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Achromobacter xylosoxidans (*Alcaligenes xylosoxidans* subsp. *xylosoxidans*) Bacteremia Associated with a Well-Water Source: Case Report and Review of the Literature

JOEL B. SPEAR, JACK FUHRER,* AND BARBARA D. KIRBY

Division of Infectious Disease, Department of Medicine, University of Health Sciences/The Chicago Medical School, 3333 Green Bay Road, North Chicago, Illinois 60064

Received 27 August 1987/Accepted 4 December 1987

A case of community-acquired *Achromobacter xylosoxidans* bacteremia in a patient with metastatic breast carcinoma is described. The patient's home drinking water was identified as the source of her bacteremia. The case represents the first in which a community-acquired infection due to this organism has been attributed to a documented water source.

Achromobacter xylosoxidans is a gram-negative oxidative organism which is uncommonly isolated from clinical specimens. *A. xylosoxidans* was originally described by Yabuuchi and Ohyama (12) in 1971, who recovered it from purulent ear drainage from seven patients with chronic otitis media. Subsequently, it has been described as the etiologic agent in meningitis (8, 11), pneumonia (1, 6, 9, 10), surgical wound infections (2, 9), septicemia (1, 2, 6, 7, 10), urinary tract infections (2, 3), peritonitis (3, 10), and pharyngitis (3). It has been isolated from several aqueous environmental sources, some of which have been associated with nosocomial outbreaks of infections (7, 10, 11).

The case which we describe is that of an elderly woman with metastatic breast cancer who became bacteremic with *A. xylosoxidans*. The same organism was subsequently recovered from an area of cellulitis on her left flank. An epidemiologic history revealed that the patient's home drinking water was untreated well water. A sample of this water was obtained and grew *A. xylosoxidans* in pure culture. This represents the first case in which the source of a community-acquired illness due to this organism has been identified.

A 79-year-old woman with a 14-year history of metastatic breast carcinoma was admitted with a 3-week history of crampy abdominal pain, anorexia, malaise, and weakness. She denied fever, chills, nausea, vomiting, diarrhea, cough, sputum production, urinary frequency, or dysuria. A fall at home prompted her admission to the hospital. Her past history was significant for breast carcinoma which had metastasized to the bones and lungs and which had recurred locally three times. Four months before admission, she developed osteomyelitis of the left foot due to *Pseudomonas aeruginosa*. This infection was treated successfully with 6 weeks of intravenous tobramycin, piperacillin, and cefoperazone. Her medications at the time of admission were aminoglutethimide (500 mg/day), fluoxymesterone (20 mg/day), ferrous sulfate (300 mg/day), digoxin (0.25 mg/day), and hydrocortisone (40 mg/day). She was a nonsmoker and nondrinker. She lived in rural Wisconsin with her husband.

Physical examination revealed a blood pressure of 110/70 mm Hg, a pulse of 132 per minute, respirations of 44 per minute, and a temperature of 101.5°F (38.6°C). The pertinent physical findings included several abrasions of the forehead and face, a well-healed mastectomy scar on the left, rales in both lung fields, and an S4 gallop rhythm. The abdomen was protruberant with generalized tenderness. There were no masses, and no peritoneal signs were noted. The bowel sounds were active. The stool was guaiac negative. The rest of the physical examination was unremarkable.

The hemoglobin on admission was 11 g%, and the leukocyte count was 23,700 per mm^3 with 71 polymorphs, 18 band forms, 10 lymphocytes, and 1 monocyte. The electrolytes were normal. The urine had a pH of 6.0 and a specific gravity of 1.020. The microscopic examination of the urine showed 1 to 2 erythrocytes and 10 to 15 leukocytes per high-power field. There was a new ill-defined left lower lobe infiltrate seen on the chest X-ray film. No sputum could be obtained.

The patient was started on cefuroxime for presumed pneumonia. Her other medications were continued, and the hydrocortisone was increased to 300 mg/day. The patient's fever diminished to 98.4°F (36.9°C) in 24 h. The following day, her admission blood cultures became positive for gram-negative rods, and tobramycin was added to the treatment regimen. The urine culture showed no growth. Blood cultures were repeated on the day after the addition of tobramycin, and these subsequently also grew the same gram-negative rods.

On the fourth hospital day, the organism was identified as *A. xylosoxidans* which was sensitive to trimethoprim-sulfamethoxazole, chloramphenicol, tetracycline, piperacillin, and imipenem. It was resistant to ampicillin, ticarcillin, cefazolin, cefoxitin, cefuroxime, ceftizoxime, ceftriaxone, gentamicin, tobramycin, and amikacin. The tobramycin and cefuroxime were discontinued, and trimethoprim-sulfamethoxazole (480 mg/day) was begun. That evening, she became hypotensive and was transferred to the intensive care unit. She required intubation with mechanical ventilation and pressor agents for support. Imipenem (2 g/day) was added.

The following day, the patient developed a large erythematous and indurated area of her left flank. An incision of this area revealed no necrotic tissue. High-dose penicillin was added to provide additional coverage against clostridia. Deep cultures taken from the incision subsequently grew *A. xylosoxidans*.

The patient remained afebrile and improved. Blood cultures drawn while she was treated with trimethoprim-sulfamethoxazole and imipenem were sterile. She was extubated on the 10th hospital day. At that time, she and her family

* Corresponding author.

requested that no further intervention be undertaken. The following day, she became hypotensive secondary to a bradyarrhythmia. Her blood pressure did not respond to fluid administration, and she died. Permission for a postmortem examination was denied.

Subsequently, the patient's husband provided us with a sample of their drinking water, which comes from a well. A culture of the ultrafiltrate of this water grew *A. xylosoxidans*.

A. xylosoxidans is a gram-negative motile organism with peritrichous flagella. The organism produces an alkaline reaction on citrate medium and will grow on cetrimide medium. It produces catalase and oxidase and converts nitrate to nitrite. As its name implies, it characteristically oxidizes xylose. It fails to oxidize most other sugars, but it may slowly oxidize glucose as well as alcohol. While *Bergey's Manual of Systematic Bacteriology* refers to this organism as *Alcaligenes denitrificans* (4), the name was recently corrected to *Alcaligenes xylosoxidans* subsp. *xylosoxidans* (5).

Epidemiologic data suggest that water is the natural source of *A. xylosoxidans* and that infections may be waterborne. Environmental sources which have been identified include swimming pools (2), dialysis fluids, distilled water (11), deionized water (10), tap water, nonbacteriostatic saline (7), and chlorhexidine disinfectant solutions (2, 11). Several nosocomial infections have been attributed to exposure to these sources (7, 10, 11).

Most infections due to *A. xylosoxidans* have been reported to occur in patients with underlying disease, including renal insufficiency, diabetes mellitus, carcinoma, alcoholism, tuberculosis, or endogenous immunosuppression (1–3, 6, 10, 11). The types of infections in these patients include peritonitis (3, 10), pneumonia (1, 6, 10), bacteremia (1, 2, 6, 7, 10), biliary tract infection (2), urinary tract infection (3), and wound infection (2). In addition, Shigeta et al. (11) reported a series of six patients who developed ventriculitis and meningitis due to this organism after undergoing craniotomies with the placement of drains or ventriculoperitoneal shunts.

The case which we describe is the first community-acquired infection due to this organism in which a possible environmental source has been identified. The patient's potable water was the likely source of the *A. xylosoxidans* which eventually led to her fatal bacteremia.

The antibiotic susceptibility data of this organism have been previously reported (2, 3, 6, 9, 10). *A. xylosoxidans* is characteristically susceptible to carbenicillin and to trimethoprim-sulfamethoxazole and resistant to the aminoglycosides. It demonstrates variable susceptibility to chloramphenicol, tetracycline, azlocillin, piperacillin, cefoperazone, and cefamandole (6, 10). The isolate which we recovered was also susceptible to the carbapenem imipenem. More data on the use of imipenem in infections due to this organism are necessary.

In conclusion, *A. xylosoxidans* is a gram-negative oxidative organism which causes infections in patients with underlying illness. The natural habitat of the organism is most likely an aqueous environment. The in vitro susceptibility data reveal that the organism is resistant to many of the antimicrobial agents commonly used to treat infections caused by gram-negative organisms.

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