CASE REPORT

Achromobacter species endocarditis: A case report and literature review

Catherine Derber MD1, Kara Elam MPH1, Betty A Forbes PhD2, Gonzalo Bearman MD MPH1

Endocarditis due to Achromobacter species is a rare, yet serious, endovascular infection. Achromobacter species infective endocarditis is associated with underlying immunodeficiencies or prosthetic heart valves and devices. A case of prosthetic pulmonary valve endocarditis secondary to Achromobacter xylosoxidans subspecies denitrificans is described in the present report. This life-threatening infection was successfully treated with combined valve replacement and prolonged antibiotic therapy. A Medline/PubMed literature review of Achromobacter endocarditis was also performed. Achromobacter species are an uncommon, yet important, cause of nosocomial endocarditis. Given the significant associated morbidity and mortality, along with a high degree of intrinsic antibiotic resistance, Achromobacter species infective endocarditis remains a clinical treatment challenge.

Key Words: Achromobacter xylosoxidans subspecies denitrificans; Alcaligenes xylosoxidans; Infective endocarditis; Nosocomial

Although frequently encountered in aquatic environments, Achromobacter xylosoxidans is an uncommon source of bloodstream infections in humans (1-3). A xylosoxidans is of epidemiological significance due to its role as a hospital pathogen, its antimicrobial resistance profile and its implication in outbreaks (4). Because A xylosoxidans endocarditis is rare, few cases have been reported in the literature. We report a patient with endocarditis caused by A xylosoxidans subspecies denitrificans, and provide a literature review of Achromobacter species endocarditis.

CASE PRESENTATION

A 54-year-old African-American woman with tetralogy of Fallot initially underwent a Blalock-Taussig shunt placement as a child, followed by total repair as a teenager. Due to valvular insufficiency, the patient initially underwent a Blalock-Taussig shunt placement as a child, followed by total repair as a teenager. Due to valvular insufficiency, the patient was readmitted to a neighbouring hospital, heart failure, abdominal pain and fever. Blood cultures, obtained four days apart, grew A xylosoxidans; susceptibility testing was not performed on these isolates. The patient was transferred back to the tertiary care facility. Repeat blood cultures performed at our hospital nine days later grew A xylosoxidans subspecies denitrificans. Antibiotic susceptibilities were determined using the Vitek 2 System (bioMérieux Inc, USA). The organism was susceptible to ampicillin/sulbactam, imipenem, cefazidime, piperacillin/tazobactam, levoflaxacin, ciprofloxacin and trimethoprim/sulfamethoxazole; intermediate to amikacin, cefepime, tobramycin and gentamicin; and resistant to ceftazolin, cefotaxin, ceftriaxone and aztreonam. Piperacillin/tazobactam was again prescribed, and blood cultures obtained two days later were negative. A repeat transesophageal echocardiogram revealed a 2.4 cm × 1.4 cm vegetation on the pulmonary valve, with moderate to severe stenosis and an ejection fraction of 70%. A computed tomography scan of the abdomen and pelvis revealed the presence of splenic infarcts, hepatomegaly, dilated right atrium and hepatic veins, and diffuse periportal edema. After consultation with the infectious diseases department, the antimicrobial regimen was changed to imipenem/cilastatin 500 mg intravenously every 8 h.

Surgery was deferred secondary to rectal bleeding, fever, hypotension and respiratory distress. Repeat blood cultures obtained eight days after starting imipenem/cilastatin therapy grew A xylosoxidans subspecies denitrificans, with no change in the antibiotic susceptibility pattern. Due to the persistence of the bacteremia, 750 mg of intravenous
levofoxacin given daily was added, and the imipenem/cilastatin dose was increased to 500 mg intravenously every 6 h. The next set of blood cultures obtained six days later was negative. One month into her second admission, the patient underwent pulmonic valve replacement. Intraoperatively, complete dehiscence of the prosthetic pulmonary valve was observed. Additionally, the patient required debridement of an anterior mediastinum and pulmonary outflow tract abscess. Histopathology of the valve was consistent with acute endocarditis; however, tissue Gram stains and cultures were negative for any pathogen. She had an uneventful postoperative recovery and received an additional four weeks of intravenous imipenem/cilastatin therapy. To our knowledge, the patient experienced no recurrence of infection within the six-month postoperative period.

**METHODS**

A literature review of *A. xylosoxidans* endocarditis was performed using the Medline/PubMed database. Only articles published in English were considered. A search using the terms “Achromobacter” and “endocarditis” yielded 14 articles. A separate search using the terms “Alcaligenes” and “endocarditis” yielded 21 articles. Due to various changes in taxonomy over the past few decades, it was opted to include cases secondary to *Achromobacter* group B and unidentified *Achromobacter* species in the present review of *A. xylosoxidans* endocarditis. References from pertinent articles were reviewed to identify additional cases. Two cases were not published in English and were, thus, not reviewed (5-6). A total of 11 articles and 12 case reports were identified (7-17) (Table 1). All cases were reported between 1960 and 2009.

**DISCUSSION**

*A. xylosoxidans* is an aerobic, motile, oxidase-positive, nonfermenting, Gram-negative rod bacterium found in aquatic environments (18). It was first described in 1971 after being cultured from the purulent discharge of seven patients with chronic otitis media (19). Although the nomenclature has changed several times since its original description, including the term *Alcaligenes xylosoxidans*, biochemical and molecular studies have now reclassified it as “*Achromobacter xylosoxidans*” (20). Of the two currently recognized subspecies, *A. xylosoxidans* subspecies *xylosoxidans* and *A. xylosoxidans* subspecies *denitrificans*, the former is considered to be more relevant in clinical disease (11). In light of recent taxonomic changes, we elected to categorize all previous cases of *Alcaligenes xylosoxidans* and all organisms not identified at the subspecies level as “*Achromobacter xylosoxidans*”, for the purpose of the present review. *A. xylosoxidans* has low virulence but can cause significant disease in hosts with impaired immunity, chronic illnesses or prosthetic devices (2,21,22). Two unnamed species closely related to *A. xylosoxidans*, “*Achromobacter* group B” and “E” and *Achromobacter* F, have also been recovered from human blood isolates (23,24). We reviewed nine cases of endocarditis secondary to *A. xylosoxidans*, one case secondary to *Achromobacter* group B, and two cases secondary to an unidentified *Achromobacter* species.

*A. xylosoxidans* is a causative pathogen in abdominal infections, pneumonia, meningitis, urinary tract infections, osteomyelitis and ocular infections (25-30). It has also been implicated in hospital outbreaks and has been isolated from faucets, contaminated chlorhexidine solutions, disinfectant dispensers and intravenous contrast dye (22,31-34). Bacteremia secondary to *A. xylosoxidans* is uncommon, and the majority

### Table 1

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age (years), sex</th>
<th>Organism</th>
<th>Comorbidities</th>
<th>Clinical presentation</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present case</td>
<td>54, female</td>
<td><em>Achromobacter xylosoxidans subspecies denitrificans</em></td>
<td></td>
<td>Tetralogy of Fallot with prosthetic pulmonary valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>50, male</td>
<td><em>A. xylosoxidans</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>69, male</td>
<td><em>A. xylosoxidans</em></td>
<td>Diabetes, dialysis, cardiovascular disease, AVR</td>
<td></td>
<td>Piperacillin/tazobactam, imipenem/cilastatin, levofloxacin; surgery</td>
<td>Recovered</td>
</tr>
<tr>
<td>9</td>
<td>37, male</td>
<td><em>A. xylosoxidans</em> subspecies <em>xylosoxidans</em></td>
<td></td>
<td>Intravenous drug user, AVR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>35, male</td>
<td><em>A. xylosoxidans</em></td>
<td></td>
<td>VSD patch repair and pacemaker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>46, male</td>
<td><em>A. xylosoxidans</em></td>
<td>Diabetes, ischemic stroke, s/p lobectomy for emphysema</td>
<td></td>
<td>Cefazidime, piperacillin; surgery</td>
<td>Recovered</td>
</tr>
<tr>
<td>12</td>
<td>33, male</td>
<td><em>A. xylosoxidans, Candida species</em></td>
<td>Myelofibrosis, s/p bone marrow transplant</td>
<td></td>
<td>Ceftriaxone, amikacin</td>
<td>Died</td>
</tr>
<tr>
<td>13</td>
<td>30, male</td>
<td><em>A. xylosoxidans</em></td>
<td>Heart failure</td>
<td></td>
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<tr>
<td>14</td>
<td>77, female</td>
<td><em>A. xylosoxidans</em></td>
<td></td>
<td>AVR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>35, male</td>
<td><em>A. xylosoxidans</em></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>16</td>
<td>20, male</td>
<td><em>Achromobacter species</em></td>
<td>Tetralogy of Fallot repair with Ivalon patch, congenital interventricular septal defect</td>
<td></td>
<td>Penicillin, streptomycin, novobiocin, chloramphenicol, triple sulphonamide, sulfadiazine; surgery in surviving patient</td>
<td>1 died, 1 recovered</td>
</tr>
<tr>
<td>17</td>
<td>28, male</td>
<td><em>Achromobacter group B</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AV: Aortic valve; AVR: AV replacement; MV: Mitral valve; PV: Pulmonary valve; s/p: Status post; RV: Right ventricle; TMP-SMX: Trimethoprim/sulfamethoxazole; VSD: Ventral septal defect
Achromobacter species endocarditis

of cases are nosocomial (2,3,31). Endocarditis secondary to Achromobacter species is rare, with only 13 cases reported in the English literature including the present one.

A xylosoxidans infections are traditionally associated with immuno-compromised or chronically ill populations (1,3,4,21,31,35). In our review of other case reports, one patient had undergone a hematopoietic stem cell transplant (12), and four other patients had chronic underlying illnesses including diabetes, heart failure or dialysis-dependent renal failure (7,8,11,13). One patient was an intravenous drug user (9). Eight of the 13 patients (62%), including our patient, had prosthetic valves or underwent septal patch repairs (8-10,14-17). In patients without immunodeficiencies or chronic illnesses, these mechanical disruptions in the host defense system could be an important risk factor for Achromobacter endocarditis.

Clinical manifestations of Achromobacter endocarditis varied, but all patients presented with fever (7-17). Polymicrobial endocarditis occurred in one patient (8%) and involved Candida species and A xylosoxidans (12). This incidence of coinfections is similar to that reported in A xylosoxidans bacteremia (2). Embolic complications associated with Achromobacter endocarditis were not uncommon, and occurred in five patients, including the present one (38%). One patient experienced a retinal hemorrhage (14), and another patient died after a cerebral embolus (15). One patient with an infected right atrial thrombus due to both Candida species and A xylosoxidans developed a pulmonary embolism and infarcts (12). A fourth patient with mitral and aortic valve A xylosoxidans endocarditis experienced recurrent bacteremia associated with the liver, spleen, and renal infarcts and abscesses observed through imaging (8). Our patient had radiologic evidence of splenic infarcts and a pulmonary embolus, although no confirmatory cultures were obtained from these sites. With the exception of the present case, no patient with embolic phenomena survived.

The crude mortality rate for patients with A xylosoxidans endocarditis is high. More than 50% of the patients with A xylosoxidans endocarditis died (7-8,12-16). Five of the surviving patients, including our patient, required surgical resection of the infected tissue in addition to a prolonged course of antibiotics (9-11,16). Only one patient with prosthetic heart tissue treated exclusively with antibiotics survived (17). Despite a full six-week course of appropriate antibiotic therapy with documented negative blood cultures, our patient developed recurrent A xylosoxidans subspecies denitrificans bacteremia on cessation of the antimicrobials. Complete resolution of the endocarditis required surgical resection of the diseased prosthetic valve with a repeat course of antibiotics.

Antibiotic susceptibility patterns for A xylosoxidans are characterized by resistance to the aminoglycosides, narrow-spectrum penicillins, first- and second-generation cephalosporins, some third-generation cephalosporins (cefotaxime and ceftriaxone) and aztreonam (2,35). A xylosoxidans is generally susceptible to ceftazidime, extended-spectrum penicillins, carbapenems and sulfonamides, while susceptibility to quinolones is variable (2). Susceptibility only to colistin was recently reported in a patient treated for an intra-abdominal abscess (25). Despite a high level of resistance to aminoglycosides, in vitro studies (2) suggest that the use of gentamicin with trimethoprim/sulfamethoxazole or beta-lactams may be synergistic. The A xylosoxidans subspecies denitrificans antibiotic susceptibility pattern in our patient was similar to those previously reported in the literature (2,35), although there was some variability in aminoglycoside and cephalosporin susceptibilities between hospital #1 and our facility. This variance may be secondary to differences in antibiotic susceptibility testing between the two hospitals or from both isolates being near the minimum inhibitory concentration breakpoint for these antibiotics.

Ten patients (77%), including the present one, had sufficient data available to determine a health care-associated relationship with the infection (7-9,12,14-17). Nosocomial infective endocarditis is defined as developing within 72 h after hospital admission or within eight weeks of an invasive procedure (36). Some authorities advocate a six-month follow-up period for the surveillance of hospital-acquired infective endocarditis (37,38). Using this modified definition, all 10 cases of Achromobacter endocarditis were hospital acquired: three patients had central venous catheters (7,8,12) and seven patients, including the present patient, underwent prosthetic valve or interventricular septal surgery within six months of their symptoms (9,14-17). Two of these patients shared the same ethylene oxide heart pump, and infection was attributed to inadequate sterilization practices (16). The remaining three cases had insufficient information to be categorized as hospital acquired. One patient underwent recent dental work (10) and one patient had been admitted to the hospital within the previous three months (11); however, further details, such as invasive procedures, were not provided.

SUMMARY
We presented a patient with complicated prosthetic valve endocarditis secondary to Achromobacter xylosoxidans subspecies denitrificans that developed four months after pulmonary valve replacement. Achromobacter species are an emerging cause of Gram-negative endocarditis. The majority of cases are nosocomial; patients with prosthetic devices or central venous catheters appear to be disproportionately affected. Management of Achromobacter endocarditis is challenging, often requiring a combination of surgery and broad-spectrum antimicrobials. Although our patient initially failed a full six-week course of systemic antibiotics, she subsequently recovered after surgical resection of the affected valve and a second course of systemic antibiotics. Our case adds to the expanding body of literature on Achromobacter species endovascular infections. To our knowledge, this is the first confirmed reported case of endocarditis involving Achromobacter xylosoxidans subspecies denitrificans.

REFERENCES


