Proceedings of the 34th World Small Animal Veterinary Congress
WSAVA 2009

São Paulo, Brazil - 2009

Next WSAVA Congress:

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ASSOCIATION OF URINARY TRACT INFECTION WITH UROLITHIASIS IN DOGS - 506
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Introduction
Urinary tract infection (UTI) occurs when an infectious agent is capable of adhere, multiply and to persist in the urinary tract (Bartges 2005). Two factors are intimately involved in the development of UTI: (1) temporary or permanent impaired natural host defense and (2) the bacterial virulence. Usually, UTIs are caused by bacterial infections, although fungal and viral infections may occur as well (Bartges 2005). The prevalence of bacterial infections associated with urolithiasis has been studied and reported, and urolithiasis may cause or be a consequence of urinary tract infection. Infections caused by urease-producing bacteria, mainly Staphylococcus spp, predispose dogs and cats to form struvite uroliths, also known as “infection stone”, “urease stone” and “urea stone”, which is composed by calcium, magnesium, ammonium and phosphate (Osborne et al. 1999). Other urease-producing microbes include Proteus spp (which is reported to be the main cause of struvite stones in humans), Pseudomonas spp and Klebsiella spp. Trauma in the urinary tract may develop in consequence of the presence of the urolith, and it is considered also a predisposing factor to UTI (Osborne & Lees 1995). The aim of this study was to investigate the UTI in dogs with urolithiasis, and to characterize the most common bacteria as well as the mineral composition of the uroliths.

Materials and Methods
Animals - Ninety client-owned dogs presenting the diagnosis of urolithiasis and UTI assisted at the Veterinary Teaching Hospital – School of Veterinary Medicine -University of São Paulo, Brazil were evaluated. Animals were composed by male (n = 40) and female (n = 50) dogs, including various breeds and mongrel dogs. Patients were selected based on clinical history, clinical signs, laboratory data (urinalysis and urine culture) and imaging exams (ultrasonography and/or radiography). Uroliths – Thirty-two uroliths were obtained after surgical removal (cistotomy or urethrostomy) and the mineral composition analysis were performed at Minnesota Urolith Center - University of Minnesota USA.

Results
Fifty female dogs (55.6%) were affected by urolithiasis and UTI, and male dogs represented 44.4% (n = 40). Staphylococcus spp was the most frequent microbe involved in UTIs (43.3% [n = 39]), followed by Proteus mirabilis (22.2% [n = 20]), E. coli (12.2% [n = 11]), Streptococcus spp (5.6% [n = 5]), and Klebsiella spp (4.4% [n = 4]). Other isolated bacteria totaled 12.3% (n = 11) which three of them were mixed infection. Fungal or viral cultures were not performed in this study. Miniature Schnauzer (n = 14) and Poodle (n = 14) were the most frequent breeds, representing 15.6% each one, followed by Cocker Spaniel (12.2% [n = 11]), Dachshund (6.7% [n = 6]), Yorkshire Terrier (5.6% [n = 5]), and Pinscher, Dalmatian and Bichon Frise totaled 9.9% (n = 3 each); other breeds in total represented 20% (n = 18). Mongrel dogs were 14.4% (n = 13). Cistotomy or urethrostomy was performed in 32 of 90 dogs with urolithiasis and UTI, and then the uroliths were obtained for mineral composition analysis. Seventeen (53.1%) uroliths were classified as simple (composed by single mineral); 10 of 17 were composed by calcium oxalate, six by struvite and one was cistine. Fifteen (46.9%) calculi were classified as compound uroliths (when one layer of the calculi comprises at least 70% of one mineral type and is surrounded by one or more layers composed of a different mineral [ > 70%]) (Ulrich et al. 2008), and according to the layers observed in those 15 compound uroliths, nidus was detected in 12 calculi, stone in 15, shell in 13 and surface in 4. Struvite was the most frequent mineral composition found in nidus (58.3%) as well as in stone (80%) and in shell (38.4%). Surface layer was detected in only 4 compound stones that presented mineral composition as calcium carbonate,
struvite and calcium oxalate. Calcium oxalate, carbonate, and ammonium urate were observed in less frequency in nidus and shell. Staphylococcus spp and Proteus mirabilis were isolated from urine of all 15 dogs that presented compound uroliths. Regarding to the simple uroliths, Staphylococcus spp, Proteus mirabilis and Streptococcus spp were the most frequent microbes detected in urine culture. No mixed uroliths were observed in this study.

Discussion and Conclusions

Urinary tract infection was more frequently observed in bitches with urolithiasis than in male dogs, which finding was similar as it has been reported in previous studies, considering that bitches are more predisposed to UTI in consequence of short urethra length as compared to male, and also males present the antimicrobic properties of prostatic fluid (Ling et al. 1998, Bartges 2004). In general, E. coli is the most frequent bacterium associated with UTI in dogs, showing the incidence of 35.3% to 45% (Kogika et al. 1995, Barsanti 2005). In this particular study, Staphylococcus spp infection was the most frequent in both female and male dogs with urolithiasis, followed by Proteus mirabilis and E. coli. Considering that the genesis of struvite stone is promoted by urinary tract infection caused by urease-producing bacteria such as Staphylococcus spp and Proteus mirabilis (Barsanti 2005, Grauer 2003), that hydrolyze urea into ammonia and carbonate, the present study may confirm the predominant involvement of those bacteria in the development of struvite urolith. Magnesium, ammonium and phosphate (struvite) was the most common mineral found in compound uroliths in nidus, stone and shell layers, suggesting that the genesis of uroliths formation could be attribute to the initial presence of ureaseproducing bacteria in all 15 cases of compound calculi. However, other factors may also be involved as the influence of diet, drugs and tubular alterations that predispose to the formation of the struvite calculi by producing an alcalinized urine. The finding concerning the compound uroliths, it suggests that factors other than UTI may also be involved that could predispose to form layers with other different mineral composition. Struvite uroliths are also report as the main cause of urolithiasis in dogs without UTI in other studies (Ling et al. 1998, Oyafuso et al. 2007). Calcium oxalate was observed in most simple uroliths, and its genesis usually has not been related to UTI, as the role of its formation is related to hypercalciuria and acid pH urine; however UTI may also develop as a consequence of trauma caused by the presence of the stone in the urinary tract (Barsanti 2005). The findings observed in the present study, concerning the bacterial and mineral composition, could add information for the management of urolithiasis in dogs.

References


Keywords: Urolithiasis, dogs, urinary tract infection