Urinary Tract Infection Due to *Rahnella aquatilis* in a Renal Transplant Patient

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***Rahnella aquatilis* is an unusual gram-negative rod belonging to the family Enterobacteriaceae. It inhabits fresh water and is rarely isolated from clinical specimens. We report the case of a urinary tract infection caused by this organism in a renal transplant patient.**

Rahnella aquatilis is a member of the family Enterobacteriaceae. The organism's natural habitat is water, from which the original 11 isolates were recovered in France. These isolates were compared with other members of the family Enterobacteriaceae by Gavini et al. (3) in 1976 by using numerical taxonomy and phenotypic characteristics. Based on the differences found, they defined the isolates as a new group of Enterobacteriaceae and named it group H₂. Later, Izard et al. (6), using DNA-DNA hybridization, showed that strains of group H₂ are closely related to each other but are remotely related to other Enterobacteriaceae; hence, they proposed the new genus *Rahnella* with one species, *R. aquatilis*.

Since then, more isolates have been recovered from Europe and the United States. In the culture collection at the Centers for Disease Control, there are more than 20 isolates (5), including the original 11 isolates recovered in France. Two isolates in the collection were isolated from humans, and in both cases the clinical significance was not clear. Only one isolate with proven clinical significance was reported previously. This was from the blood of a patient with acute lymphocytic leukemia undergoing chemotherapy (4). In this report, we describe a case of urinary tract infection caused by *R. aquatilis* in a renal transplant patient.

CASE REPORT

A 40-year-old male patient was diagnosed as having end-stage renal failure and hypertension in June 1987. In August of the same year he left for Bombay, India, where he had a living, nonrelated kidney transplant. The patient was started on immunosuppressive agents in the form of azathioprine, prednisone, and cyclosporine. Secondary to prednisone treatment he developed diabetes mellitus, which was initially managed with oral hypoglycemic therapy, but later it was managed with insulin injections for better control. In September 1987 he returned to Saudi Arabia, where he was followed in another hospital. Six months later he developed *Staphylococcus aureus* arthritis of the left wrist and was treated with antibiotics. Subsequently, he developed generalized aches and pains, easy fatigability, fever, and night sweats. He lost 16 kg over a 2-month period. The patient was referred to our center in June 1988, where the diagnosis of miliary tuberculosis was made and the patient was started on antituberculosis therapy. The human immunodeficiency vi-

rus serology of the patient was negative, but urine culture grew *Klebsiella pneumoniae* in significant numbers. This was successfully treated with antibiotics. After a long admission in the hospital, the patient's condition gradually improved and he was discharged home. He was followed regularly in outpatient clinics; creatinine was in the range of 150 to 200 $\mu\text{mol/liter}$, blood sugar was under good control, and periodic urinalysis showed no abnormalities. A full course of antituberculosis therapy was completed, and the patient was asymptomatic. In December 1991, the patient was seen at the outpatient clinic during a routine follow-up visit; urinalysis showed >50 leukocytes per high-power field. The patient was asymptomatic and denied a change in the quality of urine. Physical examination was negative for increased temperature and suprapubic, loin, or renal graft tenderness. Urine culture yielded a pure growth of >100,000 CFU of a gram-negative rod per ml; the organism was later identified as *R. aquatilis*. The leukocyte count was $6.9 \times 10^9/\text{liter}$, with normal differential. Serum creatinine was 140 $\mu\text{mol/liter}$.

Since this organism is rare and its pathogenic role in three of the four cases reported in the literature was unclear, a suprapubic aspirate was obtained. This again grew >100,000 CFU of *R. aquatilis* per ml in pure culture. The patient was started on amoxicillin, 500 mg orally three times daily. The MICs of ampicillin and ciprofloxacin were later found to be 60 and <0.75 $\mu\text{g/ml}$, respectively. The patient was brought back to the clinic, where he complained of dysuria and frequency but denied fever or suprapubic pain. There was no loin or renal graft tenderness. Urinalysis showed 20 to 30 leukocytes per high-power field, and culture grew 70,000 CFU of the same organism per ml. The patient received a 2-week course of ciprofloxacin, 500 mg orally twice daily, which resulted in resolution of the dysuria and frequency. Subsequent urinalysis showed 4 to 7 leukocytes per high-power field, and culture was negative. Urologic evaluation showed moderate reflux to the renal graft, and its correction is being planned.

MATERIALS AND METHODS

Clean-catch midstream urine and the suprapubic aspirate were inoculated soon after collection onto blood agar and MacConkey agar plates by using a 0.001-ml platinum loop. The bacterium was isolated from both plates after overnight incubation at 35°C. However, the growth in the MacConkey agar plate was deficient, present only in the first quadrant of

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TABLE 1. Biochemical reactions of *R. aquatilis* isolated from urine compared with those of *E. agglomerans* and *R. aquatilis* reported in the literature

Biochemical reaction	% of strains with a positive reaction ^a		Result for <i>R. aquatilis</i> ^b
	<i>E. agglomerans</i>	<i>R. aquatilis</i>	
Motility at 36°C	85	6	—
Motility at room temperature	100	100	+
Indole production	20	0	—
Citrate (Simmons)	50	94	+
Voges-Proskauer	70	100	+
Urea hydrolysis	20	0	—
Hydrogen sulfide	0	0	—
Esculin hydrolysis	60	100	+
<i>o</i> -Nitrophenyl- β -D-galactopyranoside	90	100	+
Lysine decarboxylase	0	0	—
Arginine dihydrolase	0	0	—
Ornithine decarboxylase	0	0	—
Fermentation			
Glucose	100	100	+
Lactose	40	100	+
Sucrose	75	100	+
Mannitol	100	100	+
Salicin	65	100	+
Sorbitol	30	94	+
Arabinose	95	100	+
Raffinose	30	94	+
Rhamnose	85	94	+
Xylose	93	94	+
Trehalose	97	100	+
Melibiose	50	100	+
Maltose	98	94	+
Yellow pigment	75	0	—

^a Percentage of strains showing positive reactions as reported by Farmer et al. (2).

^b Biochemical reaction result for the *R. aquatilis* isolate recovered in this study.

the streaked areas. Initial identification was made by using the API 20E system (Analytab Products, Plainview, N.Y.). The numerical profile number was 1005573, giving 88.8% confidence for identification as *R. aquatilis*. The identification was confirmed at the Microbiology Laboratory of the King Faisal Specialist Hospital and Research Centre, which serves as a reference facility for Saudi Arabia and the Middle East.

The following reactions were exhibited by the organism: positive citrate utilization, Voges-Proskauer test, *o*-nitrophenyl- β -D-galactopyranoside, and esculin hydrolysis. The sugars that were fermented included maltose, D-glucose, lactose, sucrose, D-sorbitol, L-arabinose, raffinose, L-rhamnose, D-xylose, melibiose, and trehalose. Negative tests

were oxidase, indole production, hydrogen sulfide production, urea hydrolysis, arginine dehydrolase, ornithine decarboxylase, and lysine decarboxylase. The isolate was motile at room temperature but not at 36°C, and there was no yellow pigment production (Table 1).

Initial susceptibility to antimicrobial agents was tested by the disk diffusion method (7). The MICs of selected antibiotics were determined by the tube macrodilution method (8). The MICs of ampicillin, cefazolin, ceftriaxone, and ciprofloxacin for the *R. aquatilis* isolate were 60, 120, 15, and <0.75 μ g/ml, respectively. The isolate was susceptible to ceftriaxone, gentamicin, amikacin, ciprofloxacin, and nitrofurantoin; it was resistant to ampicillin, cefazolin, and trimethoprim-sulfamethoxazole.

RESULTS AND DISCUSSION

The *R. aquatilis* isolate was initially identified by using the API 20E system (Analytab Products). The conventional biochemical tests that were performed confirmed the initial identification and differentiated this isolate from the *Enterobacter agglomerans*-*Erwinia herbicola* complex, which it closely resembles (2). The isolation of *R. aquatilis* in significant numbers in the urine obtained by suprapubic aspiration and the favorable response to antibiotics, as manifested by resolution of symptoms and eradication of the organism from urine, confirmed the pathogenic role of the organism in causing a symptomatic urinary tract infection in our patient. It is noteworthy that the isolate described here and those reported in the literature (1, 2, 4, 5) were all recovered from immunocompromised patients. Strains of *R. aquatilis* may previously have been misidentified as other organisms. This is exemplified by the failure of the API 20E system (Analytab Products) and the MicroScan Combo plus broth dilution panel (Baxter MicroScan, West Sacramento, Calif.) to correctly identify the isolate of Harrell et al. (5) in 1986. That isolate was recovered from the bronchial washing of a patient with AIDS. The correct identification was subsequently made at the Centers for Disease Control on the basis of conventional biochemical tests.

Recently, *R. aquatilis* was included in the data base of the API 20E system (Analytab Products), but the data bases of other commercial bacterial identification systems, including the GNI card (Vitek Systems, Inc, Hazelwood, Mo.) and Spectrum 10 (Austria Biochemical Labs, Austin, Texas), still lack the ability to identify this organism. To our knowledge, the isolate reported here represents the fifth isolate recovered from clinical specimens and only the second one with proven clinical significance (Table 2). It is likely that more clinical isolates of *R. aquatilis* will be identified if the organism is included in the data bases of other commercial bacterial identification systems. Until then, complete reliance on many of the commercial systems may result in the

TABLE 2. Cases of *R. aquatilis* reported in the literature

Age (yr)	Sex	Underlying condition ^a	Site of isolation	Outcome	Reference
42	Female	ALL, DM, and bronchial asthma	Blood	Cure ^b	4
79	Male	CLL, emphysema, and chest infection	Sputum and bronchial aspirate	Cure	1
NA ^c	NA	Burn	Burn wound	NA	2
37	Male	AIDS and chest infection	Bronchial washing	Cure	5

^a ALL, acute lymphocytic leukemia; DM, diabetes mellitus; CLL, chronic lymphocytic leukemia.

^b Proven clinical significance.

^c NA, not available.

misidentification of *R. aquatilis* as *E. agglomerans*. We concur with Farmer et al. (2) and Goubau et al. (4) that the lack of yellow pigmentation by an isolate, motility at 25°C but not at 36°C, and an ability to grow at 4 to 10°C should be used to differentiate the *R. aquatilis* bacterium from closely related organisms.

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