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Case Report

CATHETER ASSOCIATED *LEIFSONIA AQUATICA* INFECTION

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ABSTRACT

Objective: This is a case report of catheter-related infection caused by *Leifsonia aquatica* in a hemodialysis patient. *Leifsonia aquatica* is not a commonly isolated bacterium and not much is known about the virulence, pathogenesis of infection or choice of treatment.

Methods: A case report of a 65 years old man who presented with chills and rigors during hemodialysis via an internal jugular catheter.

Results: *Leifsonia aquatica* was isolated from the patient's blood culture. The organism grew on conventional media and was identified using analytical profile index (API) Coryne. The patient was successfully treated with two weeks of ceftriaxone and the catheter was removed.

Conclusion: *Leifsonia aquatica* is an aquatic bacterium capable of causing infection in the immunocompromised host and its pathogenicity is related to its ability to form biofilms. Treatment based on antimicrobial susceptibility results and removal of the catheter is necessary for a patient's recovery.

Keywords: *Leifsonia aquatica*, Catheter-related bloodstream infection, Hemodialysis.

INTRODUCTION

Leifsonia aquatica is a non-spore-forming Gram-positive rod which is motile. It was first identified by Einar Leifson in 1962 as *Corynebacterium aquaticum* and subsequently reclassified into genus *Leifsonia*. Not much is known about this organism's pathogenicity. From case reports over the years, *L. aquatica* causes infection mainly in an immunocompromised host, and catheter-related infections form a big proportion of cases identified.

CASE REPORT

This is a case report of a 65-year-old gentleman with end-stage renal disease who presented with chills and rigors which occurred only during hemodialysis for 1-week duration. He also complains of intermittent fever and productive cough with whitish sputum. He had been on thrice-weekly dialysis through the right internal jugular permanent catheter for the past 8 months. There was no pus discharge or skin changes at the catheter insertion site. He refused continuous ambulatory peritoneal dialysis in view of logistic reasons.

There was a history of hospitalization 3 months prior for catheter-related bloodstream infection. *Corynebacterium* spp. was isolated from his blood culture and he was treated with 1 week of intravenous (IV) vancomycin and discharged well with the same catheter. There was no growth from the peripheral blood culture before discharge. The patient also has a background history of diabetes mellitus, hypertension, ischemic heart disease, and chronic pleural effusion which has been investigated but no cause was found.

On admission, he was afebrile and hemodynamically stable with blood pressure of 148/78 mmHg and pulse rate of 68 beats/minute. He was not tachypneic and oxygenation under room air was 99%. Cardiac murmurs were not present and on respiratory examination, there was a reduced breath sound on the right lower zone. The examination of catheter site revealed no signs of infection. His blood investigations showed a hemoglobin value of 8.7 mg/dL (reference range: 13–17), white cell count of 6.3 × 10^9 (4–10), platelet count of 172 × 10^9 (150–410), urea 8.7 mmol/L (2.8–8.1), creatinine 538 umol/L (62–106), and C-reactive protein of 109.8 mg/L (<5.0). A raised C-reactive protein indicates inflammation or infection. However, the total white cell count in this patient was not raised and this could be due to his pre-morbids which renders him relatively immunocompromised and unable to mount a good immune response. Paired blood cultures from peripheral and catheter (both blue and red lumen) were obtained on admission.

The blood cultures were incubated in BD BACTEC™ FX blood culture system. The red lumen, blue lumen, and peripheral culture were positive after 24 h and 30 min; 24 h and 32 min; and 48 h and 30 min, respectively. Gram stain showed small, beaded Gram-positive rods which were negative for Ziehl–Neelsen staining. Blood was cultured on 5% sheep blood agar and MacConkey agar. Plate was read after 24 h of incubation and it showed growth of small, whitish colonies which is nonhemolytic on blood agar. There was no growth on MacConkey agar plate. Colonies tested positive for both catalase and oxidase test. A preliminary susceptibility patterns showed resistance toward vancomycin. The organism was identified as *Leifsonia aquatica* using analytical profile index (API) Coryne system (bioMérieux), with 96% probability of identification. Minimum inhibitory concentration (MIC) test for vancomycin was 6 mcg/mL (resistant), penicillin 2.0 mcg/mL (intermediate), gentamicin 1.5 mcg/mL (susceptible), and for ceftriaxone 1.0 mcg/mL (susceptible). MIC test interpreted was based on the Clinical and Laboratory Standards Institute (CLSI) M45, 2015.

Upon admission, the patient was empirically started on intravenous (IV) cefazolin 1 g twice daily and IV ceftazidime 1 g daily to cover empirically for CRBSI. He was also given gentamicin lock therapy post-dialysis. However, once the gram stain result was available, the antibiotic was changed to IV vancomycin and given vancomycin lock therapy post-dialysis. The patient complained of chills and rigors during dialysis on the 1st and 3rd days of admission. Subsequently, his permanent catheter was removed based on the evidence of catheter-related bloodstream infection (CRBSI), as noted from time of positivity difference of lumen blood culture and peripheral blood culture. A left internal jugular catheter was inserted. The antibiotic was also changed to IV ceftriaxone 1gram twice daily for 2 weeks duration after obtaining the antimicrobial susceptibility result. His symptoms resolved and he remained stable. A repeat blood culture on 8th day of admission showed no growth.

DISCUSSION

L. aquatica (previously known as *Corynebacterium aquaticum*) is a non-spore-forming Gram-positive rod. The name was first proposed as *Corynebacterium aquaticum* by Einar Leifson in 1962 [1]. Einar Leifson found ten isolates from distilled water samples and proposed that the habitat of these bacteria is distilled water and probably in natural freshwater. He described the colony as colorless, smooth, opaque, and produces yellow-greenish pigmentation on extended incubations. It was described as a pleomorphic rod, weakly Gram positive, motile with one to two peritrichous flagella. It was previously classified as a *Corynebacterium*. However, it was reclassified into genus *Leifsonia* due to differences in peptidoglycan cross-linking and the presence of 2,4-diaminobutyric acid [2].

The pathogenic properties of this organism are not well identified. Over the years, a few case reports have helped to shed some lights over *L. aquatica* associated infections. A literature review showed case reports of septicemia in an elderly patient with diabetic ketoacidosis [3], peritoneal dialysis peritonitis [4-7], neonatal meningitis [8], meningitis in an infant [9], neonatal urinary tract infection [10], central venous catheter (CVC) associated infection in patient with polycythemia rubra vera [11], CVC associated infection in hemodialysis patient [12-14], cellulitis due to high-pressure water injury [15], septicemia in a patient with chronic granulomatous disease [16], septic shock in a patient post cryopexy for retinal detachment [17], septicemia in a patient with acute lymphoblastic leukemia [18], and septic shock in a human immunodeficiency virus-infected patient [19].

Infection with *L. aquatica* is not frequently reported and it is typically described in immunocompromised host. However, a few case reports from healthy patients were also reported. This includes meningitis in a 7-month-old infant with no other illness [9] but the author postulated that the child might have an underlying immunodeficiency disorder. Yet, another case report of a healthy 60-year-old patient who presented with septic shock post cryopexy for retinal detachment where the authors postulated the patient could have acquired the infection from the intravenous fluid used [17]. This might show us an evolvement of the capability of the bacteria to cause infection in an immunocompetent patient. Of all the members in the genus of *Leifsonia*, only *L. aquatica* is well known as a human pathogen.

Patients with end-stage renal disease undergoing dialysis through CVC or peritoneal dialysis have been almost half of the cases that have been reported in association with *L. aquatica* infections. Patients with end-stage renal disease have impaired cellular and humoral immunity due to uremia and catheter usage may support survival of *L. aquatica* through biofilm formation. The pathogenicity of *L. aquatica* is contributed by its slow growth rate and its ability to form biofilm [20]. This could partly explain the reason why this patient has had a history of *Corynebacterium* spp. infection 3 months prior which could have been a missed *L. aquatica* infection and disregarded as a contaminant/possible line colonizer as that was the first episode. However, the previous episode of infection responded to intravenous vancomycin and surveillance culture was negative before he was discharged. The organism was cleared from peripheral blood but might have remained in biofilms in the catheter and caused another episode of bacteremia. The recurrence of catheter-related infection caused by a gram-positive rod triggered us to investigate further and to identify the organism to species level. The organism is a resident of environmental water sources [10] and oral cavity [21]. It can tolerate alkaline water conditions [22] and able to pass through polycarbonate water filters [23].

The optimum regime of the treatment of *L. aquatica* is not well established. The routinely used antibiotic is vancomycin and symptomatic resolution usually occurs in 48 hours. However, 2 to 6 weeks of treatment are usually administered [13,14]. Catheter removal is part of the management as case reports of patients having relapses showed resolution of the infection after catheter removal [5,6].

Our antimicrobial susceptibility results showed that *L. aquatica* is resistant to vancomycin and this could be related to other case reports that have also shown intermediate susceptibilities [13, 17,24]. Vancomycin may not be the most effective treatment for *L. aquatica* although some authors have had successful treatment with vancomycin despite the reduced susceptibility [14]. Other than vancomycin, a variety of antibiotics including carbapenems, linezolid, 3rd generation cephalosporins, and aminoglycosides have been used to successfully treat the infection. As in our case, the patient was successfully treated with ceftriaxone and the catheter was replaced.

CONCLUSION

In patients with hemodialysis, catheter-related infections are very important and *L. aquatica* should be considered as a causative agent. In view of the importance, careful assessment needed to ensure it is not dismissed as a contaminant *Corynebacterium* spp. From our case report, ceftriaxone was used to treat this infection effectively. Removal of catheter is suggested as part of the management of patients with CRBSI with *L. aquatica* in view of capability of this organism to form biofilms and resulting in relapses.

AUTHORS' CONTRIBUTIONS

Data collection and analysis: Kasturi Subramaniam. Drafting and review of manuscript: Kasturi Subramaniam, Wong Kon Ken.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Leifson E. The bacterial flora of distilled and stored water. III. New species of the genera *Corynebacterium*, *Flavobacterium*, *Spirillum* and *Pseudomonas*. Int Bull Bacteriol Nomencl Taxonomy 1962;12:161-70.
2. Evtushenko LI, Dorofeeva LV, Subbotin SA, Cole JR, Tiedje JM. *Leifsonia poae* gen. nov., sp. nov., isolated from nematode galls on *Poa annua*, and reclassification of '*Corynebacterium aquaticum*' Leifson 1962 as *Leifsonia aquatica* (ex Leifson 1962) gen. nov., nom. rev., comb. nov. and *Clavibacter xyli* Davis *et al*. 1984 with two subspecies as *Leifsonia xyli* (Davis *et al*. 1984) gen. nov., comb. nov. Int J Syst Evol Microbiol 2000;50:371-80.
3. Weiner M, Werthamer S. *Corynebacterium aquaticum* septicemia. Characterization of the microorganisms. Am J Clin Pathol 1975;64:378-81.
4. Casella P, Bosoni MA, Tommasi A. Recurrent *Corynebacterium aquaticum* peritonitis in a patient undergoing continuous ambulatory peritoneal dialysis. Clin Microbiol Newsl 1988;10:62-3.
5. Fujinaga S, Ohtomo Y, Hirano D, Nishizaki N, Someya T, Ohtsuka Y, *et al*. Relapsing peritonitis with *Corynebacterium aquaticum* in a boy receiving automated peritoneal dialysis. Pediatr Nephrol 2009;24:1253-4.
6. Kwon YJ, Lee DY. *Corynebacterium aquaticum* peritonitis in a patient on CAPD. Perit Dial Int 1997;17:98-9.
7. Morris AJ, Henderson GK, Bremner DA, Collins JF. Relapsing peritonitis in a patient undergoing continuous ambulatory peritoneal dialysis due to *Corynebacterium aquaticum*. J Infect 1986;13:151-6.
8. Beckwith DG, Jahre JA, Haggerty S. Isolation of *Corynebacterium aquaticum* from spinal fluid of an infant with meningitis. J Clin Microbiol 1986;23:375-6.
9. Arslan S, Bozkurt H, Guducuoglu H, Berktas M, Caksen H, Kurtoglu MG, *et al*. Septicaemia and meningitis in an infant. J Paediatr Child Health 2001;37:414-5.
10. Tendler C, Bottone EJ. *Corynebacterium aquaticum* urinary tract infection in a neonate, and concepts regarding the role of the organism as a neonatal pathogen. J Clin Microbiol 1989;27:343-5.
11. Moore C, Norton R. *Corynebacterium aquaticum* septicaemia in a neutropenic patient. J Clin Pathol 1995;48:971-2.
12. D'Amico M, Mangano S, Spinelli M, Sala E, Vigano' EF, Grilli R, *et al*. From the mailing list SIN: Epidemic of infections caused by 'aquatic' bacteria in patients undergoing hemodialysis via central venous catheters. G Ital Nefrol 2005;22:508-13.
13. Sulpher J, Desjardins M, Lee BC. Central venous catheter-associated *Leifsonia aquatica* bacteremia in a hemodialysis-dependent patient.

Diagn Microbiol Infect Dis 2008;61:64-6.
14. Porte L, Soto A, Andrighetti D, Dabanch J, Braun S, Saldivia A, *et al*. Catheter-associated bloodstream infection caused by *Leifsonia aquatica* in a haemodialysis patient: A case report. J Med Microbiol 2012;61:868-73.
15. Larsson P, Lundin O, Falsen E. "*Corynebacterium aquaticum*" wound infection after high-pressure water injection into the foot. Scand J Infect Dis 1996;28:635-6.
16. Kaplan A, Israel F. *Corynebacterium aquaticum* infection in a patient with chronic granulomatous disease. Am J Med Sci 1988;296:57-8.
17. Han L, Lei JE, Wang X, Guo LT, Kang QY, He L, *et al*. Septicemia caused by *Leifsonia aquatica* in a healthy patient after retinal reattachment surgery. J Clin Microbiol 2013;51:3886-8.
18. Fischer RA, Peters G, Gehrmann J, Jurgens H. *Corynebacterium aquaticum* septicemia with acute lymphoblastic leukemia. Pediatr Infect Dis J 1994;13:836-7.
19. Corona A, Castelli A, Ballone E, Rech R, Colombo R, Ferraris S, *et al*. A case of septic shock secondary to *Corynebacterium aquaticum* bacteremia occurring in an HIV-infected patient attending a promiscuous thermal SPA. Minerva Anestesiol 2008;74:213-5.
20. Dempsey KE, Riggio MP, Lennon A, Hannah VE, Ramage G, Allan D, *et al*. Identification of bacteria on the surface of clinically infected and non-infected prosthetic hip joints removed during revision arthroplasties by 16S rRNA gene sequencing and by microbiological culture. Arthritis Res Ther 2007;9:R46.
21. Hung WL, Wade WG, Boden R, Kelly DP, Wood AP. Facultative methylotrophs from the human oral cavity and methylotrophy in strains of *Gordonia*, *Leifsonia*, and *Microbacterium*. Arch Microbiol 2011;193:407-17.
22. Tiago I, Chung AP, Veríssimo A. Bacterial diversity in a nonsaline alkaline environment: Heterotrophic aerobic populations. Appl Environ Microbiol 2004;70:7378-87.
23. Phelps W, Baughn R, Black HS. Passage of *Corynebacterium aquaticum* through membrane filters. *In Vitro* 1980;16:751-3.
24. Funke G, von Graevenitz A, Weiss N. Primary identification of *Aureobacterium* spp. isolated from clinical specimens as "*Corynebacterium aquaticum*". J Clin Microbiol 1994;32:2686-91.