

[CASE REPORT]

Refractory Peritoneal Dialysis Peritonitis Due to *Neisseria macacae*: A Case Report and Review of the Literature

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Abstract:

The Gram-negative diplococcus *Neisseria macacae* is a commensal bacterium of the mucosal surfaces in humans. A 52-year-old woman receiving continuous ambulatory peritoneal dialysis was admitted because of abdominal pain and turbid peritoneal fluid. *N. macacae* was isolated from peritoneal fluid culture and showed susceptibility to ceftriaxone. Despite appropriate antibiotics, the peritonitis was refractory, leading to the removal of the peritoneal dialysis catheter. We herein report the first case of peritoneal dialysis peritonitis caused by *Neisseria macacae* and review previous case reports of *N. macacae* infection in humans.

Key words: *Neisseria*, *Neisseria macacae*, *Neisseria mucosa*, peritoneal dialysis, peritonitis, ceftriaxone

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Introduction

The Gram-negative diplococci *Neisseria* are commensal bacteria of the mucosal surfaces of humans (1). Two major subspecies, *N. meningitidis* and *N. gonorrhoeae*, are pathogenic in humans, while most other subspecies are recognized as non-pathogenic.

We herein report a case of refractory peritoneal dialysis (PD) peritonitis caused by *N. macacae* and review previous case reports.

Case Report

A 52-year-old woman was admitted to our hospital because of abdominal pain and diarrhea. The patient had received automated PD (APD) for three years due to obesity-related glomerulopathy. The patient had experienced PD peritonitis one month after the initiation of PD. She had a pet cat she kept in her home.

A physical examination showed that her body temperature was 36.6°C, blood pressure was 164/100 mmHg, and heart rate was 73 beats/min. She had abdominal tenderness with rebound tenderness. No signs of catheter exit-site infection were observed, but dialysate leakage from the external

catheter was found, indicating that PD peritonitis had been caused by wet contamination (Fig. 1). She denied any instance of the cat biting the catheter and said that she kept the cat away during the PD procedure. She had been using adhesive tape to bundle the PD catheter, and the remaining glue that adhered to the catheter apparently disrupted the normal connection of the catheter.

A laboratory examination on admission revealed a white blood cell count of 10,800/μL with 79% segmented neutrophils, and C-reactive protein of 3.62 mg/dL. The peritoneal fluid was turbid, and a laboratory examination revealed a white blood cell count of 10200/μL. Computed tomography of the abdomen showed no evidence of intra-abdominal abscess or focus of infection (Fig. 2).

The patient was diagnosed with PD peritonitis. Since she had complained of a rash on her skin after the administration of ceftazidime, empirical therapy with intravenous piperacillin/tazobactam (4.5 g twice daily) was continued. On the second day of admission, Gram-negative cocci appeared in the peritoneal fluid culture and were identified as *N. macacae* by matrix-assisted laser desorption ionization-time of flight mass spectrometry three days later. An antibiotic susceptibility test revealed the minimum inhibitory concentrations (MIC) to be 0.25 μg/mL for piperacillin/tazobactam and 0.032 μg/mL for ceftriaxone. Her symptoms gradu-

ally improved, and the white blood cell count of the peritoneal fluid decreased.

However, the cell count increased again on the ninth day of admission, indicating that piperacillin/tazobactam was not effective. Peritoneal fluid culture was repeated, with findings shown to be negative for both bacteria and fungi. Although the antibiotics were changed to ceftriaxone (2 g once daily), the white blood cell count in the peritoneal fluid worsened, leading to the removal of the PD catheter 20 days after admission. There were no signs of infection of the internal cuff or formation of a biofilm.

After the removal of the PD catheter, renal replacement therapy was switched to hemodialysis. Daily ceftriaxone was continued for two weeks. The patient received PD catheter placement one month later without any recurrence of peritonitis (Fig. 3).

Discussion

Neisseria species are commensal bacteria, and most of them, other than *N. meningitidis* and *N. gonorrhoeae*, rarely cause human infection (1). Reports of *N. macacae* infection in humans are limited, and to our knowledge, this is the first case of PD peritonitis caused by *N. macacae*. Despite em-

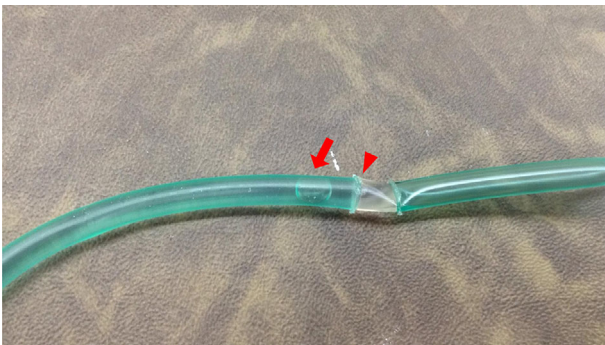


Figure 1. A picture of the PD catheter in the patient. Leakage of the fluid and incorporation of air (arrow) from the joint (arrowhead) occurred when the catheter was flexed.

pirical therapy followed by ceftriaxone, which is usually susceptible in *Neisseria* species, the condition of the patient did not improve, ultimately requiring the removal of the PD catheter.

N. macacae was first identified in rhesus monkeys (*Macaca mulatta*) in 1983 (2). Rhesus monkeys have a similar DNA sequence to humans (3). Human infection with *N. macacae* is extremely rare, and indeed, only two cases of *N. macacae* infection have been previously reported. The first case was *N. macacae* bacteremia in a five-month-old boy who had had contact with a zoo guide. The infant was treated with ceftriaxone and recovered (4). The second case was infectious endocarditis in a 65-year-old man. Antibiotics with ceftriaxone and gentamicin were not effective, and the patient ultimately died (5). In our case, *N. macacae* was identified from a peritoneal fluid culture, and the route of infection was suspected to be wet contamination. Although the patient had a cat, it was not clear if the cat was a carrier of the bacteria. *N. macacae* has also been isolated as commensal bacteria from the mouth and respiratory tract of humans (6). Indeed, in the previous case of infectious endocarditis, the patient had no history of contact with animals.

Previous research has suggested that *N. macacae* is phylogenetically similar to *N. mucosa*, a commensal bacterium of humans (7). We found four case reports describing PD peritonitis caused by *N. mucosa* (8-11). Three cases were treated with ceftriaxone, and all four cases showed a good clinical course. In the present case, empirical therapy followed by ceftriaxone was not effective. This suggests that the appearance of *N. macacae* infection to human might differ from that of *N. mucosa*. Indeed, *N. macacae* encodes orthologs of virulence factors of *N. meningitidis* and *N. gonorrhoeae* (3). In addition, *Neisseria* species have the ability to take up DNA and perform horizontal gene transfer (12). This allows the bacteria to acquire antimicrobial resistance; susceptibility to antibiotics can therefore change even in the same strain (13, 14). In our case, despite the fact that the bacteria cultured from the peritoneal fluid showed susceptibility to both piperacillin/tazobactam and ceftriaxone, refractory PD

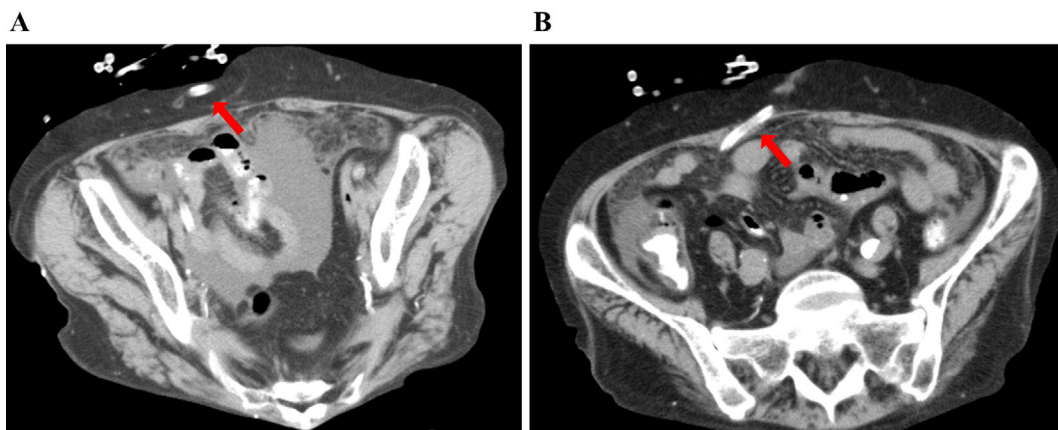


Figure 2. Images of computed tomography on admission. There were no signs of infection or inflammation at the catheter exit site (A) or insertion site (B). Arrows indicate the PD catheter.

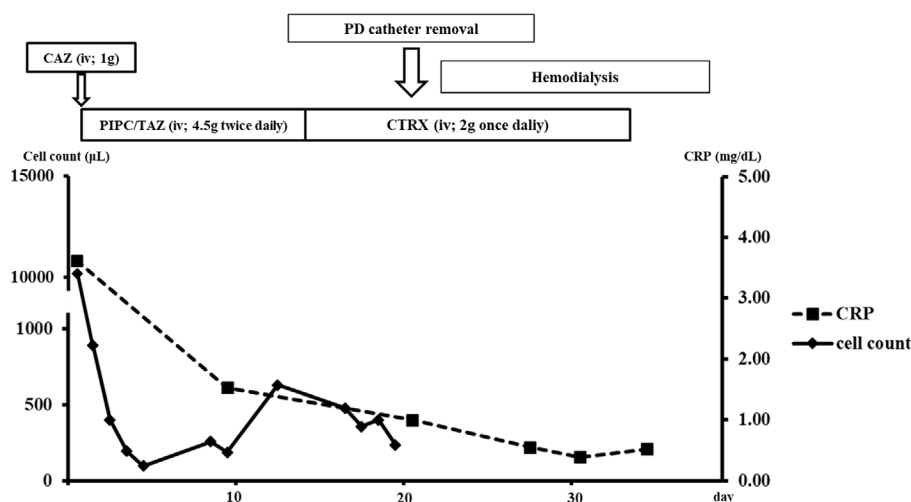


Figure 3. Clinical course of the patient. The cell count of the peritoneal fluid increased despite appropriate antibiotics administration, which led to the removal of the PD catheter 20 days after the administration. PD: peritoneal dialysis, CRP: C-reactive protein

peritonitis occurred, eventually leading to the removal of the PD catheter. Empirical therapy by combining a first-generation cephalosporin for Gram-positive bacteria and a third-generation cephalosporin for Gram-negative bacteria is recommended as the first strategy for treating PD peritonitis (15). In our case, because of the difficulty in continuing ceftazidime, the patient was initially treated with piperacillin/tazobactam, which covers both Gram-positive and Gram-negative organisms. We changed piperacillin/tazobactam to ceftriaxone during the course based on the MIC and the widely accepted recognition that ceftriaxone is effective against *Neisseria* species. In addition, a previous case report of *N. macacae* and three of the four cases of *N. mucosa* peritonitis were treated with ceftriaxone, and most showed a good clinical course (4, 5, 8-11).

The formation of biofilms is recognized as a factor influencing resistance to antibacterial drugs. However, we detected no formation of biofilms on the catheter. Although microbial substitution might have occurred during the course, repeated peritoneal fluid culture was negative for bacteria and fungi. Considering our present case and the previous case with endocarditis, it should be kept in mind that *N. macacae* can be virulent in humans.

The limitation of this report was that the antibiotics were given via intravenous injection instead of intraperitoneal administration. Since the intraperitoneal concentration of antibiotics is generally higher with intraperitoneal administration than intravenous injection, this approach seems most suitable for the treatment of PD peritonitis. We treated our patient with intravenous antibiotics in order to avoid possible contamination of the peritoneal dialysate, but this may have affected the course of the patient's recovery.

In conclusion, we reported a case of refractory PD peritonitis caused by *N. macacae*. It should be kept in mind that *N. macacae*, a commensal *Neisseria* species, can be pathogenic in humans.

The authors state that they have no Conflict of Interest (COI).

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