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Recreational Brackish Water Injury at Mangrove Lagoon Leads to *Vibrio parahaemolyticus* Acute Wound Infection with Peripheral Edema

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Abstract: A wound infection with *Vibrio parahaemolyticus* was seen in a male who injured his right foot during a water leisure activity in Indonesia. It is known that the number of vibrio species in the sea is increasing due to the rise in seawater temperature accompanying global warming. Hand in hand with that rise in vibrio species and seawater temperature is the rise in the number of vibriosis cases. Hence, paying attention to the increase in imported cases of *V. parahaemolyticus* wound infection from tropical regions is necessary. For increased diagnostic accuracy, proper bacterial testing must be conducted based on the patient's epidemiological information. We highlight the innocuous nature of the initial presentation and the importance of rapid testing for an accurate diagnosis to prevent potentially devastating sequela.

Keywords: Wound infection, Vibrio parahaemolyticus, Water leisure activity, Imported infectious disease

Introduction

Vibrio parahaemolyticus is a Gram-negative, comma-shaped, halophilic bacterium which inhabits sea and brackish water.[1] This bacterium is well known as a cause of food poisoning and mainly causes gastroenteritis through the consumption of raw fish or shellfish.[1] It is also a cause of infection in wounds that encounter seawater.[2] Whereas the incidence of gastrointestinal vibriosis has decreased in past years, the incidence associated with wound infection has increased.[3] People with immunocompromising conditions or chronic disease have a higher risk of severe infection or sepsis.[3] Therefore, it is important to make an early diagnosis based on clinical symptoms, epidemiological information and start

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empiric therapy as soon as possible. Here we report a case of wound infection with *V. parahaemolyticus* caused by injury during a water leisure activity. This case was also characterized as an imported *V. parahaemolyticus* infection from a tropical resort in Indonesia to Japan.

Case

A forty-six-year-old previously healthy male who had traveled to Indonesia in 2021 and been injured between the first and second toe of his right foot (Figure 1). He had fallen from a boat into the brackish water area during a water leisure activity and caught his foot in mangrove branches. At a hospital in Indonesia, his wound had been cleaned and sewed, he had been injected with tetanus toxoid, and was prescribed cefixime and mefenamic acid. Two days after his injury, he returned to Japan and visited Yamagata Prefectural Central Hospital complaining of



Figure 1 The first and second toe wounds of the patient's right foot



Figure 2 *Vibrio parahaemolyticus* blue-green colonies from first and second toe wounds pus swab specimen

redness and swelling from his right ankle joint to the periphery. Laboratory testing revealed his C-reactive protein was elevated to 11.531 mg/dL and white blood cell count was elevated to 14.33 × 10^9/L with 87.6% neutrophils. The pus on the suture treated by his previous doctor was taken by a sterile swab and stored at 4°C until the next day when a microbiological examination was performed. He was hospitalized and was administrated 2 g/day of ceftriaxone. No bacteria were observed by light microscope in Gram staining of the pus swab specimen. The pus swab specimen was smeared in thiosulphate citrate bile sucrose (TCBS) agar (Eiken Chemical, Tokyo, Japan) in addition to the 5% sheep blood agar (Kyokuto, Tokyo, Japan) and bromothymol blue (BTB) lactate agar (Kyokuto) for ruling out of Vibrio vulnificus infection, and these media were incubated at 35°C for a day. Several irregular-shaped, mucoid, and non-lactose degrading colonies developed on TCBS agar (Figure 2), whereas only a few coagulase-negative Staphylococcus or coryneform bacteria that could be considered skin resident bacteria developed on blood agar and BTB lactate agar. Using MALDI biotyper (Bruker, Texas, USA) and Vitek 2 (BioMérieux, Lyon, France), the bacteria were identified on TCBS agar as *V. parahaemolyticus*. The MALDI score value was 2.378 and the Vitek 2 percent probabilities were 94%, indicating very reliable identification. Susceptibility testing, performed according to Clinical & laboratory standards institute Guidelines[4] using a Dry Plate DP31 (Eiken Chemical), revealed that the bacteria was susceptible to all of the antibiotics tested except for cefazolin (Table 1). His leg recovered rapidly with antibiotic therapy, redness, swelling and pain were improved and the skin lesions did not progress to deep necrotic fasciitis and he was discharged 5 days after hospitalization.

Table 1 Susceptibility testing results of *Vibrio parahaemolyticus*

Antibiotics	Minimum inhibitory concentration (μg/mL)	Interpretation of breakpoint*
Piperacillin	16	S
Sulbactam/Ampicillin	≤2/4	S
Cefazolin	8	R
Cefotaxime	≤0.5	S
Ceftazidime	≤0.5	S
Gentamicin	2	S
Amikacin	8	S
Imipenem	≤0.25	S
Meropenem	≤0.25	S
Levofloxacin	≤0.25	S
Sulfamethoxazole-trimethoprim	≤9.5/0.5	S

* S, susceptible; R, resistant. The breakpoints were interpreted according to the Clinical and Laboratory Standards Institute.[4]

Discussion

V. parahaemolyticus is a common cause of food poisoning[1] and, less commonly, also the cause of wound infection by direct contact with seawater contaminated with this pathogen.[2] The most common vibrio species causing wound infection is *V. vulnificus*.[2] *V. vulnificus* infection tends to become severe with necrotic fasciitis, especially in patients with underlying diseases such as liver disease, immunosuppression, or other chronic diseases.[1] Similar to *V. vulnificus* infection, wound infection with *V. parahaemolyticus* tends to be serious in persons with chronic underlying diseases such as liver disease, alcoholism, or diabetes.[5] Indeed, several previous cases from different part of the world reported that elderly people or patients with chronic diseases developed necrotic fasciitis by *V. parahaemolyticus* wound infection.[6-9] Conversely, in the present case and a previous case of a 12-year-old girl in Singapore with a *V. parahaemolyticus* wound infection[10], the patients had no underlying disease and their infection remained local and relatively mild. Therefore, patients with aged or chronic underlying diseases should monitor the severity of their wound infection with *V. parahaemolyticus*.

The present case was characterized as an imported *V. parahaemolyticus* infection from a tropical resort. Vibrio species including *V. parahaemolyticus* tend to be more common in warmer waters, above 17 to 20°C.[2] In north-eastern Japan including Yamagata Prefecture where our hospital is located, seawater temperature is usually below 20°C from late autumn (November) through early summer (May). On the other hand, seawater temperature remains around 30°C throughout the year in Indonesia where this case had injured. Hence, injury during a water leisure activity in a tropical resort such as Indonesia may be considered a higher risk for infection with *V. parahaemolyticus* than north-eastern Japan. Moreover, it has been reported that the number of vibrio species in the sea is increasing due to the rise in seawater temperature accompanying global warming[11] and that vibriosis cases are similarly increasing.[12] Therefore, it should be noted if imported cases of *V. parahaemolyticus* infection from tropical legions increase in the future. However, in the countries where *V. parahaemolyticus* is mainly considered a cause of food-borne illness such as Japan, imported wound infections with *V. parahaemolyticus* may be missed or not diagnosed rapidly. Therefore, epidemiological information of patients such as this injury in a tropical resort will help clinicians to suspect imported *V. parahaemolyticus* infection and prompt treatment with appropriate antimicrobial is essential for the best prognosis.

In the diagnosis of *V. parahaemolyticus* infection, rapid culture testing is necessary. It is known that low temperature storage at 1-5°C for a day reduces the number of *V. parahaemolyticus* to less than 1/10 in fish samples.[13] Indeed, in the present case, bacterial culture testing could detect only a few colonies on TCBS agar, which is optimized for selective isolation of *vibrio spp*. However, *V. parahaemolyticus* can grow on 5% sheep blood agar in general. This phenomenon can be explained by the facts that the specimen was stored at 4°C for a day because it was taken on holiday in addition to the prior administration of cefixime right after an injury in Indonesia. Therefore, wound cultures should be sent during the early stages of infection for rapid diagnosis. However, many patients have already received antibiotics before admission, which may increase the negative rate of culture and complicate diagnosis. When *V. parahaemolyticus* infection is suspected by a patient's epidemiological information, sharing information with the laboratory will also expedite the bacterial culture testing with a selective isolation medium for *vibrio spp*.

Conclusion

We reported the imported case of wound infection with *V. parahaemolyticus* from a foreign tropical resort to Japan. Rapid and proper bacterial testing based on epidemiological information of the patient will help for accurate diagnosis of, and care for, *V. parahaemolyticus* wound infection.

Conflict of interest

None to declare.

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