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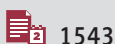
Septic Shock Caused by *Rahnella aquatilis* Bacteremia in an Immunocompetent Adult

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Statistical Analysis C
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Corresponding Author: Sarah Scoular, e-mail: Sarah.Scoular@cuanschutz.edu**Conflict of interest:** None declared**Patient:** Male, 37-year-old
Final Diagnosis: Septic shock
Symptoms: Fever • rigors
Medication: —
Clinical Procedure: —
Specialty: Infectious Diseases**Objective:** Rare disease**Background:** *Rahnella aquatilis* is a facultatively anaerobic, gram-negative rod bacterium commonly found in freshwater. There are few cases of bacteremia caused by *Rahnella aquatilis* in the literature and even fewer cases reported of it causing sepsis in immunocompetent individuals. In this case report, we present a rare case of an immunocompetent individual who developed sepsis secondary to bacteremia caused by *Rahnella aquatilis*.**Case Report:** A 37-year-old immunocompetent man with cerebral palsy and chronic enterocutaneous fistulas, with an indwelling peripherally inserted central catheter (PICC) line for total parenteral nutrition (TPN), presented to the emergency department with complaints of increased enteric drainage from his fistula, rigors, and subjective fevers following a mechanical fall, which occurred approximately 1 week before. The day following admission, the patient developed septic shock and was transferred to the intensive care unit for vasopressor support. He was given intravenous cefepime and metronidazole for empiric therapy. Blood cultures grew *Rahnella aquatilis*, and antibiotic therapy was de-escalated to monotherapy with intravenous ceftriaxone. The patient's condition stabilized, his PICC line was replaced, and he was successfully discharged, and continued on outpatient antibiotic therapy with ceftriaxone.**Conclusions:** This case report represents a novel presentation of septic shock secondary to bacteremia caused by a gram-negative rod bacterium, *Rahnella aquatilis*, in an immunocompetent host dependent on TPN via a PICC line. This case also demonstrates that *Rahnella aquatilis* can be susceptible to and treated successfully with intravenous ceftriaxone. Bacteremia caused by *Rahnella aquatilis* can cause a swift, aggressive decompensation and should be treated with antibiotics immediately.**Keywords:** Bacteremia • Gram-Negative Anaerobic Bacteria • Gram-Negative Bacterial Infections • Rahnella • Sepsis • ShockFull-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/930888>

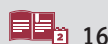
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Background

Rahnella aquatilis was originally discovered by numerical taxonomy and was later identified to be distinctly different from already classified Enterobacter species via a DNA-DNA hybridization study [1]. *Rahnella aquatilis* is a natural freshwater bacterium found throughout the world, which has been found in snails, beetles, soil, and humans [2-4]. It is capable of causing illness in humans including, but not limited to, bacteremia, respiratory infections, pyelonephritis, and infective endocarditis and was first isolated from a clinical specimen causing pathogenesis via a burn wound in 1985 by Farmer et al [5-8]. There are few cases of bacteremia caused by *Rahnella aquatilis* in the available literature and even fewer cases reported of causing sepsis in immunocompetent individuals. In this case report, we present a rare case of an immunocompetent individual who developed sepsis secondary to bacteremia caused by *Rahnella aquatilis*.

Case Report

A 37-year-old immunocompetent man with cerebral palsy, multiple enterocutaneous fistulas secondary to a perforated appendix, which occurred 20 years prior, and a previous right atrial thrombus treated by anticoagulation therapy presented to the emergency department with his caregiver with complaints of increased enteric drainage from his enterocutaneous fistula, occasional rigors, and waxing and waning subjective fevers following a mechanical fall, which occurred approximately 1 week prior. It is important to note that the patient had a long-term, indwelling, peripherally inserted central catheter (PICC) line for total parenteral nutrition (TPN). Prior to admission, the patient's enterocutaneous fistula was healing well until he fell, causing it to open up, which produced increased output requiring ostomy appliance changes approximately 2 times per day. It was noted that his caregiver provided excellent wound care and there were no signs of infection involving the enterocutaneous fistula. Upon presentation to the emergency department, the patient was afebrile with a blood pressure of 98/60 mmHg, had a heart rate and respiratory rate within normal limits, and a serum creatinine of 1.88 mg/dL, from a baseline of 0.9 mg/dL. At this time, he met no criteria for systemic inflammatory response syndrome. He was admitted to the general medicine unit for further management of his increased enterocutaneous fistula drainage and acute kidney injury.

One day after admission, the patient had an elevated whole blood lactate level of 3.4 mmol/L. At this time, he had blood culture samples drawn from his PICC line and an additional peripheral site. He was given broad-spectrum intravenous (i.v.) antibiotics to empirically treat an infection, given his increasing lactate level. He received cefepime 2000 mg and

Table 1. Antimicrobial susceptibility report of blood drawn from peripherally inserted central catheter growing >100 000 CFU/mL of *Rahnella aquatilis*.

Antimicrobial agent	Kirby-Bauer disk diffusion susceptibility
Amoxicillin/Clavulanic	Susceptible
Ampicillin	Resistant
Cefazolin	Resistant
Cefepime	Susceptible
Ceftazidime	Susceptible
Ceftriaxone	Susceptible
Ciprofloxacin	Susceptible
Ertapenem	Susceptible
Gentamicin	Susceptible
Levofloxacin	Susceptible
Piperacillin/Tazobactam	Susceptible
Trimethoprim/Sulfamethoxazole	Susceptible

metronidazole 500 mg i.v. At this time, he was not hypotensive; however, within an hour his lactate level increased to 5.5 mmol/L, and he became hypotensive, with a blood pressure of 91/50 mmHg, had an increased temperature of 39°C, an elevated heart rate of 120 beats per min, and a normal respiratory rate. Due to a new diagnosis of severe sepsis, the patient was started on i.v. fluids with normal saline for blood pressure support and was transferred to the medical intensive care unit (MICU) for a higher level of care. Linezolid 600 mg i.v. was added to his antibiotic regimen to further broaden gram-positive bacteria coverage. While in the MICU, he required vasopressor support with norepinephrine. After being incubated at 35°F (1.6°C) on MacConkey agar for 24 h, both sets of blood cultures grew lactose fermenting gram-negative rods. The linezolid was discontinued because there was no growth of gram-positive bacteria.

Given the possible etiology of the patient's infection being his PICC line, it was removed, and he received his TPN through a radiologically inserted jejunostomy tube. He continued to receive cefepime and metronidazole, and at 36 h, via matrix-assisted laser desorption/ionization time-of-flight mass spectrometry, his blood culture speciation identified >100 CFU/mL of *Rahnella aquatilis*. Via Kirby-Bauer disk diffusion testing, the *Rahnella aquatilis* demonstrated resistance only to amoxicillin and cefazolin and susceptibility to numerous other antibiotics, which are listed in **Table 1**. Because of this resistance pattern, his broad-spectrum antibiotic therapy with cefepime

and metronidazole was de-escalated to monotherapy with i.v. ceftriaxone at a dose of 2000 mg every 24 h. The patient's condition stabilized, and he was transferred back to the general medicine unit. His PICC line was replaced, and he was discharged. He continued on outpatient antibiotic therapy with ceftriaxone for a total of 10 days from the day his PICC line was removed and he made a full recovery from his *Rahnella aquatilis* bacteremia.

Discussion

Most cases of *Rahnella aquatilis* bacteremia described in the literature are in immunocompromised individuals, with very few instances of severe disease reported in immunocompetent individuals. Given the higher incidence in immunocompromised individuals than in immunocompetent individuals, it is hypothesized that *Rahnella aquatilis* acts as an opportunistic pathogen [9]. However, there are some case reports demonstrating infections occurring in immunocompetent individuals. One such case report from 1999 identified *Rahnella aquatilis* as the cause of sepsis in an immunocompetent patient who self-infused a contaminated mixture of dextrose, vitamin B, and vitamin C [10]. Previously, there were 2 cases reported of *Rahnella aquatilis* bacteremia in patients dependent on TPN, both of which were thought to be connected and iatrogenic [11]. Patients dependent on TPN are at a higher risk of bloodstream infections [12]. This increased risk of infection can be attributed to longer durations of TPN administration and thus longer durations of indwelling central or peripheral catheters [13]. Dissanaik et al reported that patients with a higher kcal/kg/day TPN requirement (36 kcal/kg/day) are more likely to have a bloodstream infection than those with lower kcal/kg/day requirements (31 kcal/kg/day) [12]. Our patient had a TPN requirement of 24.1 kcal/kg/day. Given that this requirement was lower than 31 kcal/kg/day, the quantity of TPN administered per day in our patient likely did not contribute to an increased risk of bacteremia. However, Yeung et al reviewed pediatric patients admitted to the hospital and found that the longer these patients were on TPN, the higher their risk was of a developing a bloodstream infection. At the time of admission, our patient had been dependent on TPN for about 1 year. The extended length of time that our patient was on TPN and had a PICC line in place may have contributed to his risk of acquiring a bloodstream infection and subsequent septic shock. Additionally, since there have been cases reported of *Rahnella aquatilis* bacteremia in patients dependent on TPN, our patient's TPN may have been the source of infection; however, this is speculation, and the ultimate source of infection is unknown.

The development of sepsis is a common and life-threatening complication that has been reported with enterocutaneous fistulas [14]. Since our patient had chronic enterocutaneous

fistulas and sepsis, this was a possible causative route of infection. Our patient had a history of a fistula not healing fully, and when it was almost fully healed, he had a mechanical fall about 1 week prior to presenting to the emergency department. After this fall, his enterocutaneous fistula started to have increased drainage. It was reported that his caretaker was providing excellent wound care to the area of the fistula, and no signs of an infection were present at the fistula site. Despite good wound care, the inherent risk of having an open wound placed him at higher risk for bacterial infection.

Pantoea agglomerans, formerly known as *Enterobacter agglomerans*, is a facultative anaerobic gram-negative bacillus bacterium and is very similar to *Rahnella aquatilis*. The 2 organisms are so similar that until recently, high-throughput laboratory equipment would commonly misclassify them as the same organism [8,15]. *Pantoea agglomerans* and *Rahnella aquatilis* are commonly found in the environment, specifically in freshwater, but have only recently been proven to cause disease in immunocompetent human hosts [15,16]. Infection with these rare pathogens can occur in a hospital setting, most commonly through an indwelling catheter, central line, or contaminated TPN [16]. The present case adds to the mounting evidence that bacterium that are commonly thought of as environmental or rare human pathogens must be considered as the causative organism when isolated from blood cultures in symptomatic patients.

The causative route of infection in our patient is ultimately unknown but was likely a central line-associated bloodstream infection due to his prolonged need for TPN via a PICC line. His blood culture drawn from his PICC line grew >100 000 CFU/mL of *Rahnella aquatilis* in less than 24 h after being drawn, and a second blood sample from a site other than his PICC line also grew *Rahnella aquatilis*, which confirmed the presence of a bloodstream infection. Given that his enterocutaneous fistula did not appear to be infected, and he had his PICC line placed for over 1 year, a central line-associated bloodstream infection was determined to be the source of bacteremia in this patient.

Conclusions

This case report represents a novel presentation of septic shock secondary to bacteremia caused by a gram-negative rod bacterium, *Rahnella aquatilis*, in an immunocompetent host dependent on TPN via a PICC line. This case also demonstrates that *Rahnella aquatilis* can be susceptible to and treated successfully with i.v. ceftriaxone. Bacteremia caused by *Rahnella aquatilis* can cause a swift, aggressive decompensation and must be treated with antibiotics immediately. This case informs the medical community that *Rahnella aquatilis* can be pathogenic in immunocompetent individuals and raises awareness of the potential for severe life-threatening infections.

Conflicts of Interest

None.

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