Stenotrophomonas maltophilia urinary tract infections in three dogs: a case report

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Abstract: *Stenotrophomonas maltophilia* was isolated from three dogs with lower urinary tract disorders. The bacterium was cultured from bladder wall biopsy specimens obtained during cystoscopy, whereas urine culture was negative in all cases. The culture of biopsy specimens is useful and may help with the therapy even if diagnosis of the primary disease has been made.

Keywords: cystitis; cystoscopy; *Pseudomonas* sp.

Stenotrophomonas maltophilia (initially classified as *Pseudomonas maltophilia*, later *Xenotrophomonas maltophilia*) is an aerobic, Gram-negative bacillus. It is a bacterium that can be present in almost any aquatic or humid environment and may persist for extended periods in such locations. *S. maltophilia* survives and multiplies in respiratory secretions, urine or intravenous fluids (Falagas et al. 2009). In human medicine, it is considered to be an uncommon pathogen in immune-competent individuals. Immunocompromised patients (patients with cancer, cystic fibrosis, chronic obstructive pulmonary disease, patients treated with steroids or immunosupressors) are more susceptible to *S. maltophilia* infection (Denton and Kerr 1998; Spicuzza et al. 2009). The significance of *Stenotrophomonas* as an important nosocomial pathogen has risen over the last two decades. *S. maltophilia* can cause bacteraemia, endocarditis, pneumonia, meningitis, infections of bones and joints, urinary tract, soft tissues, and wounds. The bacterium is intrinsically resistant to β-lactams and is often resistant to other antimicrobials as well (Falagas et al. 2009). In veterinary medicine *S. maltophilia* is considered to be a coloniser. In domestic animals, there are only a few reports dealing explicitly with *S. maltophilia* infection. These have detailed the isolation of the bacterium from the airways of patients with chronic respiratory disease (dog, cat, horse) (Albini et al. 2009; Winther et al. 2010). This communication reports on three dogs with *S. maltophilia* urinary tract infections diagnosed at the Clinic of Dog and Cat Diseases, University of Veterinary and Pharmaceutical Sciences between the years 2006–2010.

Case description

Case 1. The first case was of a year-old spayed female German shepherd. The dog had a history of multiple urinary tract infections (UTI) from the age of two months. The first episode had been diagnosed based on the results of a routine urinalysis without culture. It had been treated with antibiotics which were chosen empirically. The subsequent episode had been documented by urine culture and treated with appropriate antimicrobial agents according to susceptibility tests (*Enterobacter* sp. was treated with cefuroxime). However, microscopic haematuria with negative urine culture persisted. At the age of six months, the vesicourachal diverticulum had been diagnosed by cystoscopy. Biopsy specimen culture revealed haemolytic *E. coli* which was treated with co-trimoxazole. A diverticulectomy was performed one month later. After the surgery the dog did not present with any symptoms associated with urinary tract problems for seven months.

The last episode was characterised by pollakiuria and stranguria lasting two weeks. The physical examination, CBC (complete blood count) and serum

chemistry panel were normal. A specimen of urine obtained by cystocentesis showed 1+ protein with the specific gravity of 1.060. The urine sediment contained five to seven red blood cells/hpf and two to three epithelial cells/hpf. No bacteria were seen and the culture of the urine sample was negative. Ultrasound examination revealed a thickened bladder wall and small uroliths. Endoscopy of the urinary bladder revealed nodular mucosal defects, small-sized calculi, increased mucosal fragility and mucosal erosions. Biopsy specimens for culture and histological examination and urolith samples were obtained during cystoscopy. The calculi were composed of 55% calcium oxalate dihydrate (weddellitte) and 45% calcium oxalate monohydrate (whewellitte). Culture of the biopsy specimen yielded *Pseudomonas* sp. susceptible to amikacin and ceftazidime, and *S. maltophilia* susceptible to doxycycline, co-trimoxazole and ceftazidime. Histological examination revealed chronic polypoid cystitis. The dog was treated with 3rd generation cephalosporines for six weeks and all clinical signs of lower urinary tract disorder resolved. After the treatment, the parameters of urinalysis were normal. The owners refused control cystoscopy with sampling for culture because of the high number of previous anaesthesias.

Case 2. A nine month-old spayed female Labrador retriever was referred to our clinic because of a history of recurrent UTI within the previous five months. The dog had received antibiotics repeatedly (amoxicillin/clavulanic acid), but without any significant effect. The owner noted pollakiuria after completion of each course of therapy. At the age of five months, ultrasound examination was performed and sand was observed in the urinary bladder. Feeding of a urologic diet was started. At the age of six months, the dog was neutered.

The physical examination, CBC and serum chemistry panel, and ultrasound examination performed in our clinic were normal. Urinalysis showed a specific gravity of 1.050, pH 6.5 ad 1+ protein on dipstick. Lipid droplets and in rare cases small epithelial cells were seen in the urine sediment. The culture of a urine specimen collected by cystocentesis was negative. Endoscopic examination of the urinary tract and intravenous pyelography did not reveal any abnormalities. Histological examination of biopsy specimens collected during cystoscopy revealed chronic urocystitis. Culture of the specimen yielded *S. maltophilia* that was susceptible to chloramphenicol, doxycycline, co-trimoxazole, and ofloxacin. The dog was treated with quinolones for three weeks and the problems resolved. Unfortunately, the owner did not return for a control examination.

Case 3. The third dog was a twelve year-old spayed female West Highland white terrier. She presented with a history of pollakiuria without gross haematuria over the previous six months. The referring veterinarian found sand in the urinary bladder by ultrasound examination. He recommended feeding of a commercial calculolytic diet for struvite dissolution. One month later, the sand disappeared, but the problem with urination persisted.

The physical examination, CBC and serum biochemistry profile performed in our clinic were normal. A specimen of urine, obtained by cystocentesis, had 1+ protein and sediment examination results that included 3–5 WBC/hpf and 1–2 transitional epithelial cells/hpf. Cytologic examination of the urine sample suggested neoplastic disease. Culture of the sample was negative for the growth of bacteria. Ultrasound examination of the urinary bladder revealed the presence of a thickened caudal part of the bladder wall. Cystoscopy confirmed the ultrasound findings. An irregular surface of the bladder neck mucosal membrane and polypoid lesions were the main findings. The results of histological examination of the tissue obtained during cystoscopy showed transitional cell carcinoma. Culture of the specimen yielded *S. maltophilia* susceptible to doxycycline, co-trimoxazole, norfloxacin, ciprofloxacin, and piperacillin. The dog was treated with piroxicam on a long term basis for the transitional cell carcinoma. Quinolones were used as antimicrobials according to susceptibility test results and clinical signs were alleviated to a minor degree. Because of the primary disease, the owners did not agree to a control cystoscopy.

DISCUSSION AND CONCLUSIONS

S. maltophilia has emerged as an important opportunistic pathogen in the debilitated host (Looney et al. 2009). In most human patients, *S. maltophilia* infection is acquired in the hospital setting (Laying et al. 1995). However, none of our patients were hospitalised prior to cystoscopy and bladder wall biopsy. The infection may be secondary to urinary tract surgery or catheterisation or be present against a background of structural urinary tract abnormality (Vartivarian et al. 1996).

All our dogs with *Stenotrophomonas maltophilia* urinary tract infection presented with chronic urologic problems. None of the dogs were catheterised before biopsy. The only surgery was diverticulectomy in the German shepherd six months before biopsy specimen culture. This dog with a diagnosis of vesicourachal diverticulum was predisposed to have chronic urinary tract infections, because stasis of urine in the diverticulum often leads to recurrent or persistent infection and inflammation. The first culture of the bladder wall revealed haemolytic *Escherichia coli*. At the time of diverticulectomy, the culture of the biopsy specimen had not been performed. It is possible that the bladder wall was colonised with the *S. maltophilia* at that time.

In the second case we were not able to identify any predisposing factor to infection. Impairment of mucosal defence barriers (surface mucoprotein layer, intrinsic mucosal antimicrobial properties), impairment of local immune response (production of secretory immunoglobulin A) or depressed antimicrobial properties of urine may be considered (Osborne and Lees 1995). However, previous antibiotic treatment might promote further colonisation and infection by antibiotic-resistant bacteria (Martinez and Baquero 2002). In the clinical setting, differentiation between colonisation or contamination and true *S. maltophilia* infection is often difficult. It was suggested that *S. maltophilia* is associated with clinically overt infection only when acting synergistically with other pathogens. Only in the first case did we find a combination of *S. maltophilia* and *Pseudomonas* sp. In the other cases, *S. maltophilia* was the only bacterium to grow in biopsy specimen culture.

Urothelium damage caused by neoplasia is another predisposing factor for secondary bacterial infections (Osborne and Lees 1995). Nagai (1984) noted that nearly half of patients from whom *S. maltophilia* was cultured had a neoplastic lesion at the site of isolation of the bacterium (significantly higher incidence than other isolated species). He proposed that an altered microenvironment caused by anaerobic glycolysis with a resulting accumulation of lactic acid in neoplastic tissue could provide conditions favourable for the multiplication of this bacterium.

Despite the fact that we were not able to identify any risk factors in the Labrador retriever, we are convinced that the finding of *S. maltophilia* is not colonisation but rather an infection, because of the histological diagnosis of chronic cystitis.

Although reclassified, *S. maltophilia* is essentially a *Pseudomonas*, which is the 7th most common bacterial species in urinary tract infections of dogs (Ling et al. 2001). This study was made on a large number of animals. The vast majority of the *Pseudomonas* isolates were most often of the species *aeruginosa* (95%). *Pseudomonas maltophilia* was identified only in four out of 8 354 cases (0.05%). Unfortunately, there are no details of predisposing or complicating factors in these cases.

The negative results of urine culture in all three cases are interesting. *S. maltophilia* was found only in the bladder wall, but not in urine. Culture of the bladder mucosal biopsy is recommended in cases of urolithiasis and negative urine culture, but it is not a routine procedure in other causes of lower urinary tract disorders (Hamaide et al. 1998). The ability of bacteria to adhere to the surface of cells is an important factor in the colonisation of the mucosal surface. *S. maltophilia* is very well adapted to colonising epithelial cells. This is due to its positively charged surface, flagella and fimbrial adhesis (Oliveira-Garcia et al. 2003). *S. maltophilia* also forms biofilms on its own or together with other species. The biofilms may be formed on indwelling devices or within the urinary tract itself (Hatt and Rather 2008). Thus the bacterium is more resistant to antibiotics.

The clinical signs in the German shepherd and Labrador retriever resolved, while in the West Highland white terrier they were alleviated to a minor extent. This incomplete recovery is probably the consequence of the neoplastic primary disease. Unfortunately, we were not able to check the culture of the bladder wall after the treatment because of the owner´s wish not to re-biopsy. The necessity of the general anaesthesia for cystoscopy is the disadvantage of this method and may complicate the evaluation of the treatment.

S. maltophilia is found in various environments but it prefers water or humid milieu. It is able to adhere to synthetic materials and may adhere to catheters and other medical devices (Falagas et al. 2009). The possibility of contamination of the cystoscope with *S. maltophilia* was considered, but the patients were diagnosed over the space of four years and the endoscopic equipment was used for other patients with culture results negative for *S. maltophilia*. In addition, the results of the susceptibility test in all three patients were different and all dogs improved after the course of antibiotic therapy.

In conclusion, we recommend the culture of bladder wall biopsy specimens, regardless of negative

culture of urine samples, in addition to the diagnosis of the primary disease, especially in cases that may cause impairment of systemic or local host defence. The infection may exacerbate the course of the disease and reduce the chance for recovery. In addition, when risk factors in the urinary tract are present, a finding of *S. maltophilia* indicates rather infection than colonisation.

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Received: 2011–10–21
Accepted after corrections: 2012–07–28

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