

Recurrent *Achromobacter piechaudii* Bacteremia in a Patient with Hematological Malignancy

STEPHEN E. KAY,^{1*} ROBERT A. CLARK,¹ KAREN L. WHITE,² AND MARGARET M. PEEL³

Department of Microbiology, PathCare Consulting Pathologists,¹ and Oncology,² Geelong District Hospital, Geelong, Victoria 3220, and Microbiological Diagnostic Unit, Department of Microbiology and Immunology, The University of Melbourne, Victoria 3010,³ Australia

Received 22 August 2000/Returned for modification 25 October 2000/Accepted 8 November 2000

We describe a recurrent bacteremia caused by *Achromobacter* (formerly *Alcaligenes*) *piechaudii* in association with an intravenous catheter in an immunocompromised 73-year-old man. This is the first reported case of bacteremia due to *A. piechaudii*.

CASE REPORT

A 73-year-old man was admitted to the hospital with a fever of 38.3°C, rigors, and chills 1 h after routine access and flushing of his Hickman catheter. His blood pressure was 90/55 mm Hg and his pulse rate was 120 beats per min. Cardiovascular, respiratory, and abdominal examinations revealed no abnormality, and no focus of infection was apparent, although the skin around the entry site of the Hickman catheter was erythematous. The catheter had been present in his right subclavian vein during the preceding 10 months without any apparent complications.

The patient's medical history included a diagnosis, 4 years previously, of large-cell lymphoma that had been treated with multiple cycles of chemotherapy. A bone marrow biopsy performed 6 months before presentation showed recurrence of myelodysplasia or early leukemic relapse, but the marrow was not frankly leukemic at that stage. However, a cytogenetic study undertaken at that time confirmed the presence of an abnormal cytogenetic clone consistent with early recurrence of an acute myeloid leukemic process. The patient also had a history of repair of an abdominal aortic aneurysm and hernia, myocardial infarction, pneumonia, and anemia with thrombocytopenia secondary to myelodysplasia. The most recent cycle of chemotherapy had been completed 7 months prior to presentation. Regular medications included tranexamic acid, ranitidine, oxazepam, and enalapril.

Blood examination revealed a leukocyte count of 3.8×10^9 /liter (normal range, 4×10^9 to 10×10^9 /liter), with 0.72×10^9 neutrophils per liter (normal range, 2.5×10^9 to 7.5×10^9 /liter), 2.7×10^9 lymphocytes per liter (normal range, 1×10^9 to 4×10^9 /liter), and 0.3×10^9 monocytes per liter (normal range, 0.2×10^9 to 0.8×10^9 /liter). The hemoglobin level was 111 g/liter (normal range, 125 to 175 g/liter), and the platelet count was 11×10^9 /liter (normal range, 150×10^9 to 500×10^9 /liter). Two sets of blood cultures were collected, one from the Hickman catheter and one from a peripheral vein. The

blood samples were inoculated into the BacT/Alert blood culture system (Organon Teknika, Durham, N.C.). A swab of the erythematous skin around the entry site of the Hickman catheter was also cultured. The patient was treated empirically with a single dose of 180 mg of gentamicin administered intravenously. The following day, he became afebrile and was discharged.

After incubation at 35°C for 24 h, one of the two FAN aerobic blood culture bottles became positive soon after the patient left the hospital. Examination of a Gram-stained smear of this bottle's contents showed gram-negative, rod-shaped bacteria. The isolates grew on Columbia agar (CM 331; Oxoid Ltd., Basingstoke, United Kingdom) containing 5% horse blood and on MacConkey agar (CM 507; Oxoid), both incubated aerobically. The organism was initially erroneously identified as *Burkholderia pickettii* by the Dade MicroScan Walk-Away automated identification system (Dade MicroScan, Inc., Sacramento, Calif.). The isolate was erroneously identified as *B. pickettii* with a low (85%) probability. The database of the Dade MicroScan Walk-Away does not include *Achromobacter piechaudii*, which is rarely encountered. The system thus used the best-fit criteria included in the gram-negative commercial kit panel to produce the incorrect *B. pickettii* identification. This is a problem commonly encountered by microbiology laboratories when they use automated systems for the identification of rare isolates. Manufacturers of automated identification systems who expand and update their databases to include rare and recently reclassified bacteria best address the problem. The initial species identification was not made available to the treating physicians, and the organism was reported as a gram-negative bacterium along with the antimicrobial susceptibility results. The isolate was sent to a reference laboratory for definitive identification, and the results were available 4 weeks later.

Antimicrobial susceptibility was also determined by the Dade MicroScan system, and the results were made immediately available to the physicians. The isolates were susceptible to amikacin, cefepime, cefotaxime, ceftazidime, ceftriaxone, cephalexin, ciprofloxacin, imipenem, piperacillin, piperacillin-tazobactam, ticarcillin-clavulanate, and trimethoprim-sulfamethox-

* Corresponding author. Mailing address: Department of Pathology, Monash Medical Center, Locked Bag 29, Clayton, VIC 3168, Australia. Phone: (613) 9594-4551. Fax: (613) 9594-4517. E-mail: Stephen.Kay@med.monash.edu.au.

azole, and they were resistant to ampicillin, cefpodoxime, and gentamicin. They were of intermediate susceptibility to cefazolin and tobramycin.

Three weeks later, the patient was readmitted with fever and rigors 2 h after access and flushing of his Hickman catheter. He had a temperature of 39.5°C, blood pressure of 100/60 mm Hg, and a pulse rate of 105 beats per min. Cardiovascular, respiratory, and abdominal examinations again detected nothing abnormal, and the skin around the entry site of the Hickman catheter was again erythematous. This time, the leukocyte count was 1.3×10^9 /liter, with 0.7×10^9 neutrophils per liter, 0.5×10^9 lymphocytes per liter, and 0.1×10^9 monocytes per liter. The hemoglobin level was 109 g/liter and the platelet count was 7×10^9 /liter. The Hickman catheter was removed as the suspected focus of infection in this patient, and blood samples were collected from the Hickman catheter and a peripheral vein for culture. The catheter tip was also cultured. The patient was treated with cefepime (2 g, twice daily, intravenously) for 3 days, after which he was discharged. During this second admission, the same species as was isolated during the first admission, with identical antimicrobial susceptibilities, was isolated from two FAN aerobic cultures of the blood samples collected from the Hickman catheter and a peripheral vein of the patient. This result was again reported to physicians as a gram-negative bacterium. The Microbiological Diagnostic Unit of the University of Melbourne, Victoria, Australia, subsequently identified both isolates as *A. piechaudii*. This information was made available to the physicians following the patient's second discharge from the hospital. No growth was obtained from culture of the erythematous skin swab around the entry site of the Hickman catheter taken during the patient's first admission or from the Hickman catheter tip culture during the second admission.

At the Microbiological Diagnostic Unit, the isolates grew as strict aerobes on Columbia agar (Oxoid) containing 5% horse blood, nutrient agar (Oxoid), and MacConkey agar (Oxoid) after incubation at 35°C for 24 h. Colonies were nonhemolytic. Motility was demonstrated by the hanging-drop method, and peritrichous flagella were seen in a wet mount stained by the Ryu stain (1). Conventional tests were used for characterization of the isolates, the results of which are listed in Table 1. Based on growth characteristics, morphology, and biochemical reactions, the isolates were identified as *A. piechaudii* (4, 5).

Discussion. *A. piechaudii* belongs to the group of gram-negative, oxidase-positive, indole-negative, asaccharolytic, rod-shaped nonfermenters (4). It was first proposed as a new species of *Alcaligenes*, *Alcaligenes piechaudii*, in 1986 (2). At that time, its key characteristics were given as rod shaped, aerobic, gram negative, nonpigmented, motile by peritrichous flagella, nonsaccharolytic, and able to reduce nitrate but not nitrite. The new species had been recovered from human clinical material, including blood, and from soil, but no clinical information was available, so the clinical significance of the isolation of the species was unknown.

In 1988, a report on the repeated isolation of *A. piechaudii* from the ear discharge of a diabetic man provided the first

TABLE 1. Characteristics of isolates of *A. piechaudii*

| Test | Reaction |
|----------------------------------------------|----------------|
| Motility..... | + ^a |
| Growth on MacConkey agar..... | + |
| Growth on Cetrinide agar..... | + |
| Growth in 6.5% NaCl broth..... | + |
| Catalase..... | + |
| Oxidase..... | + |
| Acid from glucose, xylose ^b | - |
| Acetamide alkalization..... | - |
| Citrate utilization (Simmons)..... | + |
| Esculin hydrolysis..... | - |
| Indole production..... | - |
| Malonate utilization..... | + |
| Nitrate reduction..... | + |
| Nitrite reduction..... | - |
| Phenylalanine deaminase..... | - |
| Urease (Christensen's)..... | - |
| TSI ^c slant, acid..... | - |
| TSI butt, acid..... | - |
| H ₂ S (TSI butt)..... | + ^d |

^a Peritrichous flagella.

^b Ammonium salt basal medium.

^c Triple-sugar iron agar medium.

^d Darkening along the stab line after 3 days.

indication that this species can act as an opportunistic pathogen (3). The isolates of *A. piechaudii* being reported here differ from the strain from ear discharge described previously in that they produce a small amount of hydrogen sulfide along the line of stab in triple-sugar iron agar medium after incubation at 35°C for several days. This characteristic has been described previously for some strains of *A. piechaudii* (5). No further reports implicating *A. piechaudii* in a pathogenic role have been published, and the species is apparently only rarely isolated from clinical specimens (5).

In 1998, the description of the genus *Achromobacter* was emended, based on phenotypic characteristics, DNA base composition, DNA-DNA similarity, and 16S rRNA sequence analysis (6). Transfer of *Alcaligenes piechaudii* to the genus *Achromobacter*, as *Achromobacter piechaudii*, was proposed (6). The present members of the genus *Achromobacter* are *A. xylosoxidans*, *A. xylosoxidans* subsp. *denitrificans*, *A. ruhlandii*, and *A. piechaudii*.

The source of infection in our patient was probably environmental. The bacterium may have colonized the patient's Hickman catheter, possibly as a result of contact with water. The patient had neutropenia, which is a known predisposing factor for bacteremia in patients with cancer.

Advances in the treatment of malignancy and its complications have resulted in a greater life expectancy and a higher frequency of hospitalization for those with cancer. Consequently, the opportunities for infection of these susceptible individuals by environmental microorganisms of relatively low pathogenicity are significantly increased. In the case reported here, the causative agent of two episodes of bacteremia in a neutropenic man with hematologic malignancy was a rarely isolated environmental bacterium of low pathogenicity, *A. piechaudii*. This constitutes the second report of human disease, and the first report of bacteremia, due to *A. piechaudii*.

REFERENCES

1. Heimbrook, M. E., W. L. L. Wang, and G. Campbell. 1989. Staining bacterial flagella easily. *J. Clin. Microbiol.* **27**:2612–2615.
2. Kiredjian, M., B. Holmes, K. Kersters, I. Guilvout, and J. De Lay. 1986. *Alcaligenes piechaudii*, a new species from human clinical specimens and the environment. *Int. J. Syst. Bacteriol.* **36**:282–287.
3. Peel, M. M., A. J. Hibberd, B. M. King, and H. G. Williamson. 1988. *Alcaligenes piechaudii* from chronic ear discharge. *J. Clin. Microbiol.* **26**:1580–1581.
4. Schreckenberger, P. C., and A. von Graevenitz. 1999. *Acinetobacter*, *Achromobacter*, *Alcaligenes*, *Moraxella*, *Methylobacterium*, and other nonfermentative gram-negative rods, p. 539–560. In P. R. Murray, E. J. Baron, M. A. Tenover, F. C. Tenover, and R. H. Tenover (ed.), *Manual of clinical microbiology*, 7th ed. ASM Press, Washington, D.C.
5. Weyant, R. S., C. W. Moss, R. E. Weaver, D. G. Hollis, J. J. Jordan, E. C. Cook, and M. L. Daneshvar. 1996. Identification of unusual pathogenic gram-negative aerobic and anaerobic bacteria, 2nd ed. Williams & Wilkins, Baltimore, Md.
6. Yabuuchi, E., Y. Kawamura, Y. Kosako, and T. Ezaki. 1998. Emendation of genus *Achromobacter* and *Achromobacter xylosoxidans* (Yabuuchi and Yano) and proposal of *Achromobacter ruhlandii* (Packer and Vishniac) comb. nov., *Achromobacter piechaudii* (Kiredjian et al.) comb. nov., and *Achromobacter xylosoxidans* subsp. *denitrificans* (Rüger and Tan) comb. nov. *Microbiol. Immunol.* **42**:429–438.