MANAGEMENT OF CITROBACTER FREUNDII CYSTITIS IN A FEMALE DOG

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A one and half years old female shih Tzu dog was presented to to Referral Veterinary Polyclinic, Indian Veterinary Research Institute, with complaint of reduced food intake and hematuria. Based on clinical examination, urinalysis, abdominal ultrasonography, quantitative urine culture and antibiotic susceptibility test,the condition was diagnosed as cystitis due to infection by multidrug resistant *Citrobacter freundii*. The dog was treated with antibiotic and supportive medications for 2 weeks and had complete recovery.
Keywords: *Citrobacter freundii*, Cystitis, Immune suppression, Multidrug resistance.

Inflammation of the lower urinary tract is frequently encountered in female dogs due to their anatomically shorter and wider urethra. Pathogens causing urinary infections are mostly derived from enteric flora, which gain access into the urinary tract and colonizes, when the host defense mechanism fails to counteract it. Immune suppression has been identified as a major predisposing condition for canine cystitis (Wong *et al*., 2015). *Citrobacter freundii* was previously reported in urinary tract infection (Aurich *et al*., 2022). *Citrobacter freundii*is a gram negative, rod-shaped coliform belongs to family *Enterobacteriaceae*, is a normal inhabitant of gastrointestinal tract and considered as an opportunistic pathogen (Jean and Ardura, 2023). *C. freundii* was previously reported in canine urinary tract infection (Aurich *et al*., 2022) and which often detected in respiratory tract infections, new born illness, bacteremia and in patients suffering from diseases such as hypertension, diabetes mellitus and neoplasia or those who are immunocompromised (Jabeen *et al.,* 2023).

This report briefly describes about clinical manifestation, diagnosis and therapeutic management of *C. freundii* associated cystitis in a female dog.

Case history and Observations

A 1.5 years old female shih Tzu dog was presented to Referral Veterinary Polyclinic, ICAR- IVRI, with a complaint of hyporexia and intermittent hematuria for past one and half months. The animal had estrus bleeding two months back and developed blood mixed urination after that. The dog was treated in the nearby veterinary hospital using amoxicillin clavulanic acid, disodium hydrogen citrate and liver tonic with little improvement. On clinical examination, the dog was active and all the vital parameters were found to be normal except hyperemic conjunctival and vulval mucous membranes.

Diagnosis:

Urine sample was collected via catheterization and urinalysis revealed cloudy red urine with elevated pH (pH= 9), proteinuria (+/-, 15mg/dL), hematuria (15 RBCs/hpf), pyuria (10 WBCs/hpf) and bacteriuria. Haemato-serum biochemical evaluation showed hypoproteinemia (total protein: 4.82 g/dL) withnormal albumin (2.5 g/dL) concentration. Quantitative urine culture revealed growth of *Citrobacter freundii* with colony count 10^5CFU/mL and antibiotic sensitivity test showed susceptibility of the isolates to amoxicillin /clavulanic acid, ampicillin, piperacillin/ tazobactam, ceftazidime and cefepime and

resistance to ciprofloxacin, nitrofurantoin, imipenem, co-trimoxazole and gentamicin. Since, the isolate was resistant to antibiotics of more than three different classes, it was confirmed as multidrug resistant (MDR). On abdominal ultrasonography, urinary bladder was moderately distended with thickened wall and rough mucosal margin. Bladder content was markedly turbid and presence of large clots attached to walls could be noticed (Fig 1). Based on the clinical signs, laboratory investigation and ultrasonography the case was diagnosed as cystitis caused by MDR *C. freundii*.

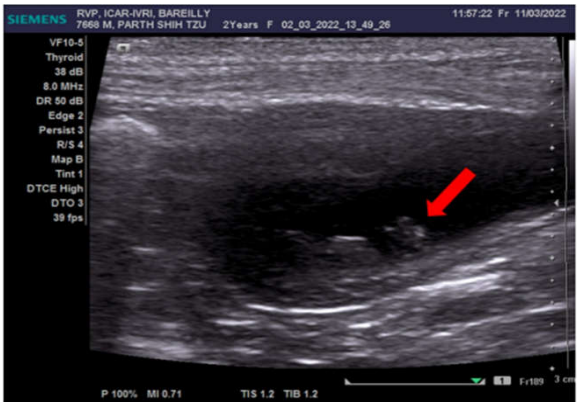

Figure 1.Pre-treatment ultrasonographic image showing urinary bladder with thickened wall and blood clots (red arrow) attached to dorsal mucosal surface.

Figure 2. Post -treatment ultrasonographic image showing reduced thickness of the bladder wall and clear anechoic contents

Treatment, Results and Discussion

Based on the antibiotic susceptibility test result, treatment was initiated with amoxicillin/ clavulanic acid at 12.5 mg/kg q12h, pantoprazole at 1mg/kg q24h and herbal reno-protective syrup at 5 ml q12h orally. Dog exhibited reduced frequency of hematuria, improvement in general activity and food and water intake. A complete urinalysis was performed after seven days of treatment, which reveled reduction in number of red blood cells (0/hpf) and pus cells (5/hpf), proteinuria (+/-, 15mg/dL) and presence of bacteria in urine. Based on the clinical response, treatment was continued for seven days and urinalysis and ultrasonographic imaging was reperformed after 14 days. Urine was normal in color and consistency, pH was acidic (pH=6), protein was negative on dipstick test and no significant number or presence of RBCs, pus cells and bacteria could be detected on urine sediment cytology. Ultrasonography revealed reduced thickness of the bladder wall and clear anechoic contents (Fig 2). These findings indicated marked improvement and recovery.

Immunocompromised dogs are most susceptible to *Citrobacter* infection. In this case, there was no clear evidences of any immune suppressive medicine administration or concurrent diseases or comorbidities, but the dog was in diestrus stage of estrous cycle. Alterations in ovarian activities including rise in progesterone and decline in 17-beta estradiol level during early diestrus can lead to suppression of cellular immunity. It may be a possible predisposing factor in this case. Inhibitory effect of progesterone on antigen presenting cells mainly maturation of dendritic cells in diestrus bitches was previously reported by Wijewardana *et al.,* 2015.

The prevalence of *Citrobacter* in canine urinary tract infection as per the study by Aurich *et al*., 2022 is low (< 3%). Although

they are less commonly associated with clinical cases of cystitis, attention has to be given for the emergence of MDR *C. freundii* isolates, as it can be resulted in limited treatment options and thereby progressing into life threatening complications like bacteremia and septicemia.

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