

## REVIEW

### PERITONITIS AND ZONOSIS: YOUR BEST FRIEND SOMETIMES ISN'T!

Brigitte Schiller,<sup>1,2</sup> Maribeth Alcaraz,<sup>3</sup> Kimberley Hadley,<sup>3</sup> and John Moran<sup>1,2,3</sup>

*Satellite Healthcare,<sup>1</sup> Mountain View; Department of Nephrology,<sup>2</sup> Stanford University, Palo Alto; WellBound,<sup>3</sup> Mountain View, California, USA*

Approximately 60% of all households in the United States have a pet, with about 74.8 million owning a dog and 25% having two dogs. There are approximately 88.3 million cat owners in the USA, with 56% of them having more than one cat (1). While the bond with animals for companionship goes back 10 000 – 15 000 years, domestic pets are also capable of transmitting diseases and causing injury. Zoonoses are one of the negative aspects to pet ownership and have consequences for individuals, especially those with compromised immunity such as patients with chronic kidney disease.

Three cases of peritonitis involving domestic pets occurring in the past 2 years have underlined the need for awareness of these unusual causes of peritonitis, as they are preventable episodes that can be easily addressed in the training and care of patients with pets.

#### CASE STUDIES

The first case involved a 49-year-old male with chronic kidney disease secondary to focal segmental glomerulosclerosis, who had been successfully treated with continuous cycling peritoneal dialysis (CCPD) for 2 years. The presenting symptoms included dyspnea,

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Correspondence to: B. Schiller, 401 Castro Street, Mountain View, California 94041 USA.

[schillerb@satellitehealth.com](mailto:schillerb@satellitehealth.com)

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nausea and vomiting, cloudy effluent, abdominal pain, and a productive cough. The PD fluid cell count revealed 3500/mm<sup>3</sup> WBC, with 96% polymorphonuclear cells (PMN), 1% lymphocytes, and 3% monocytes. The initial culture results indicated gram-negative rods thought to be of bowel origin but final culture results demonstrated *Bordetella bronchiseptica*. The patient's initial treatment for presumed pneumonia and peritonitis included ceftriaxone; this was subsequently changed to cefazolin, ceftazidime, and levofloxacin. However, intermediate resistance to cefazolin and ceftazidime prompted a change to gentamicin. The dog belonging to the patient's roommate was identified as the source of infection, as it had been treated for kennel cough 2 weeks prior to the onset of the patient's symptoms (2).

The second case involved a 34-year-old Caucasian woman with end-stage renal disease secondary to glomerulonephritis, who had been treated with CCPD for the past 2½ years. The presenting symptoms included cloudy effluent and moderate abdominal pain. Her peritoneal fluid cell count showed 1144 WBC/mm<sup>3</sup>, with 97% PMN and 3% monocytes. Gram stain was negative. The patient was treated empirically with cefazolin and gentamicin; however, treatment was changed to oral amoxicillin and clavulanic acid after the culture results revealed *Pasteurella multocida*. The patient reported that she had repeatedly found her cat playing with the cyclor line while dialyzing. She noticed a leak in her line but did not notify the clinic until 24 hours later when her effluent became cloudy.

The third case concerned a 52-year-old African-American male with end-stage renal disease due to hypertension, who had been successfully treated with

CCPD for the past 3 years. The presenting symptoms included cloudy effluent, severe abdominal pain, and hypotension. He required intravenous fluids for stabilization and was initially treated with vancomycin and gentamicin. However, hospitalization for septic shock secondary to peritonitis was required. Peritoneal fluid revealed a WBC of 11 000/mm<sup>3</sup>, with 87% PMN, 7% lymphocytes, and 8% monocytes. Gram stain showed a few gram-negative coccobacilli. Culture results revealed *Pasteurella multocida* and treatment with penicillin was later changed to oral amoxicillin and clavulanic acid. When further questioned, the patient reported his cat clawing at the heater bag of the cyclor at a time when it was being treated for an open wound on its paw.

All 3 patients were successfully treated and continue on PD. As the presentation of these patients occurred over an 18-month period in different units of our home dialysis program, we decided to review the literature to examine how best to incorporate this issue in the training and care of our PD patients.

## LITERATURE REVIEW

All published data on zoonosis-related peritonitis were reviewed, including causative agents, presenting symptoms, treatment, and animal source.

Antony and Oglesby reviewed 14 cases of *Pasteurella multocida*-induced peritonitis between 1987 and 2004, involving 7 females and 7 males ranging in age from 12 to 75 years (3). No predominant age or gender predisposition to infection with *Pasteurella multocida* was noted. Peritoneal fluid from these patients was generally turbid and cloudy and patients responded well to a variety of antibiotics. Standardized sensitivity data for *Pasteurella multocida* were recently updated and disk diffusion testing was recommended (4). Amoxicillin, tetracyclines, fluoroquinolones, and trimethoprim/sulfamethoxazole are most commonly recommended for treatment, with a suggested duration of 2 – 3 weeks as adequate antimicrobial therapy (3). Exposure to domestic cats occurred in all these cases, with contact ranging from regular contact to 9 patients with cat bites in the dialysis tubing and 1 with a cat bite involving the PD catheter. One case, in a 48-year-old female on continuous ambulatory PD (CAPD) with *Pasteurella multocida*-induced peritonitis, was found to be caused by dogs. The patient reported that her two pet dogs occasionally entered the room during her dialysis, resulting in contact with the tubing.

In an earlier review of peritonitis cases caused by *Pasteurella multocida*, one case involving a pediatric patient was linked to a bite from a pet hamster, while in cases with cat-transmitted disease the common theme

was domestic cats being allowed in the bedroom where dialysis occurred. One of the patients was found to have scratches on both hands, suggesting possible touch contamination of the cyclor connection system (5).

Two other cases of peritonitis involving *Pasteurella multocida* and contact with cats were reported by Malik *et al.* (6). In both cases, a fluid leak in the dialysis tubing preceded the onset of peritonitis; one was associated with an abscess near the PD catheter exit site. In both cases, the patients suspected their pet of being responsible for the leak. In another report of a common peritonitis presentation caused by *Pasteurella multocida* in a 48-year-old female on CAPD, frequent breaks in hand washing technique were found to be contributing to the infection, with the patient indicating that her cat frequently licked her hands prior to and during fluid exchanges. The curiosity of the cat also resulted in frequent investigation of the tubing and dialysate bags by the animal (7).

*Pasteurella multocida* is a gram-negative nonmotile coccobacillus found in the nasal, gingival, and tonsillar regions of cats and dogs. It is the most common cause of infection from animal bites (8) or scratches with an inflammatory reaction at the site resulting in diffuse localized cellulitis. It is also reported as having caused respiratory infection, peritonitis, meningitis, bacteremia, and endocarditis in humans (9).

Bite infections from domestic animals contain a mix of aerobes and anaerobes from the skin of the patient and the mouth of the animal (8). *Bordetella bronchiseptica* is a gram-negative bacterium that colonizes the respiratory tracts of dogs (kennel cough), cats, pigs, and rabbits. It is an uncommon infection in humans and generally produces a whooping cough-like syndrome in immunocompromised individuals, but more significant morbidity has been reported in this population (10).

A 67-year-old male on CCPD was reported to have suffered from peritonitis caused by *Capnocytophaga cynodegmi*. His only contact with domestic animals was the neighbor's cat, which he fed occasionally (11). *Capnocytophaga cynodegmi* is a gram-negative fusiform bacillus without flagella that moves by gliding motility. It is part of the normal flora of dogs and is responsible for localized wound infections in humans from a dog bite; however, a few cases of systemic diseases such as pneumonia, endocarditis, and meningitis, especially in patients in immunocompromised states, have been reported (12).

Except for the two cases involving a hamster bite and contact with a dog, all reported cases involved regular contact with a domestic cat, cat bites in the tubing, or skin scratches. The cases illustrate the potential harm caused by zoonotic transmission of diseases to patients on PD, even with rare exposure.

The majority of the patients presented with the usual initial symptoms of peritonitis, including turbid cloudy effluent and abdominal discomfort, chills, fever, nausea, or vomiting. No specific clinical manifestations indicative of zoonosis-induced peritonitis were identified. *Pasteurella multocida* and *Capnocytophaga cynodegmi* normally took 3 – 7 days to be identified. Episodes of culture-negative peritonitis caused by zoonosis may be unrecognized because of empiric standard treatment. The majority of the reported cases involved patients utilizing CCPD, and it has been suggested that the long tubing used for the cyclor may be a strong attraction for cats (5). Furthermore, the natural attraction to human body fluid by carnivorous animals such as cats and dogs has been implicated in these infections (7). Complications and response to routine therapy appear to be similar to peritonitis caused by other bacteria and the overall outcome in the reported cases appears to be comparable to other events of peritonitis.

However, domestic pets have also been studied for their positive impact on human health through their social support. There is evidence that pets have a positive influence on a number of health-related concerns. In a randomized trial, patients assigned to pet ownership and medication compared to medication alone showed significantly less response to mental stressors than the medication alone group, as measured by blood pressure, heart rate, and renin response (13).

Furthermore, pets appear to alleviate depression, possibly by altering the behavior of their owners by shifting attention to the pet's needs and providing an opportunity to touch or stroke another living thing, which has been shown to enhance mental and physical health (14).

We therefore do not discourage pet ownership in home dialysis patients but strongly emphasize the importance of a teaching program to help prevent pet-transmitted infections in these patients. Initial as well as ongoing evaluation of the patient's risk for zoonosis due to pet ownership, containment of pets, and early identification of animal bites or punctures to the PD equipment, as well as recognition of pets' illness are among the main topics to be addressed. Table 1 summarizes these recommendations as a ready-to-use road map for home dialysis programs.

## CONCLUSION

Given the high prevalence of cardiovascular disease (15) and depression (16) in patients with chronic kidney disease, in addition to the burden of chronic disease with maintenance dialysis treatment, a strong argument

TABLE 1  
Recommendations to Prevent Pet-Transmitted Diseases and Infections in Peritoneal Dialysis (PD) Patients

### Initial evaluation

- Inquire about exposure to pets through ownership or through exposure to pets from friends and neighbors at the start of PD training.
- Ask about responsibilities for pet-care duties and how these duties are handled.
- Question the patient's ability to contain the pet away from dialysis equipment and place where dialysis takes place.
- Ask if pet containment will be problematic and examine possible solutions with patient and family.
- Provide scenarios involving pet ownership in training so patients can learn to recognize potential harmful situations and become aware of symptoms to report.

### Ongoing patient education

- Teach patients that personal and procedural hygiene are extremely important in preventing zoonotic infections.
- Stress the need for mandatory hand washing when in contact with a pet and performing connections and exchanges.
- Consider mandatory exclusion of pets from room where dialysis takes place.
- Inform patients that PD equipment, tubing, and bags can be an attraction for pets and the necessity of keeping pets away from areas where the equipment is stored and used.
- Continue to inquire about pet containment strategies during clinic visits.
- Teach patients to report scratches or bites.
- Inquire about kennel placement of pets and remind patients that exposure to other animals in a community setting may increase the risk of a pet acquiring an infection.
- Teach patients to look for signs of illness in pets and the importance of prompt treatment.
- Stress the importance of promptly reporting any animal bites or punctures to PD equipment.

### Diagnosing peritonitis

- Consider a pet-acquired source of infection in differential diagnosis of peritonitis.
- Be aware of the possibility of transmission of methicillin-resistant *Staphylococcus aureus* infection from pet to human.
- Question patient and family members about recent exposure/contact with animals.
- Inquire about the recent and past health of family pets.
- Be aware that PD effluent culture results from zoonotic organisms can take 3–7 days.
- Consider a zoonotic cause in culture-negative peritonitis.

can be made that psychosocial support with pet ownership should not be discouraged in patients undergoing PD. However, all measures necessary to prevent a pet-transmitted disease should be in place and frequently reinforced.

**DISCLOSURES**

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**PATIENT RESOURCES**

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