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Occurrence Study of Urinary Tract Disorders with Special Reference to Uncomplicated Bacterial Cystitis in Dogs

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ABSTRACT

Urinary tract disorders are common clinical presentation in dogs and are typical reasons for most antimicrobial prescriptions in companion animals. Avoidance of unnecessary antimicrobial administration is a key tenet of antimicrobial stewardship; knowing the percentage of occurrence obviates over-treatment and the optimal duration of therapy. Therefore, a study was planned to know the occurrence of urinary tract disorders in dogs at VCC, Jabalpur, M.P. The overall occurrence of urinary tract disorders in dogs at VCC, Jabalpur was 6.19 %. Among dogs confirmed for urinary tract disorders, dogs affected with upper urinary tract disorders were found to be 69.10 % and dogs affected with lower urinary tract disorders were found to be 30.94 %. Further classification of dogs afflicted with lower urinary tract disorders showed the occurrence of complicated cystitis as 25.28 % and uncomplicated or simple cystitis as 74.42 %. Age wise occurrence of uncomplicated cystitis was significantly higher (2.45 %) in dogs of 4-8 years of age group. Gender wise occurrence was significantly higher in female dogs (2.38 %) compared to male dogs. Ultrasonographic examination revealed echo textural variations in dogs like altered bladder wall thickness, starry sky appearance and presence of sludge. Urinalysis examination uncovered presence of epithelial cells, RBC, WBC, pus cells, crystals, granular casts, hyaline casts, leukocyte cast, epithelial cells, transitional epithelial cell, squamous epithelial cell and bacteria either alone or in combination in microscopic examination of urine in cases of uncomplicated bacterial cystitis.

HIGHLIGHTS

- Overall occurrence of urinary tract disorders in dogs at VCC, Jabalpur was 6.19 %.
- Renal biomarkers, ultrasonographic examination and urinalysis were used to identify uncomplicated bacterial cystitis.

Keywords: Dogs, urinary tract disorders, uncomplicated bacterial cystitis, ultrasonography, urinalysis

Urinary tract disorders in male and female dogs may be caused by a variety of fundamentally different causes like microbial colonization of the urine or any urinary tract organ or as a consequence of retrograde infection from urethra to kidney caused by bacteria, fungi or parasites (Elena *et al.*, 2019).

Disorders in UTI are a relatively common condition in dogs and occurs when there is a compromise in host defense mechanisms, which is characterized by abnormal micturition, anatomic structural alteration, impaired mucosal barrier and properties of urine (Chawla, 2020).

UTIs can be broadly classified on the basis of anatomical site of involvement into upper urinary tract infections comprising affections related to kidney (pyelonephritis) and ureter and lower urinary tract infections comprising conditions of the prostate (prostatitis), bladder (cystitis) and urethra (urethritis). Among lower UTIs, cystitis as a primary affection is found in higher percentage among

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females and old-aged animals and is generally defined as inflammation of bladder. It can be a consequence of favorable factors such as bladder topography and size (Dobre *et al.*, 2019). Hence, cystitis can be further differentiated into complicated cystitis (involvement of upper urinary tract infection, endocrinopathy and chronic kidney disease) and uncomplicated or simple cystitis.

Uncomplicated bacterial cystitis usually referred to as sporadic bacterial cystitis, is the most common morbidity in dogs in which bacterial infection of the urinary bladder with compatible lower urinary tract signs in dogs or cats are observed (Weese, 2019). Clinical signs of cystitis can be variable depending on the severity but most common symptoms include pollakiuria, polyuria, dysuria, stranguria, hematuria, incontinence, adaptation of altered posture while urination, restlessness, decreased appetite, vomition, weight loss, lethargy and depression.

The gold standard test for diagnosis of cystitis is considered to be urinalysis performed in order to analyze features of urine. Urine sample were examined microscopically by allowing the urine to run on centrifuge at 1500 rpm for 10 mins. A drop of sediment treated with 10% solution of acetic acid was then placed on a slide, applied cover slip and examine under under both low (10x objective) and high (40x objective) power of a microscope in order to observe organized (epithelial cells, erythrocytes, leukocytes, casts, mucous threads, microorganisms and parasites) and unorganized sediment (crystals) (Shweta, 2016).

Abdominal ultrasonography, a non-invasive technique can be performed in context to urogenital tract. Abnormalities such as change in size and shape of urinary bladder, space occupying lesions, stones and obstruction present in the urinary system can be detected with the help of ultrasonographic examination (Chawla, 2020).

MATERIALS AND METHODS

The proposed study was conducted in the Department of Veterinary Medicine, College of Veterinary Science and Animal Husbandry, Nanaji Deshmukh Veterinary Science University, Jabalpur for a period of six months.

Experimental animals

For the present study, a total of 2243 dogs presented at Veterinary Clinical Complex, College of Veterinary Science & A.H., NDVSU, Jabalpur (M.P.) were screened for a period of six months. The dogs were screened for the presence of clinical symptoms viz. pollakiuria, stranguria, hematuria, cloudy urine with abnormal odour, urinary incontinence, altered posture while urination, decreased appetite, lethargy, depression, polyuria, polydipsia, vomition and weight loss if any. All the screened dogs were further suspected for urinary tract disorders on the basis of clinical signs and duration of illness. Confirmation was done on the basis of renal markers *i.e.,* creatinine and BUN, ultrasonography and urinalysis.

Collection of samples

Blood samples

Approximately 3 ml of blood samples were collected aseptically from cephalic vein or saphenous vein of dogs suspected as well as confirmed cases of bacterial cystitis. Out of which 1 ml was collected in vial containing EDTA for routine hematology and 2 ml was collected in clot activator vials. Serum was harvested after centrifugation, frozen and stored at -20°C until further biochemical analysis was done.

Urine samples

Approximately 20 ml of urine samples were collected in suspected as well as confirmed cases of uncomplicated cystitis in dogs in suspected as well as confirmed cases of bacterial cystitis in dogs in order to differentiate lower urinary tract disorders from upper tract disorders.

Diagnostic imaging (Ultrasonography)

Diagnostic imaging was performed to confirm cystitis in the suspected dogs. Ultrasonographic examination was performed by using Philips HD7 XE Ultrasound machine with 3-12 MHz linear array transducer for internal structure. The dogs were kept in minimal stress condition, so that the evaluation was not affected. The echogenicity of identifiable lesions was monitored on the grey scale 2-D image and classified subjectively as normal anechoic, hyperechoic, presence of sludge, mixed echogenicity pattern or altered wall thickness as compared to normal clear lumen and wall thickness of bladder.

Renal function markers

Renal function markers i.e., Creatinine and BUN were estimated in suspected as well as confirmed cases of bacterial cystitis in dogs in order to differentiate lower urinary tract disorders from upper tract disorders.

STATISTICAL ANALYSIS

The chi-square test of significance was applied to the qualitative data pertaining to the occurrence of the disease.

RESULTS AND DISCUSSION

Overall occurrence of urinary tract disorder in dogs at VCC, Jabalpur

A total of 2243 dogs were screened for the urinary tract disorders, out of which 164 dogs showed clinical signs pertaining to urinary tract disorders. Out of 164 dogs suspected, 139 were found affected with urinary tract disorders. Therefore, the overall occurrence of urinary tract disorders in dogs at VCC was 6.19 per cent and among the suspected dogs, the occurrence was 84.75 per cent (Table 1).

Among 32 confirmed cases of uncomplicated / simple bacterial cystitis, clinical signs on the basis of variable duration of illness comprised of pollakiuria i.e., 75 % (24/32), stranguria/ dysuria i.e., 65.63 % (21/32), altered posture of urination i.e., 25 % (8/32), low grade fever i.e., 25 % (8/32), hematuria i.e., 21.88 % (7/32), polyuria i.e., 18.75 % (6/32), abnormal odour i.e., 15.63 % (5/32), urinary incontinence i.e., 12.50 % (4/32), lethargy i.e., 9.38 % (3/32), cloudy urine i.e., 6.25 % (2/32), decreased appetite i.e., 6.25 % (2/32) and vomition i.e., 3.13 % (1/32).

The overall occurrence of urinary tract disorders observed in present study correlated well with the findings of Forrester *et al.* (1999) and Adamama *et al.* (2017) who recorded the dogs affected with urinary tract disorders to be 4.6 % and 1.82 %, respectively in their findings. Also, the occurrence of lower urinary tract disorders associated well with the findings of Stiffler *et al.* (2006), Olby *et al.* (2010) and Liebelt and Pigott (2019) who reported it to be 27 %, 36 % and 33 %, respectively. However, comparatively higher occurrence of lower urinary tract disorders was reported by Kogika *et al.* (1995), Yehia and Salem (2015) and Adamama *et al.* (2017) as 74.5 %, 75 % and 90.7 %, respectively. Most urinary tract infections are the result of ascending bacteria from rectal or faecal contamination or from distal urogenital tract. Presence of anatomic or functional abnormality or a co-morbidity may also predispose the dog for urinary tract disorders (Shashank *et al.*, 2022). The varying results of occurrence studies of urinary tract disorders at VCC, Jabalpur, with the reports of previous researchers might be attributed to the differences in experimental design and procedures followed in estimating the occurrence percentage, rearing and management of pets and environmental condition.

Table 1: Occurrence of urinary tract disorders in dogs at VCC, Jabalpur

Particulars	No. screened	No. affected	Occurrence (%)
Total Dog population	2243	139	06.19%
Dogs suspected for urinary tract disorders	164	139	84.75%

Distribution of urinary tract disorders in dogs at VCC, Jabalpur

Out of 139 confirmed cases of dogs with urinary tract disorders, 96 (69%) were found positive for upper urinary tract disorders and 43 (31%) were found positive for lower urinary tract disorders. Among these 43 cases positive for lower urinary tract disorders, 11 (26%) were found positive for complicated cystitis and 32 (74%) were found positive for uncomplicated / simple bacterial cystitis as shown in Fig. 1.

Age wise occurrence of bacterial cystitis in dogs

Age wise occurrence was observed to be significantly higher for dogs ranging in age group of 4-8 years of age i.e. 2.45 % (18 out of 694) followed by dogs of more than 8 years of age i.e. 1.24 % (9 out of 563) and the minimum occurrence was recorded in dogs of upto 4 years of age i.e. 0.41 % (5 out of 986). Although, bacterial cystitis can be seen in any age group, but the frequency is higher in middle aged dogs which is well evident in the present study. The possible reason of occurrence of cystitis in middle aged dogs might be due to changes in

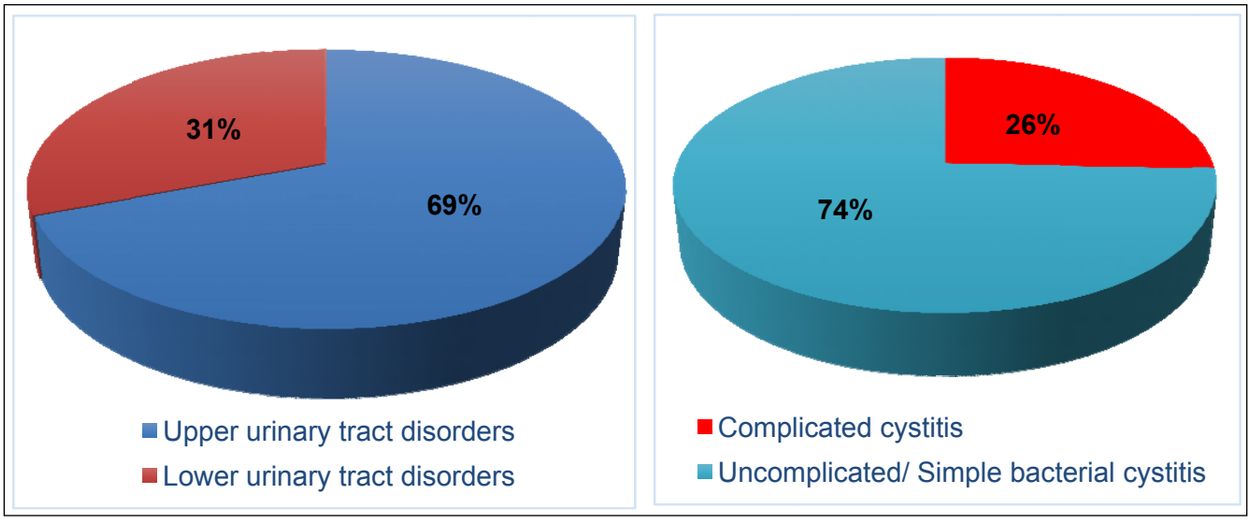

Fig. 1: Distribution of urinary tract disorders in dogs at VCC, Jabalpur

immune system, hormonal fluctuations, urinary retention, environmental factors, medications and under lying health conditions (Chew *et al*., 2010) (Table 2).

Gender wise occurrence of bacterial cystitis in dogs

Gender wise predisposition showed that out of total 2243 dogs screened for study, 1488 were males and 755 were females and a significantly higher occurrence was noted in female dogs i.e., 2.38 % (18/755) in comparison to male dogs i.e., 0.94 % (14/1488). This significant difference in gender wise occurrence of urinary tract disorders observed in female may be attributed with the higher incidence of bladder infection in females as compared with males, probably due to a shorter urethra which offers a smaller degree of protection against ascending bacteria. Also, the urethra of a male dog is exposed to more frequent washing by urine flow due to the different micturition habit of males (Kivisto *et al.*, 1977) (Table 02).

Table 2: Age wise occurrence of bacterial cystitis in dogs

Age groups (Years)	No. screened	No. affected (n=32)	Occurrence (%)
Upto 4	986	5	0.41
4-8	694	18	2.45
>8	563	9	1.24
χ^2 value = 12.768; $p < 0.05$ (Significant)			

Gender wise occurrence of bacterial cystitis in dogs

Sex	No. screened	No. affected (n=32)	Occurrence (%)
Male	1488	14	0.94
Female	755	18	2.38
χ^2 value = 7.419; $p < 0.05$ (Significant)			

Breed wise occurrence of bacterial cystitis in dogs

A substantially higher occurrence was recorded in Pug i.e., 4 % (2/50) followed by Doberman i.e., 3.70 % (1/27), Rottweiler i.e., 2.22 % (1/45), other breeds (French Mastiff, Bull Mastiff, Lhasa Apso, Belgian Malinois) i.e., 1.75 % (1/57), Spitz/Pomeranian i.e.,1.59 % (1/63), German Shepherd i.e., 1.55 % (6/386), non-descript i.e., 1.31 % (11/841) and Labrador Retriever i.e., 1.16 % (9/774). The results of the breed wise occurrence lines well with the result of Kocurekova *et al.* (2021) who reported higher breed wise occurrence of bacterial cystitis in small breed dogs. On the contrary to the result of present study, Yamanaka *et al.* (2019) and Amphaiphan *et al.* (2021) reported higher occurrence of bacterial cystitis in mixed breed dogs. The occurrence of bacterial origin of UTI in small breeds of dogs may be due to the fact that the smaller breeds are more susceptible to formation of urinary stones. Pug breeds are prone to developing UTI due to short urethra and presence of excess skin folds around the genitals (Ettinger *et al.*, 2017). Moreover, the

breed wise relative differences in bacterial cystitis might also be due to variation in geographical locations, genetic makeup, breed availability and differences in management practices (Fig. 2).

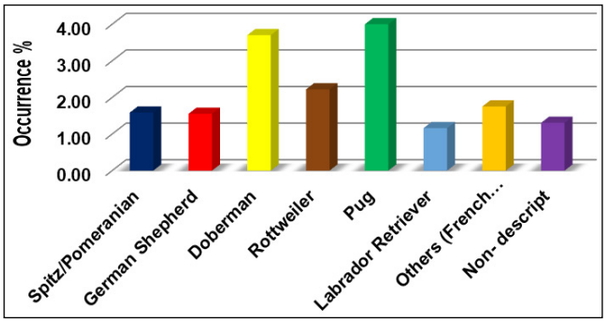

Fig. 2: Breed wise occurrence of bacterial cystitis in dogs

Diagnostic imaging (Ultrasonography)

In this study, ultrasound was found to be a quick, practical and sensitive method for identifying changes in urinary bladder in cystitis, which plays an important role in diagnosing the condition The abdominal ultrasonography findings in dogs affected with bacterial cystitis in dogs revealed thick and distinct three layered urinary bladder wall in 09 dogs, bladder wall appeared thicker and hyperechoic without distinction of different layers in 11 dogs, sludge in lumen of bladder in 11 dogs and irregularity of bladder mucosa with hyperechoic bladder wall in 03 dogs (Fig. 3a).

The ultrasonographic changes observed were in accordance with the findings of Elgazzar *et al*. (2021), who concluded the presence of thickened bladder wall with turbid content with clear distinction of the submucosa, muscularis and serosa in cystitis in dogs (Fig. 3b). Similarly, Hassan *et al*. (2019) identified bacterial cystitis in contiguity with increase of bladder wall echogenicity, decrease in circumscribed anechoic area, hyperechoic suspended material representing cellular debris and irregular bladder mucosa. Dehmiwal *et al*. (2015), visualized submucosa and serosa with hyperechoic and hypoechoic muscularis layer and inflamed thickened wall clearly visible with the distinction of different layers of the urinary bladder wall in cystitis.

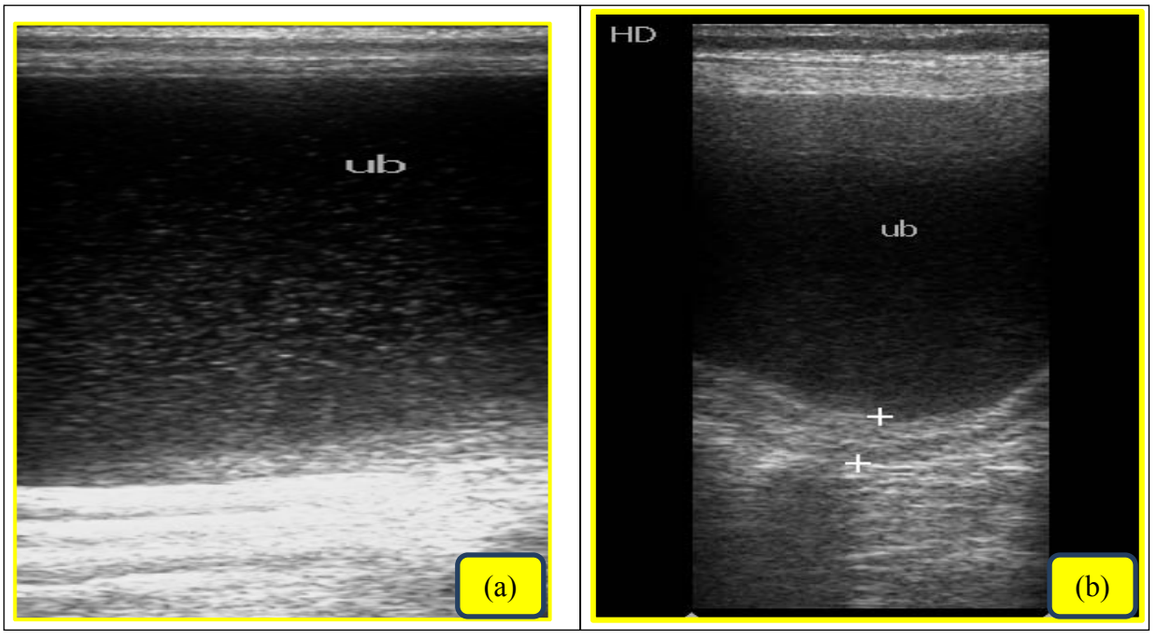

Fig. 3: Ultrasonogram of urinary bladder showing **(a)** Lots of sludge and starry sky appearance suggestive of chronic cystitis **(b)** Urinary bladder wall thickness of 6.70 mm thickness with irregular boundary wall texture and lots of urine volume suggestive of cystitis

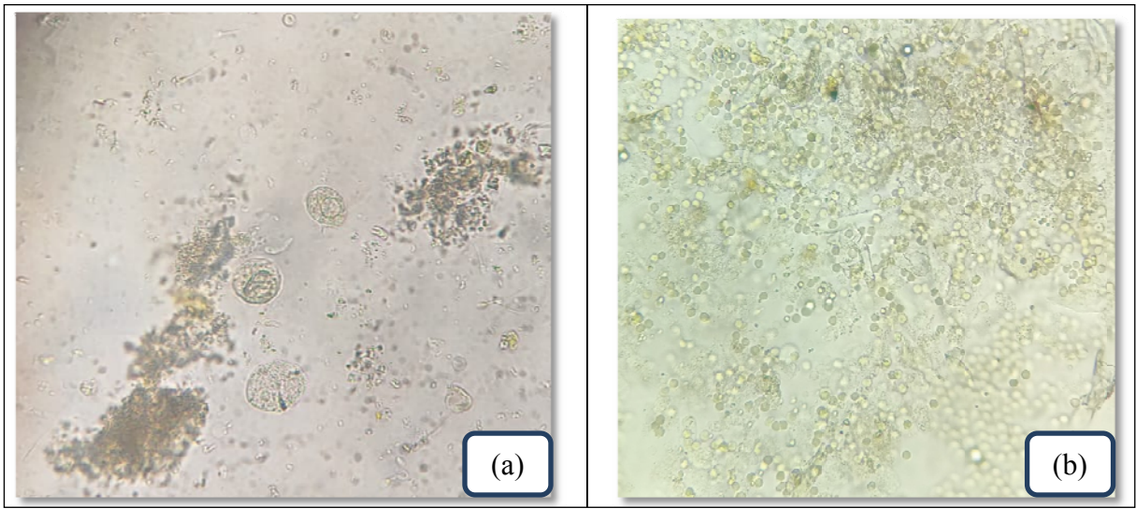

Fig. 4: Microscopic examination of urine sediment in dogs affected with bacterial cystitis showing **(a)** Exfoliated transitional epithelium **(b)** Pus Cells

Urinalysis

Microscopic examination of urine sediment in dogs affected with bacterial cystitis revealed the presence of epithelial cells, RBC, WBC, pus cells, crystals, granular casts, hyaline casts, leukocyte cast, epithelial cells, transitional epithelial cell, squamous epithelial cell and bacteria either alone or in combination (Fig. 4). The result of the study is in concordance with the findings of Dunning and Stonehewer (2012), Jasim (2012) and Smee *et al*. (2013) who also reported the microscopic findings like epithelial cells, RBC, WBC, pus cells, casts and bacteria in urine samples of dogs affected with bacterial cystitis in dogs. The variable microscopic findings in urine sediment of dogs affected with bacterial cystitis depends on the extent of the damage caused on the mucosal defence barrier of uroepithelium, feeding of commercial diet rich in magnesium and calcium, decreased water intake, dehydration, inappropriate habits of urination and accumulation of sediments on ventral wall of bladder and urethra (Cetin *et al*., 2003).

CONCLUSION

The overall occurrence of complicated cystitis to be 25.28% and uncomplicated or simple bacterial cystitis to be 74.42 %. Dogs of 4 - 8 years of age had more occurrence with pug breed being most affected with bacterial cystitis. Urinalysis revealed presence of transitional epithelial cell, squamous epithelial cell and bacteria either alone or in combination in cases of bacterial cystitis of dogs. Ultrasonography revealed sludge in lumen, hyperechoic bladder wall, irregularity of bladder mucosa, thick and distinct three-layered urinary bladder wall.

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