Case report

Necrotizing pneumonia in a patient with untreated *Mycobacterium kansasii* infection

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A B S T R A C T

Mycobacterium kansasii is the second most commonly occurring Non-Tuberculous Mycobacteria (NTM) in the United States. Infection is typically seen in middle aged males, and the risk of infection is greatly increased in immunocompromised hosts. Pulmonary infection presents in clinical parallel to that of *Mycobaterium tuberculosis* (TB) and is therefore often misdiagnosed. A combination of clinical, radiological, and microbiological evidence of infection is generally required to clinch the diagnosis. Treatment of such cases include prolonged courses of rifampin in combination with 2 other antimicrobial agents. The overall prognosis with appropriate treatment is good with the exception of disseminated disease in severely immunocompromised hosts. In patients who are misdiagnosed or undertreated, there is progressive destruction of the lung parenchyma with distortion of lung architecture. This can in-turn lead to bronchiectatic changes leaving the airways exposed to devastating superimposed bacterial pneumonia. We describe a case of a patient with untreated *M. kansasii* infection who developed superimposed necrotizing pneumonia and respiratory failure requiring prolonged ventilatory support.

1. Introduction

Pulmonary cavitary lesions occur frequently in clinical practice. In patients presenting with cough, fever, hemoptysis, and weight loss along with such cavitary lesions, there is a high clinical suspicion for mycobacterial infections, particularly tuberculosis [1]. Among immunocompromised patients such as those with HIV, *Mycobacterium Avium Complex* (MAC) infection is considered as an important differential, however infection by other nontuberculous mycobacteria (NTM), particularly by *Mycobacterium kansasii*, may occur even in otherwise immunocompetent individuals [2]. *M. kansasii* is the second most prevalent cause of NTM disease in different countries such as United States, China, South American countries, and some European countries such as Poland, Slovakia, and the United Kingdom [3]. Despite its prevalence, it is often overlooked as a possible source of pulmonary infection [4]. These patients usually develop cavitary lesions typically affecting the upper lobes of the lungs [5]. With an early diagnosis and appropriate follow up, the disease can usually be treated effectively [6], however if the disease is left untreated or if it becomes disseminated in an immunocompromised host, the prognosis declines rapidly [7,8]. Furthermore, NTM infections are not only often present in patients with pre-existing structural lung damage but can, by themselves, cause structural damage to the lung parenchyma, which can lead to formation of permanent abnormalities such as necrotizing dilations of the bronchial airways and bronchial fistulae [9–11]. Such anatomical changes may predispose patients with NTM to

superimposed infection with other pathogens. We present the case of a middle-aged male who presented with a superimposed severe necrotizing bacterial pneumonia on a cavitary lesion from untreated pulmonary *M. kansasii* infection.

2. Case report

The patient is a 57-year-old male who presented to our hospital complaining of fever, malaise, productive cough and shortness of breath which had begun 4 days prior to admission. This was accompanied by decreased appetite with unintentional weight loss and non-productive cough for the past year. Initial physical examination showed a cachectic and ill-appearing male with dyspnea and accessory muscle use. Lung auscultation was pertinent for right basilar crackles. Vitals signs were as follows: blood pressure of 98/63 mmHg, pulse rate of 106 bpm, respiratory rate of 28 per minute, body temperature of 104.1 F, body mass index of 16 m^2/kg, saturating 99% on room air with desaturations to 88% occurring with minimal exertion. Laboratory testing revealed leukocytosis of 21,600 per μl, serum sodium of 126 mmol/L, serum potassium of 2.5 mmol/L and hyperlactatemia of 2.9 mmol/L; arterial blood gas analysis on room air showed respiratory alkalosis with a pH of 7.52, pCO2 21 mmHg, pO2 80 mmHg and HCO3 17 mmol/L. Initial chest x-ray showed a moderate dense opacity in the superior segment of the right lower lobe suggestive of pneumonia (Fig. 1). He was admitted for severe sepsis secondary to community acquired pneumonia with initial treatment regimen including IV Ceftriaxone and

Fig. 1. Chest X Ray from admission showing hyperinflation and a dense opacity on the superior segment of the right lower lobe suggesting pneumonia.

Fig. 2. Chest CT scan done one year before admission shows small consolidation in the lateral aspect of the superior segment of the right lower lobe.

Azithromycin. His past medical history was significant for centrilobular emphysema secondary to an extensive 40-year smoking history of 1–3 packs-per-day, chronic alcohol use disorder consuming over 24 drinks per week and fleeting right upper lobe nodules which were, at the time, determined to be secondary to an infectious etiology. One year prior to admission, he had a CT scan of the chest (Fig. 2) for routine investigation of a pulmonary nodule. This CT revealed a small area of consolidation. At that time, given concern for postobstructive atelectasis he underwent flexible bronchoscopy which revealed no obstruction, however, Acid fast bacilli culture from the bronchoalveolar lavage sample obtained from the right lower lobe later grew *Mycobacterium kansasii*. He was subsequently prescribed a 3-drug regimen by his pulmonologist which included Ethambutol, Azithromycin and Rifampin. Four weeks after treatment initiation, he was prematurely forced to discontinue it due to daily episodes of diarrhea, nausea and vomiting. He was instructed to return to his pulmonologist to begin an alternative treatment regimen for *M. kansasii* infection but, despite being symptomatic, he lost follow up and did not seek medical attention for several months until the current presentation. On the first day of the current hospitalization, a chest CT obtained for accurate assessment of his pulmonary disease showed extensive consolidation of the superior segment of right lower lobe extending into the right upper lobe with multiple cavitary type foci concerning for necrotizing pneumonia along with a cavitary lesion in the superior segment of the right lower lobe measuring 4.6 × 3.4 × 4.9 cm (Fig. 3A–C), seen on the previous chest CT done the year prior, but now increased in size. During
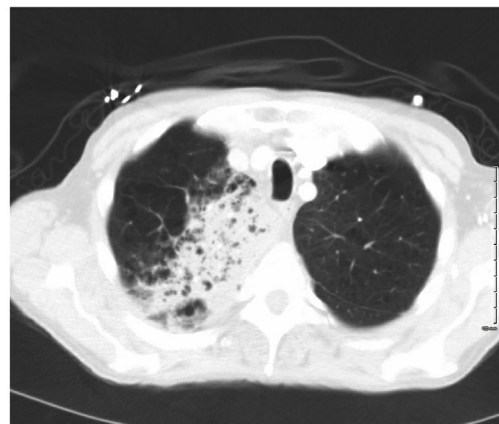
Fig. 3. A. CT scan on admission demonstrating large area of consolidation involving the right upper lobe extending to the suprahilar region containing multiple low-density foci which may reflect multiple cavitary areas. This was suggestive of severe necrotizing pneumonia. **B.** CT scan on admission of the superior segment of the right lower lobe demonstrating a posterior cavitary lesion that is thick-walled and irregularly marginated measuring 4.6 cm by 3.4 cm by 4.9 cm. **C.** CT scan on admission revealing smaller cavitary type foci seen inferomedially in the right lower lobe along with areas of consolidation and dilated airways likely representing bronchiectatic changes.

hospitalization day two his clinical status deteriorated and he experienced severe respiratory distress with hypoxia despite high-flow oxygen via nasal cannula, and ultimately required transfer into medical ICU followed by intubation and mechanical ventilation given acute hypoxic respiratory failure. Sputum samples which were obtained came back positive for Methicillin-sensitive *Staphylococcus aureus* (MSSA). It was deemed that his clinical condition was a consequence of necrotizing pneumonia due to MSSA superimposed on his chronic untreated pulmonary *M. kansasii* infection, which probably caused structural changes that facilitated the MSSA infection. The episode of MSSA pneumonia was treated accordingly with IV antibiotics and he exhibited gradual improvement, being successfully extubated after 12 days of ventilator-dependence. He was educated on the dire importance of outpatient pulmonology follow up for reinstatement of an antibiotic regimen against *M. kansasii* and cessation of smoking and alcohol use. Despite implementation of appropriate therapies and risk factor control, his 6 and 12-month mortality rate remains high.

3. Discussion

The exact incidence and prevalence of NTM infections is not clear because, unlike tuberculosis, the reporting of NTM disease is not mandatory. Nevertheless, some studies have encountered an overall averaged annual prevalence of NTM ranging from 1.4 to 6.6 cases per 100,000 individuals, and an incidence of 2.4 cases per 100.000 adults per year, with some evidence that the prevalence may increase significantly with aging [12–14].

M. kansasii belongs to the group photochromogens, and is a slow-growing acid-fast bacillus, being the second most common NTM infection in the United States after *Mycobacterium avium* complex (MAC). These organisms are generally isolated from treated water sources such as tap water, swimming pools and fish tanks, but have also been isolated from natural water sources as well [15,16]. Cases in the US have most commonly been encountered in the southern and central regions of the country. The infection is acquired through the aerosol route, whereas most other NTM have also been reported to be acquired through inoculation or ingestion as well [2,12]. Infections by *M. kansasii* have been associated with heavy smoking and alcohol abuse. Other risk factors include COPD, previous gastrectomy, immunocompromised status, or a history of prior pulmonary TB [6]. In patients with HIV, the incidence of *M. kansasii* infection rises with a CD4 count of $< 50/mm^3$ [7]. Clinically, *M. kansasii* can affect multiple organs and systems, either individually or with disseminated disease. Pulmonary disease is the most common presentation of *M. kansasii* infection. It is usually seen in the form of chronic pulmonary cavitary lesions typically affecting the upper lobes of the lungs. Symptoms of pulmonary *M. kansasii* typically resembles that of tuberculosis, often leading to misdiagnosis. These symptoms include cough, hemoptysis, chest pain, shortness of breath, weight loss, and fevers with sweating. Progressive destruction of the lung parenchyma may occur with persistent infection, which can in turn lead to bronchiectasis. Cutaneous disease is also possible, with lesions resulting from *M. kansasii* infection presenting in various forms including nodules, pustules, ulcers, and abscesses [17,19].

According to the American Thoracic Society (ATS) and Infectious Disease Society of America (IDSA), the diagnosis is essentially established by the presence of clinical, radiographic, and microbiological evidence [18]. Radiographic evidence is best described by the presence of nodular or cavitary opacities on chest x-ray, or features of multifocal bronchiectasis with nodules on CT scan [18]. The most acceptable methods of microbiological evidence include positive culture results from at least two separate expectorated sputum samples, or from at least one bronchial wash or lavage, or lung biopsy with mycobacterial histopathologic features (granulomatous inflammation or AFB) and positive culture for NTM or biopsy showing mycobacterial histopathologic features (granulomatous inflammation or AFB), and one or more sputum or bronchial washings that are culture positive for NTM.

Contamination of samples is not frequently encountered with *M. kansasii,* therefore any positive isolation of *M. kansasii* must be considered for therapy [19]. The first line treatment regimen for pulmonary *M. kansasii* infection is rifampin, isoniazid (with supplementary pyridine), and ethambutol. The recommended treatment duration includes 12 months of negative sputum cultures [18]. Resistance to isoniazid and ethambutol may occur, but are commonly associated with resistance to rifampin as well [20]. Secondary agents should be considered in cases of resistance to rifampin. Alternatives include amikacin, ciprofloxacin, clarithromycin, rifabutin, streptomycin, or sulfonamides [21]. Ideally, samples should be tested for sensitivities prior to the initiation of rifampin and the second line agents. With the exception of HIV patients with disseminated disease, the overall prognosis of *M. kansasii* infection is good with implementation of timely and appropriate treatment [7,22].

In patients who have been left untreated, or those with disseminated disease - typically seen in low CD4 count HIV or in the immunocompromised - the overall prognosis is poor [7]. The worse prognosis in untreated patients is likely secondary to severe distortions of lung parenchyma from expanding cavitary lesions and spreading infection. These disease patterns include nodular disease as well as bronchiectasis which can affect the middle lobe and lingula [5]. Because of inflammatory destruction and airway obstruction seen in bronchiectasis, such patients may have recurrent pneumonias and respiratory failure [23]. Some case reports have even attributed pneumothorax resulting from *M. kansasii* infection [24]. Our patient likely developed progressive *M. kansasii* infection with resultant bronchiectatic changes leading to bacterial pneumonia. Necrotizing pneumonia is an uncommon yet fatal complication of bacterial pneumonia. It is characterized by pulmonary gangrene and inflammatory changes with resultant formation of multiple small necrotic cavities [25]. Previous case reports describe patients with necrotizing pneumonia resulting in rapid clinical decline and septic shock, often requiring ventilatory support [26]. It is therefore crucial that critically ill patients with pneumonia receive immediate broad-spectrum antibiotics to prevent further complications, especially in patients with underlying bronchiectasis. The most common implicating organisms are similar to that of community acquired pneumonia, with *Streptococcus pneumoniae* being present in 30%–60% of cases [26]. In cases of rapid clinical decline despite appropriate antibiotic therapy, or the presence of pulmonary gangrene - which is evidenced by obliteration of pulmonary arterial supply to affected parenchyma or decreased contrast uptake in lung parenchyma with included necrosis affecting > 50% of the involved lobe - surgical resection or drainage should be considered [27,28].

4. Conclusion

Patients who present with clinical features similar to tuberculosis but without known exposure to *Mycobacterium tuberculosis* should be evaluated for nontuberculous mycobacteria (NTM) - namely *Mycobacterium avium* complex (MAC) and *M. kansasii* infection - especially in the presence of cavitary lesions and predisposing risk factors. Complete clinical, radiographic, and microbiological criteria are required to establish a diagnosis. Treatment with antimycobacterial drugs should be promptly initiated and a full course should be completed since there is evidence that, in patients in which treatment has been delayed or who have severe disseminated disease, the prognosis declines rapidly. The worse prognosis in such cases is secondary to increased overall infection burden, and destruction of lung parenchyma with irreversible bronchiectatic changes. Given the prevalence of architectural changes in the lung parenchyma in patients with MAC and *M. kansasii* infection, superimposed pneumonia must be recognized promptly and treated aggressively to avoid devastating complications such as pulmonary gangrene and necrotizing pneumonia.

Conflict of interest

The authors declare no conflict of interest.The authors confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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