Pets are 'risky business' for patients undergoing continuous ambulatory peritoneal dialysis

Yahya Salim Yahya Al-Fifi MD[1], Chris Sathianathan MD[2], Brenda-Lee Murray MSc[3], Michelle J Alfa PhD[3]

YSY Al-Fifi, C Sathianathan, B-L Murray, MJ Alfa. Pets are 'risky business' for patients undergoing continuous ambulatory peritoneal dialysis. Can J Infect Dis Med Microbiol 2013;24(3):e96-e98.

The authors report the first case in Manitoba of a patient undergoing continuous ambulatory peritoneal dialysis who experienced three successive infections with *Pasteurella multocida* and *Capnocytophaga* species over an eight-month period. These zoonotic infections were believed to originate from contact with the patient's household pets. To prevent such infections, the authors recommend the development and implementation of hygiene guidelines outlining the risks associated with owning domestic pets for continuous ambulatory peritoneal dialysis patients.

Key Words: *CAPD; Capnocytophaga; Hand hygiene;* Pasteurella multocida*; Pets; Zoonotic infections*

Les animaux de compagnie sont dangereux pour les patients sous dialyse péritonéale continue ambulatoire

Les auteurs rendent compte du premier cas manitobain d'un patient sous dialyse péritonéale continue ambulatoire (DPCA) qui a subi trois infections successives par les espèces de *Pasteurella multocida* et de *Capnocytophaga* sur une période de huit mois. On croit que ces zoonoses étaient attribuables au contact avec les animaux domestiques du patient. Pour les prévenir, les auteurs recommandent d'élaborer et de mettre en œuvre des directives d'hygiène liées à la propriété d'animaux domestiques pour les patients sous DPCA.

CASE PRESENTATION

A 49-year-old man with end-stage renal failure secondary to type I diabetes undergoing continuous ambulatory peritoneal dialysis (CAPD) since August 2010 presented to the emergency room with severe abdominal pain in October 2011. Several days before presentation to the emergency room, the patient had been feeling unwell; this developed into localized, dull pain at the centre of the abdomen that extended to the flanks. Approximately 24 h to 48 h before presentation, the pains became sharp and diffuse throughout the abdomen; the pain escalated gradually and then became constant. The pain was aggravated by movement and eased by lying down on one side, but it did not radiate. The patient complained of fever, chills and rigors that were occasionally associated with nausea, vomiting and night sweats. No other notable symptoms were reported.

On physical examination, the patient was oriented and alert, with a blood pressure of 150/80 mmHg and a regular heart rate of 84 beats/min. He was pale but not jaundiced, and there was no sign of lymphadenopathy. His peritoneal dialysis (PD) catheter was in place and showed no signs of redness, discharge or leakage.

Five months earlier, in May 2011, the patient experienced similar symptoms and was diagnosed with PD-related peritonitis. Culture analysis of the PD fluid revealed *Pasteurella multocida*, a normal oropharyngeal flora of cats and dogs (1,2) (Table 1). This strain of *P multocida* was sensitive to numerous antibiotics (Table 2). The patient was treated empirically with vancomycin and tobramycin for two days followed by cefazolin for four days, and then given intraperitoneal (IP) ceftazidime for seven days and, finally, oral amoxicillin-clavulanate for seven days. Further questioning revealed that the patient had a dog and a cat at home; however, the patient was adamant that the animals were never in the vicinity while he was performing his dialysis. He did not recall any breaks or leaks in the dialysis tubing, although he did admit that he did not always use adequate hand hygiene when handling his catheter.

In August 2011, the patient acquired a PD infection secondary to *Enterobacter cloacae* (Table 1), which was characterized by cloudy dialysate and abdominal pain. The source of the infection was not likely zoonotic because this pathogen is commonly found in the human gastrointestinal tract. The patient was successfully treated with IP cefazolin and tobramycin for three days followed by IP ceftazidime and ciprofloxacin orally for 14 days.

Analysis of the dialysate in October 2011 (Table 1) revealed an elevated white blood cell (WBC) count of $13{,}631\times10^6$cells/L with 89% polymorphonuclear neutrophils and 11% monocytes. Due to the patient's history and the fact that he owned household pets, this PD infection was suspected to be zoonotic in origin. The initial Gram stain revealed no bacteria; however, several days later, *Capnocytophaga* was recovered from liquid media that had been inoculated with PD fluid. Bacterial 16S ribosomal DNA (rDNA) sequencing was performed to determine the species, but was unable to differentiate between *Capnocytophaga cynodegmi* and *Capnocytophaga canimorsus* (both normal flora of domestic pets). Antibiotic treatment was initiated with IP cefazolin and tobramycin for 14 days.

The patient responded to antibiotic treatment and all subsequent CAPD bags were clear post-therapy until January 2012 when he presented again with cloudy dialysate and abdominal pain. As shown in Table 1, his CAPD fluid grew *Capnocytophaga* species. Bacterial 16S rDNA sequencing identified this isolate as *C canimorsus*. He was treated with IP cefazolin and tobramycin for three days followed by IP cefazolin and ciprofloxacin to complete 21 days of antibiotic therapy. It is possible that the same strain of *Capnocytophaga* was responsible for both infections; however, the second infection most likely occurred separately and was not a continuation of the first infection.

In March 2012, the patient developed a PD catheter exit site infection that grew *Corynebacterium jeikeium* and manifested as a 2 cm × 4 cm area of induration over the catheter tunnel. He was treated with IP cefazolin and the catheter was removed in April 2012. The exit site infection and the previous *E cloacae* CAPD infection are not likely related to the zoonotic infections, but they do further attest to the consequences of poor hand and catheter hygiene.

In view of the patient's history of multiple CAPD infections, in addition to his exit site infection, he was switched to hemodialysis after removal of his PD catheter. Since being switched, he has experienced no further issues and continues to do well.

[1]*Department of Medicine, University of Manitoba;* [2]*Department of Nephrology, St Boniface Hospital;* [3]*Diagnostic Services of Manitoba, Winnipeg, Manitoba*

Correspondence: Dr Michelle J Alfa, Diagnostic Services of Manitoba, St Boniface General Hospital, 409 Tache Avenue, Winnipeg, Manitoba R2H 2A6. Telephone 204-237-2105, fax 204-237-7678, e-mail malfa@dsmanitoba.ca

TABLE 1
History of Infection

Date	Peripheral WBC count*, $\times 10^9$/L	Continuous ambulatory peritoneal dialysis fluid			
		WBC count, $\times 10^6$/L	Gram stain	Culture results	Therapy†
May 14, 2011	19.1	No peritoneal dialysis fluid analysis available	Negative	*Pasteurella multocida*‡	Vancomycin and tobramycin: 2 days Cefazolin: 4 days Ceftazidime: 7 days Amoxicillin-clavulanate (PO): 7days
August 17, 2011	No peripheral WBC count available	5800	Negative	*Enterobacter cloacae*	Cefazolin and tobramycin: 3 days Ceftazidime and ciprofloxacin (PO): 14 days
October 27, 2011	19.5	13,631	Negative	*Capnocytophaga*§ *canimorsus/cynodegmi*	Cefazolin and tobramycin: 14 days
January 31, 2012	No peripheral WBC count available	7300	Negative	*Capnocytophaga canimorsus*	Cefazolin and tobramycin: 3 days Cefazolin and ciprofloxacin to complete 21 days antibiotic therapy.

**Normal range 4.5×10^9 cells/L to 11×10^9 cells/L; †All antibiotics were administered by intraperitoneal route unless otherwise indicated; ‡The recommended therapy for general* Pasteurella multocida *infections is penicillin G, ampicillin, amoxicillin, cefuroxime and cefpodoxime. Alternative therapies include doxycycline, levofloxacin, moxifloxacin and trimethoprim-sulfamethoxazole (13); §The recommended therapy for* Capnocytophaga *(typical infection from dog bite) is amoxicillin-clavulanate. Alternative therapies include piperacillin-tazobactam, clindamycin, imipenem-cilastatin, doripenem and meropenem (13). Note: There are no specified recommended therapies for* Pasteurella *and* Capnocytophaga *peritoneal dialysis-related peritonitis. Therapy is generally based on sensitivities and intraperitoneal administration of antibiotics is the preferred route. PO Per os (oral); WBC White blood cell*

TABLE 2
Bacteria and antibiotic susceptibilities

CAPD bacterial infection	Susceptibility	
	Sensitive	Resistant
Pasteurella multocida	Amoxicillin-clavulanate	N/A
	Ampicillin	
	Ceftriaxone	
	Erythromycin	
	Levofloxacin	
	Tetracycline	
	Trimethoprim-sulfamethoxazole	
Capnocytophaga species	No susceptibility tests performed on this bacterium	
Enterobacter cloacae	Cotrimoxazole	Cefazolin
	Gentamycin	Ampicillin
	Ciprofloxacin	
	Pipercillin	

CAPD Continuous ambulatory peritoneal dialysis; N/A Not applicable

DISCUSSION

P multocida is a small Gram-negative coccobacillus found in the oral cavity and upper respiratory tract of 70% to 90% of cats and 55% to 66% of dogs (1-3). It is a zoonotic pathogen and the most frequent causative agent in human pasteurella infection (4). *P multocida* can cause a variety of infectious diseases in humans such as sepsis, cellulitis, pulmonary infections and meningitis, among others (1,4-6). The mechanisms of infection are not entirely clear and continue to be elucidated; however, the presence of a capsule and lipopolysaccharide have been identified as key virulence factors for avoiding the host immune system (5).

Generally, *P multocida* is a rare cause of peritonitis in patients undergoing PD. Only 26 cases have been reported in the literature, three of which have involved children (3). Similar to our patient, 25 of the 26 cases of *P multocida* peritonitis can be linked to close contact with household cats (2,3). Very few cases have been associated with dogs compared with cats, which could be due to the fact that cats exhibit a higher prevalence of colonization with *P multocida* (2). It has been reported that approximately 20% of cats harbour *Pasteurella* species on their claws (4). In addition, cats are more likely to play with dialysis tubing; their sharper teeth and claws increase the probability of puncturing tubes or bags, thus transmitting the pathogen to the patient (2). Furthermore, cats are more of a self-grooming animal than dogs, which could result in the presence of the bacterium directly on the fur. Thus, even petting a domestic cat could result in transfer of the organism to the hands of PD patients or caregivers.

C canimorsus and *C cynodegmi* are slow-growing, thin, Gram-negative bacilli that are a part of the normal flora of dogs and, more rarely, cats (7). Generally, infections caused by *Capnocytophaga* species, especially *C canimorsus*, progress rapidly and are transmitted by dog bite. Symptoms of infection can vary and depend on the severity of the case (8). Infectious diseases caused by *Capnocytophaga* species in humans include, but are not limited to, septicemia, meningitis, osteomyelitis, purulent arthritis and endocarditis (7). Little is known about the pathogenesis of *Capnocytophaga* infection, but the clinical course of infection suggests the bacterium has the ability to avoid the immune system, particularly in the early stages of infection (7).

Capnocytophaga species causing peritonitis is even more rare than *Pasteurella* peritonitis, with only three cases being reported in the literature (9). Although *C canimorsus* and *C cynodegmi* are more common in dogs than cats, two of the three cases of *Capnocytophaga* species peritonitis reported were linked to close contact with cats (9,10). In one case, the patient's cat was allowed to sleep with him and punctured the dialysis tubing during the night (11), whereas the other case was a patient who had frequent visits from a neighbour's cat, who he periodically fed (9).

The fact that our patient was infected consecutively by *P multocida* and *Capnocytophaga*, but did not report any bites or scratches from his animals nor remember his cat playing with his dialysis tubing, emphasizes the importance of hand hygiene when dealing with PD equipment and bag changes. This is imperative for preventing infection in PD patients who are in close contact with domestic animals, especially cats.

Our data support the recommendations by Rondon-Berrios and Trevejo-Nunez (2), Weiss and Panesar (12), Pers et al (10), Schiller et al (6) and Sol et al (3) that PD patients who own pets be made aware of the need for proper hand hygiene before PD bag changes and the risk of zoonotic infection if these precautions are not taken. The need to ensure pet oral secretions do not come into contact with PD equipment and the threat of these infections should be clearly communicated to PD patients. We recommend strict hygiene guidelines be emphasized and periodically reviewed with PD patients who have pets.

REFERENCES

1. Mugambi SM, Ullian ME. Bacteremia, sepsis, and peritonitis with *Pasteurella multocida* in a peritoneal dialysis patient. Perit Dial Int 2010;30:381-3.
2. Rondon-Berrios H, Trevejo-Nunez GJ. Pets or pest: Peritoneal dialysis-related peritonitis due to *Pasteurella multocida*. J Microbiol Immunol Infect 2010;43:155-8.
3. Sol PM, van de Kar NC, Schreuder MF. Cat induced *Pasteurella multocida* peritonitis in peritoneal dialysis: A case report and review of the literature. Int J Hyg Environ Health 2013;216:211-3.
4. Satomura A, Yanai M, Fujita T, et al. Peritonitis associated with *Pasteurella multocida*: Molecular evidence of zoonotic etiology. Ther Apher Dial 2010;14:373-6.
5. Harper M, Boyce JD, Adler B. *Pasteurella multocida* pathogenesis: 125 years after Pasteur. FEMS Microbiol Lett 2006;265:1-10.
6. Schiller B, Alcaraz M, Hadley K, Moran J. Peritonitis and zoonosis: Your best friend sometimes isn't! Perit Dial Int 2011;31:127-30.
7. Gaastra W, Lipman LJ. *Capnocytophaga canimorsus*. Vet Microbiol 2010;140:339-46.
8. Hawkins J, Wilson A, McWilliams E. 'Biting the hand that feeds': Fever and altered sensorium following a dog bite. Emerg Med J 2011;28:1071-3.
9. Chow KM, Pang WF, Szeto CC, Li PK. Playing cat and mouse with a gram-negative organism causing peritonitis. Perit Dial Int 2010;30:662-3.
10. Pers C, Tvedegaard E, Christensen JJ, Bangsborg J. *Capnocytophaga cynodegmi* peritonitis in a peritoneal dialysis patient. J Clin Microbiol 2007;45:3844-6.
11. Chadha V, Warady BA. *Capnocytophaga canimorsus* peritonitis in a pediatric peritoneal dialysis patient. Pediatr Nephrol 1999;13:646-8.
12. Weiss GA, Panesar M. *Pasteurella multocida* peritonitis with bacteremia on initiation of peritoneal dialysis. Perit Dial Int 2012;32:363-4.
13. Gilbert ND, Moellering RC, Eliopoulos GM, Chambers HF, Saag MS. The Sanford Guide to Antimicrobial Therapy 2012, 42nd edn. Sperryville: Antimicrobial Therapy Inc, 2012.