Traumatic Arm Wound Infected With *Vibrio cholerae* in a Non-immunocompromised Host

David Hirota, MD; Anjali Sachdev, MD; Lauri Thrupp, MD; Jamie Joyner, MD; George M. Wabba, MD; Josh K. Shajan, MBA; Garrett A. Wirth, MD, MS, FACS

**Abstract:** A 23-year-old man living in Orange County, California who was involved in a motor vehicle accident suffered a closed both-bone forearm fracture that was treated with open reduction and internal fixation. The patient then developed wound necrosis and abscesses that revealed a pure culture of non-toxigenic *Vibrio cholerae*. The wound required debridement and excision, which was followed by split-thickness skin grafting. He also received antibiotics and eventually fully recovered.

*Vibrio cholerae* non-O1 serotype has been reported to cause a broad spectrum of illnesses including: bacteremia, central nervous system infections, pulmonary infection, gastrointestinal disease, and skin and skin structure infections, such as cellulitis, wound infections, and necrotizing fasciitis. Most skin and skin structure infections are related to direct exposure to fresh, brackish, or salt water. Most cases are found in patients who also have underlying liver disease or are in a known immunocompromised state. The authors present a case of necrotizing wound infection caused by *Vibrio cholerae* non-O1 serotype in a patient with no known immunocompromising illness or liver disease. A review of the literature for similarly reported cases will also be presented.

**Case Report**

A 23-year-old Hispanic man was brought in by ambulance as a trauma activation following a motor vehicle accident with closed distal diaphyseal fractures of the left radius and ulna in addition to having multiple abrasions on both the dorsal and volar aspects of his forearm (Figures 1–2). In the emergency department the patient was neurovascularly intact and compartment syndrome was not clinically evident. The patient’s injury was temporarily stabilized with a splint until other injuries were ruled out and until the trauma service granted surgical clearance. Next the patient was taken to the operating room for definitive treatment where open reduction and internal fixation were performed (Figure 3). There were no perioperative complications and no cultures were taken at that time.
The patient’s medical, surgical, and social history were unremarkable. He had not been taking any medications and denied any drug allergies. The patient also ruled out any abusive behavior with drugs or alcohol, prior or current diarrhea, gastrointestinal symptoms, or liver disease. Further patient history revealed that the patient was originally from Mexico and had lived in Orange County, California for the past 5 years.

He denied having eaten any shellfish for at least 2 weeks prior to the accident, although he had often eaten shellfish in the past. In the accident, the patient’s vehicle rolled into the Santa Ana River, a concrete-lined riverbed and flood control channel, which drains a large watershed from the San Bernardino Mountains. The site of the accident was close to 10 miles inland from the Pacific Ocean. At the time of the accident both the water level and flow were low. The patient reported that the vehicle landed upside down in the river leaving the patient’s arms exposed to the knee-deep water while he extracted himself from the vehicle.
The patient initially did well postoperatively. By hospital day 8, he remained afebrile, but developed wound necrosis that required debridement in the operating room. Operative findings included two small purulent subcutaneous fluid collections in the wound. Direct Gram stain of this fluid showed only a few white blood cells, but no organisms. However, the culture showed moderate growth in pure culture of a Gram-negative bacillus identified as a *Vibrio cholerae*.

The wound required serial debridement and excision and was healing without further clinical evidence of infection (Figures 4–6). Split-thickness skin grafting was performed on hospital day 13. The patient was given antibiotics, initially cefazolin, followed by piperacillin/tazobactam. After *Vibrio* was recovered from the necrotic wound, the antibiotics were changed to doxycycline, which was continued until 48-hours after the placement of the split-thickness skin grafts (Figures 7–9). He recovered and has returned to full function with no other complications (Figures 10–13). The *Vibrio cholerae* identification was confirmed at the Orange County Public Health Department Laboratory as a non-O1 strain.

In Orange County, California, prior environmental sampling by the Health Department and by scientists at UC Irvine have recovered non-O1 *Vibrio cholerae* in the Newport Beach Back Bay and the Pacific Ocean in front of the Balboa Beach Pier. The organism is ubiquitous in the environment and is presumed to be present in the Santa Ana River. The likely pathogenesis of our patient’s infection was direct inoculation of the organism from the stagnant river water into the traumatized area (ie, minor cut or abrasion following the motor vehicle accident) that later developed into a postoperative necrotic wound infection.

**Discussion**

*Vibrio cholerae* is a motile, curved Gram-negative bacillus with a single polar flagellum. There are more than 200 serogroups of *Vibrio cholerae*. Only the O1 and O139 serogroups are associated with clinical cholera and have pandemic potential. The organism lives in aquatic environments, typically attached to algae, plankton, and crustacean shells in a symbiotic manner. Epidemic and pandemic *Vibrio* O1 and O139 strains contain the *Vibrio Pathogenicity Island* (VPI) that is responsible for colonization and toxin expression resulting in clinical and epidemiologic pathogenicity of O1, O139, and some non-O1 strains. These factors are in contrast with most non-O1 strains, which are biochemically similar to *Vibrio cholerae* O1 and O139 but do not agglutinate in O1 or O139 antiserum. The VPI has also been found in occasional non-
O1 strains that can cause a variety of symptoms ranging from a mild diarrhea to a severe watery diarrhea resembling cholera. Non-O1 strains can also cause a variety of non-diarrheal illnesses including cerebritis, acalculous cholecystitis, bacteremia, and soft tissue infections.1–10 The majority of these cases are patients with liver disease or who are in other immunocompromising states.11–16 Patients with liver disease are more vulnerable to severe disease due to non-O1 Vibrio strains, particularly with bacteremia.15 There have been only a few reports of wound infections due to non-01 Vibrio cholerae in patients without liver disease or immunocompromising illness as summarized in Table 1.6–9

**Table 1. Non-O1 Vibrio skin and skin structure infections in patients without known liver disease or immunocompromised state.**

<table>
<thead>
<tr>
<th>Gender, age (years)</th>
<th>Infection site</th>
<th>Source of exposure</th>
<th>Location, year</th>
<th>Comorbidities</th>
<th>Surgical therapy</th>
<th>Antibiotic therapy (days)</th>
<th>Outcome</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>M, (1.8)</td>
<td>Thighs, L arm</td>
<td>Baltic Sea</td>
<td>Finland, 2003</td>
<td>None</td>
<td>Excision with grafting</td>
<td>Cefuroxime (11)</td>
<td>Survived</td>
<td>Lukinmaa et al7</td>
</tr>
<tr>
<td>F, (11)</td>
<td>Face, neck</td>
<td>Ocean, North Queens</td>
<td>Australia, 2001</td>
<td>None</td>
<td>Debridement, excision with grafting</td>
<td>Ciprofloxacin and ceftazidime (21)</td>
<td>Survived</td>
<td>Norton et al9</td>
</tr>
<tr>
<td>M, (63)</td>
<td>L leg</td>
<td>Lake, Colorado</td>
<td>Colorado, 1989</td>
<td>Peripheral vascular disease, thrombophlebitis, DVT</td>
<td>Debridement</td>
<td>Cephapirin then ciprofloxacin (14)</td>
<td>Survived</td>
<td>Mulder et al6</td>
</tr>
<tr>
<td>M, (23)</td>
<td>L arm</td>
<td>Santa Ana River, California</td>
<td>California, 2005</td>
<td>None</td>
<td>Debridement, excision with grafting</td>
<td>Cefazolin, Piperacillin/ tazobactam, doxycycline (12)</td>
<td>Survived</td>
<td>Present case</td>
</tr>
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**Conclusion**

Non-O1 Vibrio cholerae infections remain uncommon, especially in the non-immunocompromised host. Although non-01 Vibrio cholerae has been found in the coastal waters of California, to our knowledge this appears to be the first reported case in California of a non-O1 Vibrio cholerae causing a wound infection in a non-immunocompromised host.

**References**


