

Shewanella-Related Bacteremia and Fournier's Gangrene: A Case Report

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Shewanella algae and *Shewanella putrefaciens* have been implicated for causing serious infections in humans, including disseminated infection. We report the possible first case of *Shewanella*-related Fournier's gangrene and bacteremia caused in a 65-year-old Chinese male with nephrotic syndrome. He was successfully managed by surgical debridement and antibiotic therapy.

Keywords. bacteremia; Fournier's gangrene; *Shewanella*.

A 65-year-old Chinese male with past history of hypertension, diabetes, hyperlipidemia, nephrotic syndrome, chronic renal impairment, and congestive heart failure was admitted for fever (temperature 38.1°C), chills, dyspnea, orthopnea, and bilateral ankle edema. He also complained of vomiting and diarrhea in the past week. Patient had no contact with seawater, fish, or marine environment. Initial laboratory tests revealed 4.9×10^9 /L total white blood cell count, 3.8×10^9 /L (77.2%) absolute neutrophil count, 514 μ mol/L serum creatinine, 20 g/L serum albumin, 78 IU/L serum alanine aminotransferase, and 227 mg/L C-reactive protein. He was initially given empirical intravenous amoxicillin and clavulanate.

His condition deteriorated with acute respiratory distress, acute renal failure, severe metabolic acidosis (arterial blood pH 7.27, serum bicarbonate 7.4 mmol/L, base excess -16.8 mmol/L), acute coronary syndrome, and disseminated intravascular coagulopathy (international normalized unit 1.78 in day 3 hospitalization, platelet count 34×10^9 /L on day 5 hospitalization) requiring renal replacement therapy and intensive care support. He was noted to have scrotal erythema and edema compatible with scrotal abscess. Surgical exploration revealed cutaneous blisters and erythema over left hip region, with necrotic and edematous skin and fascia in the entire scrotal wall

and septum. The testes were spared. Partial scrotoectomy was performed for the diagnosis of Fournier's gangrene.

Gram-negative bacilli isolated from the blood culture broth were susceptible to ceftazidime, imipenem, gentamicin, and levofloxacin in vitro. Amoxicillin and clavulanate combination was switched to ceftazidime. The organism was later identified as *Shewanella algae* (99% probability *S algae* by Vitek 2 automated system). Levofloxacin was added because of the patient's critical condition. Catheterized urine grew *Klebsiella* species. In the operating theater, scrotal fluid aspirated grew *Shewanella putrefaciens* (95% probability *S putrefaciens* by Vitek 2; subsequent matrix-assisted laser desorption ionization time-of-flight [MALDITOF] testing showed A++ identification as *S putrefaciens*), whereas scrotal tissue excised grew *S algae* (negative growth in NaCl 0%; subsequent MALDITOF testing showed A++ identification as *S algae*), *Staphylococcus haemolyticus*, *Enterococcus faecium*, and *Candida albicans*.

Two days after operation, a contrast computer tomography of abdomen and pelvis was negative for perineal abscess or gas collection. Repeated blood culture taken 4 days after the initial positive one was negative. Two further surveillance blood cultures were negative. The patient had prolonged hospitalization and finally succumbed due to complication of hospital-acquired pneumonia.

Members of genus *Shewanella* are saprophytic Gram-negative bacteria widely distributed in the environment. Together with genera *Vibrio*, *Aeromonas*, and *Plesiomonas*, *Shewanella* spp are considered as part of marine flora [1]. Previously, *Shewanella* spp were grouped into the *Pseudomonas* genus. Although *Shewanella* spp are infrequently isolated in the clinical laboratory, *S algae* and *S putrefaciens* are the more pathogenic species in humans, and both have been isolated from a variety of clinical specimens. *Shewanella putrefaciens* was considered to cause most of the human infections before the discovery of *S algae* [2]. *Shewanella* colonies are convex, smooth, and occasionally mucoid on sheep blood agar. *Shewanella algae* is asaccharolytic, halophilic, and grows on 6% sodium chloride (percent weight/volume), whereas *S putrefaciens* does not require salt for growth and is saccharolytic [3,4]. Due to the infrequent update of these 2 *Shewanella* species in the databases of automated identification systems, the clinical laboratory may encounter difficulty in reliably differentiating between *S algae* and *S putrefaciens*. In this case report, the cultured *Shewanella* isolates were first identified by the Vitek 2 automated system and confirmed by MALDI-TOF mass spectrometry.

DISCUSSION

Shewanella spp can cause a wide spectrum of clinical conditions, ranging from skin and soft tissue infection including necrotizing

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fasciitis, osteomyelitis, pneumonia, pericarditis, intra-abdominal infection, bacteremia, and disseminated infections [1, 5–11]. Polymicrobial infections are common. *Shewanella algae* has been reported to be the predominant human clinical isolate, whereas *S putrefaciens* were more often isolated from nonhuman isolates such as freshwater fish and marine species [12]. Comorbidities such as diabetes, chronic hepatic diseases, chronic renal diseases, and chronic lower limb infections are possible predisposing factors. *Shewanella* spp are generally susceptible to antibiotics with activity against *Pseudomonas* spp, including third-generation cephalosporins, quinolones, and aminoglycosides.

CONCLUSIONS

To the best of our knowledge, this is the first report of *S algae* and *S putrefaciens* related Fournier's gangrene. The pre-existing chronic kidney disease in our patient is believed to have put him at risk of infection. Our patient did not have any seawater exposure, but *Shewanella* spp, as mentioned above, can be present in the environment, so it is difficult to delineate a definite source of acquisition. Although susceptibility of imipenem was reported, ceftazidime was used due to concerns of possible resistance to imipenem [13]. Clinicians may consider *Shewanella* spp in susceptible patients with Gram-negative bacteremia, especially those who had seawater exposure.

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References

1. Vignier N, Barreau M, Olive C, et al. Human infection with *Shewanella putrefaciens* and *S. algae*: report of 16 cases in Martinique and review of the literature. *Am J Trop Med Hyg* **2013**; 89:151–6.
2. Simidu U, Kita-Tsukamoto K, Yasumoto T, Yotsu M. Taxonomy of four marine bacterial strains that produce tetrodotoxin. *Int J Syst Bacteriol* **1990**; 40:331–6.
3. Holt HM, Gahrn-Hansen B, Bruun B. *Shewanella algae* and *Shewanella putrefaciens*: clinical and microbiological characteristics. *Clin Microbiol Infect Off Publ Eur Soc Clin Microbiol Infect Dis* **2005**; 11:347–52.
4. Jorgensen JH, Pfaller MA, Carroll KC, et al., eds. *Manual of Clinical Microbiology*. 11th ed. Washington, DC: ASM Press; **2015**.
5. Botelho-Nevers E, Gouriet F, Rovey C, et al. First case of osteomyelitis due to *Shewanella algae*. *J Clin Microbiol* **2005**; 43:5388–90.
6. Tan CK, Lai CC, Kuar WK, Hsueh PR. Purulent pericarditis with greenish pericardial effusion caused by *Shewanella algae*. *J Clin Microbiol* **2008**; 46:2817–9.
7. Myung DS, Jung YS, Kang SJ, et al. Primary *Shewanella algae* bacteremia mimicking *Vibrio* septicemia. *J Korean Med Sci* **2009**; 24:1192–4.
8. Ahmed N, Casey K, Liu E, Fune L. Necrotizing fasciitis of the lower extremity caused by *Shewanella algae*. *Surg Infect* **2013**; 14:165–6.
9. Wagner N, Otto L, Podda M, et al. Travel-related chronic hemorrhagic leg ulcer infection by *Shewanella algae*. *J Travel Med* **2013**; 20:262–4.
10. Ananth AL, Nassiri N, Pamoukian VN. *Shewanella algae*: a rare cause of necrotizing fasciitis. *Surg Infect* **2014**; 15:336–8.
11. Jacob-Kokura S, Chan CY, Kaplan L. Bacteremia and empyema caused by *Shewanella algae* in a trauma patient. *Ann Pharmacother* **2014**; 48:128–36.
12. Khashe S, Janda JM. Biochemical and pathogenic properties of *Shewanella algae* and *Shewanella putrefaciens*. *J Clin Microbiol* **1998**; 36:783–7.
13. Héritier C, Poirel L, Nordmann P. Genetic and biochemical characterization of a chromosome-encoded carbapenem-hydrolyzing ambler class D beta-lactamase from *Shewanella algae*. *Antimicrob Agents Chemother* **2004**; 48:1670–5.