, leukopenia, and chest radiographs showing multilobar infiltrates with cavitation. A history of colonization with CA-MRSA, or personal or family history of recurrent furuncles or skin abscesses, may also support this diagnosis [10]. Prompt collection of blood, sputum, and pleural fluid cultures before initiating empirical antibiotics is crucial for accurate diagnosis and targeted therapy [11]. Although CA-MRSA isolates often exhibit susceptibility to various non-β-lactam agents in vitro, the Infectious Diseases Society of America (IDSA) recommends vancomycin, linezolid, or clindamycin as first-line agents for treating both CA-MRSA and HA-MRSA pneumonia [12].

Pseudomonas aeruginosa is another aggressive pathogen known to cause severe respiratory infections, particularly in immunocompromised patients or those with structural lung disease [13].

Posterior Reversible Encephalopathy Syndrome (PRES) is a rare clinical entity characterized by symptoms such as visual disturbances, headache, seizures, and altered mental status. MRI of the brain typically reveals vasogenic edema predominantly involving the posterior subcortical regions. Although the exact pathophysiology of PRES remains unclear, it is believed to result from endothelial dysfunction and impaired cerebral autoregulation [14].

PRES has been reported in association with severe infections, sepsis, and shock. Other known associations include autoimmune disorders, chemotherapy, immunosuppressive agents such as cyclosporine and tacrolimus (FK-506), and eclampsia. Notably, in most reported cases with available culture data (84%), gram-positive organisms—particularly gram-positive cocci—were isolated from blood or tissue cultures, indicating a possible link between these infections and the onset of PRES [14].

Conclusion

In conclusion, we report the case of a 40-year-old woman with uncontrolled asthma who developed severe necrotizing pneumonia. The patient had a history of over-the-counter use of inappropriate antibiotics and steroids prior to presentation. She was admitted to our hospital and required a 29-day hospital stay. Imaging studies, including CT chest, confirmed necrotizing pneumonia. The causative organisms isolated were MRSA and Pseudomonas aeruginosa. During her hospital course, she experienced an exacerbation of bronchial asthma and hypoxia and subsequently developed Posterior Reversible Encephalopathy Syndrome (PRES) in the setting of severe gram-positive sepsis. She was successfully treated with appropriate antibiotics, cautious use of steroids, bronchodilators, and non-invasive ventilation support.

Conflicts of interest

Authors declare no conflicts of interest.

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