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A case report of *Shewanella algae* wound infection in Kanchipuram, South India: An emerging pathogen

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Abstract:

Shewanella are Gram-negative non-fermentative oxidase-positive saprophytic bacteria producing H₂S. Although rarely associated with infection, they are seldom associated with skin and soft-tissue infections, abscesses, wound infection, osteomyelitis, intracranial infections, peritonitis, neonatal infections and outbreak infections. A 24-year-old male presented with open wound over the dorsum of the right foot with exposed muscles and tendons five days following a road traffic accident (RTA) with pus discharge. X-ray of the right foot showed fracture third metatarsal. Wound swab culture showed the growth of *Shewanella algae* and *Escherichia coli*. *S. algae* was susceptible to Amikacin, Cefotaxime, Ceftazidime and Imipenem and resistant to Ciprofloxacin. The patient was treated with injection Amikacin, regular dressings, limb elevation and analgesics for 10 days. Tissue specimen from the wound was sent for culture after 10 days and was negative for bacterial growth. Open reduction and internal fixation with axial K-wire with plates and screw and split skin rafting was done. The patient responded well to the treatment, and follow-up was uneventful. In the present case, there was no history of contact with marine environment, and infection developed following RTA wound. Although *S. algae* is rarely isolated, clinicians must be aware of rare pathogens. The present case highlights the importance of *Shewanella* spp. as a potential emerging infectious agent.

Keywords:

Identification, Road Traffic Accident, *Shewanella* spp.

Introduction

Shewanella are saprophytic bacteria present in the soil, water (marine, fresh and brackish water) sewage and dairy products. Although *Shewanella* spp. are rarely associated with medical illness, there have been cases of cellulitis, ear infection skin and soft-tissue infection, osteomyelitis and endocarditis.^[1]

Two species of *Shewanella* are implicated in causing infections, *Shewanella algae* and *Shewanella putrefaciens*. *S. algae* was first described in 1990 as a new species. It was often

implicated in skin and soft-tissue infections with breach in the dermis such as traumatic ulcer and frequently associated with marine environment. Outbreak-associated infections in hospital settings have also been reported in Korea.^[2] In the hospital scenario, infection can be acquired from sources such as sink water and fluids used for irrigation of wound and hospital environment such as soil, surfaces of trolleys and water used in the humidifier.^[2] Although the infections are associated with exposure to the marine environment, cases without contact with marine environment are on the rise.^[3]

S. algae are emerging infectious disease and are usually susceptible to Aminoglycosides,

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Quinolones, third-generation Cephalosporins and Carbapenems.^[3] Resistance to Carbapenems and Piperacillin-Tazobactam has been reported.^[3] Early identification and aggressive therapy (medical and surgical debridement) is essential. We report a case of *S. algae* infection in a young male following trauma.

Case Report

A 24-year-old male presented with pain, swelling and open wound with purulent discharge over the right foot. The patient had a history of trauma (road traffic accident [RTA]) five days earlier. On examination, there was an open wound of 7 cm × 4 cm size over the dorsum of the right foot with muscles and tendon exposed. There was no history of exposure to marine environment. X-ray of the right foot showed fracture third metatarsal. Wound was debrided, and pus discharge was sent for culture and sensitivity.

Direct gram staining of the pus showed the presence of pus cells and Gram-negative bacilli; the specimen was inoculated onto MacConkey agar and blood agar and incubated at 37°C for 18–24 h. On MacConkey agar, two types of growth were observed mucoid non-lactose-fermenting and lactose-fermenting colonies. Both types of colonies were identified as per the standard microbiological procedures. Both the type of colonies on Gram stain revealed Gram-negative bacilli. The non-lactose-fermenting colonies were oxidase positive and showed alkaline/no change (K/NC) reaction with H₂S production. Based on the above findings, a presumptive identification of *Shewanella* species was done, and further speciation was done to differentiate *S. algae* from *S. putrefaciens* by nitrate reduction test, ornithine dehydrolase test and presence of growth at 42°C. Based on these findings, the bacteria were identified as *S. algae*. The lactose-fermenting colonies were identified as *Escherichia coli*. Antibiotic susceptibility testing was performed by Kirby–Bauer disc-diffusion method for Gentamicin, Amikacin, Ciprofloxacin, Cefotaxime, Ceftazidime and Imipenem, and the results were interpreted by Clinical and Laboratory Standards Institute guidelines.^[4] *S. algae* was susceptible to Gentamicin, Amikacin, Cefotaxime, Ceftazidime, Imipenem and resistant to Ciprofloxacin. *E. coli* was susceptible to Gentamicin, Amikacin, Ciprofloxacin, Cefotaxime Ceftazidime and Imipenem. Since the patient has presented with signs of inflammation such as pain, swelling and purulent discharge, the direct Gram stain examination revealed pus cells and Gram-negative bacilli and hence both the bacteria isolated were considered as significant. After wound debridement, K-wire fixation was done, and the patient was treated with Amikacin and supportive therapy such as limb

elevation. After 10 days, wound debridement was done once again, and the tissue was sent for repeat culture which was negative for growth. Later on, the patient was treated with open reduction internal fixation with plates and screw. Split skin grafting was done for the wound, and the patient responded well to the treatment.

Discussion

Shewanella spp. are associated with the environment. Although they are seldom associated with medical disease, they can cause a wide range of infections such as skin and soft-tissue infections, cellulitis, abscesses (cerebellar), wound infections, osteomyelitis, health-care-associated infections, peritonitis, neonatal infections, outbreak infections and intracranial infections. The most common predisposing factors are trauma, injuries causing breach in the dermis and exposure to the marine environment.^[5]

In India, the first case of *Shewanella* infection (soft-tissue infection) was reported in Delhi by Goyal *et al.*^[6] A total of five cases of *Shewanella* infection have been reported by Sharma *et al.* in South India.^[7] In the present case report, the patient had a history of trauma following which he developed infection. The patient could have been exposed to *S. algae* on contact with soil during the RTA, as they are saprophytes commonly present in soil. There was no history of contact with marine environment. Although exposure to sea water is a common risk factor for acquiring *Shewanella* infection, many studies could not establish this association similar to the present case scenario.^[8,9]

Shewanella spp. can also be isolated from tap water from sink and humidifiers, saline used for irrigation of wound and surfaces of trolleys in the hospital environment. In our hospital, ground water is used as water source which is treated by reverse osmosis (in operation theatres) and chlorination before usage, and periodic surveillance (every month) is performed for assessing the microbial quality of the water along with hand hygiene audits. In the present scenario, we did not isolate *Shewanella* spp. from the hospital environment.

S. putrefaciens and *S. algae* are the two species implicated in causing human infections. *S. algae* was isolated in the present case. *S. algae* has been implicated more in human infections than *S. putrefaciens* because of production of bacterial haemolysin.^[6]

In the present case report, we isolated *E. coli* and *S. algae* and both were sensitive to Amikacin, Gentamicin, Cefotaxime, Ceftazidime and Imipenem. *Shewanella* spp. responds well to Beta-lactams, Aminoglycosides

and Quinolones. In the present case, *S. algae* showed resistance to Ciprofloxacin. The patient was started on injection Amikacin initially and was continued with the same after obtaining susceptibility report and responded well to the treatment. The cases of MDR *Shewanella* spp. have been reported in the literature.^[3] Isolates showing resistance to Imepenem and Piperacillin-Tazobactam have been documented^[10] *Shewanella* spp. can also cause resistance by producing an oxacillinase enzyme. Outbreak-associated infections in a hospital setting has also been reported in Korea.^[1] *Shewanella* infections should be treated with a combination of surgical therapy/debridement and appropriate antibiotics to avoid unfavourable outcome such as necrotising fasciitis and sepsis.

The present case highlights the importance of *Shewanella* spp. as a potential emerging infectious agent with a propensity towards drug resistance and causing outbreaks. Although it is associated with the marine environment in most of the cases, other predisposing factors should also be considered. It is necessary to identify and treat aggressively to reduce the morbidity associated with this infection.

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Conflicts of interest

There are no conflicts of interest.

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