Aeromonas sobria peritonitis in a peritoneal dialysis (PD) patient: a case report and review of the literature

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Abstract

Background: Peritonitis is a common cause of catheter removal and mortality in the patient undergoing peritoneal dialysis (PD). Various pathogenic organisms have been identified as the etiology of PD-related peritonitis, among which Aeromonas sobria is a rare one. Several studies have indicated that Aeromonas sobria might be of particular clinical significance because of its enterotoxin production. We here present a case of peritonitis due to Aeromonas sobria in a PD patient and review of the related literature.

Case presentation: A 37-year-old man with chronic renal failure who was secondary to chronic glomerulonephritis had been on PD for approximately 6 months without any episode of peritonitis. In July 2015, he was admitted to the hospital for fever, vomiting, abdominal pain, diarrhea and cloudy dialysate several hours after eating stinky tofu. The peritoneal effluent culture yielded Aeromonas sobria. The patient was given intraperitoneal amikacin and intravenous levofloxacin for 10 days. And the patient’s symptoms such as diarrhea, abdominal pain were relieved and the cloudy effluent turned to be clear. Unfortunately, peritoneal dialysis catheter was blocked because of fibrin clot formation in the setting of inflammation, and finally it was removed.

Conclusions: Aeromonas species are rare causes of PD-related peritonitis, however they should not be ignored. Clinicians should be aware of monitoring the hygiene protocol and retraining patients at regular intervals, especially for such rare cases.

Keywords: Peritoneal dialysis (PD)-related peritonitis, Aeromonas sobria, Stinky tofu, Antibiotics

Background

Peritonitis is not only a common complication in patients undergoing peritoneal dialysis (PD), but also a main cause of catheter removal and mortality in PD patients [1]. Various of pathogenic organisms, including Staphylococcus aureus, S.epidermidis and enterogenous bacteria, have been recognized as the pathogens of PD-related peritonitis, among which Aeromonas sobria is rare. Several studies have indicated that Aeromonas sobria may be of particular clinical significance because of its enterotoxin production. The Aeromonas species, are facultative anaerobic, rod-shaped, gram-negative microorganisms widely found in water, sewage and soil, and can also be isolated from varieties of foods including raw meats, sea foods and milk. Animals and humans are usually infected through the contaminated food [2, 3]. Aeromonas species may act as conditional pathogenic bacteria which can cause various infections including bacteremia, wound infections, skin and soft-tissue infections, pneumonia, endophthalmitis, endocarditis, meningitis, cholangitis, urinary tract infections, septic arthritis, osteomyelitis, and gastroenteritis, especially in immunocompromised patients [2, 4]. Aeromonas sobria, which belongs to the Aeromonas species, has seldom been reported in PD-related peritonitis. Here, we present a case of peritonitis caused by Aeromona sobria in a PD patient and review of the related literature.

Case presentation

A 37-year old man with chronic renal failure who was secondary to chronic glomerulonephritis had been on PD for approximately 6 months without any episode of
peritonitis. In July 2015, he was admitted to the hospital because of fever, vomiting, abdominal pain, diarrhea and cloudy dialysate several hours after eating stinky tofu. Physical examination showed: blood pressure was 175/97 mmHg, pulse was 90 beats per minute and body temperature was 39.1°C, periumbilical tenderness, defense and rebound. No erythema and exudates were found around PD catheter exit site. Laboratory examinations revealed an increased white blood cell (WBC) count (14.22 × 10^9 cells/L with 89.8% neutrophils). Hemoglobin was 110 g/L, albumin was 36.1 g/L, serum potassium was 2.86 mmol/L, and C-reactive protein was 67.5 mg/L. Dialysate leukocyte count was 12,800 × 10^6 /L with 30% polymorphonuclear cells, indicating PD-related peritonitis. The first peritoneal effluent culture was obtained before initiation of antibiotics therapy (intraperitoneal ticoplanin 200 mg every other day and intravenous cefotiam 1000 mg twice daily for 8 days). After treatment, the patient’s fever and diarrhea were relieved. However, he still suffered from abdominal pain and the peritoneal effluent was still turbid. Analysis of dialysate for the second time showed that leukocyte count was 3200 × 10^6 /L with 90% polymorphonuclear cells. Aeromona sobria was isolated from peritoneal effluent on the fifth day after the treatment, and drug sensitivity test showed that it is sensitive to amikacin, ceftazidime, cefepime, levofloxacin and meropenem, and resisted to ampicillin, cefotaxime, and piperacillin /tazobactam. Therefore, amikacin and levofloxacin (intraperitoneal amikacin 200 mg and intravenous levofloxacin 300 mg per day for 10 days) were prescript. The abdominal pain was relieved and peritoneal effluent turned to be clear gradually. Unfortunately, the peritoneal dialysis catheter was blocked because of fibrin clot formation in the setting of inflammation. Although urokinase was used to salvage the catheter, it was removed finally. The patient switched to hemodialysis and was discharged from hospital after recovery.

**Discussion and conclusions**

Aeromonas is usually classified into four main species: *Aeromonas hydrophila*, *Aeromonas caviae*, *Aeromonas salmonicida* and *Aeromonas sobria* [5]. It’s commonly believed that the major virulence factors of Aeromonas species are haemolysins including enterotoxins, invasins, aerolysin, adhesins, proteases, phospholipase and lipase [4, 6]. Aeromonas sobria bacteremia is reported to have the highest mortality rate in this genus (Aeromonas sobria - 56%, Aeromonas hydrophila - 33%, Aeromonas caviae - 17%) [7]. Aeromonas sobria may act as opportunistic pathogen that can cause bacteremia, intestinal and other extraintestinal infection, and can be isolated from sea water, soil, fish and many other food. Such infections occurred predominantly in patients with chronic hepatic disease, gastroenteritis, malignancy and immunocompromised status [4]. Although gastroenteritis is the most common infection of Aeromonas species, peritonitis caused by Aeromonas species are not uncommon, especially spontaneous bacterial peritonitis in patients with cirrhosis [8–10]. However, peritonitis episodes due to Aeromonas species have seldom been reported in PD patients [11–22] (Table 1). The most frequently isolated specie was *A. hydrophila* (10:71.4%), while *A. sobria* was reported owning higher virulence (1:7.1%). The pathogenic mechanism of Aeromonas peritonitis in patients undergoing PD could be associated with direct exposure to contaminated water. From the literature review (Table 1), we found that two of the cases may be possibility of water-related infection, however, such infection has rarely been proven. Another possible mechanism is transmural migration from the gastrointestinal tract to the blood. The outcomes of PD-related peritonitis caused by Aeromonas species are generally good; however, recurrent peritonitis can occur (21.4%). The reason of recurrence may be biofilm formation on the surfaces of catheter. Recently, Joana et al. [23] found that no major differences on microbial density of the catheter cultures were observed between the catheters removed due to infectious and non-infectious causes. However, microbial yields were higher on the cuffs of catheters removed due to infection, which indicated that microbial biofilm is universal in PD catheters with the subclinical menace. Cuffs colonization may significantly contribute to infection. In this sense, it would not be prudent to prophylactically remove the PD catheter in PD-related peritonitis patients.

Aeromonas peritonitis has an abrupt onset in most patients. In this case, the patient presented fever, vomiting, abdominal pain, diarrhea and cloudy peritoneal effluent several hours after eating stinky tofu. Stinky tofu, a kind of traditional Chinese food, is usually considered unhygienic. The tofu have to be placed in water for a long time to increase the unique smell. Human body may get infected after eating stinky tofu contaminated by Aeromonas sobria. Aeromonas can produce enterotoxin and hemolysin, causing gastrointestinal symptoms such as abdominal pain and diarrhea. Then the bacterial translocation plays a important role in the pathogenesis of PD-related peritonitis. Therefore, we speculated that the stinky tofu might be the source of infection.

Aeromonas sobria grow rapidly in summer [9]. The patient we reported here got infected in summer, and the anemia, low albumin, and immunosuppressive status of the patient increased the risk of opportunistic infection. Moreover, hypokalemia caused by vomiting and diarrhea not only decrease intestinal peristalsis, but also increase intestinal permeability, both of which facilitate bacterial translocation [24]. The increased cellulose
| Case/Reference | Age  | Sex | PD Duration (months) | Cause of ESRD | Reason of infection | Underlying condition | Aeromonas Species | Antibiotics | Outcome |
|----------------|------|-----|----------------------|---------------|--------------------|----------------------|-------------------|-------------|---------|
| 1/ [11]        | 62   | male | 2                    | Nephrosclerosis | Exposure to goldfish water | Total gastrectomy due to perforation of hemorrhagic gastric ulcer 1 year ago | A. hydrophila | Cefazolin + cefepime | cure     |
| 2/ [12]        | 63   | female | 11                  | Systemic lupus erythematosus | Didn’t wear mask and omitted thorough hand washing during PD after she engaged in gardening | Systemic lupus erythematosus | A. hydrophila | Vancomycin + ceftazidime | cure     |
| 3/ [13]        | 44   | female | 5                   | Chronic glomerulonephritis | Peritoneal dialysis catheter dropped into the toilet | Poor hygiene | A. hydrophila | Cefazolin + ceftazidime | cure     |
| 4/ [14]        | 68   | female | 11                  | Diabetes | Ate raw or incompletely cooked fish | Chronic gastritis, duodenal ulcer | A. salmonicida | Cephradine + ceftazidime | cure     |
| 5/ [15]        | 54   | female | 19                  | Chronic glomerulonephritis | Gut bacterial translocation | Adenocarcinoma of the colon with distant metastasis | A. hydrophila | Cefazolin + tobramycin | Recurrence two times; shifted to hemodialysis |
| 6/ [15]        | 70   | male  | 22                  | Chronic renal failure | Gut bacterial translocation | Liver cirrhosis caused by hepatitis | A. hydrophila | Cefazolin + tobramycin + ceftazidime | Recurrence 10 days later; then cure |
| 7/ [16]        | 71   | male  | 8                   | Congestive cardiomyopathy | Fingernails were dirt after he engaged in gardening | Nothing in particular | A. hydrophila | Vancomycin + gentamicin + ciprofloxacain | cure     |
| 8/ [17]        | 53   | male  | unknown              | Chronic renal failure | Unknown | Unknown | A. caviae | Ampicillin + cefotaxime | cure     |
| 9/ [17]        | 55   | male  | unknown              | Diabetes | Unknown | Unknown | A. hydrophila | Cefotaxime | cure     |
| 10/ [18]       | 52   | female | 10                 | Unknown | Alcohol-base disinfectant spray also used for houseplant | Nothing in particular | A. caviae | Vancomycin + aztreonam | cure     |
| 11/ [19]       | 53   | female | 18                | Hypertension | Presence of the indwelling peritoneal catheter | Immunosuppressive therapy following cadaveric kidney transplantation | A. hydrophila | Cefotaxime | Recurrence 6 weeks later; then cure |
| 12/ [20]       | 53   | male  | 28                  | Unknown | Transmural migration | Immunosuppressive therapy following cadaveric kidney transplantation | A. hydrophila | Ampicillin + flucloxacillin + cefotaxime | cure     |
| 13/ [21]       | 14   | female | unknown             | Unknown | Unknown | Unknown | A. hydrophila | Ampicillin | Recovery; died from uremia 1 week later |
| 14/ [22]       | 70   | male  | 36                  | Type 2 diabetes, hypertension | A laceration from flood-disaster | Dyslipidemia and ischemic heart disease | A. sobria | Amikacin + levofloxacain | cure     |
exudation and fibrin clot formation in the setting of inflammation made peritoneal catheter blocked [25]. In consequence, the patient had to remove the catheter and switch to hemodialysis. Therefore, the patients undergoing PD should pay more attention not to eat any contaminated food, and avoid constipation in order to prevent from opportunistic bacterial infection.

Aeromonas species can produce β-lactamases which make most of them resistant to ampicillin, pencillin and first- or second-generation cephalosporins, while sensitive to third-generation cephalosporins, carbapenems, chloramphenicol, fluoroquinolones, and aminoglycosides [2, 4, 26–28], which is consistent with our drug sensitivity tests. However, our result indicated that Aeromonas sobria was resistant to cefotaxime which belongs to third-generation cephalosporins. Recent literature also suggests that Aeromonas species show an increasing trend of resistance to third-generation cephalosporins [2]. Amikacin and levofloxacin treatment were efficient in this case. The patient finally shifted to hemodialysis with the catheter removed. It’s noteworthy that the third-generation cephalosporins which is well known as the empirical approach to the therapy of bacterial infection caused by Aeromonas sobria may be ineffective sometimes.

In conclusion, Aeromonas species are rare causes of PD-related peritonitis. Which should not be ignored. Clinicians should be aware of monitoring the hygiene protocol and retraining patients, especially in such rare cases.

Abbreviations
PD: Peritoneal dialysis; WBC: White blood cell

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Availability of data and materials
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Authors’ contributions
P.S. collected clinical data, drafted and revised manuscript, J.D. collected clinical data and searched the relative literatures, T.H. searched the relative literatures and made analysis and revised the English of manuscript, X.F., L.Z., and L.S. provided with clinical assistance and contributed for the acquisition of these data, Y.L. revised the manuscript and takes responsibility for the work, all authors have read and approved of the final version.

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Not applicable.

Consent for publication
Written informed consent was obtained from the patient for publication of this Case Report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

Competing interests
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