Review Article

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The successful treatment of *Brevundimonas diminuta* using ceftriaxone, in a patient on continuous ambulatory peritoneal dialysis: A case report and literature review

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ABSTRACT

Brevundimonas diminuta (B. *diminuta)* is found in the healthcare environment and in the community. At present, there are few reports of infections caused by this microorganism, especially in patients undergoing continuous ambulatory peritoneal dialysis (CAPD). A 44-year-old woman undergoing CAPD was diagnosed with a *B. diminuta* infection. Ceftriaxone was given both intravenously and intraperitoneally. After treatment with ceftriaxone, the peritoneal dialysis fluid white cell count, neutrophil count, and symptoms improved. To the best of our knowledge, this is the first case report of a *B. diminuta* infection in a patient had undergoing CAPD in Thailand.

Keywords: *Brevundimonas diminuta,* ceftriaxone, continuous ambulatory peritoneal dialysis, peritoneal dialysis

INTRODUCTION

Brevundimonas diminuta (B. *diminuta)* is a Gram-negative rod under the genus of *Brevundimonas*. *B. diminuta* is a non-lactose-fermenting, non-spore forming, and slow-growing aerobic bacteria. It can be found in the community and healthcare environment with low virulence.[1] At present, there are few reports in the literature of human infections caused by this microorganism, especially in patients undergoing continuous ambulatory peritoneal dialysis (CAPD). We found only one case report in a CAPD who was patient infected with *B. diminuta* in Turkey.[2] It is necessary to find the most active antimicrobial regimens against *B. diminuta* infection in this subset of patients. Here, we report the first case of *B. diminuta* infection in a patient undergoing CAPD in Thailand.

REPORT OF A CASE

This is a 44-year-old woman with end-stage renal disease who has been undergoing CAPD, specifically, four exchanges per day for 1 year. For her past medical history, 10 h prior, she had ten instances of diarrhea and turbid peritoneal fluid. In the emergency room, she was febrile (38.6°C), which had abdominal pain, a blood pressure of 190/106 mmHg, a pulse of 102 beats/min, a respiratory rate of 20 breaths/min, and full score on the Glasgow Coma

Scale ($E_4V_5M_6$). Physical examination revealed obvious active bowel sounds and moderate generalized tenderness. Pertinent laboratory findings of the patient were as follows: White cell count of 14,200 cells/mm^3 (83% neutrophils), platelet count of 430,000 cells/mm^3, serum lactate of 0.9 mmol/L, total bilirubin of 0.7 mg/dl, serum creatinine of 6.35 mg/dl, and a white cell count of peritoneal dialysis fluid 3949 cells/mm^3 (93% neutrophils). Peritoneal fluid culture was obtained, and Intraperitoneal (IP) cefazolin 1 g and ceftazidime 1 g were administered in the last cycle of peritoneal dialysis dwelled for 8 h. On the 6th day of antibiotic treatment, the peritoneal fluid culture showed the growth *B. diminuta*. The antimicrobial susceptibility is shown in Table 1. A blood culture showed no growth. After the susceptibly result came back, she still had a fever (38.0°C) and abdominal pain. Ceftazidime and cefazolin were stopped and IP meropenem 1 g was administered in the last cycle of peritoneal dialysis dwelled for 8 h. After changing antibiotics, the patient's symptoms improved, peritoneal fluid became clear, and the peritoneal dialysis fluid white cell and neutrophil counts were decreased [Figure 1]. The antibiotic was de-escalated to intravenous (IV) ceftriaxone 2 g/day at day 10 of treatment. The patient was administered ceftriaxone 1 g intraperitoneally on the 3rd day of IV ceftriaxone treatment. The patient's symptoms, peritoneal dialysis fluid white cell, and neutrophil counts were improved. Including the IP meropenem, the total duration of antibiotic therapy was 21 days.

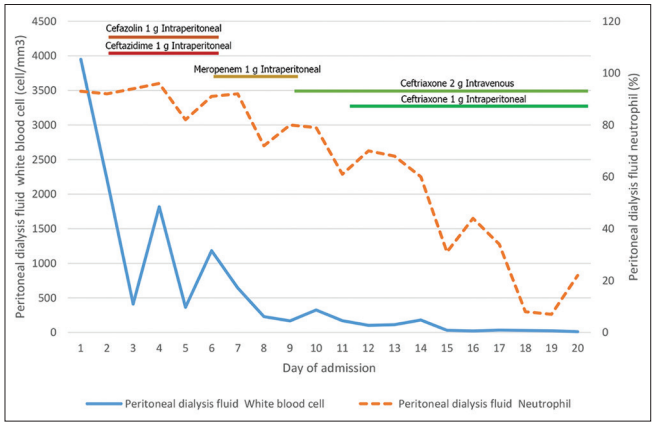

Figure 1: Peritoneal dialysis fluid white blood cell and peritoneal dialysis fluid neutrophil (%)

Table 1: The antimicrobial susceptibility of *Brevundimonas diminuta* in the reported case

Antibiotic	Susceptibility test[a]
Amikacin	Susceptible
Ceftazidime	Intermediate
Ceftriaxone	Susceptible
Ciprofloxacin	Resistant
Imipenem	Susceptible
Meropenem	Susceptible
Piperacillin/Tazobactam	Susceptible

[a]Disk diffusion method was used for antimicrobial susceptibility testing and interpreted accordance with the Clinical and Laboratory Standards Institute 30th Edition[3]

DISCUSSION

B. diminuta is not a common pathogen in CAPD-related infections.[4] This Gram-negative pathogen has been isolated from clinical specimens, including blood, urine, and sputum. Bacteremia is the primary source of infection, especially in an immunocompromised host.[1] There was only one case report in a 39-year-old woman undergoing CAPD who was infected with *B. diminuta*. She received successful treatment with IV cefoperazone-sulbactam and IP amikacin.[2] Our case report demonstrated successful treatment using IV ceftriaxone and IP ceftriaxone for the treatment of a *B. diminuta* infection in patients undergoing CAPD. The antimicrobial susceptibility of *B. diminuta* in our study was different from the previous case report. The *B. diminuta* isolate from our study was more susceptible to most antimicrobial agents than the previous case report in Turkey.[2] The *B. diminuta* isolate in our study was resistant to ciprofloxacin which was the same as the previous study in the USA.[5] The proposed mechanisms of resistance to ciprofloxacin are intrinsic resistance and the mutation of DNA gyrase and topoisomerase genes.[5] The *B. diminuta* isolate in our study was intermediate to ceftazidime. However, we found partial clinical improvement in this patient by decreasing the peritoneal dialysis fluid white cell. This case was de-escalated meropenem to ceftriaxone to avoid carbapenems overuse. Based on Clinical and Laboratory Standards Institute 30th edition, the minimal inhibitory concentration (MIC) breakpoint of non-Enterobacterales susceptible to ceftriaxone was not more than 8 mcg/ml.[3] Regarding the pharmacokinetics of ceftriaxone during peritoneal dialysis, after IP ceftriaxone 2 g with 5 h dwelling time, in six adults patients who did not have peritonitis at the time of study, the duration of ceftriaxone concentration above 8 mcg/mL was about 12 h, resulting as a maintained time above MIC of 50%.[6] The recommended percentage of time above MIC for cephalosporins is 50–70%.[7] We infer that ceftriaxone 1 g administered IP once daily cannot reach a 50–70% time above MIC. Our patient was given IV ceftriaxone 2 g once daily, in addition to IP ceftriaxone 1 g with an 8 h dwelling time. The ceftriaxone's concentration could be maintaining a 50–70% time above MIC for this dosing interval. After administering IP ceftriaxone, the drug concentration distributes to plasma and is excreted from the body. At the end of the 8 h dialysis session, the dialysate was drained. This affected the concentration of ceftriaxone in the peritoneal fluid. After administering IV ceftriaxone, the plasma drug concentration was distributed to the peritoneal cavity. Due to this, the concentration of ceftriaxone in peritoneal fluid was able to reach 50–70% time above MIC.[6,8] The limitation of this case was the measurement of ceftriaxone level cannot be done. By having this sufficient time above MIC for *B. diminuta* infection, this could be the reason explaining the improvement of our patient's symptoms.[7] Nevertheless, the treatment with only IV ceftriaxone 2 g was not able to reach desired time above the MIC for *B. diminuta* CAPD infection. Due to the mean estimated, IV ceftriaxone excreted into the peritoneal cavity was 4.5%.[9] The previous study regimen suggested IP ceftriaxone 200 mg administered in each exchange to maintain a ceftriaxone concentration in dialysate above 8 mcg/mL for 100% of the time.[6] However, in a clinical situation, we recommended administering IP ceftriaxone 250 mg in each exchange for dosing convenience.

CONCLUSIONS

Minimal treatment data are available for *B*. *diminuta* infection in patients undergoing CAPD. Our case report suggested treatment using a combination of IP ceftriaxone and IV ceftriaxone in this group of patients to improve outcomes. We also suggested increasing the dose of IP ceftriaxone in *B*. *diminuta* infected patients undergoing CAPD.

Ethical Consideration

Informed consent for the present publication has been given by the spouse of the patient.

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