Case report

A rare case of *Shewanella* septicemia: risk factors, environmental associations and management

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SUMMARY

Shewanella species are Gram-negative, saprophytic, motile bacilli. Exposure to aquatic environment and raw fish ingestion have been defined as significant associated risk factors. The two species most commonly associated with human infections are *Shewanella algae* and *Shewanella putrefaciens* and major portion of infections (80%) caused by the former. Herein, we report a case of *Shewanella* septicaemia in a 70-year-old man in Omaha, NE who had no exposure to aquatic environment. To date, no defined treatment guidelines are present due to rarity of *Shewanella* infections, which is contributing to emerging antibiotic resistance.

BACKGROUND

Shewanella is a genus of the *Shewanellaceae* family which includes motile Gram-negative bacilli. This species was once named *Pseudomonas putrefaciens*; originally classified in the family of *Vibrioneceae* until the 1990s, when it was reclassified as genus *Shewanella*.[1] The majority of these bacteria were originally found in aquatic environments. Risk factors and comorbidities associated with *Shewanella* infections have been described as chronic leg ulcers, peripheral vascular disease, diabetes, chronic liver disease and kidney disease. Exposure to aquatic environments[2] and raw fish ingestion[3] have also been defined as significant risk factors leading to infection.

CASE PRESENTATION

A 70-year-old man with a prior medical history of coronary artery disease and alcoholic cirrhosis with transjugular intrahepatic portosystemic shunt, performed 5 years ago, presented to the emergency department with a complaint of shortness of breath for 2 days. When inquired of epidermiological history he had no history of raw fish ingestion, recent travel or sick contacts. Vitals examination showed a heart rate of 139 beats/min, blood pressure of 170/95 mm Hg and respiratory rate of 32 breaths/min. Physical examination showed a chronic rash consistent with stasis dermatitis on his bilateral lower extremities and additional red discoloration and tenderness in his right leg.

INVESTIGATIONS

Due to suspicion of an acute pulmonary embolism, CT angiography was performed which showed no evidence of a pulmonary embolism but revealed bilateral pleural effusions. Other laboratory investigations showed: white blood count: 16 k/μL, serum lactic acid: 3.0 mmol/L, bilirubin: 3.4 mg/dL and B-type natriuretic peptide: 1170 pg/mL. Blood cultures were also drawn.

DIFFERENTIAL DIAGNOSIS

A diagnosis of exacerbation of congestive heart failure and sepsis secondary to cellulitis was made.

TREATMENT

Patient was started on vancomycin 15 mg/kg every 12 hours and meropenem 1 g every 24 hours. The blood cultures and subsequent sensitivity report were followed for further management. He also received a diuretic with significant improvement in dyspnea. Gram stain showed Gram-negative rods in aerobic and anaerobic bottles. No organism was detected by multiplex PCR. However, traditional culture on chocolate agar and blood agar plates grew *Shewanella* species on day 3. Further analysis with matrix-assisted laser desorption/ionisation and microbioal identification using biomerieux VITEK identified the organism as *Shewanella putrefaciens*. Therefore, antibiotics were de-escalated to levofloxacin 750 mg one time per day, based on results of the sensitivity report.

OUTCOME AND FOLLOW-UP

The treatment was continued for 2 weeks and the patient improved within that time.

DISCUSSION

Shewanella spp are unusual organisms that cause human infections within a restricted geographic distribution, mainly limited to warm climates, with the majority of cases occurring in Southeast Asia, Southern Europe and South Africa.[4] *Shewanella algae, putrefaciens, halitosis* and *xiamenensis* are all involved in human infections. However, the two species most commonly seen in human infections are *Shewanella algae* and *Shewanella putrefaciens* with the majority of infections (80%) being caused by the former.[1] The pathogenicity of these organisms is still not fully understood. Analysis using 16S rRNA and gryB is used to differentiate between *S. algae* and *S. putrefaciens*. Interestingly, it was observed in a study of 179 Danish isolates that all isolates of *S. algae* were resistant to colistin, in contrast to *S. putrefaciens*.[5] Therefore, in the future polymyxin susceptibility may prove to be an economical way of making a distinction between these two species.[6] They are rare but potentially

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fatal causative pathogens of bacteremia as well as skin and soft tissue infections. Vignier *et al* described in their study that during the reported cases from 1973 to 2011, 44% of those cases had marine exposure.[7] Yousfi *et al* looked at cases from 2012 to 2016 and reported that 43% of the cases had marine exposure.[8] However, in this case, our patient lacked the classical exposure to marine environment or ingestion of raw fish, which is another important association to be wary of. He, however, had underlying hepatobiliary disease which was identified as possible risk factors for *Shewanella* in this case. Another risk factor in our patient might have been his chronic stasis dermatitis which could have provided a nidus for bacterial entry.

Risk factors predisposing to *Shewanella* infection include the aforementioned underlying diseases such as hepatobiliary disease, malignancy and end stage renal disease (ESRD). A recent study conducted by Takata *et al*[3] described that dysregulated iron metabolism due to the aforementioned comorbidities increases the risk of *Shewanella* infection.[3] Our patient's underlying hepatobiliary disease and prior history that revealed iron overload may explain the causation of his *Shewanella* infection.

The above-mentioned study by Vignier *et al*[7] reported bacteremia in 28% cases, while Yousfi *et al*[8] reported bacteremia in 18% of cases, and mortality was 13% and 8%, respectively. *Shewanella* is usually susceptible to third and fourth generation cephalosporins, aminoglycosides, carbapenems, erythromycin, floroquinolones, chloramphenicol and to some extent, tetracyclines and trimethoprim-sulfamethoxazole. It is resistant to first and second generation cephalosporins, penicillin and colistin.[9] Emerging resistance has been reported to imipenem and piperacillin/tazobactam due to the presence of the class D beta-lactamases enzyme.[10–12] This poses concern as piperacillin/tazobactam is one of the most commonly used drugs in initial empiric therapy for sepsis. Due to the rarity of *Shewanella* infection, no defined treatment guidelines are currently in place. Right now, treatment is continued until the blood cultures become negative in the patient, which in our belief, is contributing to emerging antibiotic resistance.

From the Discussion section, we have tried to emphasise the fact that patients who present with the risk factors previously described, *Shewanella* should be included in the differential even if the exposure to marine environments is not present, as in our patient. Initial empiric antibiotic therapy for patients presenting with sepsis should also factor in coverage for *Shewanella*. With newer studies showing increasing incidence of *Shewanella* and associated antibiotic resistance, clear guidelines regarding antibiotic choice and duration are needed.

Learning points

- *Shewanella* should be in differentials for sepsis, especially in patients returning from trips to temperate climates with seawater exposure.
- Empiric antibiotics for sepsis should cover basic marine pathogens in patients with history of seawater exposure including *Vibrio, Shewanella* and *Aeromonas.*
- Early diagnosis and prompt initiation of appropriate antibiotics have shown good outcomes.

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