10.5152/turkjnephrol.2021.21077

Case Report

Turkish Journal of Nephrology

An Unusual Cause of Peritonitis in a Peritoneal Dialysis Patient: *Leifsonia aquatica*

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ABSTRACT

Peritonitis continues to be an important cause of catheter losses in peritoneal dialysis (PD) patients. Although the causes of peritonitis are predominantly Gram-positive bacteria, Gram-negative bacteria and Fungi also appear as causative agents. Recently, rare atypical agents have been reported more frequently in patients with peritonitis. The disease course, response to treatment, and results of peritonitis cases with these rare etiologies in the literature will be a guide for other clinicians. Here, we present *Leifsonia aquatica* peritonitis in a 23-year-old female patient who was hospitalized for peritonitis. This microorganism, which is usually encountered as an infectious agent in extraperitoneal areas in immunosuppressed patients, has been reported to be extremely rare in PD patients as a cause of peritonitis. *Leifsonia* is a highly resistant microorganism living in the surrounding waters, and all peritonitis cases with this agent resulted in the loss of the peritoneal catheter. *Leifsonia* peritonitis is a treatment-resistant infection that often leads to catheter loss despite appropriate antibiotic therapy. These cases can be prevented by appropriate patient selection and training in PD techniques.

Keywords: Continuous ambulatory peritoneal dialysis, Leifsonia aquatica, peritonitis

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Received: April 20, 2021 **Accepted:** May 17, 2021

Cite this article as: Özkarabıyık N, Öztürk İ, Erken E, Güngör Ö, Altunören O. An unusual cause of peritonitis in a peritoneal dialysis patient: *Leifsonia aquatica*. *Turk J Nephrol*. 2021; 30(4): 322-325.

INTRODUCTION

Peritoneal dialysis (PD) maintains its importance among the treatment options for end-stage renal disease (ESRD). Peritonitis is a major cause of PD catheter loss and conversion to long-term hemodialysis in PD patients.[1] Although less than 5% of peritonitis episodes result in death, peritonitis is the direct or major contributing cause of death in around 16% of PD patients.[2] In addition, severe or prolonged peritonitis leads to structural and functional alterations of the peritoneal membrane, eventually leading to membrane failure. The most common causative microorganisms of peritonitis are: *Staphylococcus epidermis*, *Staphylococcus aureus*, Coliform bacteria, *Klebsiella* species, Enterobacteriaceae, *Pseudomonas*, Mycobacteria, and fungi. However, in recent years, unusual pathogens have been increasingly reported as the cause of peritonitis, such as *Kocuria rosea*, *Cellulosimicrobium cellulans,* and others, in PD patients.[3,4]

Leifsonia aquatica is a Gram-positive rod that is typically found in environmental water habitats.[5] In the literature, there are extremely rare reports of *L. aquatica* as the cause of peritonitis in chronic PD patients. This is the presentation of a PD patient who experienced an episode of peritonitis with an exceedingly rare and highly resistant pathogen, *L. aquatica*.

CASE PRESENTATION

A 23-year-old female PD patient applied to our PD outpatient clinic with complaints of fatigue, loss of appetite, and cloudy dialysis fluid. She had a medical history of diabetes mellitus and ESRD for about 2 years, and she had been on continuous ambulatory PD treatment

program for 6 months. She was admitted to the hospital with a probable diagnosis of peritonitis. She had been hospitalized and treated for culture-negative peritonitis 1 month previously. The following measurements were recorded in her physical examination: body temperature was 36.7°C, heart rate (HR) 94 beats/min, number of breaths 16/min, systolic/diastolic blood pressure 123/77 mm Hg, and body mass index 24.2 kg/m^2. There was no abnormal finding in the cardiovascular, respiratory, neuromuscular, and abdominal physical examinations. Abdominal tenderness, rebound, and defense were not present. Her laboratory values were: fasting blood glucose 143 mg/dL, blood urea nitrogen (BUN) 25 mg/dL, serum creatinine (sCr) 4.65 mg/dL, serum sodium (Na) 137 mmol/L, serum potassium (K) 3.6 mmol/L, calcium (Ca) 9.4 mg/dL, alanine aminotransferase (ALT) 13 U/L, albumin: 26.6 g/L, C-reactive protein (CRP) 132 mg/L, white blood cells (WBC) 10 240 cells/µL, hemoglobin 8.8 g/dL, and platelet count (PLT) 442 000 cells/µL. The results of blood gas analysis were pH 7.36, pCO_2 42.9 mmHg, HCO_3 22.3 mmol/L, and pO_2 47.4 mmHg.

Peritoneal fluid sampling for Gram stain, culture, and cell count were immediately performed. For fluid culture, 50 mL of PD effluent was centrifuged at 3000 g for 15 minutes, and then 5 mL of fluid sediment was resuspended and inoculated in standard blood culture media. Peritoneal fluid WBC were 1079/mm^3, and polymorphonuclear leukocytes were 1054/mm^3. Blood culture was also taken, and empirical intraperitoneal antibiotic treatment was started with the diagnosis of peritonitis. Vancomycin at 1 g every 48 hours and ceftazidime at 1 g every 24 hours were administered intraperitoneally. Daily complete blood count, CRP, and peritoneal fluid cell count follow-up were performed to monitor the treatment response. On day 2, fluid WBC decreased to 589/mm^3 and CRP level decreased to 114 mg/L, but then fluid WBC increased to 1035 and 1433 cells/mm^3 on days 3 and 4. Intraperitoneal gentamycin at 0.6 mg/kg daily was added to the treatment regimen and ceftazidime was replaced with intravenous meropenem, with dose adjustment according to the patient's glomerular filtration rate. Abscess formation was not observed on contrast-enhanced abdominal CT. On the sixth day of treatment, the fluid WBC count was 517 cell/mm^3 and the CRP level was 100 mg/L. As the patient showed uremic symptoms, a double lumen cuffed intravenous catheter was placed, to begin hemodialysis treatment.

The blood culture of the patient was negative. Meanwhile, *L. aquatica* was detected in 2 peritoneal fluid cultures which were obtained on 2 consecutive days. It was susceptible to linezolid, gentamicin, and ciprofloxacin. Vancomycin was replaced with peroral 600 mg linezolid 2 times a day. The response to treatment with linezolid, meropenem and gentamycin was not satisfactory (CRP level: 130 mg/L and peritoneal fluid WBC: 1461/mm^3 on day 9). The peritoneal catheter was removed on day 10, because the patient was not responsive to treatment at all. After catheter removal, the antibacterial treatment was continued. The patient's CRP levels decreased day by day, eventually reaching 16 mg/L, along with full recovery of her symptoms.

Informed consent was obtained from the patient to present her clinical course in the clinical literature, with the assurance that her identity would not be revealed.

Main Points

- In peritoneal dialysis (PD) patients, the causes of peritonitis are predominantly Gram-positive bacteria. Rare atypical agents are being reported more frequently in patients with peritonitis, in recent years.
- *Leifsonia aquatica* are non-spore-forming, motile, Gram-positive bacteria that are typically found in environmental water habitats. Infections due to *L. aquatica* are rarely reported, typically being more common in immunocompromised hosts, especially in patients with a central venous catheter.
- *Leifsonia* peritonitis is an extremely rare and treatment-resistant infection. It follows a fluctuating course, with increases and decreases in the number of peritoneal cells in response to antibiotic therapy, and eventually ends with the loss of the peritoneal catheter. The disease course, response to treatment, and results of peritonitis cases with these rare agents in the literature will be a guide for other clinicians.
- These peritonitis episodes with rare microorganisms may be caused by the patients' lack of attention to their own hygiene. From this perspective, patient education and training programs have a key role in preventing peritonitis in patients on chronic PD. These training programs should be conducted frequently for PD patients and their caregivers.

DISCUSSION

Here, we report a case of peritonitis caused by a very rare pathogen in a PD patient. *L. aquatica* are non-spore-forming, Gram-positive bacteria that are typically found in environmental water habitats, and were first described by Leifson in 1962.[5,6] They were previously classified under the Corynebacterium species, but later turned out to be a different species.[7,8] They have been isolated from samples of distilled water from municipal supplies. The organism is motile by peritrichous flagella, and catalase- and oxidase-positive.[9] Colonies are often yellow; however, pigment production may be delayed, requiring extended incubation.[9]

Infections due to *L. aquatica* are rarely reported, typically being more common in immunocompromised hosts. A review of the literature revealed case reports of neonatal meningitis,[10] neonatal urinary tract infection,[11] and central venous catheter-associated infections in 3 patients with chronic myeloid leukemia, polycythemia rubra vera, and parenteral nutrition dependence.[12–14] In addition, 3 case reports of bloodstream infection with *Leifsonia* originating from a tunneled central venous catheter in chronic hemodialysis patients were reported.[15–17]

In PD patients, there is only one report of *L. aquatica* peritonitis in the literature.[18] Since *L. aquatica* was formerly known as *Corynebacterium aquatica*, rare reports of peritonitis due to this microorganism can be found with the search term *Corynebacterium aquatica*.[19–21] *L. aquatica* is a highly resistant bacterium. In all the reported cases, it was observed that PD patients with *C. aquatica* or *L. aquatica* peritonitis lost their peritoneal catheters even if they were treated with a combination of various antibiotics. A fluctuating response to antibiotic treatment was reported with decreasing and increasing peritoneal cell counts. In our case, the number of peritoneal cells fluctuated despite the appropriate antibiotic treatment, which was adjusted according to the sensitivity tests of the peritoneal culture results. However, the patient eventually lost her peritoneal catheter due to refractory peritonitis.

This peritonitis episode with the rare microorganism may have been caused by the patient's lack of attention to her own hygiene and the cleanliness of her PD catheter. Our patient is not well educated, and lives in the countryside. In a case report published by Gardenier et al. the patient developed *Leifsonia* peritonitis after camping at Yellowstone National Park.[18] From this standpoint, patient education and training programs have a key role in preventing peritonitis in patients on chronic PD. These training sessions should be conducted frequently for PD patients and their caregivers. Chern et al. reported a significantly higher incidence of PD-related peritonitis in patients who had never received compulsory education.[22] They concluded that a lower educational level is an independent and major risk factor for peritonitis.

Another important issue in patients with resistant or refractory peritonitis is the usage of the proper culture technique in identifying the causative organism. The ISPD guideline recommends that PD centers review and improve their culture methods, if their culture-negative peritonitis rates are above 15%.[23] The same guideline reports that inoculation of a supernatant obtained from centrifugated PD effluent on solid culture media or standard blood culture media increases the yield of positive results by 5-10 times. This sampling and culture methods must be the standard in any PD treatment center. Identification of the causative organism decreases the time span for the resolution of infection and increases the chance of treatment success.

In conclusion, rare microorganisms have been increasingly seen in PD patients recently. Most of them are highly resistant to treatment, and many patients have lost their catheters. The proper culture techniques and the early administration of treatment with wide-spectrum antibiotics are crucial in these patients.

Informed Consent: Informed consent was obtained from the patient who participated in this case.

Peer Review: Externally peer-reviewed.

Author Contributions: Concept – N.Ö., O.A.; Design - İ.Ö., O.A.; Supervision - İ.Ö., E.E., Ö.G., O.A.; Resource - N.Ö., İ.Ö., O.A.; Materials - N.Ö., İ.Ö.; Data Collection and/or Processing - N.Ö., İ.Ö.; Analysis and/or Interpretation - E.E., Ö.G., O.A.; Literature Search - N.Ö., O.A.; Writing - N.Ö., O.A.; Critical Reviews - E.E., Ö.G., O.A.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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