Successful Treatment of a Case of Necrotizing Fasciitis due to *Vibrio vulnificus* in a Cold Climate in Japan

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**Abstract**

*Vibrio vulnificus* infection often occurs in warm regions, frequently leading to necrotizing fasciitis, sepsis, and death. We herein report a rare case presenting in a cold climate region in northern Japan, Aomori district, of a *V. vulnificus* infection complicated by necrotizing fasciitis and septic shock. The patient’s prior history of injury and typical clinical course were helpful clues to the diagnosis of *V. vulnificus* infection, and early initiation of antimicrobial treatment saved his life. *V. vulnificus* infection should be considered even in cold regions, particularly if patients have risk factors.

**Key words:** *Vibrio vulnificus*, necrotizing fasciitis, septic shock, cold climate

(Intern Med 55: 1007-1010, 2016)
(DOI: 10.2169/internalmedicine.55.5231)

**Introduction**

*Vibrio vulnificus* is a Gram-negative halophilic bacterium that is present in warm coastal regions. *V. vulnificus* infection is a highly lethal disease that causes serious skin and soft tissue infections and sepsis (1). Patients with weakened immune systems, particularly those with chronic hepatic disorders, diabetes, and alcoholism, are known to be at high risk of developing this infection (2-4). The infection develops via the following modes: primary septicemia, wounds, and gastrointestinal infections (1). The incidence of *V. vulnificus* infection shows seasonal and regional patterns because *V. vulnificus* grows in warm water temperatures around 20°C and lower salinity at coastal regions (3, 5, 6).

In the United States, *V. vulnificus* infections have gradually increased according to an investigation from 1996 to 2010 (7). According to the Cholera and Other Vibrio Illness Surveillance (COVIS), there are more reports at coastal areas, particularly in the warm Gulf coast area (8). In Japan, many cases of *V. vulnificus* infection have been reported in warm western Japan, while less in the northern relatively cold climate regions (9).

In the pertinent literature, no case of *V. vulnificus* infection that led to necrotizing fasciitis in the Aomori Prefecture has been reported to date, except limited cases of otitis media or cellulitis (10, 11). We herein report our experience with the successful treatment of a patient with a history of high alcohol consumption who had *V. vulnificus* infection complicated by necrotizing fasciitis and septic shock in the summer season in a cold climate region.

**Case Report**

The patient was a 75-year-old fisherman residing in Aomori Prefecture, Japan. He daily consumed ocean-fresh seafood which he caught in Mutsu Bay and drank heavily. He had no past history except hypertension.

Three days before the onset of his disease, he was injured in his right foot while boating. On the morning of August 11, 2013, he noticed swelling and pain in his left forearm and gradually spreading blisters in his left forearm. Two days later, he visited the general medicine and dermatology department of our hospital. He had a body temperature of 37.5°C; swelling, tenderness, and aggregated vesicles in the left forearm; swelling and tenderness in the right foot; and a rash in the left lower inner leg. He was diagnosed with an insect bite. The next morning, he was...
emergently transferred to our hospital because he experienced difficulty in movement.

The physical examination revealed clear consciousness, body temperature of 35.8°C, respiration rate of 28 bpm, blood pressure of 105/91 mmHg, and heart rate of 116 bpm. The left forearm and both lower extremities showed redness, swelling, and tenderness (Figure A). The left forearm also had blisters. No specific findings were noted on an exploratory skin incision. No organisms were observed in the wound specimen. A blood test indicated thrombocytopenia and severe renal dysfunction. A blood gas analysis showed an increased lactic acid level and severe metabolic acidosis (Table). Based on his prior history of a boating injury and clinical findings, necrotizing fasciitis was considered and ceftriaxone was empirically started.

Blood testing after admission revealed a low white blood cell count of 800/μL and a low platelet count of 28,000/μL. Along with the skin lesions further spreading, the circulation dynamics became unstable. Administration of catecholamine and continuous renal replacement therapy were initiated. Breathing on his own became difficult and the patient was kept on a respirator. The next day, an exploration by skin incision in the upper left arm revealed necrotic fasciitis, and minocycline, meropenem, and clindamycin were empirically administered. Finally, V. vulnificus was isolated from the cultures of the blister samples of his left forearm and blood.

Identification and antibiotic susceptibility testing was performed using the MicroScan Walk Away 96 Plus system (Neg Combo Panel NENC1J Worksheet, SIEMENS, Erlangen, Germany). We administered ceftazidime and minocycline as definitive therapy according to the results of tests. The skin lesions deepened to some extent and hemorrhagic bullae were apparent (Figure B). After an improvement in his general condition, the patient was weaned off of the respirator on the 8th day. Magnetic resonance imaging demonstrated partial necrosis of the muscles and fascia in left upper limb and both lower limbs. On the 30th day, the patient was transferred to a university hospital for plastic surgery.

Discussion

V. vulnificus is a Gram-negative bacillus that preferentially grows in warm coastal regions with a brackish zone. V. vulnificus infection develops in three modes: primary septicemia, wound, and gastrointestinal infections (1). Septicemia has a mortality rate of 50% or higher (2, 3). Septic and gastrointestinal infections are associated with an oral intake of contaminated seafood. Wound infection occurs upon injury in the ocean or exposure of a wound to seawater. V. vulnificus infection can progress to severe skin and soft tissue infections, including necrotizing fasciitis (1, 12).

The patient in our case developed necrotizing fasciitis and septic shock due to V. vulnificus infection in the summer in a cold region of Japan. V. vulnificus grows in relatively low-salinity, brackish and coastal regions at water temperatures of 20°C and higher (3, 5, 6). According to Oishi et al., most of V. vulnificus infection cases were reported in Western Japan (9). On the other hand, cases reported in northern Japan regions, such as Tohoku and Hokkaido districts including Aomori, accounted for only 1.1% of all cases. In the relevant literature we identified five sepsis cases of V. vulnificus infection in these districts from 1975 to 2013. However, in Aomori, there were no reports of necrotizing fasciitis. In this case, the patient was injured in the right foot on a fishing boat several days before disease onset and daily consumed ocean-seafood in Mutsu Bay, thus it was most probable that seawater exposure of his wound or the intake of seafood from Mutsu Bay caused the infection. A study by the Aomori Prefectural Industrial Technology Research Center Fisheries Research Institute indicated that the seawater temperature at 15 meters deep exceeded 20°C at the end of July 2013. Although Aomori is a cold region, V. vulnificus might have been growing in the sea when the water temperature was high in the summer. In cold regions, incidences of V. vulnificus infection have been reported in Denmark, around the Baltic Sea (14). The water temperature in the Baltic Sea is gradually rising and the incidence of V. vulnificus infection is increasing (15). An Israeli paper reported an outbreak of this infection in a year when the seawater temperature increased, suggesting the influence of climate change (16). As global warming progresses, V. vulnificus could easily proliferate in the summer in colder coastal areas where the seawater temperature exceeds 20°C, and the incidence of necrotizing fasciitis caused by the pathogen might subsequently increase in cold regions in the future.

A well-known risk factor of V. vulnificus infection is chronic liver disease, particularly hepatic cirrhosis. Other risk factors include immunocompromised status, diabetes, and alcoholism (2-4). Johnston et al. reported an increased risk of infection in individuals who drink 30 mL or more of
Table. Laboratory Data.

<table>
<thead>
<tr>
<th>Complete Blood Count</th>
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</thead>
<tbody>
<tr>
<td>White Blood Cells</td>
<td>4,100/μL</td>
<td>TP</td>
<td>5.9 g/dL</td>
</tr>
<tr>
<td>Neutrophil</td>
<td>75%</td>
<td>Alb</td>
<td>2.5 g/dL</td>
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<tr>
<td>Lymphocyte</td>
<td>14.7%</td>
<td>Glucose</td>
<td>147 mg/dL</td>
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<tr>
<td>Monocyte</td>
<td>9.4%</td>
<td>C-reactive protein</td>
<td>45.9 mg/dL</td>
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<tr>
<td>Red Blood Cells</td>
<td>428±10^6/μL</td>
<td>Creatine phosphokinase</td>
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<td>Hematocrit</td>
<td>48.4%</td>
<td>Myoglobin</td>
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<tr>
<td>Hemoglobin</td>
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<td>Endotoxin</td>
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<tr>
<td>Platelet</td>
<td>8.4±10^6/μL</td>
<td>IL-6</td>
<td>52,000 pg/mL</td>
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<td>Biochemical examination</td>
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<tr>
<td>BUN</td>
<td>35.6 mg/dL</td>
<td>Fibrinogen</td>
<td>801 mg/dL</td>
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<tr>
<td>Cre</td>
<td>4.2 mg/dL</td>
<td>HBsAg</td>
<td>(-)</td>
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<tr>
<td>Uric acid</td>
<td>8.1 mg/dL</td>
<td>HCV antibody</td>
<td>(-)</td>
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<tr>
<td>Na</td>
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<td>K</td>
<td>3.1 mEq/L</td>
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<tr>
<td>Cl</td>
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<td>pH</td>
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<td>AST</td>
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<td>pCO2</td>
<td>19.2 mmHg</td>
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<tr>
<td>ALT</td>
<td>46 IU/L</td>
<td>pO2</td>
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<td>ALP</td>
<td>247 IU/L</td>
<td>HCO3^−</td>
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<td>γ-GTP</td>
<td>447 IU/L</td>
<td>Base excess</td>
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<tr>
<td>LDH</td>
<td>221 IU/L</td>
<td>Lactate</td>
<td>12.5 mmol/L</td>
</tr>
</tbody>
</table>

Arterial blood gas (room air)

- CO2: 38 mmHg
- HCO3^−: 28 mmol/L
- O2: 99%
- Ω: 7.134
- pH: 7.40
- pH: 7.38
- HCO3^−: 27 mmol/L
- CO2: 38 mmHg
- O2: 99%

alcohol per day (17). Although we did not detect any hepatitis virus infection in our patient and he did not have cirrhosis, he might have had alcohol-related liver injury. According to a survey by the Ministry of Health, Labour and Welfare, the proportion of drinkers in the Aomori prefecture is one of the highest in Japan (18). People who live in a cold region and have high alcohol consumption may have an increased risk of developing V. vulnificus infection in the future.

As reported here, we experienced a rare case of summer V. vulnificus infection that led to necrotizing fasciitis and septic shock in a patient with high alcohol consumption residing in a cold region. When a physician encounters a patient with necrotizing fasciitis in the summer from a cold region and risk factors, such as chronic liver impairment, immunocompromised conditions, or high alcohol consumption, are present, the collection of information on whether the patient has previously been exposed to seawater or consumed seafood is important. People in cold regions must be educated about V. vulnificus infection.

The authors state that they have no Conflict of Interest (COI).

Acknowledgement
We thank the staff members of Aomori Prefectural Industrial Technology Research Center Fisheries Research Institute for their valuable support.

References

