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Serratia marcescens as a cause of peritonitis in peritoneal dialysis: a clinical case and therapeutic approach.

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Abstract

Introduction: Peritoneal dialysis (PD) is increasingly used as a replacement method in end-stage chronic renal disease (ESRD), mainly due to its autonomy and quality of life benefits. However, peritonitis in PD, particularly *Serratia marcescens* peritonitis, can be a serious complication requiring catheter removal.

Clinical case: We present the case of a 17-year-old adolescent who presented three episodes of peritonitis in PD characterized by dialysate fluid turbidity, abdominal pain, and vomiting without diarrhea in less than six months.

Diagnostic workshop: The peritoneal fluid had a leukocyte count between 4,370 and 16,000 u/ul in each admission. The culture of the peritoneal fluid reported Serratia Marcescens in all three episodes.

Treatment: For three weeks, empirical antibiotic treatment was with intraperitoneal ceftazidime (1 g/day, adjusted for antibiogram). After the last episode, the PD catheter was removed, and a second catheter was placed on the contralateral side.

Outcome: Four days after catheter insertion, DPA was gradually restarted at low volume. After one year, the patient was free of peritonitis.

Conclusions: *Serratia marcescens* is a gram-negative bacterium primarily responsible for recurrent peritonitis with a poor prognosis. Peritonitis caused by *Serratia marcescens*, like other Enterobacteriaceae, requires vigilant antibiotic management. Treatment tailored to the recommendations, despite in vitro sensitivity to third-generation cephalosporins, may improve the survival of the technique while preserving the catheter.

Keywords :

Catheter Removal, Peritonitis, Peritoneal Dialysis, *Serratia marcescens*.

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Peritoneal dialysis (PD) peritonitis remains the most common serious complication of end-stage renal disease (ESRD). The variety of pathogens and the emergence of antibiotic-resistant bacteria pose challenges for treatment options to protect the peritoneum from the risk of anatomical changes. Aside from antibiotic-resistant peritonitis, repeated episodes of peritonitis require the removal of the PD catheter. Additionally, certain gram-negative bacteria, such as *Serratia marcescens*, typically indicate that catheter removal should occur after the first episode; attempts to salvage the catheter can potentially lead to serious complications, ranging from sepsis to septic shock, as noted in several studies, including those on *Serratia marcescens* peritonitis [1]. This Enterobacteriaceae is an opportunistic gram-negative bacterium commonly found in the urinary, gastrointestinal, and respiratory tracts and spreads through direct contact. Risk factors include prolonged hospitalization, intravenous catheterization, intraperitoneal catheterization, urinary tract catheterization, and airway instrumentation. *Serratia marcescens* is challenging to treat because of its ability to produce beta-lactamases, which confer high intrinsic resistance to a broad spectrum of antibiotics, including cefazolin, ampicillin, and tetracycline. The documentation of *Serratia marcescens* peritonitis is rare in the literature, and the outcomes are generally unfavorable. We report a case of recurrent peritonitis caused by *Serratia marcescens* in a 17-year-old female who required removal of the PD catheter.

Clinical case

Medical records

This is a 17-year-old female with end-stage chronic kidney disease secondary to reflux nephropathy who has been receiving automated peritoneal dialysis (APD) since she was 11 years old. The patient is independent, has a Charlson score of 2, is well supervised, and maintains an adequate metabolic balance (nCRP > 0.8 g/kg/day), demonstrating appropriate fluid clearance and balance for peritoneal dialysis (weekly Kt/V> 2.5 and CHC > 55 ml/min).

Diagnostic workshop

Six years after PD catheter placement, the patient developed *Serratia marcescens* peritonitis, characterized by turbidity in the dialysate effluent, without any digestive disturbances or abdominal pain. The leukocyte count in the dialysate was 6,300 cells/mm³, with a predominance of neutrophils.

Treatment

Initially, the institutional protocol was implemented using intraperitoneal cefazolin (1 g), ceftazidime (1 g), and gentamicin (7 mg/kg). This treatment was subsequently adjusted based on the antibiogram, with ceftazidime alone continued for three weeks. As a result, there was favorable clinical evolution and elimination of effluent turbidity after five days of antibiotic treatment.

Two months later, the patient was readmitted due to a recurrence of peritonitis caused by the same microorganism, *Serratia marcescens. The patient* presented with cloudy dialysate effluent, vomiting, and abdominal pain. The dialysate leukocyte count was 16,000 u/mm³, with a predominance of neutrophils. The outcome was remarkably favorable, demonstrating significant clinical improvement and clearance of the effluent after five days of antibiotic treatment.

Four months after her second episode of peritonitis, the patient reported abdominal pain, vomiting without diarrhea, and turbidity of the peritoneal dialysate for three days. Clinically, she remained stable, demonstrating a biological inflammatory syndrome (Table 1).

Table 1. Laboratory studies.

Parameters	Values	Reference range
Leukocytes (u/mm ³)	16,100	4,000-10,000
Neutrophils (u/mm ³)	14,800	1,500-7,500
C-reactive protein (mg/l)	118	<6
Ferritin (ng/ml)	311	5-204
Cytobacteriological examination of dialysate fluid		
Leukocytes (u/mm ³)	4,320	<100
Polymorphonuclear neutrophils	90%	
Lymphocytes (%)	10%	
Direct examination	gram-negative bacteria	
Crop	*Serratia Marcescens*	

Cytobacteriological examination of the dialysate revealed the presence of *Serratia marcescens*, accompanied by a leukocyte count of 4370 leukocytes/mm³, 90% of which were neutrophils. Aerobic and anaerobic cultures confirmed the presence of the same microorganism.

After receiving empirical antibiotic treatment, only intraperitoneal ceftazidime (1 g/day, adjusted according to the antibiogram) was administered for three weeks.

Evolution

The clinical course featured a reduction in abdominal pain and vomiting after two days, along with clearance of the dialysis fluid following five days of antibiotic treatment.

Due to recurrent episodes and the presence of a severe atypical pathogen, the PD catheter was removed. Despite good initial responses to antibiotic therapy based on the antibiogram, a new catheter was placed on the contralateral side, and ceftazidime was continued for an additional two weeks.

Four days after catheter insertion, low-volume APD was gradually restarted. After one year, the patient was free of peritonitis.

Discussion

This case of recurrent peritonitis caused by *Serratia marcescens* in a 17-year-old patient highlights the challenges of managing this pathogen. *Serratia marcescens* is an opportunistic gram-negative bacterium commonly found in healthcare settings. It poses significant risks due to its inherent antibiotic resistance and tendency to form biofilms on medical devices, including PD catheters. Despite its relatively low

incidence, *Serratia marcescens* peritonitis can lead to serious complications, such as sepsis and the spread of infection to other body parts or organs [2, 3].

Serratia marcescens causes peritonitis within a relatively short period. This finding aligns with existing literature documenting the potential for recurrent infections with this pathogen in patients with ESRD [4, 5].

The patient's clinical course was complicated by the necessity of catheter removal due to repeated episodes of peritonitis caused by the same organism, despite an initial satisfactory response to antibiotic therapy tailored to the antibiogram. This decision was made based on the recommendations of prior studies that emphasize the importance of catheter removal in cases of repeated or refractory peritonitis, particularly when caused by multidrug-resistant microorganisms such as *Serratia marcescens* [6, 7].

Several studies have reported varying outcomes and treatments (Table 2) when comparing the current results with the literature. While some cases are effectively managed with antibiotic therapy alone, others necessitate catheter removal or a switch to hemodialysis due to persistent infections or complications, such as osteomyelitis [8].

The variability in outcomes emphasizes the necessity for personalized care and treatment strategies that consider antibiotic susceptibility, patient comorbidities, and catheter status.

Furthermore, the rise in treatments for multidrug-resistant strains of Serratia marcescens raises concern, as it limits treatment options and could potentially jeopardize patient outcomes and access to dialysis. [9]. This highlights the importance of careful management and antibiotic and infection control measures to prevent and manage Serratia marcescens infections in patients with ERCT. [10].

Table 2. *Serratia Marcescens* case report in Peritoneal Dialysis (1965-2024).

Author, year	Patients (n)	Antibiotic régimen	Duration	Result
McCracken A, 1965 [9]	3	Polymyxin E	NA	2 died, 1 transferred to HD.
Hortling L, 1984 [7]	1	Aztreonam.	NA	Success, no catheter removal.
Connacher A, 1988 [11]	1	IP: gentamicin+cefuroxime or piperacillin, and cotrimoxazole (4 episodes)	120 days	Transferred to HD.
Bizette G, 1995 [8]	1	NA.	NA	Complicated with osteomyelitis.
Grabe D, 1997 [12]	1	Gentamicin + Ceftizoxime	14 days	Success, no catheter removal.
Krishnan M, 2002 [13]	7	NA.	NA	A cured patient.
Zhao W, 2007 [5]	1	IP: ceftazidime + cefazolin , followed by IV: cefotaxime , finally Imipenem IV.	41 days	Transferred to HD.
Kang J, 2013 [14]	1	IP: cefazolin + ceftazidime, followed by Gentamicin and Ceftazidime IP, finally Ciprofloxacin PO.	20 days	Transferred to HD.
Bhave P, 2016 [15]	1	IP: cefazolin + gentamicin, followed by Meropenem IP.	21 days	Success, no catheter removal.
Sarihan I, 2017 [16]	1	IP: cefazolin , secondarily, Gentamicin IP, followed by Ciprofloxacin PO.	21 days	Success, no catheter removal.
Ilhan K, 2018 [4]	1	IV: cefazolin + ceftazidime, secondarily piperacillin tazobactam.	35 days	Transferred to HD.
NingY , 2020 [17]	1	IP: cefazolin + ceftazidime , followed by levofloxacin. Then, cefoperazone and sulbactam sodium , meropenem, and finally amikacin.	29 days	Success, no catheter removal.

HD: Hemodialysis, IP: Intraperitoneal, IV: Intravenous, PO: Oral . NA: Not available.

Serratia marcescens is a group 3 Enterobacteriaceae, and according to CA-SFM 2023 [10], this group is sensitive to third-generation cephalosporins in vitro. Monotherapy carries the risk of selecting resistant mutants, and combining it with an aminoglycoside could lead to therapeutic failure due to mutant selection. It should be paired with fluoroquinolones to avoid selecting mutants resistant to third-generation cephalosporins. In contrast, the selection risk is either absent or significantly reduced with fourth-generation cephalosporins (cefepime, cefpirome), which are not hydrolyzed by cephalosporinases, regardless of their production level.

In short, our case highlights the challenges we have faced in the recurrent management of *Serratia marcescens* peritonitis, despite in vitro susceptibility to third-generation cephalosporins. The CA-SFM 2023 recommendations encourage the implementation of new therapies for Enterobacteriaceae, which could reduce the recurrence of this peritonitis and prolong the technique's effectiveness future.

Conclusions

Serratia marcescens is a gram-negative bacterium primarily responsible for recurrent peritonitis and has a poor prognosis. Like other Enterobacteriaceae, Serratia marcescens can lead to peritonitis and requires careful antibiotic management. Although it shows in vitro susceptibility to third-generation cephalosporins, treatment aligned with recommendations may enhance technique survival while maintaining the integrity of the catheter.

Abbreviations

DP: Peritoneal dialysis.
ESRD: End-stage chronic kidney disease.
HD: hemodialysis.
IP: Intraperitoneal.
IV: Intravenous.
NA: Not available.

Additional information

No supplementary materials have been declared.

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Authors' contributions
Nabil Hmaiduch: Conceptualization, methodology, research, writing – original draft.
Quds Yacoubi: Conceptualization, methodology, research.
Naima Ouzeddoun: Conceptualization, methodology, research.
Loubna Benamar: Conceptualization, Project management, Supervision, validation, visualization, Writing – review and editing.
All the authors read and approved the final version of the manuscript.

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The authors have written permission from the patient for publication.

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The authors declare that they have no conflicts of interest.

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Not declared.

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