Case Report

Pneumonia due to a Rare Pathogen: Achromobacter xylosoxidans, Subspecies denitrificans

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1. Introduction

Achromobacter xylosoxidans, subspecies denitrificans, is a gram-negative bacillus recently emerging as a causative agent of infection [1]. The Achromobacter species has many subspecies the most clinically important of which are xylosoxidans and denitrificans [1]. There are infrequent reports of infections with this organism involving various organs (Table 1). It seems that a dysfunctional immune status and/or prior structural damage plays a role in the pathogenicity of Achromobacter xylosoxidans, subspecies denitrificans. We report a rare case of pneumonia due to this organism in a 45-year-old female with bronchiectasis secondary to chronic aspiration.

2. Case Presentation

This is a 45-year-old White female with past medical history of asthma and gastroesophageal reflux disease (GERD) treated with Nissen fundoplication in the past. She presented to our clinic with chronic cough productive of greenish sputum. She improved with previous antibiotic use of levofloxacin on several occasions but her symptoms would recur as soon as she stops the antibiotics. Chest X-ray at initial evaluation showed an infiltrate bilaterally more pronounced on the right lower lobe. A CT scan of the chest was obtained and confirmed the infiltrates and showed bronchiectatic changes bilaterally in the lower lobes (Figure 1). Her autoimmune screen came back negative for rheumatoid arthritis and Sjogren’s syndromes, yet her immunoglobulins were elevated and her alpha one antitrypsin and immunoglobulin E (IgE) were at normal levels. Her sweat chloride test was normal. Chronic recurrent aspiration was suspected and an esophageal pH monitor along with esophageal manometry confirmed our suspicion of chronic aspiration secondary to severe acid reflux with elevated DeMeester score. Bronchoscopy was performed to rule out an obstructive disease and to obtain samples to rule out mycobacterial disease. Cultures came back positive for heavy growth of a nonfermenter later identified as Achromobacter xylosoxidans, subspecies denitrificans. Sensitivities were evaluated and the bacteria was sensitive to levofloxacin, amikacin, cefepime, cefazidime, gentamicin, meropenem, piperacillin/tazobactam, tobramycin, and trimethoprim-sulfamethoxazole. It was found to be resistant to aztreonam, cefotaxime, and ciprofloxacin, with incubation period of 5 days. Airway clearance techniques with percussion and flutter valve and bronchodilator therapy with hypertonic saline nebulizers were initiated. She was started on a 3-week course of levofloxacin but her symptoms recurred one month after stopping the antibiotic despite airway clearance.
Table 1: Previous reports of infections with *Achromobacter xylosoxidans subspecies denitrificans*, detailing type of infection, antimicrobial sensitivity, and duration of treatment.

| Year reported | Type of infection | Isolation specimen | Comorbid conditions | Sensitivity | Antibiotic of choice | Treatment duration |
|---------------|-------------------|--------------------|---------------------|-------------|----------------------|--------------------|
| 2011 [6]      | Prosthetic valve endocarditis | Blood | Tetralogy of Fallot | Cefepime, cefazidime, ciprofloxacin, imipenem, levofloxacin Piperacillin/tazobactam Ticarcillin/clavulanic acid, trimethoprim-sulfamethoxazole | Piperacillin/tazobactam (not specified), then imipenem | 6 weeks of piperacillin/tazobactam, then 8 weeks of imipenem |
| 2011 [5]      | Meningitis | Cerebrospinal fluid | | | Meropenem 2 g intravenously (IV) | 15 days |
| 2014 [9]      | Peritoneal dialysis catheter Exit site infection | Pus collected from exit site | Diabetes mellitus, chronic kidney disease (near end stage renal disease) | | Ciprofloxacin 250 mg every twelve hours | 14 days |
| 2012 [8]      | Right renal abscess with renocutaneous fistula | Pus collected from intrarenal abscess | Hypertension, chronic kidney disease, benign prostatic hyperplasia Recurrent bilateral nephrolithiasis | | Meropenem 1 g IV | 60 days |
| 2013 [7]      | Prosthetic valve endocarditis with aortic root abscess | Blood | Congenital aortic stenosis, history of aortic valve valvotomy | | Meropenem, trimethoprim-sulfamethoxazole, then levofloxacin | 4 weeks |
| 2014 [4]      | Pneumonia | Sputum | History of tuberculosis | | Meropenem 1 g q 8 hours | 2 weeks |
| 2014 [9]      | Peritoneal dialysis Catheter related peritonitis | Effluent dialysate | End stage renal disease on peritoneal dialysis | Ciprofloxacin (other antibiotics not specified) | Ciprofloxacin (not specified) | Duration not specified |
| 2017          | Current case Pneumonia / Bronchiectasis | Bronchoalveolar lavage | Gastroesophageal reflux disease, asthma | Amikacin, cefepine, cefazidime, gentamicin, levofloxacin, meropenem, piperacillin/tazobactam, tobramycin, trimethoprim/sulfamethoxazole | Levofloxacin | 6 weeks |
techniques. She was started again on levofloxacin for two more weeks with good clinical response and no recurrence of symptoms after a total 5 weeks of antibiotic therapy. She was referred for surgical intervention to abolish the ongoing injury to the airway and stop the aspiration insult to the airways.

3. Discussion

*Achromobacter denitrificans* is an aerobic, nonglucose fermenter gram-negative bacillus and flagellated and motile and produces acid from xylose [1]. The genus *Achromobacter* has multiple subspecies: *xylosoxidans, ruhlandii, piechaudii, denitrificans, spanius, insolitus,* and *marplatensis.* The most clinically significant subspecies are *Achromobacter xylosoxidans* and *denitrificans* [2]. It can be found in nature in soil, and the *xylosoxidans* subspecies has an affinity for aquatic surfaces. There are more clinically significant isolates of the subspecies *xylosoxidans* compared to *denitrificans* in terms of incidence of infection and clinical variety. Reports about infections with *Achromobacter denitrificans* are rare as an emerging pathogen.

There is a multitude of respiratory system infection cases due to *Achromobacter xylosoxidans,* subspecies *xylosoxidans* but not *denitrificans* [3]. The first reported pneumonia case due to *Achromobacter denitrificans* was reported from India in a 48-year-old male clerk in a chemical factory. It was isolated from sputum at two different occasions with no other concomitant isolates. It was sensitive to meropenem, imipenem, piperacillin-tazobactam, ticarcillin, trimethoprim-sulfamethoxazole, and third-generation cephalosporins. It was successfully treated with two weeks of meropenem [4]. Our case is to date the second reported case of *Achromobacter xylosoxidans* subspecies *denitrificans.* Other reported infections in adults include meningitis [5], endocarditis [6], endocarditis with aortic root abscess [7], renal abscess [8], peritoneal dialysis catheter related peritonitis [9], and exit site infection [10] (Table 1).

Diagnosis depends on isolation of the organism depending on site of the infection. So far, we have reported isolates from septum, pus, peritoneal fluid, and cerebrospinal fluid (Table 1). Identification can be via standard culturing methods. In our case bronchoalveolar lavage samples have been incubated in Blood Agar (TSA with 5% Sheep Blood)/MacConkey Agar Plate using a BioMérieux VITEK-2 system, incubated at 36-37 degrees Celsius.

The immunosuppressed population are at higher risk of infection due to *Achromobacter* species [3], yet as seen in Table 1 most of the patients had not been overtly immunocompromised but may have had predisposing conditions (end stage renal disease, presence of catheters, etc.). Both cases with involvement of respiratory system had a background of bronchiectasis. The former [4] was most likely secondary to tuberculosis while in our case it is most likely secondary to recurrent aspiration. We theorize that the damaged bronchiectatic lung tissue predisposed to the infection with this organism. This had been illustrated before in that *Achromobacter* species is known to colonize and infect cystic fibrosis patients [11]. In the other reported cases (Table 1), we can notice that structural damage and/or foreign body had been present: previous trauma, prosthetic valve, peritoneal dialysis catheter, and renal stones. Pathogenicity of *Achromobacter* species has been previously studied [12] with demonstrated ability to form biofilms and motility (via pili and flagella) which can potentiate infections in setting of structural damage and devices.

Management depends on administration of appropriate antibacterial agents, yet duration of treatment is not exactly defined due to lack in specific guidelines in this regard. The cases reported so far (Table 1) had been managed with different regimens but the most palpable response was to carbapenems with durations ranging from 2 to 14 weeks (Table 1). The sensitivity of the isolates is outlined below in Table 1, but the *Achromobacter* species had been historically responsive to antipseudomonal agents [1] with various success rates depending on site of infection and complexity of the cases. Our patient was cured after 5 weeks of oral levofloxacin therapy (after initial failure after three weeks). The outcome is generally excellent with clearance of the infection.

4. Conclusion

Rare causes of pneumonia should be investigated since appropriate detection can facilitate accurate antibacterial management. We theorize that structural damage (bronchiectasis secondary to chronic aspiration) plays a role in the pathogenesis of pneumonia in our patient. Combined management with antibiotics and airway clearance techniques resulted in an excellent outcome.

Conflicts of Interest

The authors have no conflicts of interest or financial disclosures to announce.

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