

# A Unique of *Rhizobium radiobacter* Peritoneal Dialysis Catheter-related Peritonitis from a Cat Bite

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**Abstract** Peritoneal dialysis catheter-related peritonitis is typically related to catheter insertion or hygiene. Organisms usually manifest as gram positive organisms typically Staphylococci or gram negative bacilli that typically colonize aqueous environments such as *Pseudomonas spp.* as well as other unusual mycobacterial or fungal pathogens. The authors present a unique case of peritoneal dialysis catheter-related peritonitis manifesting after the patient's cat bit the proximal aspect of the catheter attachment tubing. After failure to clinically improve after outpatient treatment of *Staphylococcus hemolyticus* and *Staphylococcus capitis* catheter related-peritonitis with intraperitoneal Vancomycin and empiric Gentamicin, repeat peritoneal cultures were sent that demonstrated growth of *Rhizobium radiobacter*. The patient was admitted inpatient and treatment was tailored to intraperitoneal Cefepime with clearance of peritoneal cultures and rapid improvement in peritoneal white blood cell count and the patient's clinical condition. The patient was subsequently discharged on oral Ciprofloxacin with complete recovery and catheter salvage.

**Keywords:** peritoneal dialysis, *Rhizobium radiobacter*, peritonitis, intraperitoneal, sensitivity

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## 1. Introduction

*Rhizobium radiobacter*, a formerly reclassified from Agrobacterium class by 16s RNA analysis [1], is an aerobic gram-negative, motile, non-spore forming oxidase positive bacillus. Natural habitats for the bacteria exist in plants and soil [2]. Initially regarded as a contaminant, the organism was first determined in 1980 to cause prosthetic aortic valve endocarditis [3]. Previous case series have demonstrated the bacteria to be an opportunistic pathogen in patients with chronic indwelling catheters and hematologic malignancies. To this date, there are no reported cases of transmission of *R. radiobacter* via cat exposure. Due to the infrequent incidence of *R. radiobacter*, large clinical trials assessing its impact and treatment options are lacking.

## 2. Case Presentation

A 38 year-old female with end-stage renal disease on intermittent nocturnal peritoneal dialysis via Tenckhoff catheter for over two years secondary to type-1 diabetes mellitus presented to Hahnemann University Hospital in Philadelphia, Pennsylvania in October 2016 upon her nephrologist's request due to positive IP cultures. Her symptoms began several days after her cat bit her

peritoneal dialysis (PD) connection tubing just distal to the Tenckhoff catheter attachment (see Figure 1). She subsequently developed nausea, vomiting, and abdominal discomfort that lasted 1-2 days. Outpatient dialysis cultures were initially positive for *Staphylococcus hemolyticus* and *Staphylococcus capitis* with white blood cell count demonstrating 90 cells/uL and 27% neutrophils. The patient was subsequently treated with three doses of IP Vancomycin and one initial dose of IP Gentamicin over the course of nine days. Two days later, due to persistent fatigue, decreased energy, and decreased appetite, repeat outpatient peritoneal cultures were taken that were positive for gram-negative bacilli. The patient was contacted and referred to the hospital for further evaluation.

After admission, the patient initially underwent treatment with IP vancomycin and gentamicin (Dianeal PD-2 Intraperitoneal dialysis solution with 2L of 1.5% dextrose, 8meQ KCl additive, 4mg gentamicin and 40mg vancomycin) for 3 days and intravenous cefepime dosed at 2g q48 hours for 3 days. IP infusion dwell-time was set to 2.5 hours on a q3 hour basis. Initial inpatient peritoneal fluid analysis indicated WBC count of 274 cells/uL, 49% neutrophils, confirming the diagnosis of peritoneal catheter-related peritonitis. Peritoneal culture repeated while inpatient on 5% sheep's blood revealed gram-negative bacilli. Speciation by Vitek 2 (BioMérieux, Inc., Durham, NC) demonstrated *Rhizobium radiobacter* (see Figure 2, Figure 3). Subsequent peritoneal fluid analysis the next day revealed

a WBC count of 9 cells/uL with 5% neutrophils with no demonstrated culture growth (see Table 1). Sensitivity analysis confirmed susceptibility to cefepime, ciprofloxacin, and piperacillin-tazobactam (see Table 2) and the patient's antibiotics were changed via infectious disease consult to IP cefepime 125mg/L (Dianeal PD-2 Intraperitoneal dialysis solution with 2L of 1.5% dextrose, 8meQ KCl additive). The patient's symptoms gradually improved with this regimen and was discharged on oral ciprofloxacin 500mg daily for a 3 week treatment course with PD catheter retention.

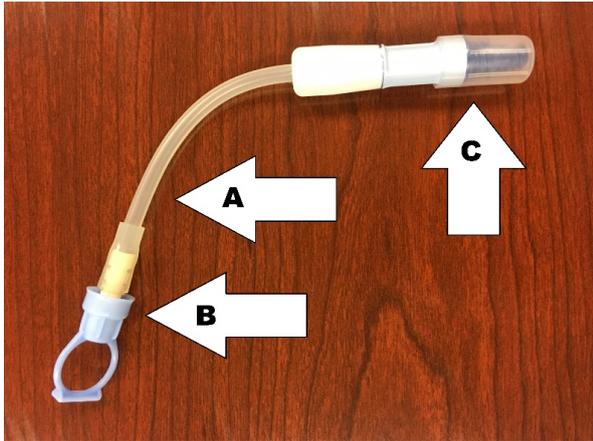


Figure 1. Peritoneal dialysis catheter demonstrating bite site (A). PD attachment site (B) and tubing connector (C) are noted

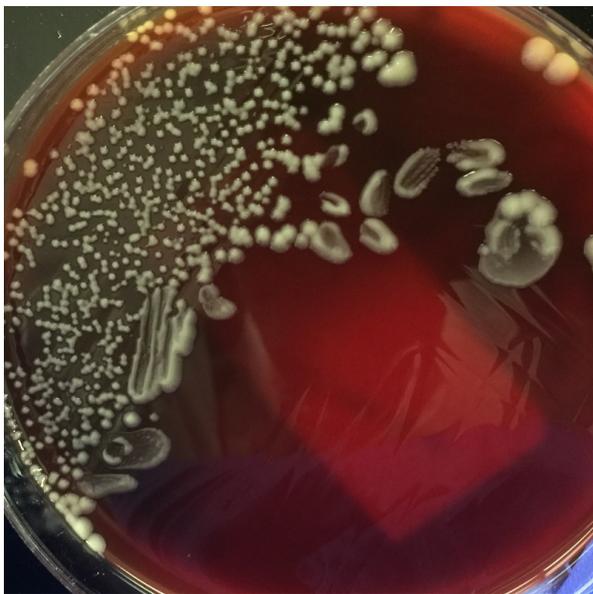


Figure 2. Colonies of *R. radiobacter* on blood agar

Table 1. Results of peritoneal fluid and culture

Peritoneal Fluid	9 Days Prior to Admit	2 Days Prior to Admit	Day 1, Inpatient	Day 2, Inpatient
RBC	Not Reported	Not Reported	1054	1
WBC	90	181	274	9
Neutrophils	27%	56%	49%	5%
Culture	<i>Staphylococcus epidermidis</i> , <i>Staphylococcus haemolyticus</i>	<i>Rhizobium radiobacter</i>	<i>Rhizobium radiobacter</i>	No Growth

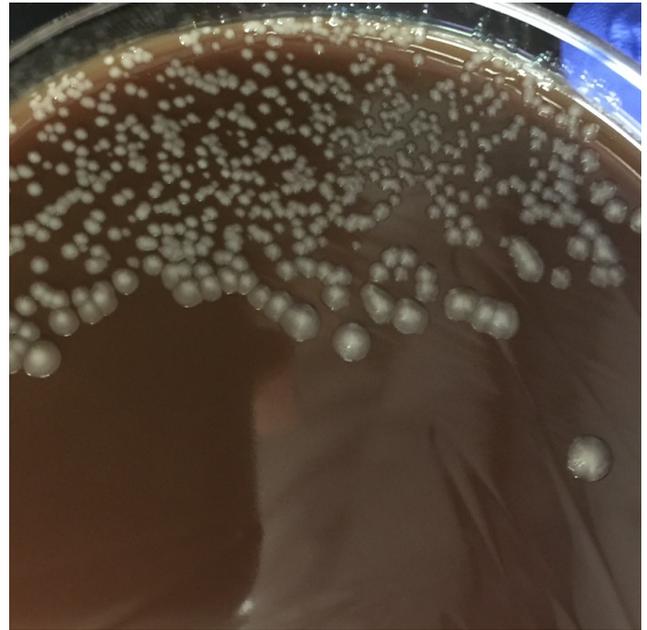


Figure 3. *R. radiobacter* growth on chocolate agar

Table 2. MIC sensitivities of *R. radiobacter* isolate

Antibiotic	MIC Value	Interpretation
Aztreonam	16	Intermediate
Cefepime	<2	Sensitive
Ciprofloxacin	<0.5	Sensitive
Gentamicin	4	Sensitive*
Imipenem	<1	Sensitive
Levofloxacin	<1	Sensitive
Meropenem	<1	Sensitive
Piperacillin	<16	Sensitive
Ticarcillin/Clavulinate	<8	Sensitive
Tobramycin	16	Resistant
Trimethoprim/Sulfamethoxazole	>80	Resistant

\*Gentamicin is commonly reported sensitive at this range, although the same effect is not observed in vivo.

### 3. Discussion

*Rhizobium radiobacter* is an infrequent cause of opportunistic infection largely of indwelling catheters and foreign material. The largest case-series involved 13 Taiwanese patients with *R. radiobacter* infection, of which the majority had chronic indwelling catheters. All isolates were susceptible to cefepime, ciprofloxacin, piperacillin-tazobactam, and carbapenems [4]. Although treatment frequently required foreign device removal [5], recent reports indicate that early and appropriate antibiotic therapy may allow catheter salvage in catheter-related *R. radiobacter* peritonitis [6]. *R. radiobacter* isolates should be evaluated in the appropriate clinical context as pseudo-outbreaks have been reported due to nonsterile processing equipment and/or handling of laboratory specimens [7]. As two separate laboratories confirmed *R. radiobacter* by culture and reactive peritoneal cell counts in our patient, true infection was confirmed.

This case documents the first reported transmission of *R. radiobacter* via cat exposure. The patient's cat may have been colonized with *R. radiobacter* while being near

plants and soil at or nearby the patient's home. Infections transmitted by cat bites tend to be polymicrobial, including *Staphylococci*, *Streptococci*, *Corynebacterium*, *Capnocytophaga*, *Pasteurella*, and anaerobic flora [8]. A 1997-2013 literature review by Poliquin et al. found 30 cases of PD catheter-related peritonitis resulting from *Pasteurella* with cats being the most common source animal. Appropriate treatment and catheter retention was generally obtained with two weeks of amoxicillin-clavulinate or IP cefazolin [9].

The revised 2016 International Society of Peritoneal Dialysis lists pets as a modifiable risk factor for PD catheter-related peritonitis [10]. As zoonotic injuries constitute approximately 1% of emergency department visits and \$30 million US dollars yearly, clinicians and patients alike should be aware of potential complications of pet-related interactions with indwelling medical devices [11].

#### 4. Conclusion

Although uncommon, *R. radiobacter* should be considered in the differential diagnosis of potential pathogens in zoonotic peritoneal catheter-related peritonitis. The importance of patient pet owner education in taking measures to prevent zoonotic infections cannot be overstated.

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