CASE REPORTS

Implantable Cardiac Defibrillator Pocket Infection Due to a Previously Undescribed Cupriavidus Species

Joshua B. Christensen, 1,2* Nicholas P. Vitko, 2 Martin I. Voskuil, 2 and Jose R. Castillo-Mancilla 1

University of Colorado Denver, School of Medicine, Department of Medicine, Division of Infectious Diseases, Aurora, Colorado, 1
and University of Colorado Denver, School of Medicine, Department of Microbiology, Aurora, Colorado 2

Received 10 March 2010/Returned for modification 17 April 2010/Accepted 21 April 2010

The genus Cupriavidus consists of Gram-negative, nonfermenting bacteria most of which are environmental organisms, though some species have been associated with human disease. We report the recovery and identification of an isolate that represents a previously undescribed species of Cupriavidus from an implantable cardiac defibrillator pocket infection.

CASE REPORT

A 29-year-old woman with congenital heart disease and a left-sided implantable cardiac defibrillator (ICD) placed on 16 September 2008 for complete heart block underwent a lead revision due to atrial lead dislodgement on 17 February 2009. She subsequently developed pain, erythema, and swelling at the pocket site and was admitted on March 22. Four of 4 paired sets of aerobic and anaerobic blood cultures drawn on admission were positive for methicillin-sensitive Staphylococcus aureus (MSSA) at one day, using the BACTEC 9240 system (BD, Franklin Lakes, NJ), which led to the diagnosis of pacemaker endocarditis. This was treated initially with intravenous nafcillin and gentamicin and complete removal of all hardware on 25 March, with placement of a new right-sided ICD on 1 April, which was complicated again by lead dislodgement, requiring a revision on 3 April. Follow-up blood cultures, consisting of 2 sets of paired bottles each on 23, 26, and 31 March, had no growth at 7 days. She was discharged home to complete 6 weeks of intravenous nafcillin and oral rifabutin. Eleven days after the revision, she was readmitted for pain and swelling over the right pocket. Four sets of paired blood cultures were negative on this admission. The ICD pocket was explored, and cultures sent for analysis. The cultures grew small Gram-negative rods when incubated aerobically at 24 h on both blood and MacConkey agar at 37°C with 5% carbon dioxide; there was no growth anaerobically at 48 h. The isolate was sensitive to levofloxacin. No other organisms were isolated. Her antibiotic regimen was changed to intravenous vancomycin, oral rifabutin, and oral levofloxacin, and she was discharged. With each manipulation of the ICD, bacitracin solution was used to irrigate the pocket.

The patient completed a 6-week course of intravenous vancomycin, oral levofloxacin, and oral rifabutin. She tolerated the regimen well, and had no evidence of recurrence after completion of her antibiotic course. No further complications with the ICD were noted.

The isolate was an aerobic, motile, Gram-negative rod that grew in tryptic soy broth at both 30 and 42 degrees. It was nonfermentative on MacConkey and triple sugar media and was found to be positive for oxidase, urease, citrate, and catalase. It exhibited negative results in the following tests: nitrate, pyrolidonyl arylamidase (PYR), and esculine hydrolysis. Fla

* Corresponding author. Mailing address: University of Colorado Denver, School of Medicine, Department of Medicine, Division of Infectious Diseases B168, Aurora, CO 80045. Phone: (303) 724-4932. Fax: (303) 724-4926. E-mail: Joshua.Christensen@ucdenver.edu.

Published ahead of print on 28 April 2010.

FIG. 1. Flagellum staining of the bacteria isolated from the implantable cardiac defibrillator pocket infection.
gellum staining showed peritrichous flagella (Fig. 1). The isolate was sensitive to levofloxacin, with a MIC of 0.12 µg/ml, to ceftriaxone, with a MIC of 0.5 µg/ml, and to meropenem, with a MIC of 4.0 µg/ml. MIC determinations were performed using the Etest method (AB Biodisk, Solna, Sweden). A reference laboratory (ARUP Laboratories, Salt Lake City, UT) identified the organism to the genus Cupriavidus by partial 16S rRNA analysis.

Shaken cultures were grown in LB broth incubated aerobically with 5% carbon dioxide at 37°C. We isolated genomic DNA from the culture using a DNeasy kit (Qiagen, Madison, WI), and primers were designed based on published sequences from NCBI for Cupriavidus 16S rRNA, using FastPCR (University of Helsinki, Finland). The 16S rRNA gene was then amplified by touchdown PCR using an Advantage 2 PCR kit (Clontech, Mountain View, CA) and gel purified using a MiniElute gel extraction kit and a QIAquick PCR purification kit (Qiagen). The samples were sent for sequencing at the University of Colorado Sequencing Core. The 16S rRNA analysis yielded a 1,393-base fragment which, when blasted against the NCBI genomic database, had no perfect matches.

The 16S rRNA gene sequence is considered an important component of describing a new species, with 1% difference from described species generally required to warrant a new species designation (3). Our consensus sequence was compared to the NCBI GenBank bacterial DNA database. Comparison of the 16S rRNA gene sequences found a maximal identity of 98% for segments in the alignment, with the highest similarities being to C. taiwanensis, C. respiraculi, C. metallidurans, C. pauculus, C. gilardi, and other species of the genus Cupriavidus. The described species include Cupriavidus necator (also previously identified as Alcaligenes eutrophus), C. basilensis (first described in Basel), C. campinensis (first isolated in Kempen), C. gilardi (after G. L. Gilardi), C. metallidurans (enduring metal), C. oxalaticus (pertaining to oxalate), C. pauculus (previously known as CDC group IVc-2), and R. paucula, as well as R. pauculus (pauculus or rare in human infections), C. respiraculi (pertaining to the respiratory system), C. taiwanensis (first isolated in Taiwan), and a recently described novel species isolated from cystic fibrosis patients (4, 6, 12, 13, 15).

C. pauculus, initially known as CDC group IVc-2, has been recognized as an opportunistic pathogen that has been described in several serious infections, including bacteremia, catheter-associated bacteremia, abscesses, peritonitis, respiratory infections, and tenosynovitis, usually in immunocompromised patients, and has been implicated in nosocomial infections (2, 4, 8, 9, 11). The bacteria have also been isolated from pool water, ground water, and bottled mineral water (14). C. respiraculi, C. pauculus, C. gilardi, C. metallidurans, C. basilensis, and a novel Cupriavidus species have been found in clinical isolates from cystic fibrosis patients (5, 6, 16). C. gilardi has also been described in a fatal disseminated infection in a child with aplastic anemia (7).

Cardiac device infections occur in about 1% of cases, with patients presenting with these infections more likely to have had device replacement and prior lead dislodgement (10). The organisms most often associated with these infections include Staphylococcus epidermidis, other Gram-positive flora, and Staphylococcus aureus; Gram-negative organisms are uncommon (1). Ours is the first case of a Cupriavidus infection of an ICD, with a previously undescribed Cupriavidus species.

Nucleotide sequence accession number. The consensus 16S rRNA sequence obtained in this study was submitted to GenBank under accession number GU810004.

ACKNOWLEDGMENTS

Financial support for J.B.C. was partially provided by grant T32 AI007447 (Colorado HIV Research Training Program). We gratefully acknowledge Nancy Fitzgibbons, of the University of Colorado Hospital Clinical and Reference Laboratory, for assistance with the flagellum stain.

REFERENCES


