Peritonitis Caused by *Roseomonas* in a Patient Undergoing Automated Peritoneal Dialysis: Case Report and Literature Review

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**Abstract**

A 48-year-old man was admitted with cloudy dialysate and diagnosed as peritoneal dialysis (PD)-related peritonitis caused by *Roseomonas* infection. This is the third case of PD-related peritonitis due to *Roseomonas* species and also the first case of peritonitis in automated peritoneal dialysis. Despite its low virulence and rare incidence in peritoneal dialysis, clinicians should be alert to the possibility of *Roseomonas* infection due to its high resistance to antibiotics. Literature on *Roseomonas* infection is also reviewed. The current guidelines for empirical peritonitis in PD patients do not adequately cover such infection. Refractory treatment in high risk cases should alert clinicians to upgrade antibiotics even for a vague manifestation.

**Key words:** *Roseomonas*, peritonitis, peritoneal dialysis

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**Introduction**

Peritoneal dialysis (PD) is the primary treatment for patients with end-stage renal disease (ESRD) with residual renal function. However, PD-related peritonitis is the most common cause of withdrawal from PD. *Roseomonas* is a rare infectious pathogen in all populations. To our best knowledge, there have been only 2 patients with PD-related peritonitis due to *Roseomonas* reported in the literature (1, 2). Herein, we report the 3rd case of PD-peritonitis caused by *Roseomonas* and present a review of the literature.

**Case Report**

A 48-year-old man suffering from IgA nephropathy-related end-stage renal disease (ESRD) received automated peritoneal dialysis (APD) for one year, Automated PD set with Cassette, with Luer lock connector. The dose of APD was 1.5%*5L*1 bag and 2.5%*5L*1 bag. Unfortunately, during a routine visit in this outpatient department (OPD) for PD, cloudy dialysate was noted by nurses. The white blood cell (WBC) count of dialysate was 1,468/cumm and the neutrophil percentage was 87%. After tracing his history, one week previously, cloudy dialysate had occurred but he did not pay particular attention to it. He also denied any abdominal pain, poor appetite or fever during that week. He did not have diarrhea and the exit site was clean without discharge. PD-related peritonitis was highly suspected and after collecting dialysate culture, empirical antibiotics, intraperitoneal (IP) Cefazolin 250 mg quater in die (qid) and Cefazidime 250 mg qid, were administered. Other laboratory data were as follows: serum albumin, 3.1 g/dL; WBC, 8,300 cells/cu mm; and C-reactive protein (CRP), 2 mg/dL. The patient was hospitalized and empirical antibiotics were administered for three days. An additional 4 days of antibiotics were prescribed when culture studies were negative and WBC count in dialysate had improved (from 1,468 cells/cu mm to 430 cells/cu mm). Seven days later in the OPD, we shifted the antibiotic to Ciprofloxacin 250 mg per os (po) per 12 hours according to the sensitivity test of dialysate culture. The culture study showed that the bacterium was *Roseomonas* species, which was resistant to Ampicillin/

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Sulbactam, Piperacillin/Tazobactam, and all cephalosporins, except for Cefepime. Eight days after usage of Ciprofloxacin at home, dialysate WBC count was 1,584 cells/cu mm but he still reported feeling well generally. However, ten days after Ciprofloxacin usage, his dialysate became turbid again and he was readmitted on the 21st day of peritonitis. We then changed Ciprofloxacin to IP Cefazolin 250 mg qid and Gentamicin 40 mg qid. Initially, the dialysate WBC count was up to 594 cells/cu mm but had reduced to 102/cumm at the end of treatment. The whole treatment course was probably due to the fewer times of connection in peritoneal dialysis (CAPD) and 1 case of APD. We speculate that the source of the infection in the present case was due to water contamination. The reasons for our postulation are as follows: First, the patient later reported washing his hands using turbid water from a faucet fed by a broken lead pipe just prior to changing the dialysate. We collected turbid water from the same faucet but the results of culture studies were negative. Second, after the first hospitalization, we used Ciprofloxacin per os but the condition of peritonitis progressed. Of course, this may have been due to poor reabsorption of the oral medication caused by the peritonitis. However, a more likely reason is that he used the turbid water again to wash his hands. Therefore, we strongly suspect that the source of *Roseomonas*, which led to peritonitis, was probably water contamination. This result is consistent with findings of the two previous case reports (1, 2).

The treatment of peritonitis caused by *Roseomonas* should focus on selection of the most effective antibiotic. Previous studies on antibiotic sensitivity tests have shown that *Roseomonas* is most sensitive to Amikacin and Imipenem (≥99% susceptibility), followed by Ciprofloxacin (90%), and Ticarcillin (83%) (3). In the present case, the results of antibiotic sensitivity tests were similar to those of previous reports. However, the guidelines of the International Society for Peritoneal Dialysis (ISPD) in 2010 suggest IP Cefazolin and Ceftazidine or Gentamicin empirically. Owing to residual renal function, we selected Cefazolin and Ceftazidine for the present case. However, this meant that the empirical treatment did not adequately cover *Roseomonas*. Fortunately, *Roseomonas* is not fastidious and will grow in most laboratory facilities within 3 days, but if the quantity of bacteria is small, it may take longer. In the present case, the culture took 7 days to develop. In this condition, progression of peritonitis may occur even with the use of empirical antibiotics Cefazolin and Ceftazidine. Therefore, if PD-related peritonitis is refractory to treatment the clinician should consider the possibility of *Roseomonas* infection, despite its rarity. All three cases were fully cured by aminoglycosides (Netilmicin in the two other cases and Gentamicin in the present case) (1, 2). The duration of treatment is unknown.

**Discussion**

*Roseomonas* is a pink-pigmented, gram-negative coccobacillus bacterium. Bacterial cells appear as plump coccoid rods or cocci, in pairs or short chains. *Roseomonas* infection is currently infrequent. To our best knowledge, only 61 cases have been reported in the literature (3-13). Of these, there are only two cases of PD peritonitis caused by *Roseomonas*. This is the 3rd case of *Roseomonas* infection in a PD case and it is the first case in an APD patient. Moreover, the two previous reports on PD-related cases of *Roseomonas* infection described the microbiological characteristics. The present study is the first to discuss the clinical manifestation and treatment of PD peritonitis caused by *Roseomonas*. This infection comes from environmental water sources (14), so patients on PD are at high risk due to daily contact with much water and the high concentration of glucose in dialysate. According to the review of Rabindranath et al. (15) on these two differential modalities on peritonitis, APD seems to be less risk for peritonitis. That result was similar to our finding in Table 1: 2 cases of continuous ambulatory peritoneal dialysis (CAPD) and 1 case of APD. We speculated this maybe due to the fewer times of connection in APD. However, the persistent contaminated water lead to *Roseomonas*-related peritonitis in the present patient even further rare incidence of APD-related peritonitis compared as PD peritonitis.

Possibly due to the low virulence of *Roseomonas* (16), in all three known cases of PD-related *Roseomonas* infection, abdominal pain was mild or absent and there was no fever (Table 1). All three patients suffered from turbid dialysate. In the present case, in addition to turbid dialysate, both the lower serum albumin (from 3.7 to 3.1 g/dL) and worse ultrafiltration (1,000 c.c. to 500 c.c. per day) suggested the possibility of peritonitis. Therefore, even when the presentation and clinical manifestation are vague, the clinician should still be alert to other signs of peritonitis which may indicate the possibility of *Roseomonas* infection.

What is the source of this rare infection? The pathogenesis of *Roseomonas* infections is currently poorly understood (14). Water contamination had been reported and the 2 previous reports of PD peritonitis cases both suggested that infection was water related (1, 2). We also suspect that the source of the infection in the present case was due to water contamination. The reasons for our postulation are as follows: First, the patient later reported washing his hands using turbid water from a faucet fed by a broken lead pipe just prior to changing the dialysate. We collected turbid water from the same faucet but the results of culture studies were negative. Second, after the first hospitalization, we used Ciprofloxacin per os but the condition of peritonitis progressed. Of course, this may have been due to poor reabsorption of the oral medication caused by the peritonitis. However, a more likely reason is that he used the turbid water again to wash his hands. Therefore, we strongly suspect that the source of *Roseomonas*, which led to peritonitis, was probably water contamination. This result is consistent with findings of the two previous case reports (1, 2).

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![Figure 1. Summary of the complete treatment course.](image-url)
Contaminated water. For the prevention of Roseomonas species with a "mucoid phenotype". The three reasons depicted above rendered the present patient highly susceptible to invasion by Roseomonas. Production of biofilm on foreign materials may play an important role in the virulence of invasive infections caused by Roseomonas. Third, according to Elshibly et al. in 2005 (6), the hands of a patient exposed to dirty water can lead to a high risk of contamination. Our patient’s insistence on washing his hands with dirty water exposed him to a high risk of infection. From dirty water. Our patient’s insistence on washing his hands with dirty water exposed him to a high risk of contamination. The present patient’s serum albumin level was only 3.4 g/dL before peritonitis was diagnosed which means he had a relatively poor nutritional status. Second, water contamination is likely the main source of Roseomonas infection, but this may need to be extended up to 4 weeks in complicated cases.

There are several possible risk factors of peritonitis in PD patients. First, Roseomonas infection appears to only occur in immunocompromised patients. Such as those with leukemia, malignancy, and sepsis (3). ESRD patients are well known to be immunocompromised. In summary, we suggest at least 2 weeks of adequate antibiotics coverage for Roseomonas infection, but this may need to be extended up to 4 weeks in complicated cases.

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

References


Table 1. Literature Review of All 3 Cases with PD Peritonitis due to Roseomonas

<table>
<thead>
<tr>
<th>Case</th>
<th>Abdominal pain</th>
<th>PD</th>
<th>Antibiotics</th>
<th>Outcome</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>62 y/o, F*, 1997</td>
<td>Vague</td>
<td>no</td>
<td>CAPD*</td>
<td>IP 2g vancomycin qid 2 weeks</td>
<td>Recovery</td>
</tr>
<tr>
<td>65 y/o, F, 2000 (3)</td>
<td>Mild</td>
<td>no</td>
<td>PD</td>
<td>IP 2g vancomycin qid 4 days</td>
<td>Recovery</td>
</tr>
<tr>
<td>48 y/o, No, 2011</td>
<td>No</td>
<td>no</td>
<td>APD*</td>
<td>IP Ceftazolin 250mg qid</td>
<td>Recovery</td>
</tr>
</tbody>
</table>

*F=female, M=male, CAPD=continuous ambulatory peritoneal dialysis, IP=intrapерitoneal
d automated peritoneal dialysis
Qid=quater die (4 times a day), qd=queaque die (every day)

Treatment lasted 14 days in the first case in 1997 and for an unknown duration in the second case in 2000. In the present case, the whole course of adequate coverage by antibiotics (Ciprofloxacin and Gentamicin) was 40 days. However, in the Ciprofloxacin phase, he still used contaminated water for hand-washing. As a result, Gentamicin provided around 27 days of adequate coverage. In summary, we suggest at least 2 weeks of adequate antibiotics coverage for Roseomonas infection, but this may need to be extended up to 4 weeks in complicated cases.

There are several possible risk factors of peritonitis caused by Roseomonas in PD patients. First, Roseomonas infection appears to only occur in immunocompromised patients, such as those with leukemia, malignancy, and sepsis (3). ESRD patients are well known to be immunocompromised and the present patient’s serum albumin level was only 3.4 g/dL before peritonitis was diagnosed which means he had a relatively poor nutritional status. Second, water contamination is likely the main source of Roseomonas infection. Perhaps the most important factor for the prevention of Roseomonas infection is avoidance of contaminated water.

Conclusion

Roseomonas infection in PD patients is extremely rare and the only presentation is vague abdominal pain in some patients. The empirical treatment course for PD-related peritonitis should be closely followed if there is a high risk for Roseomonas. Other than Cefepime and Carbapenem, no beta-lactam-like antibiotics should be used due to the high resistance of Roseomonas. It is imperative that the underlying source of Roseomonas be determined in order to eradicate this infection.


