

Case Report: *Vibrio Furnissii* isolated from a case of acute gastroenteritis in China

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Abstract

Vibrio furnissii, formerly classified as the aerogenic biogroup of *Vibro fluvialis*, is a motile, Gram-negative, oxidase-positive, halophilic bacteria. It is widely distributed in the marine environment and marine products and was first defined in 1983 by Don J. Brenner. It is an emerging pathogen that can lead to diarrhea, bacteremia, cellulitis, and other manifestations. Whereas, its virulence factors and molecular epidemiological features remain largely unknown. The treatment guideline for *V. furnissii* infection has not been established. We herein report the first case of gastroenteritis caused by *V. furnissii* in China and review the relevant literature.

Case presentation: A 42-year-old female presented with diarrhea and nausea associated with fever. Microscopic examination of feces displayed 2-4 white blood cells/HPF, 0-1 red blood cells/HPF. The occult blood test was weakly positive. Laboratory tests displayed a high proportion of blood cell neutrophils. A feces culture revealed *V. furnissii* infection.

Conclusion: *V. furnissii* is a pathogenic bacteria often ignored as a non-cholera *Vibrio* compared to *Vibrio cholerae* and *Vibrio haemolyticus* which are more common in patients. The combination therapy of levofloxacin, berberine hydrochloride tablets, and paracetamol tablets is an effective treatment of gastroenteritis caused by *V. furnissii*. More importantly, clinical monitoring of *V. furnissii* is imperative.

Keywords

Vibrio furnissii; Gastroenteritis; Diarrhea; Levofloxacin.

Introduction

V. furnissii is a gram-negative, straight/slightly curved rod that is motile via polar flagella [1]. *V. furnissii* has frequently been isolated from the estuarine environment [2]. It is one of the 11 non-cholera

Vibrio species pathogenic in humans that cause clinical infections such as diarrhea, bacteremia, and cellulitis [2-5]. The bacterium resembles *Aeromonas hydrophila* in phenotypical and biochemical properties with the exception that *A. hydrophila* does not have the ability to grow in 6% NaCl [6]. The virulence factors and molecular epidemiological features of *V. furnissii* remain largely unknown. The best antimicrobial therapy for *V. furnissii* infection has not been established yet. There have been only a few cases of reports of gastroenteritis related to *V. furnissii*, none of which have been reported in China.

Case Presentation

A 42-year-old woman with acute gastroenteritis and fever for two days presented to the emergency department of the Academy of Traditional Chinese Medicine (Jiangsu, China) on 31 August 2022. She had three to four episodes of loose stools per day and nausea. She was not on any medications and had no history of cardiovascular disease, diabetes mellitus, chronic kidney disease, or hypertensive disease.

Her stools were watery, not blood stained, without melena, and non-purulent. Microscopic examination of the feces displayed 2-4 white blood cells/HPF, 0-1 red blood cells/HPF. The occult blood test was weakly positive. On examination, the patient's vital signs were normal and her temperature was 38.7°C. Laboratory tests revealed a normal white blood cell count (9,180/ul, reference: 3,500-9,500/ul), but with an unnormal neutrophils counts (8,330/ul; reference: 1,800-6,300/ul) and the proportion of neutrophils was as high as 90.8% (reference: 40-75%). Her C-reactive protein level was 6.55 mg/L (reference: <4 mg/L).

The patient was started on oral levofloxacin (0.5 g once daily), berberine hydrochloride tablets (0.2 g every eight hours), and paracetamol tablets (0.5 g every 12 hours). The stool specimen from the case was received at the microbiology laboratory attached to the Academy of Traditional Chinese Medicine (Jiangsu, China). The specimen was inoculated on a blood agar plate and alkaline peptone water (pH 8.6) according to the standard procedures. We performed a sub-cultivation from the alkaline peptone water to the vibro chromogenic agar plate after enrichment for six hours as the alkaline peptone water became turbid. The colonies on the blood agar plate were yellow with a clear hemolytic ring and were wathet blue on the vibro chromogenic agar.

The colonies were confirmed as *Vibrio furnissii* using the Matrix-assisted laser-desorption/ionization time-of-light mass spectrometry (MALDI-TOF MS; Antu, Zhengzhou, Henan, China). The score value was 9.127. Antibiotic susceptibility testing of the isolates was taken by the standard Kirby-Bauer disc diffusion method following the Clinical and Laboratory Standards Institute (CLSI) guidelines. The strain was resistant (ug per disc) to ampicillin (10), and sensitive (ug per disc) to amoxicillin/clavulanic acid (20/10), ampicillin/sulbactam (10/10), piperacillin (100), piperacillin/tazobactam (100/10), amikacin (30), gentamicin (10), ciprofloxacin (5), levofloxacin (5), chloramphenicol (30), and trimethoprim/sulfamethoxazole (1.25/23.75).

After treatment, the patient was symptomatically better and the repeat stool culture revealed no intestinal pathogens.

Discussion

V. furnissii is a gram-negative capsular vibrio with no spores. It is 1.5-4 µm long and 0.3-0.8 µm wide. It is ubiquitously present in aquatic marine environments, is halophilic, and can grow well in 3% and 70% sodium peptone water. It cannot survive without salt [7]. This bacteria causes diarrhea and bromatoxism, but the clinical manifestations are mainly diarrhea and stomach ache accompanied by nausea and emesis.

Members of the genus *Vibrio* are major causes of human gastroenteritis resulting from the consumption of contaminated marine products. In our case, the patient ate preserved vegetables rich in salt from a fast food restaurant. This food was likely contaminated by the *V. furnissii*. The organism then multiplied quickly, causing acute gastroenteritis.

Hemolysin, in addition to other pathogenic *Vibrio* factors, such as proteases, hemagglutinins, and other hydrolytic exoenzymes, has been suggested to be an important virulence factor in the pathogenesis of many *Vibrio* species and is the most feared virulence factor involved in the gastrointestinal disorders caused by *V. parahaemolyticus* [8-10]. However, little is known about *V. furnissii* and its possible production of toxins, which may be important in both pathogenesis and virulence. Flagellum is a virulence factor in *Vibrio* and several bacteria. *V. furnissii* culture supernatants lyse erythrocytes, and their lethal effects on epithelial cells are a remarkable feature of pathogenesis [11]. In addition to haemagglutinins and other hydrolytic exoenzymes, hemolysin is also responsible for pathogenesis [12-16]. A functional role of phosphomannomutase in the virulence of *V. furnissii* was reported [17]. The lipopolysaccharide component also plays an important role in virulence by preventing the formation of the complement membrane attack complex, precluding cell lysis [17].

A literature survey of the PubMed database showed no reports of *V. furnissii* being isolated from humans in China. There are few bacteremia and gastroenteritis cases reported associated with *V. furnissii* in other countries (Table 1), and a small number of established in-depth studies have been done on this emerging pathogen to date.

Table 1: Literature review of case of *Vibrio Furnissii* infection.

Country	Study period	Number of cases	Age/sex	Probable portal of entry	Underlying disease	Ref
Brasil	1993	16	unknown	Gastrointestinal tract	unkonwn	[11]
Peru	1994	14	2-40 /M&F	Gastrointestinal tract	unkonwn	[2]
USA	2011	1	62 y/M	unknown	diabetes	[3]
India	2017	1	73 y/F	Gastrointestinal tract	diabetes	[4]
Japan	2018	1	53 y/M	unknown	malnutrition	[5]
China	This case	1	42 /F	Gastrointestinal tract	None	

In our case, the *V. furnissii* isolated was resistant to ampicillin and sensitive to amoxicillin/clavulanic acid, ampicillin/sulbactam, piperacillin, piperacillin/tazobactam, amikacin, gentamicin, ciprofloxacin, levofloxacin, chloramphenicol, and trimethoprim/sulfamethoxazole. Other reports revealed the same pattern of antibiotic resistance [3,18]. The mechanism of antimicrobial resistance of *V. furnissii* may due to posses-

sing of drug resistance genes[19]. Treatment with oral levofloxacin coupled with berberine hydrochloride and paracetamol tablets was effective against the gastroenteritis caused by *V. furnissii* in our case.

This case highlights the necessity of future studies on antimicrobial treatment of *V. furnissii*. Infection due to *V. furnissii* might be underestimated, and the absence of reported cases from other countries is likely due to a lack of attention rather than low incidence. The clinical importance of *V. furnissii* is not well documented in the literature, and thus monitoring *V. furnissii* is important.

Conclusion

V. furnissii is a pathogenic bacteria that can cause diarrhea, bacteremia, cellulitis, and other manifestations. As a non-cholera Vibrio, it garners less attention compared to *Vibrio cholerae* and *Vibrio haemolyticus*, which are more common. Further research is needed to explain the pathogenic mechanism of *V. furnissii*. Proteases, haemagglutinins and other hydrolytic exoenzymes, and hemolysin are responsible for its pathogenesis. The lipopolysaccharide component also plays an important role in its virulence. Our study demonstrated that combination therapy with levofloxacin, berberine hydrochloride tablets, and paracetamol tablets is effective for gastroenteritis caused by *V. furnissii*. This research guides the treatment of *V. furnissii* infection and highlights the importance of clinical monitoring of *V. furnissii*.

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