



Case report

Severe cellulitis and bacteremia caused by *Plesiomonas shigelloides* following a traumatic freshwater injury



Kevin M. Pennycook*, Keith B. Pennycook, Tess A. McCready, David Kazanowski

Ascension Providence Rochester Hospital, Wayne State University, 1101 West University Dr., Rochester, MI 48307, United States

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ABSTRACT

Plesiomonas shigelloides is a gram-negative bacillus that most commonly causes self-limited diarrhea in humans. Extraintestinal manifestations of *P. shigelloides*, including skin and soft tissue infections, are extremely uncommon. We present a case of severe cellulitis and bacteremia in an 80-year-old female caused by *Plesiomonas shigelloides* following a traumatic freshwater injury in Michigan, USA

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Introduction

Plesiomonas shigelloides is a gram-negative bacillus found in soil and water that typically causes enteric disease in humans after the consumption of raw seafood. Those who contract the disease usually experience self-limited secretory diarrhea, however, some cases can be severe [1]. The bacteria are a freshwater organism that favors tropical or subtropical areas [2]. Extraintestinal manifestations of *P. shigelloides*, including skin and soft tissue infections, are extremely uncommon. We present a case of severe cellulitis and bacteremia caused by *Plesiomonas shigelloides* following a traumatic freshwater injury in Michigan, USA.

Case report

An 80-year-old Caucasian female with a past medical history of hypertension, asthma, and hypothyroidism presented to the Emergency Department with an erythematous and edematous right lower extremity with ecchymosis, superficial erosions, and clear drainage (Fig. 1A). Four days prior, the patient suffered a laceration to the affected leg while boating on a freshwater river in Michigan, USA. After the incident, she remained in wet pants for multiple hours. During the ensuing days, the patient noted

increased edema, erythema, and pain to the affected leg. Bullae developed four days following the trauma. The patient drained the lesions resulting in the expression of clear fluid and sloughing of the epidermis. This forced the patient to seek care.

The patient's vital signs were within normal limits during the initial evaluation. Laboratory results yielded a WBC count of 7400 cells/mcL with 50% band neutrophils and elevated lactate of 3.0 mmol/L. Blood cultures were obtained, 1 g ceftriaxone IVPB was given, and the patient was admitted to the hospital for cellulitis of the right lower extremity, bacteremia, and lactic acidosis. The following morning, the patient was discovered to have acute hypoxic respiratory failure with altered mentation and hypotension. The patient was transferred to the Intensive Care Unit secondary to severe sepsis.

Cefepime and metronidazole were started in the ICU and the patient was able to return to the medical floor upon improving clinically. After 48 h, blood cultures grew *Plesiomonas shigelloides*. Antimicrobial susceptibilities displayed the organism was sensitive to ceftriaxone, ciprofloxacin, ertapenem, and meropenem. Ciprofloxacin was added to her treatment regimen.

However, the patient experienced changes in her stool and ciprofloxacin was discontinued after 7 days due to concerns for *Clostridium difficile* infection. General surgery was consulted and performed a wound debridement on the seventh day (Fig. 1B). The patient's condition continued to improve throughout her 14-day hospital stay and she was discharged to inpatient rehab on a 10-day course of 500 mg metronidazole TID and a one month course of 2 g ceftriaxone IVPB administered daily. The patient was discharged from inpatient rehab after an additional 14 days and instructions to follow up with her family doctor (Figure 3).

* Corresponding author.

E-mail addresses: gt2888@wayne.edu (K.M. Pennycook), keith.pennycook@wayne.edu (K.B. Pennycook), tsolansk@med.wayne.edu (T.A. McCready), co0568@wayne.edu (D. Kazanowski).



Fig. 1. Cellulitis of the right lower extremity. A. Initial presentation in the Emergency Department. B. Seventh day of admission following surgical debridement. C. Day 28 prior to discharge.

Discussion

P. shigelloides typically causes a self-limited enteric disease consisting of watery diarrhea following the ingestion of contaminated water or raw seafood [3,4]. Extraintestinal manifestations attributed to *P. shigelloides* are extremely rare including but not limited to bacteremia, cellulitis, peritonitis, meningoenzephalitis, ocular infections, and pneumonia. Patients who suffer from non-enteric diseases typically have major systemic conditions leading to immunocompromised states [1]. To our knowledge, it is extremely rare for *P. shigelloides* to cause cellulitis with subsequent bacteremia, and even more uncommon to occur in North America.

P. shigelloides is distributed worldwide, excluding the polar ice caps. The organism requires freshwater or brackish water of temperatures between 8 and 45 degrees Celsius to survive. *P. shigelloides* is carried by many animal species, yet a predominant

host has not been identified [1]. A 2008 study found that 3.9% of Ring-billed and Herring gull feces on a Lake Michigan beach tested positive for *P. shigelloides* [2]. The location of our patient's injury, the Clinton River, occurred in the natural habitat of these gulls [5,6]. We hypothesize these two species may have been the source of *P. shigelloides* in the Clinton River. These migratory gulls may have contracted the bacteria in the natural tropical habitat of *P. shigelloides*, and introduced the bacteria to Michigan's freshwater system thousands of miles away. In the summer months, when our patient's injury occurred, the Clinton River water temperature would be ideal for the growth of *P. shigelloides* [7]. The alternative explanation of this gram-negative bacillus permanently inhabiting the Clinton River is unlikely, as water temperatures fall below freezing in the winter months.

Certain strains of *P. shigelloides* exhibit the ability to cause invasive enteric disease. A previous study investigated this

mechanism by displaying how the bacteria bind to the surface of colonic epithelial cells, cause cytoskeleton rearrangement via tyrosine phosphorylation, and after 60 min, cause subsequent apoptosis of the infected cells [8]. We hypothesize the *P. shigellosis* that precipitated the cellulitis and bacteremia in our patient was of the invasive phenotype. Our patient had an open wound and remained in wet pants for several hours after the initial injury providing ample time for the bacteria to adhere to and enter the epithelial cells. With the protective epidermis no longer intact, the bacteria gained access to damaged cells in the dermis, subcutaneous tissue, and blood vessels resulting in the clinical picture of cellulitis and bacteremia. The entire disease sequela may have been prevented if our patient quickly sought out medical attention and properly irrigated the wound.

In previously documented extraintestinal infections of *P. shigelloides*, patients were treated with fluoroquinolones, carbapenems, or a combination [1]. Our patient was started on ciprofloxacin and later transitioned to ceftriaxone due to concerns of *C. difficile* infection. Fluoroquinolones are a controversial topic in infectious disease with many well-known side effects such as tendonitis, peripheral neuropathy, and *C. difficile* infection. The use of fluoroquinolones should be withheld to situations of serious bacterial infections where the benefits of treatment outweigh the side effect risks [9]. The *P. shigelloides* that infected our patient was found to be susceptible to ceftriaxone; an antimicrobial with a less innocuous side effect profile. This case illustrates the necessity of bacterial culture and sensitivity testing. Performing these measures ensures increased treatment options, rather than relying solely on preferred treatments documented in the literature. This case also demonstrates the importance for physicians to broaden their differential and keep an open mind for a unique treatment plan tailored to the patient presentation.

CRediT authorship contribution statement

Kevin M. Pennycook: Conceptualization, Writing - original draft, Writing - review & editing, Visualization, Supervision. **Keith B. Pennycook:** Conceptualization, Writing - original draft, Writing - review & editing, Supervision. **Tess A. McCready:** Conceptualization, Writing - review & editing. **David Kazanowski:** Writing - original draft.

References

- [1] Janda JM, Abbott SL, Mciver CJ. *Plesiomonas shigelloides* revisited. Clin Microbiol Rev 2016;29(2):349–74.
- [2] Kinzelman J, Mclellan SL, Amick A, et al. Identification of human enteric pathogens in gull feces at Southwestern Lake Michigan bathing beaches. Can J Microbiol 2008;54(12):1006–15.
- [3] Janda JM. *Plesiomonas*. Bergey's manual of systematic bacteriology. In: Garrity GM, editor. Aeromonadacea. second ed New York: Springer-Verlag; 2005. p. 740.
- [4] Shah N, Dupont HL, Ramsey DJ. Global etiology of travelers' diarrhea: systematic review from 1973 to the present. Am J Trop Med Hyg 2009;80(4):609–14.
- [5] Bird Web. Herring gull, http://www.birdweb.org/birdweb/bird/herring_gull#, [Accessed 14 August 2019].
- [6] Bird Web. Ring-billed gull, http://birdweb.org/Birdweb/bird/ring-billed_gull#, [Accessed 14 August 2019].
- [7] Health Department Health and Community Services. Beach test data. 2019. . [Accessed 14 August 2019] <https://health.macombgov.org/Health-Programs-EnvironmentalHealth-WaterQuality-BeachTestData>.
- [8] Tsugawa H, Ono T, Murakami H, Okawa Y. Invasive phenotype and apoptosis induction of *Plesiomonas shigelloides* P-1 strain to Caco-2 cells. J Appl Microbiol 2005;99(6):1435–43.
- [9] U.S. Food and Drug Administration. FDA updates warnings for fluoroquinolone antibiotics on risks of mental health and low blood sugar adverse reactions. 2018. . [Accessed 14 August 2019] <https://www.fda.gov/news-events/press-announcements/fda-updates-warnings-fluoroquinolone-antibiotics-risks-mental-health-and-low-blood-sugar-adverse>.