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Catheter-Related *Rahnella aquatilis* Bacteremia in a Pediatric Bone Marrow Transplant Recipient

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***Rahnella aquatilis*, a rarely encountered member of the family *Enterobacteriaceae*, was twice isolated from the blood of a pediatric bone marrow transplant recipient. This is the first report of a pediatric case of *R. aquatilis* bacteremia, and it was probably related to inappropriate handling of a Hickman catheter.**

Rahnella aquatilis, an infrequently isolated gram-negative rod, is the only species of the genus *Rahnella* within the *Enterobacteriaceae* family. The organism's natural habitat is water, from which most isolates have been recovered (3). Infections in humans have only occasionally been reported (1, 2, 5, 6).

We report what we believe to be the first case of systemic infection by *R. aquatilis* in a pediatric patient. It occurred in a 7-year-old boy after autologous bone marrow transplantation for neuroblastoma, and it was probably related to inappropriate handling of an indwelling intravenous Hickman catheter.

Case report. The patient, a caucasian boy, was 16 months old when stage IV neuroblastoma with disseminated skull lesions was diagnosed in 1986. Chemotherapy combined with surgery induced complete remission but the tumor relapsed in early 1992 with metastases in the bone marrow, skull, spine, and right caput femoris. Chemotherapy was reinstituted according to the current guidelines of the German Society for Pediatric Oncology in combination with local irradiation of the bone lesions. Irradiation with radiolabeled metaiodobenzylguanidine (^{131}miBG) and autologous transplantation with peripheral stem cells were planned as further treatment steps.

Before ^{131}miBG therapy in August 1992, a double-lumen Hickman catheter was implanted. Between infusions both parts of the catheter were filled with heparin solution (100 international units [IU]/ml). Heparin was once accidentally injected into one lumen of the catheter with syringe and needle by perforating the catheter wall instead of using the hub. This incident was reported only 2 days later; the catheter was then repaired.

Four days after the incident, ^{131}miBG treatment (2 × 5.5 MBq) was completed and the conditioning regimen for transplantation (melphalan, etoposide, and carboplatin) was initiated. Autologous transplantation with the patient's peripheral stem cells took place 8 days later. During the following days, the patient occasionally had a low grade fever. Repeated blood specimens drawn only through the intact catheter lumen (which permitted easier flow of blood than the repaired part of the catheter) remained sterile. Empirical antimicrobial treatment was started with gentamicin, azlocillin, and flucloxacillin and was later changed to amikacin, ceftriaxone, and vancomycin supplemented with amphotericin B. In spite of the broad antimicrobial coverage, the patient developed high fever (39.5°C) on day 13 (25 days after the perforation incident). The C-reactive protein level had risen continuously from 1.6 mg/dl on day 9 to 20.3 mg/dl on day 13.

Since a catheter-related infection was suspected, both parts of the catheter were flushed with 50,000 IU of urokinase (a fibrinolytic agent). Afterward, two blood samples drawn through each lumen yielded *R. aquatilis*. The two isolates were identified by the API 20E commercial system (bioMérieux, Nürtingen, Germany). Both of them had the numerical profile number 1005573, giving 95.3% confidence for identification as *R. aquatilis*. The identity of our isolates was confirmed by conventional biochemical testing at the German National Reference Center for Enteric Pathogens in Hamburg according to the panel of tests reported by Farmer et al. (3). Some of the biochemical reactions exhibited by our isolate are shown in Table 1.

In vitro antimicrobial susceptibility testing by the agar diffusion method showed our isolates to be susceptible to various aminoglycosides (gentamicin, tobramycin, and amikacin), amoxicillin-clavulanic acid, ceftriaxone, imipenem, and co-trimoxazole. The isolates were resistant to amoxicillin, azlocillin, cefazolin, cefuroxime, chloramphenicol, and fosfomycin.

Antibiotic treatment (amikacin and imipenem-cilastatin) administered via both parts of the catheter and repeated flushing with urokinase led to defervescence and normalization of C-reactive protein levels. The catheter was left in place, and the patient recovered uneventfully.

On the basis of 11 isolates recovered from water in France, in 1976 Gavini et al. (4) defined a new group in the family *Enterobacteriaceae* which they named "group H2." Izard et al. (7) showed by DNA-DNA hybridization that the strains of group H2 were only remotely related to other members of the *Enterobacteriaceae*. Hence, they proposed the new genus *Rahnella* (in honor of the German-American microbiologist Otto Rahn) with one species, *R. aquatilis*.

Biochemically, *R. aquatilis* has no single distinguishing feature to differentiate it from other members of the family *Enterobacteriaceae* (3). Characteristically, strains of *Rahnella* are nonmotile at 36°C and negative for lysine and ornithine decarboxylases and for arginine dihydrolase and do not produce a yellow pigment. These properties differentiate the *Rahnella* sp. from the heterogeneous group of bacteria classified in the *Enterobacter agglomerans-Erwinia herbicola* complex (3).

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TABLE 1. Biochemical reactions of the *R. aquatilis* isolate from this study[a]

Reaction
Positive
Methyl red
Voges-Proskauer
Citrate (Simmons')
Phenylalanine deaminase
Malonate utilization
D-Glucose, acid
D-Glucose, gas
Esculin hydrolysis
o-Nitrophenyl-β-D-galactopyranoside
Fermentation of lactose, sucrose, D-mannitol, dulcitol, salicin, D-sorbitol, L-arabinose, raffinose, L-rhamnose, maltose, D-xylose, trehalose, cellobiose, melibiose, and D-mannose
Negative
Indole production
Hydrogen sulfide
Urea hydrolysis
Lysine decarboxylase
Arginine dihydrolase
Ornithine decarboxylase
Motility (28 and 37°C)
Gelatin hydrolysis (22°C)
Growth in KCN
Tartrate, Jordan's
Acetate utilization
Lipase
DNase
Oxidase
Yellow pigment production
Fermentation of adonitol, mucate, and myo-inositol

[a] Incubation at 28°C; reading of positive tests after 2 days and of negative tests after 7 days.

Interestingly, the human isolates reported by Alballaa et al. (1) and Goubau et al. (5) were identified by the API 20E system with the same profile number as our isolates. The same identification system was applied by Harrell et al. (6). Alballaa et al. (1) draw attention to the fact that *R. aquatilis* is not included in the data base of several other commercial bacterial identification systems. Strains now identified as *R. aquatilis* may have been misidentified as *E. agglomerans* in the past (3).

Only very few human infections due to *R. aquatilis* have been reported in the literature (1, 2, 5, 6). It is noteworthy that all of them occurred in immunocompromised patients. Underlying factors included acute and chronic lymphoblastic leukemia, AIDS, and immunosuppression after renal transplantation. The strains of *R. aquatilis* were isolated from the respiratory tract (2, 6), urine (1), and blood (5). Farmer et al. (3) mention one isolate originating from a burn wound. Thus, there is little doubt that *R. aquatilis* can act as an opportunistic pathogen in immunocompromised hosts.

Interestingly, the only reported case of septicemia due to *R. aquatilis* was also related to a Hickman catheter (5). In our case, it is likely that the inappropriate handling of the Hickman catheter played a major causative role. In addition, the patient's immune system was extremely compromised. It is likely that the recurrent episodes of low grade fever soon after transplantation were due to a developing catheter infection in the perforated lumen and that the first blood samples were sterile only because they had been drawn through the intact lumen of the catheter. The increasing body temperatures, the continuous rise of the C-reactive protein levels, and the nonresponse to broad antibacterial treatment are all in accordance with a progressing catheter infection. The first blood sample drawn through the repaired lumen yielded *R. aquatilis*. At this stage, a blood specimen drawn through the intact lumen of the catheter was positive, too. Fortunately, it was possible to preserve the catheter by conservative treatment.

Our results of antimicrobial susceptibility testing are in agreement with those of other authors (1, 5, 6) who reported susceptibility of *R. aquatilis* to the aminoglycosides, broad-spectrum cephalosporins, and quinolones. Thus, a variety of antimicrobial agents is at hand for treatment of infections caused by this organism.

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