Vibrio vulnificus necrotizing fasciitis associated with acupuncture

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Abstract

Necrotizing fasciitis is a severe life-threatening infection of the deep subcutaneous tissues and fascia. Infection with *Vibrio vulnificus*, a halophilic Gram-negative bacillus found worldwide in warm coastal waters, can lead to severe complications, particularly among patients with chronic liver diseases. We herein present an unusual case of necrotizing fasciitis caused by *V. vulnificus* triggered by acupuncture needle insertion. The patient, who suffered from diabetes mellitus and non-alcoholic fatty liver disease and worked at a fish hatchery, denied any injury prior to acupuncture. This is the first ever reported case of *V. vulnificus* infection triggered by acupuncture needle insertion, clearly emphasizing the potential hazards of the prolonged survival of *V. vulnificus* on the skin. The potential infectious complications of acupuncture needle insertion are discussed.

Introduction

Vibrio vulnificus is a naturally occurring, free-living, inhabitant of estuarine and marine environments throughout the world, residing in high numbers in filter-feeding shellfish (oysters, clams, and mussels).¹ This bacterium is considered one of the most dangerous waterborne bacterial pathogens and is responsible for the vast majority of seafood-related deaths worldwide.^{2,3} Human infections with *V. vulnificus* occur almost wherever the pathogen has been isolated, with reports mainly published from the USA,⁴ and Southeast Asia.⁵ However, disease cases have also been reported from Australia, Europe, South America, and the Mediterranean region.^{3,6}

The two main types of infection caused by *V. vulnificus* are primary septicemia and wound infections. Primary septicemia which is characterized by fever, chills, and hypotension is

the most serious and life-threatening feature of the disease and usually occurs following ingestion of raw or undercooked seafood. This type of infection comprises approximately 40–45% of all infections with *V. vulnificus* in the United States and Southeast Asia, where eating raw or undercooked seafood is a common practice. The case fatality rate of this type of infection could reach ~50%.¹ Wound infections occur when a patient suffers an injury before or during exposure to seawater or marine animals harboring the bacterium. Worldwide, the vast majority of human disease has been reported from USA and Southeast Asia, while reports from other parts of the world are largely sporadic and typically due to wound infection.

Immunocompromized patients are at the highest risk for developing severe complications. Chronic liver diseases, primarily liver cirrhosis, have been considered as the most influential factor predisposing patients for catastrophic complications.⁷ In addition, diabetes mellitus, malignancy, end-stage renal disease, chronic immunosuppressive therapy, and iron-overload associated conditions such as hemochromatosis and thalassemias are all associated with increased susceptibility to *V. vulnificus* infection.

Necrotizing fasciitis (NF) is a rapid and severe life-threatening infection and is considered a true medical emergency. NF associated with *V. vulnificus* infection can occur during both types of infections, primary septicemia and wound infection, and carries a frightening case fatality rate.⁸ NF involves a rapidly progressive infection reaching the deep subcutaneous tissues and fascia causing considerable subcutaneous edema with purpura, ecchymoses, and hemorrhagic bullae, rapidly evolving into vascular occlusion or ischemia, tissue necrosis and gangrene.

In 1996 an outbreak of severe soft tissue infections caused by *V. vulnificus* erupted in Israel among fish farmers and fish consumers.⁶ All the patients in Israel suffered from wound infection during handling live fresh fish cultivated in inland fish farms. Here we describe the first reported case of NF due to *V. vulnificus* triggered by acupuncture needle insertion, we discuss the potential infectious hazards of acupuncture and review the literature for similar cases.

Case Report

A 62 year-old-man suffering from obesity, diabetes mellitus, hyperlipidemia, and non-alcoholic liver cirrhosis was referred to the emergency department due to fever, chills, and progressive swelling of his left arm. The patient's spouse mentioned that 36 hours prior

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to his admission he underwent acupuncture needle insertion along the anterior medial aspect and radial side of his left hand. The patient used to work as an assistant hatchery manager at an inland fish farm that cultivated fish for commercial use. The patient denied any injury prior to his illness. Thirty hours prior to his admission he complained of generalized weakness and fever. During the day prior to his admission his condition worsened rapidly with progressive swelling of his left arm. His physical examination upon hospital admission was remarkable for severe disorientation, his vital signs showed a blood pressure of 88/50 mmHg, 124 beats per minute, 38 breaths per minute, and O₂ saturation at room air of 82%. The physical findings were suggestive of necrotizing fasciitis with severe edema, ecchymoses, hemorrhagic bullae, and progressive tissue necrosis of two fingers (Figure 1). His laboratory studies were compatible with multi-organ failure with acute renal failure, rhabdomyolysis, disseminated intravascular coagulation, and elevated liver enzymes. The patient was treated with ceftriaxone, penicillin, and clindamycin pending culture results. The patient underwent surgical debridement with fasciotomy and amputation of 2 necrotic fingers within 24 hours of his arrival to the emergency department. Blood and wound cultures grew *V. vulnificus*. Antimicrobial susceptibility showed that the bacterium was susceptible to third-generation cephalosporins, fluoroquinolones, tetracyclines, aminoglycosides,

and extended-spectrum penicillins. Clindamycin and penicillin were stopped and he was treated with ceftriaxone to complete two weeks of treatment. Biochemical and molecular characterization identified the bacterium as a biotype 3 strain, the main biotype responsible for human disease in Israel. In the first two weeks of his stay he received hemodialysis treatment for severe kidney failure with complete recovery of kidney function. During the 3rd week he suffered from septic shock. The patient was treated with meropenem, vancomycin, vasopressors, and mechanical ventilation. Blood cultures grew *Pseudomonas aeruginosa* that was susceptible to meropenem. The patient required skin grafts due to extensive skin loss and underwent tracheostomy due to failed weaning from mechanical ventilation. He also suffered from critical illness polyneuropathy. His condition improved gradually and after 72 days of hospital stay he was referred to a rehabilitation facility where he stayed for another 2 months.

Discussion

The case described is the first ever reported case of *V. vulnificus* infection triggered by acupuncture needle insertion. The infection evolved despite the use of standard precautions before needle insertion including single use of disposable sterile needles and local disinfection with alcohol 70%. At the time of presentation the first clinical impression was that his illness may have been caused by other more common bacterial pathogens capable of

causing NF such as *Staphylococcus aureus* or group-A β -*Streptococcus*. However, his exposure history of contact with brackish water accompanied by a short incubation time from acupuncture to symptom onset was highly suggestive of NF due to *V. vulnificus*. The patient denied any injury prior to acupuncture, this implies that *V. vulnificus* may have survived on the skin for at least one day before the acupuncture. The prolonged survival of *V. vulnificus* on the skin has been previously demonstrated by other authors from Israel.⁹ To date, only three other cases of NF associated with acupuncture have been reported in the English literature, the causative pathogens in these cases were *Pseudomonas aeruginosa*,¹⁰ *S. aureus*,¹¹ *Enterococcus faecalis* and Gram-negative rods.¹² Acupuncture associated infections due to vibrios have been reported only once, in non-English literature, the report described a Korean patient suffering from liver cirrhosis who developed non-O1, non-O139 *Vibrio cholera* septicemia following acupuncture.¹³

Acupuncture has become extremely popular for pain management and other medical conditions. According to data released by the National Institutes of Health (NIH) in 2008 nearly 3.1 million American adults and 150,000 children used acupuncture in 2007.¹⁴

Acupuncture is usually considered to be a safe procedure with very few adverse effects, one review estimated that that serious adverse events occur in 0.55 per 10,000 acupuncture treatments.¹⁵ Infectious complications of acupuncture are nowadays extremely rare, previous observations indicated that the most common complications were viral hepatitis due to the use of reusable needles.¹⁶ A more

recent systematic review identified only 239 reported cases of infections associated with acupuncture,¹⁷ all of which were bacterial without any reports of viral transmission. The vast majority (81%) of these infections were associated with *Mycobacterium (chelonae, abscessus, and haemophilum)*, while the rest included other bacteria such as *S. aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *P. aeruginosa*, *E. faecalis*, and *Listeria monocytogenes*.

Necrotizing fasciitis caused by *V. vulnificus* is a fatal disease, especially among immunocompromised hosts and particularly patients with liver cirrhosis from any cause. The mainstay of treatment of patients with NF is timely antimicrobial therapy combined with surgical debridement and fasciotomy. The clinical manifestations of NF caused by *V. vulnificus* and other bacterial pathogens such as group-A β -*Streptococcus*, *S. aureus*, *Aeromonas* species, or *K. pneumoniae* are indistinguishable, making it difficult to differentiate between the different causative pathogens at the time of hospital admission. A group of authors from Taiwan addressed this issue by comparing the clinical characteristics, laboratory findings, and outcome of patients suffering from NF caused by *V. vulnificus* to NF caused by *S. aureus*,¹⁸ *Aeromonas* spp.,¹⁹ and *K. pneumoniae*.²⁰ They concluded that NF caused by *V. vulnificus* progresses more rapidly than NF caused by *S. aureus* or *K. pneumoniae*.

To date, the largest cohorts of NF caused by *V. vulnificus* were published by three different groups from Taiwan.^{18,19,21-28} These studies were sufficiently detailed and described different aspects of the disease such as clinical characteristics,¹⁸⁻²⁰ laboratory data,²¹ timing of surgery,²⁴ and antimicrobial therapy.²⁵ Based on these cohorts the case fatality rate of NF following primary septicemia and wound infection averaged 55.7% and 28.9%, respectively.

Most reports of human infections due to *V. vulnificus* have been reported from USA and Southeast Asia. However, the past 20 years had witnessed a significant increase in reports of human infections outside these regions mainly from Europe and the Middle East. This coincided with several ecological surveys showing that *V. vulnificus* thrives in water, shellfish and sediment along the Mediterranean coasts.²⁹⁻³³ It has been suggested by us,³⁴ and others,^{35,36} that the emergence of *V. vulnificus* disease outside the traditional zones (i.e. USA and Southeast Asia) was mainly driven by climate change.

Antimicrobial susceptibility testing of *V. vulnificus* strains from several areas showed that the bacterium is susceptible to third-generation cephalosporins, fluoroquinolones, tetracyclines, aminoglycosides, and extended-spectrum penicillins.³⁷⁻⁴⁰ To date, the vast majority of publications advocate the use of third-gen-

Figure 1. Left arm at hospital admission 36 h following acupuncture.

eration cephalosporins plus tetracyclines as the initial antimicrobial therapy for patients with presumed NF caused by *V. vulnificus*.^{19,22,24,25,41,42} This combination therapy exhibited a synergistic effect against *V. vulnificus*,^{43,44} and was associated with a better outcome among patients with *V. vulnificus* septicemia.^{41,45} Nonetheless, these recommendations are based on retrospective analysis of data combined with experimental evidence for the role of tetracyclines in eradicating *V. vulnificus*.⁴⁶ Other treatment options that have been found to be also effective include fluoroquinolones plus minocycline (or analogue), penicillins plus aminoglycosides,^{24,25} and carbapenems.⁴⁷ In our experience,^{6,48} and others in Israel,³⁹ we did not find any advantage for a specific antimicrobial therapy among patients with *V. vulnificus* infection.

Conclusions

Patients with chronic liver disease are highly susceptible to invasive infections caused by *V. vulnificus*. These patients should be careful during exposure to brackish water and avoid any exposure to raw or undercooked marine animals. Acupuncture should always be carried out using clean care practices. The prolonged survival of *V. vulnificus* on the skin should prompt individuals to proper cleansing post exposure to brackish water or marine animals.

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