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CASE REPORT

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Successful treatment of *Serratia Marcescens* peritonitis in a patient receiving peritoneal dialysis

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Abstract

An old man receiving peritoneal dialysis was diagnosed with *Serratia marcescens* peritonitis, a rare case with poor prognosis. Powerful antibiotics based on culture results and enough duration cured the case successfully despite its high virulence.

KEYWORDS

peritoneal dialysis, peritonitis, *serratia marcescens*

1 | INTRODUCTION

Peritoneal dialysis (PD) is an important option for kidney replacement therapy in patients with kidney failure,[1] providing better quality of life and lower mortality in the first years than hemodialysis treatment.[2] PD-associated peritonitis is still a major cause of technique failure and death among PD patients,[3] in which some highly virulent bacteria, such as *Serratia marcescens,* may lead to catheter removal and dialysis modality change or even death.[4-9] *Serratia marcescens* is a rare agent causing peritonitis, and few cases of *Serratia marcescens* peritonitis in previous reports were successfully cured without removing the peritoneal catheter.[10-13] Here, we presented a case of *Serratia marcescens* peritonitis that was successfully treated using multiple antibiotics successively based on the results of PD effluent culture. After treatment with meropenem for 10 days, the patient showed considerable clinical improvement, reported relief from abdominal pain, and peritoneal dialysis effluent analysis showed a decreased leukocyte count to normal. The case of *Serratia marcescens* peritonitis suggests that antibiotics should be chosen carefully, and powerful antibiotics, such as meropenem, may be first considered to improve its prognosis.

2 | CASE REPORT

A 79-year-old male with kidney failure due to chronic glomerulonephritis had been undergoing PD for 19 months. This patient had no previous episodes of peritonitis. He presented at our hospital with abdominal pain and a cloudy peritoneal dialysate for 3 days. The PD effluent contained 7170 leukocytes/mm^3 with 87% neutrophils (Figure 1), and intraperitoneal cefathiamidine (1.0 g/d) and ceftazidime (1.0 g/d) were administered empirically. On day 3, peritoneal fluid cultures revealed *Serratia marcescens*, which was sensitive to amikacin, cefoperazone sodium and sulbactam sodium, levofloxacin, cefepime, aztreonam, and

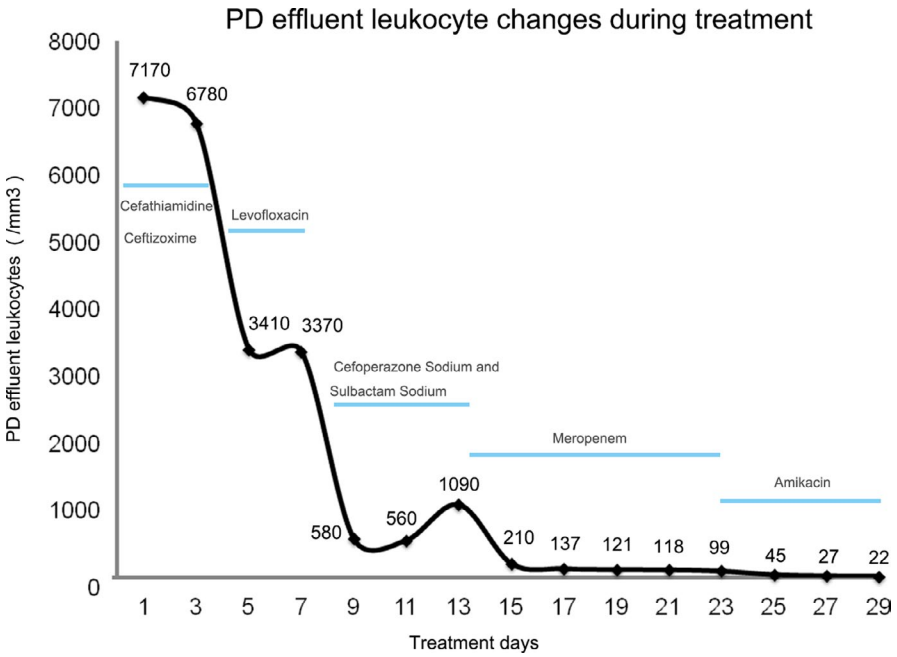

FIGURE 1 Changes of the leukocyte counts in the peritoneal dialysis effluents at different stages of treatment. The initial empirical antibiotic treatment with intraperitoneal cefathiamidine and ceftizoxime was changed to levofloxacin and cefoperazone sodium and sulbactam sodium, based on the results of the peritoneal fluid culture, but there was no improvement in the leukocyte count. Then, intraperitoneal meropenem was administered with satisfactory results, followed by intraperitoneal amikacin treatment for final eradication of the pathogen

TABLE 1 Summary of Reported Cases of *Serratia marcescens* Peritonitis in Patients on Peritoneal Dialysis, 1965-2020

Authors, year	Pts (n)	Antibiotic regimen	Duration	Outcome
McCracken AW, 1965[4]	3	Polymyxin E	NA	Two died, one was transferred to HD
Hortling L, 1984[10]	1	Azthreonam	NA	Success
Connacher AA, 1988[5]	1	IP gentamycin and cefuroxime or piperacillin, and co-trimoxazole (4 episodes)	4 mo	Transferred to HD
Bizette GA, 1995[17]	1	NA	NA	NA
Grabe DW, 1997[11]	1	IP gentamycin and ceftizoxime	14 d	Success
Krishnan M, 2002[6]	7	NA	NA	One was cured
Chen YW, 2007[7]	1	IP ceftazidime and cefazoline, followed by IV cefotaxime, finally IV imipenem	41 d	Transferred to HD
Kang JH, 2013[8]	1	IP cefazoline and ceftazidime, followed by IP gentamycin and ceftazidime, and finally oral ciprofloxacin	20 d	Transferred to HD
Bhave P , 2016[12]	1	IP cephazolin and gentamycin, followed by IP meropenem	21 d	Success
Sarihan I, 2017[13]	1	IP cefazoline, secondly IP gentamycin, followed by oral ciprofloxacin	21 d	Success
Ilhan Kilic, 2018[9]	1	IV cefazoline and ceftazidime, secondly piperacillintazobactam	35 d	Transferred to HD
Current case	1	IP cefazolin and ceftazidime, followed by levofloxacin, then cefoperazone sodium and sulbactam sodium, meropenem, and finally amikacin	29 d	Success

Note: Success: Continued PD without catheter removal.

Abbreviations: HD, hemodialysis; IP, intraperitoneal; IV, intravenous; NA, not available; Pts, patients.

meropenem. The antibiotics were changed to intraperitoneal levofloxacin (0.3 g/d), and the PD effluent analysis showed a significant decrease in the leukocyte count to 3410/mm^3, but the leukocyte count did not reduce further after 4 days of levofloxacin treatment. Then, cefoperazone sodium and sulbactam sodium (1.5 g/d) were applied intraperitoneally, and the effluent leukocyte count declined to 560-580/mm^3. Although 2-week therapy was performed,

the patient still had abdominal pain and cloudy effluent fluid. However, another PD effluent analysis showed that the leukocyte count increased to 1090/mm^3 with 84% neutrophils (Figure 1). Thereafter, the antibiotic treatment was changed to intraperitoneal meropenem (1.0 g/d), as *Serratia marcescens* was also sensitive to this drug. After treatment with meropenem for 10 days, the patient showed considerable clinical improvement, reported relief from abdominal pain, and PD effluent analysis showed a decreased leukocyte count of 99/mm^3 with 22% neutrophils (Figure 1). Finally, the patient was discharged with a final treatment of intraperitoneal amikacin (0.2 g/d) for 6 days, and he remains well up to his last follow-up.

3 | DISCUSSION

Although the peritonitis rate has decreased all over the world currently, it still remains by far an important complication requiring patients to transfer to hemodialysis and has a major impact on patient survival. *Serratia marcescens* peritonitis is most commonly refractory to antibiotics, and has worse clinical outcomes, including catheter loss, technical failure, and death. *Serratia marcescens* is a gram-negative conditional pathogen that is commonly found in the urinary, gastrointestinal, and respiratory tracts.[14] It is notoriously difficult to treat because of an intrinsic antimicrobial resistance profile and is associated with worse outcomes than other gram-negative organisms.[12] Cases of peritonitis caused by *Serratia marcescens* are especially rare and are associated with a poor prognosis, as only a few successfully treated cases of *Serratia marcescens* peritonitis have ever been reported. In previous case reports of *Serratia marcescens* peritonitis, only five patients were successfully treated without removal of the PD catheter (Table 1). Therefore, *Serratia marcescens* peritonitis is believed to have the worst outcome of all gram-negative infections.[13,15,16] Diabetes, complications, poor hygiene, and intrauterine devices may contribute to the low-resolution result rate among these unsuccessful episodes.[7,8,13] Therefore, prevention of *Serratia marcescens* peritonitis may be of great importance because of its bad prognosis during peritonea dialysis treatment. In addition, it should be well recognized that prolonged attempts to treat *Serratia marcescens* peritonitis and to "save the catheter" must be avoided to prevent poor patient outcomes. Catheter removal should also be considered to prevent morbidity and mortality from *Serratia marcescens* peritonitis, and it may protect the peritoneal membrane for future use.

In the current case, even though antibiotic treatments were amended four times (Figure 1) based on the effluent culture results, the *Serratia marcescens* peritonitis was successfully treated. There may be two reasons for the successful treatment. First, the patient had no history of previous steroid or immunosuppressant therapy, and non-diabetes disease. Second, meropenem, which was used to treat the current case of *Serratia marcescens* peritonitis, had never been administered before in the current case, which may have led to a favorable outcome. Bhave et al administered meropenem intraperitoneally immediately after *Serratia marcescens* was isolated in culture, and they successfully treated their patient without removing the catheter.[12] However, in the beginning, we chose other sensitive antibiotics (levofloxacin, cefoperazone sodium, and sulbactam sodium, despite being sensitive in vitro) without satisfactory results, and next we tried to use intraperitoneal meropenem for 10 days with clinical and laboratory improvement. *Serratia marcescens* has been reported to have the ability to produce amp-C beta-lactamases, which inactivates cephalosporins and often complicates the therapy.[13] In our experience, cefoperazone sodium and sulbactam sodium did not fully eradicate the pathogen although the *Serratia marcescens* strain in our case was sensitive to the drug in vitro. The above two cases suggest that antibiotics should be chosen carefully, and powerful and effective antibiotics, such as meropenem, might be first considered because of its high virulence once the cultures of *Serratia marcescens* grow up. Although meropenem is a microbiologically inappropriate choice as a first-line agent, it still represents an attractive proposition for multidrug-resistant Gram-negative PD peritonitis, especially for cases caused by *Serratia marcescens* if it is sensitive to meropenem according *to* peritoneal fluid culture results.

4 | CONCLUSION

Since *Serratia marcescens* peritonitis delivers a poor prognosis, clinicians should step up their vigilance on it, and powerful antibiotics, such as meropenem, might be effective to counteract culture verified *Serratia marcescens* peritonitis in the early stage as to avoid catheter removal in PD patients.

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CONFLICT OF INTEREST

No conflict of interest to declare.

AUTHOR CONTRIBUTIONS

NY: collected the data and drafted the manuscript. LL: followed up the patient and involved in the idea of the manuscript and revised the manuscript.

ETHICAL APPROVAL

Written informed consent for publication of the case was obtained from the patient prior to the writing of this case report.

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