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Report of Six Cases of Human Infection by *Serratia plymuthica*

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***Serratia plymuthica* is an uncommon cause of human infection. Only one case of chronic osteomyelitis and two cases of sepsis secondary to central venous catheter infection have been documented. We report the isolation of *S. plymuthica* from six patients. The organism was recovered from blood cultures in three cases in which the patients had lymphoblastic leukemia, lymphoma, or stroke. Two isolates were recovered from exudates (following knee and abdominal surgery). In the last case, the organism was isolated from the peritoneal fluid of a patient with cholecystitis. The infection was considered nosocomial in five cases and community acquired in the other.**

The genus *Serratia* consists of 10 recognized species (5): *Serratia marcescens*, *S. liquefaciens*, *S. ficaria*, *S. rubidaea*, *S. fonticola*, *S. odorifera*, *S. plymuthica*, *S. grimesii*, *S. proteamaculans* subsp. *proteamaculans*, *S. proteamaculans* subsp. *quinovora*, and *S. entomophila.*

S. marcescens is recognized as an important nosocomial pathogen capable of causing urinary tract infections, pneumonia, intravenous catheter-associated infections, osteomyelitis, and endocarditis (4). Other *Serratia* species have caused infections less frequently.

S. plymuthica is not generally recognized as an organism capable of causing serious human infections. However, it has recently been shown to be a significant pathogen in a case of chronic osteomyelitis (9) and in three cases of sepsis associated with infection associated with a central venous catheter (1, 3, 6).

We report the laboratory isolation of *S. plymuthica* from six patients. Three isolates were recovered from blood cultures, two were from surgical wound exudates, and one was from peritoneal fluid. Five isolations occurred between July and September of 1989, and the last occurred 1 year later.

MATERIALS AND METHODS

Bacteremia. *S. plymuthica* was isolated in pure culture from the blood of three patients. Two were hematologic patients who had central venous catheters. The third patient had suffered a cerebrovascular accident and developed pneumonia during his hospital stay.

(i) Case 1. A 29-year-old male diagnosed with a relapse of acute lymphoblastic leukemia had a silicone-type Hickman (Chemocath) central venous catheter in place for chemotherapy. He developed a fever of 39°C associated with the handling of the catheter. Three blood cultures and a culture of the central venous catheter tip were obtained. Because of the fever, empirical antimicrobial therapy consisting of ceftazidime, amikacin, and vancomycin was initiated, in accordance with our hospital protocol for infection in hematologic and immunosuppressed patients. The patient was discharged after 12 days.

(ii) Case 2. A 25-year-old female was diagnosed with Burkitt's-type non-Hodgkin's lymphoma. She was treated with chemotherapy through a central venous catheter. She developed a fever of 39°C associated with manipulation of the catheter. Three blood cultures were obtained. The same empirical antimicrobial therapy was administered as for case 1. The patient defervesced and was discharged after 13 days of hospitalization.

(iii) Case 3. A 79-year-old man was admitted to the hospital because of a stroke. On the fourth day, he presented with fever of 38°C, tachypnea, and lethargy. His peripheral leukocyte count increased to 11,000/mm^3. Chest X ray showed a consolidation in the upper right lobe consistent with the diagnosis of pneumonia. Three blood cultures were collected. Therapy consisted of cefotaxime and the patient improved. The fever defervesced on the fourth day of treatment, but the patient died later from his underlying disease.

Infections of surgical wounds. *S. plymuthica* was isolated from two patients with surgical wounds.

(i) Case 4. A previously healthy 22-year-old man was admitted to the hospital with an open fracture of the right knee that required reconstructive surgery of the anterior cruciate ligaments. Fourteen days after surgery, swelling, erythema, and cutaneous necrosis developed at the site of the surgical wound. The infection site was incised, and a culture of exudate was obtained. The patient was treated by using drainage and local antiseptic cures consisting of twice-daily cleaning with povidone-iodide. No systemic antimicrobial treatment was used. Five days later, local symptoms disappeared, and a repeat culture of the exudate was negative.

(ii) Case 5. A 75-year-old woman underwent surgery because of an incarcerated eventration. Four days postsurgery, she developed fever and swelling and erythema at the surgical wound site. The infected site was incised, and a culture of the secretion was obtained. Therapy consisted of cefotaxime, and the patient was discharged after 2 weeks.

Infection in a case of cholecystitis (case 6). *S. plymuthica* was isolated from peritoneal fluid in a patient with acute cholecystitis. A 75-year-old woman was an emergency admission who was diagnosed with gangrenous cholecystitis that required cholecystectomy. *S. plymuthica* was recovered from peritoneal fluid. The patient was treated empirically with gentamicin and ampicillin, improved significantly, and was discharged.

Cultures from catheter tips and samples from wound exudates and peritoneal fluid were incubated for 18 to 24 h at 37°C on MacConkey agar, aerobic and anaerobic sheep blood agar, and thioglycolate broth medium.

All nine blood specimens were inoculated into 6A and 7A culture bottles, using the Bactec 730NR system (Becton Dickinson Microbiology Systems, Cockeysville, Md.). Biochemical testing was performed with the Microscan Gram-Negative Combo 1 panel (Baxter Diagnostics, West Sacramento, Calif.). Antimicrobial susceptibility testing was performed with the same panel.

RESULTS

S. plymuthica was recovered on sheep blood agar and produced lactose-fermenting colonies on MacConkey agar. Four biotype code numbers were obtained, all of which corresponded to *S. plymuthica* (7550030/2, 7550030/6, 7040035/6, and 7100004/6). The following results were obtained. Acid was produced from glucose, sucrose, raffinose, arabinose, and melibiose. Positive reactions were observed for nitrate reduction, Voges-Proskauer, and esculin hydrolysis. Acid was not produced from sorbitol, rhamnose, inositol, or adonitol. Negative reactions were observed for urea hydrolysis, H_2S, indole, tryptophan deaminase, malonate utilization, L-lysine, L-ornithine decarboxylase, and L-arginine dihydrolase. These identifications were confirmed in the Baxter-Travex Technical Services Laboratory, Brussels, Belgium.

All isolates were resistant to cefuroxime (MIC, >16 μg/ml).

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Four isolates were resistant to cefazolin (MIC, >16 μg/ml). The other two isolates (biotypes 7550030/6 and 7550030/2) were of intermediate susceptibility to cefazolin (MIC, 16 μg/ml). In one case, the isolate was resistant to ampicillin (MIC, >16 μg/ml; biotype 7040035/6). The remaining isolates were susceptible to ampicillin (five of six), cefotaxime (six of six), gentamicin (six of six), amikacin (six of six), tobramycin (six of six), trimethoprim-sulfamethoxazole (six of six), imipenem (six of six), and aztreonam (six of six).

DISCUSSION

Recent reports of *S. plymuthica* in the medical literature are probably attributed to the widespread use of database and automated identification systems that are capable of distinguishing among several *Serratia* species. It is therefore likely that the organism will be increasingly recognized as a cause of human infection.

The pathogenic role of this organism has not been determined. The first reports of *S. plymuthica* infection consisted of a case of sepsis with infection of a central venous catheter (6) and a case of chronic osteomyelitis (9). *S. plymuthica* was previously considered to be a saprophyte when recovered from burn sites (2) because of eradication of the organism by topical treatment with 1% silver sulfadiazine.

All of our cases, except one, were nosocomial in source and were clearly limited in duration. It is hypothesized that infection was acquired through contaminated water, since water is one of the reservoirs of this organism. Unfortunately, the environmental source of this organism could not be substantiated. In our patients, the organism was clearly pathogenic, producing general symptoms that did not disappear until treatment was started.

We consider five of these infections (cases 1 to 5) nosocomial in source because infection developed during the period of hospitalization (8). We rejected the possibility of cross-transmission because patients were located in different services (except the hematology cases) with no shared personnel. These five cases occurred within a 3-month period and involved invasive therapeutic procedures.

The remaining case, in which the organism was isolated from peritoneal fluid during an emergency cholecystectomy, was not considered a nosocomial infection. In fact, the infection was acquired before admission and without any prior intervention. A case from a patient with mesenteric adenitis due to *S. plymuthica* was reported previously (7).

Our results of antimicrobial susceptibility testing are similar to previous reports (2, 6, 9), including resistance to cefazolin and cefuroxime and susceptibility to cefotaxime. Horowitz et al. (6) and Domingo et al. (3) reported resistance to ampicillin, while Zbinden and Blass (9) showed that 80% of isolates recovered from five patients were susceptible to ampicillin. Clark and Janda (2) also reported susceptibility to ampicillin, and we found resistance to ampicillin in only one of six isolates. The observation of ampicillin-susceptible but cefazolin-resistant *Serratia* spp. is difficult to explain, but our findings are concordant with the cases reported previously.

The isolates of *S. plymuthica* from our six patients produced serious disease. All of our patients responded to therapy. *S. plymuthica* must be considered an organism capable of causing serious human infections. Further studies are necessary to establish the epidemiology and pathogenic role of *S. plymuthica*. We report our experience in these six cases to show the clinical relevance of this species, which must be taken into consideration when it is isolated.

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