

Vibrio vulnificus necrotizing fasciitis associated with acupuncture

Yael Kotton,^{1,2} Soboh Soboh,³
Naiel Bisharat^{1,2}

¹Department of Medicine D, Emek Medical Center, Afula; ²The Rappaport Faculty of Medicine, Technion – Israel Institute of Technology, Haifa;

³Department of Medicine B, Baruch Padeh Medical Center, Poriya, Tiberias, Israel

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

Correspondence: Naiel Bisharat, Department of Medicine D, Emek Medical Center, Yitshak Rabin Boulevard 21, 18341 Afula, Israel.
Tel.: +972.4649.4520 - Fax: +972.4649.4518.
E-mail: bisharat_na@clalit.org.il

Key words: Acupuncture; necrotizing fasciitis; shellfish; *Vibrio vulnificus*.

Contributions: YK wrote the initial draft, SS gathered the relevant medical data and contributed his part to the initial draft, NB wrote the final draft.

Conflict of interest: the authors declare no potential conflict of interest.

Received for publication: 14 March 2015.

Revision received: 16 June 2015.

Accepted for publication: 25 June 2015.

This work is licensed under a Creative Commons Attribution NonCommercial 3.0 License (CC BY-NC 3.0).

©Copyright Y. Kotton et al., 2015
Licensee PAGEPress, Italy
Infectious Disease Reports 2015; 7:5901
doi:10.4081/idr.2015.5901

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 immunocompromized 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.

References

- Jones MK, Oliver JD. *Vibrio vulnificus*: disease and pathogenesis. *Infect Immun* 2009;77:1723-33.
- Feldhusen F. The role of seafood in bacterial foodborne diseases. *Microbes Infect* 2000;2:1651-60.
- Oliver JD. *Vibrio vulnificus*. In: Thompson FL, Austin B, Swings JG, eds. *The biology of vibrios*. Washington, D.C.: ASM Press; 2006. pp. 349-366.
- Gary Hlady W, Klontz KC. The epidemiology of *Vibrio* infections in Florida, 1981-1993. *J Infect Dis* 1996;173:1176-83.
- Chuang YC, Yuan CY, Liu CY, et al. *Vibrio vulnificus* infection in Taiwan: report of 28 cases and review of clinical manifestations and treatment. *Clin Infect Dis* 1992;15:271-6.
- Bisharat N, Agmon V, Finkelstein R, et al. Clinical, epidemiological, and microbiological features of *Vibrio vulnificus* biogroup 3 causing outbreaks of wound infection and bacteraemia in Israel. *Israel Vibrio Study Group. Lancet* 1999;354:1421-4.
- Haq SM, Dayal HH. Chronic liver disease and consumption of raw oysters: a potentially lethal combination—a review of *Vibrio vulnificus* septicemia. *Am J Gastroenterol* 2005;100:1195-9.
- Chen SC, Chan KS, Chao WN, et al. Clinical outcomes and prognostic factors for patients with *Vibrio vulnificus* infections requiring intensive care: a 10-yr retrospective study. *Crit Care Med* 2010;38:1984-90.
- Colodner R, Chazan B, Kopelowitz J, et al. Unusual portal of entry of *Vibrio vulnificus*: evidence of its prolonged survival on the skin. *Clin Infect Dis* 2002;34:714-5.
- Saw A, Kwan MK, Sengupta S. Necrotizing fasciitis: a life-threatening complication of acupuncture in a patient with diabetes mellitus. *Singapore Med J* 2004;45:180-2.
- Hsieh RL, Huang CH, Uen WC. Necrotizing fasciitis after acupuncture in a patient with aplastic anemia. *J Altern Complement Med* 2011;17:871-4.
- Macuha F Jr., Ahn A, Graham R. Necrotizing fasciitis associated with acupuncture: a case report. *J Hosp Med* 2010;5:565-6.
- Lim TS, Ji A, Lee JH, Chang S, et al. Non-O1, non-O139, *Vibrio cholerae* septicemia after acupuncture. *Ewha Med J* 2013;36:S22-S4.
- Barnes PM, Bloom B, Nahin RL. Complementary and alternative medicine use among adults and children: United States, 2007. *Natl Health Stat Report* 2008:1-23.
- White A. A cumulative review of the range and incidence of significant adverse events associated with acupuncture. *Acupunct Med* 2004;22:122-33.
- Lao L, Hamilton GR, Fu J, et al. Is acupuncture safe? A systematic review of case reports. *Altern Ther Health Med* 2003;9:72-83.
- Xu S, Wang L, Cooper E, et al. Adverse events of acupuncture: a systematic review of case reports. *Evid Based Complement Alternat Med* 2013;2013:581203.
- Tsai YH, Wen-Wei Hsu R, Huang KC, et al. Comparison of necrotizing fasciitis and sepsis caused by *Vibrio vulnificus* and *Staphylococcus aureus*. *J Bone Joint Surg Am* 2011;93:274-84.
- Tsai YH, Hsu RW, Huang TJ, et al. Necrotizing soft-tissue infections and sepsis caused by *Vibrio vulnificus* compared with those caused by *Aeromonas* species. *J Bone Joint Surg Am* 2007;89:631-6.
- Hsu JC, Shen SH, Yang TY, et al. Necrotizing fasciitis and sepsis caused by *Vibrio vulnificus* and *Klebsiella pneumoniae* in Diabetic patients. *Biomed J* 2015;38:136-42.
- Chao WN, Tsai SJ, Tsai CF, et al. The laboratory risk indicator for necrotizing fasciitis score for discernment of necrotizing fasciitis originated from *Vibrio vulnificus* infections. *J Trauma Acute Care Surg* 2012;73:1576-82.
- Lee YC, Hor LI, Chiu HY, et al. Prognostic factor of mortality and its clinical implications in patients with necrotizing fasciitis caused by *Vibrio vulnificus*. *Eur J Clin Microbiol Infect Dis* 2014;33:1011-8.
- Tsai YH, Hsu RW, Huang KC, et al. Laboratory indicators for early detection and surgical treatment of *Vibrio* necrotizing fasciitis. *Clin Orthop Relat Res* 2010;468:2230-7.
- Chao WN, Tsai CF, Chang HR, et al. Impact of timing of surgery on outcome of *Vibrio vulnificus*-related necrotizing fasciitis. *Am J Surg* 2013;206:32-9.
- Chen SC, Lee YT, Tsai SJ, et al. Antibiotic therapy for necrotizing fasciitis caused by *Vibrio vulnificus*: retrospective analysis of an 8 year period. *J Antimicrob Chemother* 2012;67:488-93.
- Kuo YL, Shieh SJ, Chiu HY, et al. Necrotizing fasciitis caused by *Vibrio vulnificus*: epidemiology, clinical findings, treatment and prevention. *Eur J Clin Microbiol Infect Dis* 2007;26:785-92.
- Tsai YH, Hsu RW, Huang KC, et al. Systemic *Vibrio* infection presenting as necrotizing fasciitis and sepsis. A series of thirteen cases. *J Bone Joint Surg Am* 2004;86A:2497-502.
- Tsai YH, Huang TJ, Hsu RW, et al. Necrotizing soft-tissue infections and primary sepsis caused by *Vibrio vulnificus* and *Vibrio cholerae* non-O1. *J Trauma* 2009;66:899-905.
- Arias CR, Olivares-Fuster O, Goris J. High intragenomic heterogeneity of 16S rRNA genes in a subset of *Vibrio vulnificus* strains from the western Mediterranean coast. *Int Microbiol* 2010;13:179-88.
- Canigral I, Moreno Y, Alonso JL, et al. Detection of *Vibrio vulnificus* in seafood, seawater and wastewater samples from a Mediterranean coastal area. *Microbiol Res* 2010;165:657-64.
- Cantet F, Hervio-Heath D, Caro A, et al. Quantification of *Vibrio parahaemolyticus*, *Vibrio vulnificus* and *Vibrio cholerae* in French Mediterranean coastal lagoons. *Res Microbiol* 2013;164:867-74.
- Ghinsberg RC, Dror R, Nitzan Y. Isolation of *Vibrio vulnificus* from sea water and sand along the Dan region coast of the Mediterranean. *Microbios* 1999;97:7-17.
- Normanno G, Parisi A, Addante N, et al. *Vibrio parahaemolyticus*, *Vibrio vulnificus* and microorganisms of fecal origin in mussels (*Mytilus galloprovincialis*) sold in the Puglia region (Italy). *Int J Food Microbiol* 2006;106:219-22.

34. Paz S, Bisharat N, Paz E, et al. Climate change and the emergence of *Vibrio vulnificus* disease in Israel. *Environ Res* 2007;103:390-6.
35. Vezzulli L, Colwell RR, Pruzzo C. Ocean warming and spread of pathogenic vibrios in the aquatic environment. *Microb Ecol* 2013;65:817-25.
36. Baker-Austin C, Stockley L, Rangdale R, et al. Environmental occurrence and clinical impact of *Vibrio vulnificus* and *Vibrio parahaemolyticus*: a European perspective. *Environ Microbiol Rep* 2010;2:7-18.
37. Hsueh PR, Chang JC, Chang SC, et al. In vitro antimicrobial susceptibility of *Vibrio vulnificus* isolated in Taiwan. *Eur J Clin Microbiol Infect Dis* 1995;14:151-3.
38. Shaw KS, Rosenberg Goldstein RE, He X, et al. Antimicrobial susceptibility of *Vibrio vulnificus* and *Vibrio parahaemolyticus* recovered from recreational and commercial areas of Chesapeake Bay and Maryland Coastal Bays. *PLoS One* 2014;9:e89616.
39. Zaidenstein R, Sadik C, Lerner L, et al. Clinical characteristics and molecular subtyping of *Vibrio vulnificus* illnesses, Israel. *Emerg Infect Dis* 2008;14:1875-82.
40. Hsueh PR, Lin CY, Tang HJ, et al. *Vibrio vulnificus* in Taiwan. *Emerg Infect Dis* 2004;10:1363-8.
41. Liu JW, Lee IK, Tang HJ, et al. Prognostic factors and antibiotics in *Vibrio vulnificus* septicemia. *Arch Intern Med* 2006;166:2117-23.
42. Morris JG Jr, Tenney J. Antibiotic therapy for *Vibrio vulnificus* infection. *JAMA* 1985;253:1121-2.
43. Chuang YC, Ko WC, Wang ST, et al. Minocycline and cefotaxime in the treatment of experimental murine *Vibrio vulnificus* infection. *Antimicrob Agents Chemother* 1998;42:1319-22.
44. Chuang YC, Liu JW, Ko WC, et al. In vitro synergism between cefotaxime and minocycline against *Vibrio vulnificus*. *Antimicrob Agents Chemother* 1997;41:2214-7.
45. Chiang SR, Chuang YC. *Vibrio vulnificus* infection: clinical manifestations, pathogenesis, and antimicrobial therapy. *J Microbiol Immunol Infect* 2003;36:81-8.
46. Bowdre JH, Hull JH, Cocchetto DM. Antibiotic efficacy against *Vibrio vulnificus* in the mouse: superiority of tetracycline. *J Pharmacol Exp Ther* 1983;225:595-8.
47. Matsumoto K, Ohshige K, Fujita N, et al. Clinical features of *Vibrio vulnificus* infections in the coastal areas of the Ariake Sea, Japan. *J Infect Chemother* 2010;16:272-9.
48. Bisharat N. Molecular and seroepidemiological studies to investigate the emergence of *Vibrio vulnificus* in Israel. Thesis Dissertation. Tel-Aviv University; 2009.