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Case report

Achromobacter xylosoxidans/denitrificans bacteremia and subsequent fatal *Escherichia coli/Streptococcus anginosus* pleural empyema

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A B S T R A C T

Achromobacter xylosoxidans, a gram-negative bacillus with low virulence has rarely been reported to cause clinically significant infections. We report an unusual case of MDR *Achromobacter xylosoxidans*/denitrificans bacteremia from a peripherally inserted central catheter (PICC) and subsequent fatal pleural empyema due to MDR *Escherichia coli* and *Streptococcus anginosus*. A 44-year-old male presented to the hospital with chief complaints of chest tightness associated with a productive cough. He was found to have pleural empyema secondary to MDR *E. coli* and S. anginous. Three months prior to current presentation, he had a history of MDR *A. xylosoxidans* originating from a PICC. The patient expired even after appropriate management. Thoracic empyema continues to cause significant morbidity and mortality despite the improvement of antimicrobial therapy and the existence of multiple options for drainage of the infected pleural space. The bacteriology of thoracic empyema has been changing since the introduction of antibiotics. Typical antibiotics used to treat these MDR pathogens have become obsolete. Therefore, physicians should be aggressive in their diagnostic approach to pleural empyema, since the isolation of MDR aerobic gram-negative bacilli or multiple pathogens from the pleural fluid is associated with a poor prognosis and indicates a need for more aggressive antimicrobial chemotherapy. Also, the association of indwelling medical devices and MDR Achromobacter bacteremia should be known.

1. Introduction

Achromobacter xylosoxidans (*A. xylosoxidans*) is a low virulence gram-negative bacillus recently emerging as a causative agent of infection in both immunocompromised and immunocompetent populations [[1,2]]. Multi Drug Resistant (MDR) *A. xylosoxidans* has rarely been reported to cause clinically significant infections. We report an unusual case of MDR *Achromobacter xylosoxidans*/denitrificans bacteremia from a peripherally inserted central catheter (PICC) and subsequent fatal pleural empyema due to MDR *Escherichia coli* (*E. coli*) and *Streptococcus anginosus* (*S. anginosus*).

2. Case presentation

A 44-year-old male presented to the hospital with chief complaints of right foot pain, swelling and inability to ambulate. Medical history was significant for type 2 diabetes mellitus, diabetic foot ulcer, and osteomyelitis of right foot status post intravenous antibiotics through a peripherally inserted central catheter (PICC). On physical examination, the patient was noted to have bilateral lower extremity edema and a right foot plantar ulcer associated with erythema and warmth. Magnetic Resonance Imaging of right foot showed hallux Metatarsophalangeal (MTP) plantar soft tissue ulcer with gas locules at hallux MTP joint associated with Hallux metatarsal/proximal phalangeal osteomyelitis with septic arthritis. The patient underwent a right foot partial first ray amputation. Also, a Computed Tomography of chest obtained for shortness of breath revealed an incidental segmental and subsegmental bilateral upper lobe pulmonary emboli and a right upper lobe wedge-shaped peripheral ground glass and cavitary opacities consistent with pulmonary infarcts.

Cultures were obtained from peripheral blood and PICC line. Both grew *Achromobacter xylosoxidans*/denitrificans which was resistant to meropenem, cefepime, piperacillin/tazobactam aztreonam, gentamicin, and tobramycin and sensitive to ciprofloxacin, levofloxacin, and Bactrim. *A. xylosoxidans* was considered MDR and the PICC was considered the primary source of bacteremia. Repeat blood cultures after three days of empiric antibiotic therapy were negative. The PICC was removed and a new PICC was placed and the patient was subsequently discharged on intravenous ciprofloxacin and vancomycin for six weeks. Also, a transesophageal echocardiogram was negative for vegetation and endocarditis was ruled out.

Three months later, the patient was readmitted for chest tightness associated with a productive cough and nausea which were present for four days prior to presentation. On physical examination, the patient

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was noted to have right sided crackles, bilateral lower extremity edema, and a right foot plantar ulcer. The patient was tachycardic with a heart rate of 112 and afebrile. Laboratory studies revealed an elevated leukocyte count of 17 k/ul with a neutrophil predominance of 79% and low hemoglobin of 8.5 g/dL. He had normal electrolytes, normal kidney function and normal liver enzymes. Initial imaging with chest x-ray showed right lung opacity with lower lobe predominance. On further imaging with a Computed Tomography of the chest revealed no evidence of PE and showed right lower lobe consolidation with small right pleural effusion, right upper lobe consolidation with partial ground glass opacity and a right upper lobe cavitary lesion measuring 3.5 × 2 cm. The effusion and consolidations were new whereas the cavitary lesion was thought to be secondary to ischemic necrosis of previous pulmonary infarction at the same location.

A diagnostic thoracentesis was done which showed turbid fluid with a total nucleated cell count of 36034/μL with 67% segmented granulocytes and many bacteria seen on gram stain. The Pleural fluid cultures grew *E. coli* which was resistant to ampicillin, gentamicin, levofloxacin, and ciprofloxacin and sensitive to ceftriaxone, Bactrim, aztreonam, cefepime, meropenem, imipenem, piperacillin/tazobactam and *S. anginosus* which was pan-sensitive to ceftriaxone, clindamycin, vancomycin, levofloxacin, erythromycin. *E. coli* was considered MDR and the patient was started on intravenous zosyn and a video-assisted thoracoscopic surgery with decortication was done for right pleural empyema. The patient's clinical condition was initially improving but after an extensive hospital stay he subsequently died after a cardiac arrest (see Figs. 1–3).

3. Discussion

Achromobacter xylosoxidans (previously termed Alcaligenes Xylosoxidans) was first described by Yabuuchi and Ohyama in 1971 after it was isolated from the ear discharge of patients with chronic otitis media [2]. *A. xylosoxidans* is a flagellated, motile, aerobic, gram-negative bacillus that is a non-glucose fermenter. The genus Achromobacter has multiple species: xylosoxidans, ruhlandii, piechaudii, denitrificans, spanius, insolitus, and marplatensis. Clinically significant species are xylosoxidans and denitrificans [1]. They are difficult to identify and separate by phenotype and even by 16S rRNA gene sequence, and vernaculars such as 'Achomobacter spp.' or '*Achomobacter xylosoxidans*/denitrificans' are widely used. In immunocompromised hosts, nosocomial infections like endocarditis, urinary tract infections, and pneumonia, caused by *A. xylosoxidans* have been observed [3]. Case mortality ranging from 3% for bacteremia with up to 80% for neonatal infection has been previously described for *A. xylosoxidans* nosocomial infections [2]. *A. xylosoxidans* pneumonia has a high case fatality rate of 67% [4]. Pulmonary involvement by *A. xylosoxidans* has been seen in cystic fibrosis patients. *A. xylosoxidans* pneumonia has been reported in patients with underlying malignancy, patients with IgM deficiency and those on mechanical ventilation [2]. Rare complications like empyema, adult respiratory distress syndrome, chronic scarring, secondary and recurrent pneumonia have been reported [4].

Treatment of *A. xylosoxidans* is usually difficult due to drug resistance [2]. Achromobacter species isolates have been found to be resistant to first and second-generation cephalosporin, aminoglycosides and narrow spectrum penicillins. They are usually susceptible to sulfonamides, carbapenems, and broad-spectrum penicillins third-generation cephalosporins; and variably susceptible to fluoroquinolones [4]. However, in our case it was found to be MDR and was only sensitive to ciprofloxacin, levofloxacin and Bactrim. An organism is considered MDR when an isolate is non-susceptible to at least one agent in three or more antibiotic classes. Adjustment of antibiotic therapy should be performed according to antibiotic susceptibility testing [3]. The prognosis is generally excellent with clearance of the infection [1]. Duration of treatment is not exactly defined due to lack in specific guidelines [1].

Thoracic empyema continues to cause significant morbidity and mortality despite the improvement of antimicrobial therapy and the existence of multiple options for drainage of the infected pleural space. These infections can be diagnostically challenging and usually need a sophisticated multidisciplinary management strategy [5]. The bacteriology of thoracic empyema has been changing since the introduction of antibiotics. Before the antibiotic era, Streptococcus pneumoniae or B-hemolytic streptococci were isolated in most empyema fluid, and *Staphylococcus aureus* was the most common pathogen of thoracic empyema from 1955 to 1965. Over the past 30 years, aerobic gram-positive organisms have been the most frequent isolates in acute thoracic empyema. *Staphylococcus aureus* and Streptococcus pneumonia accounted for approximately 70% of all aerobic gram-positive isolates. However, MDR gram-negative organisms were seen mostly in immunocompromised hosts, especially those with diabetes mellitus, malignancy and those with other MDR risk factors [6].

S. anginosus group previously referred to as Streptococci milleri group are catalase negative, facultative anaerobes and includes three taxonomically distinct species: *S. anginosus*, Streptococcus intermedius and Streptococcus constellatus. They tend to form abscesses and empyema thoracis which is their unique characteristic [7]. *E. coli* is a Gram-negative bacillus and a facultative anaerobe. Cases of pneumonia due to *E. coli* are uncommon and are usually hospital-acquired, accounting for 9% of cases reported [8]. In our patient, the subsequent MDR E. coli could possibly be attributed to impaired immunity.

The three phases of empyema, exudative (stage I), fibrinopurulent (stage II), and organizing (stage III) represent a continuously evolving process that can be arrested by therapeutic intervention. The Stage I empyema is usually treated with antibiotics and thoracocentesis or chest tube drainage. Stage II disease is treated usually with fibrinolytic therapy or video-assisted thoracoscopic debridement. For Stage III empyema, decortication is required. Early and aggressive management of empyema provides rapid relief from sepsis and may shorten the hospital stay [9]. The development of antimicrobial resistance among

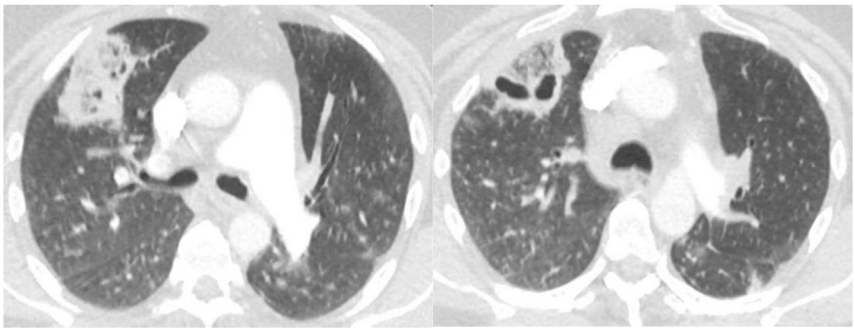

Fig. 1. Initial axial Computed Tomography of the chest showing a right upper lobe wedge-shaped peripheral ground glass and cavitary opacities consistent with pulmonary infarcts.

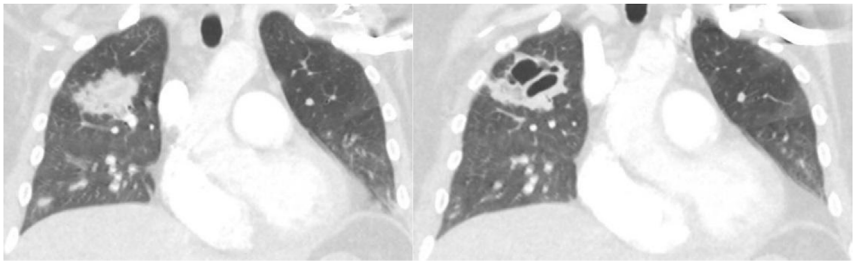

Fig. 2. Initial coronal Computed Tomography of the chest showing a right upper lobe wedge-shaped peripheral ground glass and cavitary opacities consistent with pulmonary infarcts.

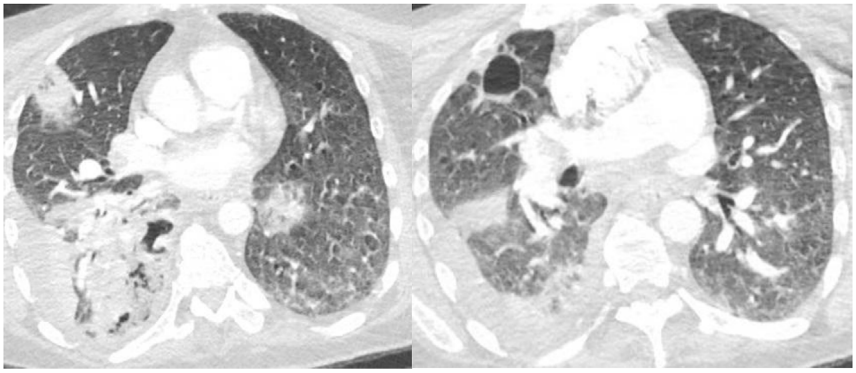

Fig. 3. Repeat Computed Tomography of the chest showing right lower lobe consolidation with small right pleural effusion, right upper lobe consolidation with partial ground glass opacity and a right upper lobe cavitary lesion measuring 3.5 × 2 cm.

gram-negative pathogens has been progressive and persistent. Classic agents used to treat these pathogens have become obsolete. Of the few new drugs available, many have already become targets for bacterial mechanisms of resistance. MDR should be managed with the assistance of an expert in the treatment of such infections. Treatment options are currently limited. The antimicrobial stewardship and infection control policies contribute significantly against the worldwide emergence and spread of MDR pathogens [10].

In conclusion, our case is unique as infection with one rare MDR organism led to a fatal infection with another MDR organism. An occurrence like this has never been reported in medical literature to the best of our knowledge. Firstly, physicians should be aware of the association of PICC and Achromobacter bacteremia. Secondly, physicians should pay more attention to pleural empyema and its microbiologic etiology since the isolation of MDR aerobic gram-negative bacilli or multiple pathogens from the pleural fluid is associated with a poor prognosis and indicates a need for more aggressive antimicrobial chemotherapy.

Disclosure statement

No potential conflict of interest was reported by the authors. No funding was received.

References

[1] H. Awadh, M. Mansour, O. Aqtash, Y. Shweihat, Pneumonia due to a rare pathogen, Case Rep Infect Dis 2017 (2017) 3969682.
[2] S.S. Karanth, A. Gupta, M. Prabhu, Community acquired bilateral upper lobe pneumonia with acute adrenal insufficiency: a new face of achromobacter xylosoxidans, Australas. Med. J. 5 (10) (2012) 531–533.
[3] E. Pérez Barragán, J. Sandino Pérez, L. Corbella, M.A. Orellana, M. Fernández-Ruiz, Achromobacter xylosoxidans bacteremia: clinical and microbiological features in a 10-year case series, Rev. Española Quimioter. 31 (3) (2018) 268–273.
[4] S. Aundhakar, M. Mane, A. Bharadiya, S. Pawar, Watch out! Pneumonia secondary to achromobacter denitrificans, Ann. Med. Health Sci. Res. 4 (Suppl 1) (2014) S22–S24.
[5] T.H. Tsai, J.S. Jerng, K.Y. Chen, C.J. Yu, P.C. Yang, Community-acquired thoracic empyema in older people, J. Am. Geriatr. Soc. 53 (7) (2005) 1203–1209.
[6] K.Y. Chen, P.R. Hsueh, Y.S. Liaw, P.C. Yang, K.T. Luh, A 10-year experience with bacteriology of acute thoracic empyema: emphasis on Klebsiella pneumoniae in patients with diabetes mellitus, Chest 117 (6) (2000) 1685–1689.
[7] S. Noguchi, K. Yatera, T. Kawanami, et al., The clinical features of respiratory infections caused by the Streptococcus anginosus group, BMC Pulm. Med. 15 (2015) 133.
[8] F.Y. khan, *Escherichia coli* pleural empyema: two case reports and literature review, Ann. Trop. Med. Public Health 4 (2011) 128–132.
[9] B.C. Tong, J. Hanna, E.M. Toloza, et al., Outcomes of video-assisted thoracoscopic decortication, Ann. Thorac. Surg. 89 (1) (2010) 220–225.
[10] S.S. Kanj, Z.A. Kanafani, Current concepts in antimicrobial therapy against resistant gram-negative organisms: extended-spectrum beta-lactamase-producing Enterobacteriaceae, carbapenem-resistant Enterobacteriaceae, and multidrug-resistant Pseudomonas aeruginosa, Mayo Clin. Proc. 86 (3) (2011) 250–259.