

Studies on Incidence, Clinical Features and Ultrasonographic Changes in Urinary Tract Infections of Dogs in and around Navsari, Gujarat

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ABSTRACT

Considering urinary tract infections as commonly encountered ailment in dogs and cats which accounts for significant use of antimicrobials, the present study was carried out to know the incidence and clinical features of urinary tract infection (UTI) in dogs in and around Navsari. During study period, 37 of 895 registered cases were primarily suspected for UTI based on clinical signs. Of which, 18 dogs were found positive for pyuria/bacteria on microscopic examination of urine with 2.0% (18/895) overall incidence. The hospital based incidence among the suspected cases was 48.64% (18/37). Significantly, higher incidence was observed in dogs aged between 6-10 years (50.0 %) followed by 2.5-6.0 year (44.45%) and the least in > 10 year (5.55%) age group. The incidence was comparatively higher in males (61.1%) than in females (38.9%). Breed-wise, the higher incidence of UTI was observed in Labrador Retriever (27.8%) followed by non-descript, Pug, German Shepherd, Cocker Spaniel and crossbreds (11.1% each) and Pomeranian, Doberman and Saint Bernard contributed 5.60% each. Clinical signs included inappetence (77.80%), haematuria (61.11%) and dribbling of urine along with stranguria (38.90%). Additional signs were pale/anaemic mucous membranes and dullness/depression (27.80%), pyrexia (22.20%), dysuria (16.70%) and vomiting (11.10%). Vital parameters showed non-significant difference from healthy dogs. About 50% dogs had K/Ao ratio within normal range, whereas, 16.67% cases showed enlarged kidneys. Most dogs had normal echogenicity and normal cortico-medullary distinction. Urinary bladder wall revealed increased wall thickness (>0.23 cm) in 83.33% cases with normal echogenicity in 50% cases. These findings underscore the importance of urinalysis along with clinical and USG examination of dogs with UTI.

Keywords: Dogs, Incidence, Urinary tract infection, Ultrasonography

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INTRODUCTION

Urinary tract infection (UTI) occurs when microbial colonization, often by bacteria, affects any part of the urinary tract, except the distal urethra, which has normal bacterial flora. UTIs develop when host defence are compromised, allowing pathogens to attach, multiply, and remain in the system. Bacteria are the most common cause of UTIs, but fungi, protozoa, algae, and rarely, viruses can also be agents (Roopali *et al.*, 2018). The variable incidence of UTI is observed in all over the world. In India, overall incidence of canine UTI varies from 1.1-8.39 % (Madhvi, 2021; Sahu *et al.*, 2021; Thomas *et al.*, 2023), and among the suspected cases it was reported between 33.33-81.88% (Hariharan *et al.*, 2016; Madhvi, 2021; Lathamani *et al.*, 2022). The disparity in incidence of UTIs could be due to difference in the size of population studied or due to inclusion and exclusion criteria employed in the study (Yogeshpriya, 2012; Lathamani *et al.*, 2022). UTI may show a number of clinical signs such as pollakiuria, stranguria, dysuria, haematuria, and inappropriate urination or periuria (Smee *et al.*, 2013). Diagnosis of a UTI is made based on information obtained from history, clinical findings, USG and urinalysis and (ideally) urine culture examination. Of these, urinalysis is a crucial clinical diagnostic tool (Yadav *et al.*, 2020). Other useful diagnostic tests include complete blood counts (CBC), chemistry profiles and abdominal ultrasounds (Olin and

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Bartges, 2015). UTI represents a significant indication for antibiotic prescription in small animal practice. However, true status of urinary tract infections has not yet been explored in dogs of south Gujarat, India. Hence, the present study on incidence, clinical signs and ultrasonographic changes in UTI affected dogs of south Gujarat was undertaken.

MATERIALS AND METHODS

The present study was conducted over a period from February to August, 2024 on clinical cases in the Department of Veterinary Medicine in collaboration with Veterinary Clinical Complex, College of Veterinary Science and A.H., Kamdhenu University, Navsari (Gujarat, India). Of the total 895 registered canine cases, 37 were primarily suspected for urinary tract infection based on clinical signs such as inappetance, haematuria and dribbling of urine along with stranguria, pale/anaemic mucous membranes, dullness/depression, pyrexia, dysuria and vomiting. Further, clinical examination, urinalysis and ultrasonography were performed on these cases.

Various physical (colour, transparency, pH and specific gravity) and chemical parameters (protein, blood, bile pigment, bile salts, ketone bodies, glucose, nitrite, leukocytes etc.) of urine samples collected from suspected cases were estimated using commercially available urine analysis strips (URISCAN 7 strip, Q-Line Pvt. Ltd., Republic of Korea) and urine analyser (URISCAN Optima, Q-Line Pvt. Ltd., Republic of Korea). Simultaneously, collected urine sediments were examined under microscope (40x) after centrifugation at 750 g for 5 min for presence/intensity of erythrocytes, leucocytes, epithelial cells, casts and crystals as per the method by Sandhu and Singh (2019).

The USG examination of urinary tract was performed to notice alterations in the echogenicity and echotexture of renal parenchyma and renal size and prostatic parenchyma and size (males), urinary bladder wall thickness and presence of cystolith and tumorous growth as per the guidelines given by Mattoon and Nyland (2015).

Data pertaining to incidence were analysed using Chi-square test at probability of 5% and confidence interval at 95% level on IBM SPSS statistical software version 20.0 (Snedecor and Cochran, 1994). Further, clinical signs were grouped into different subgroups and their frequency was calculated.

RESULTS AND DISCUSSION

Overall, Age, Sex and Breed-wise Incidence

Among the 895 fresh cases registered at VCC, Navsari for medical treatment, 37 were primarily suspected for UTIs based on clinical signs. Out of 895, 18 dogs were found positive for pyuria on microscopic examination of urine sample and on cultural isolation, with overall incidence of UTIs of 2.0% (18/895). Yogeshpriya (2012) and Thomas *et al.* (2023) also observed 1.1% and 2.5% overall incidence of UTIs in dogs, respectively. On contrary, higher overall incidence (between 5-10%) was reported by Sahu *et al.* (2021) and Madhvi (2021). The hospital based incidence among the suspected cases was 48.64% (18/37). Similar trend on hospital based incidence was also reported previously by Hariharan *et al.* (2016) and Madhvi (2021) with 30-40% incidence among

suspected cases. Still higher incidence (81.88%) in suspected cases of UTIs was detected by Lathamani *et al.* (2022), whereas Yehia and Salem (2015) and Mustapha and Goel (2020) reported much low incidence (<25%) of UTIs. The disparity in incidence of UTIs could be due to difference in the size of population studied or due to inclusion and exclusion criteria employed in the study (Lathamani *et al.*, 2022).

Significantly the highest incidence was observed in dogs aged 6-10 years (50.0%), followed by 2.5-6.0 year (44.45%) and the least in >10 year (5.55%) age group ($p \leq 0.05$) (Table 1). Similarly, Sahu *et al.* (2021) reported the highest incidence in dogs of 6-8 years age (53.84%) followed by 8 years (23.07%), 4-6 years age (11.53%) and 2-4 years age (7.69%), whereas, dogs less than 2 years age had one case of UTI (3.84%). The finding of higher incidence in age group between 6 and 10 years is in agreement with earlier reports (Wong *et al.*, 2015; Lippi *et al.*, 2019). On the contrary, Olby *et al.* (2010) and Yogeshpriya (2012) found higher incidence of UTIs in dogs aged below 6 years as compared to other age groups. The difference in incidence of UTIs in different age group of dogs might be due to the fact that majority of dogs presented to the hospital were of this age group (Yogeshpriya, 2012).

Further, comparatively higher incidence was observed in males (61.1%) than females (38.9%). Previously, Mendóza-López *et al.* (2017) also found higher incidence in males (74.22%) compared to females (25.78%). However, most studies reported higher incidence in female dogs (Wong *et al.*, 2015; Sahu *et al.*, 2021; Thomas *et al.*, 2023). Further, the incidence was the highest in intact males (38.9%) followed by castrated males (22.2%), spayed females (22.2%) and lowest in intact females (16.7%) (Table 1). Seguin *et al.* (2003) found a similar pattern, while Wong *et al.* (2015) reported higher incidence in castrated males than intact males.

Among the breeds, higher incidence of UTI was observed in Labrador Retriever (27.8%) followed by non-descript, Pug, German Shepherd, Cocker Spaniel and crossbreeds (11.1% each) and others (Table 1). The finding of higher rate of infection in Labrador Retriever is in agreement with report of Wong *et al.* (2015). Similarly, Sorensen *et al.* (2018) also noted higher occurrence in Labrador Retriever followed by Mixed breed dogs and the least in Cocker spaniel, while Madhvi (2021) observed high incidence in Labrador Retriever (28.57%) breed of dogs followed by Rottweiler (14.29%), German Shepherd and Pug (11.43% each), and others.

Clinical Findings

During clinical examination of UTI cases, clinical signs and their frequencies were noted as given in Table 2. The most common clinical signs observed were inappetance (77.80%), haematuria (61.11%) and dribbling of urine along with stranguria (38.90%). Additional signs were pale/anaemic mucous membranes and dullness/depression (27.80%), pyrexia (22.20%), dysuria (16.70%) and vomiting (11.10%). Lalmuanpui *et al.* (2019) also reported similar most common clinical signs in dogs affected with UTIs. In a report from India,

Yogeshpriya *et al.* (2018) observed pyuria (42.85%) as major clinical signs followed by haematuria (28.57%), stranguria (35.71%), pollakiuria (25%), anorexia (28.57%), dark yellow urine (14.28%), foul smelling urine (17.85%) and emesis (3.87%). Inappetance observed in UTIs affected dog is likely due to pain caused by abdominal discomfort from lower urinary tract infections (Madhvi, 2021). Haematuria in UTIs affected dogs might be a result from bacterial invasion, irritation from urinary stones, or bladder lesions. The dribbling of urine in this study may be due to inflamed mucosal epithelium of the bladder and urethra, or small cystoliths and uroliths causing obstruction. Stranguria could be linked to partial urinary outflow obstruction and inflammation of the urogenital tract. Dysuria might be associated with inflammation of the urethra and external genitalia. Pain during urination can lead to retained urine and incomplete bladder emptying (Senior, 2005). Clinical examination of vital parameters, *viz.*, temperature, pulse and respiration, showed non-significant difference from healthy dogs.

Table 1: Age, sex and breed wise incidence of UTI in dogs

Factor	Groups	No. (n=18)	%	χ^2 value
Age	< 6 years	08	44.45	6.34*
	6- 10 years	09	50.00	
	>10 years	01	05.55	
Sex	Intact Male	07	38.90	2.00
	Castrated Male	04	22.20	
	Intact Female	03	16.70	
	Spayed Female	04	22.20	
Breeds	Labrador	05	27.80	6.00
	Non-descript	02	11.10	
	Pug	02	11.10	
	German Shepherd	02	11.10	
	Cocker Spaniel	02	11.10	
	Crossbreed	02	11.10	
	Pomeranian	01	05.60	
	Doberman	01	05.60	
	Saint Bernard	01	05.60	

*indicates significant at $p \leq 0.05$

Table 2: Frequency distribution of clinical signs in dogs affected with UTIs

Clinical Signs	UTIs affected dogs (n=18)	Percentage
Inappetance	14	77.80
Haematuria	11	61.11
Dribbling of urine	07	38.90
Stranguria	07	38.90
Pale/ anaemic	05	27.80
Dullness/depression	05	27.80
Pyrexia	04	22.20
Dysuria	03	16.70
Vomiting	02	11.10

Urinalysis

The color of urine ranged from light yellow to red. Simultaneously, urine transparency in most of affected dogs was clear along with turbid urine in four cases. These observations are in close association with previous reports

(Madhvi, 2021; Patel *et al.*, 2022; Thomas *et al.*, 2023). The change in color and turbidity in the urine of affected dogs could be due to large concentrations of bacteria, fat crystals or mucus (Madhvi, 2021). The mean urine pH of UTI affected dogs was 5.68 ± 0.17 , which was significantly ($p \leq 0.01$) lower than healthy dogs (6.74 ± 0.20). Further, specific gravity of urine in UTI affected dogs was 1.030 ± 0.00 , which was significantly higher than in healthy dogs (1.020 ± 0.00). The present findings are in accordance with findings of Grimes *et al.* (2019). Generally, bacterial infections result into renal tubular acidosis which may lead to acidic urine pH. Further, it is stated that the renal disease, or a partial deficiency or incomplete action of ADH can lead to high specific gravity (Ristic and Skeldon, 2011). During the study, Proteinuria, haematuria and glucosuria was observed in UTIs affected dogs. Moreover, presence of nitrite, bile salts and bile pigments were also noticed in 1-3 dogs out of 18. These findings are in agreement with findings of Patel *et al.* (2022) and Thomas *et al.* (2023). Proteinuria and glucosuria may result from glomerulonephropathy, tubular transport defects, inflammation or infection within the urinary tract (Parrah *et al.*, 2013).

Microscopically out of 18 cases, erythrocytes were observed in 17 (94.44%) cases. Of which 1-5 cells/HPF were observed in 22.22%, 5-50 cells/HPF were observed in 38.89% and >50 cells/HPF were observed in 33.33% cases. The results are in agreement with previous reports (Madhvi, 2021; Patel *et al.*, 2022). During the study, leucocytes were observed in 77.78% urine samples of UTIs affected dogs. Further, presence of crystals (22.22%), cast (11.11%), epithelial cells (22.22%) and bacteria (44.40%) were also observed in UTIs affected dogs. Similar findings were reported by Punia *et al.* (2018) and Patel *et al.* (2022).

Table 3: Frequency distribution of ultrasonographic findings in UTI affected dogs

USG findings	Groups	No. (n=18)	%
Kidney			
K/Ao ratio	<5.5	06	33.33
	5.5 – 9.1	09	50.00
	>9.1	03	16.67
Echogenicity	Normal	15	83.33
	Hyperechoic	03	16.67
Echotexture	Normal CMD	13	72.22
	Poor CMD	05	27.78
Urinary bladder			
Wall thickness	<0.23 cm	03	16.67
	>0.23 cm	15	83.33
Other findings	Normal	09	50.00
	Hyperechoic mass	04	22.22
	Stone	04	22.22
	Sludge	01	05.56
Prostate(n=11)			
Size	Normal	08	72.73
	Enlarged	03	27.27
Parenchyma	Homogeneous	09	81.81
	Hyperechoic foci	02	18.19

CMD-Cortico-medullary distinction



Ultrasonographic Findings

During USG examination of UTI cases, kidney size was measured using the ratio of kidney length to aorta diameter (K/Ao ratio). K/Ao ratio between 5.5 and 9.1 was considered as normal, whereas, ratios <5.5 indicating smaller kidneys and >9.1 indicating enlarged kidneys (Mattoon and Nyland, 2015). About 50% dogs having UTIs had K/Ao ratio within normal range, only 16.67% cases showed enlarged kidney. Most dogs displayed normal echogenicity (83.33%) and normal cortico-medullary distinction (72.22%). USG findings of urinary bladder revealed increased urinary bladder wall thickness (>0.23 cm) in 83.33% cases with normal echogenicity in 50% cases (Fig. 1). In few cases, abnormal findings such as hyperechoic masses, stones and sludge were observed (Table 3) (Fig.2, 3). The major USG finding of increased bladder wall thickness (>0.23 cm) in UTI affected dogs is in close agreement with previous reports (Dehmiwal *et al.*, 2015; Yogeshpriya *et al.*, 2018; Lalmuanpui *et al.*, 2019; Madhvi, 2021; Shashank *et al.*, 2023). During the study, enlarged prostate was also observed in 27.27% cases with hyperechoic foci in prostate parenchyma in 18.19% cases (Fig. 4). Previously, Yogeshpriya (2012) also reported prostatic enlargement in 14.28% cases, whereas, Madhvi (2021) observed enlarged

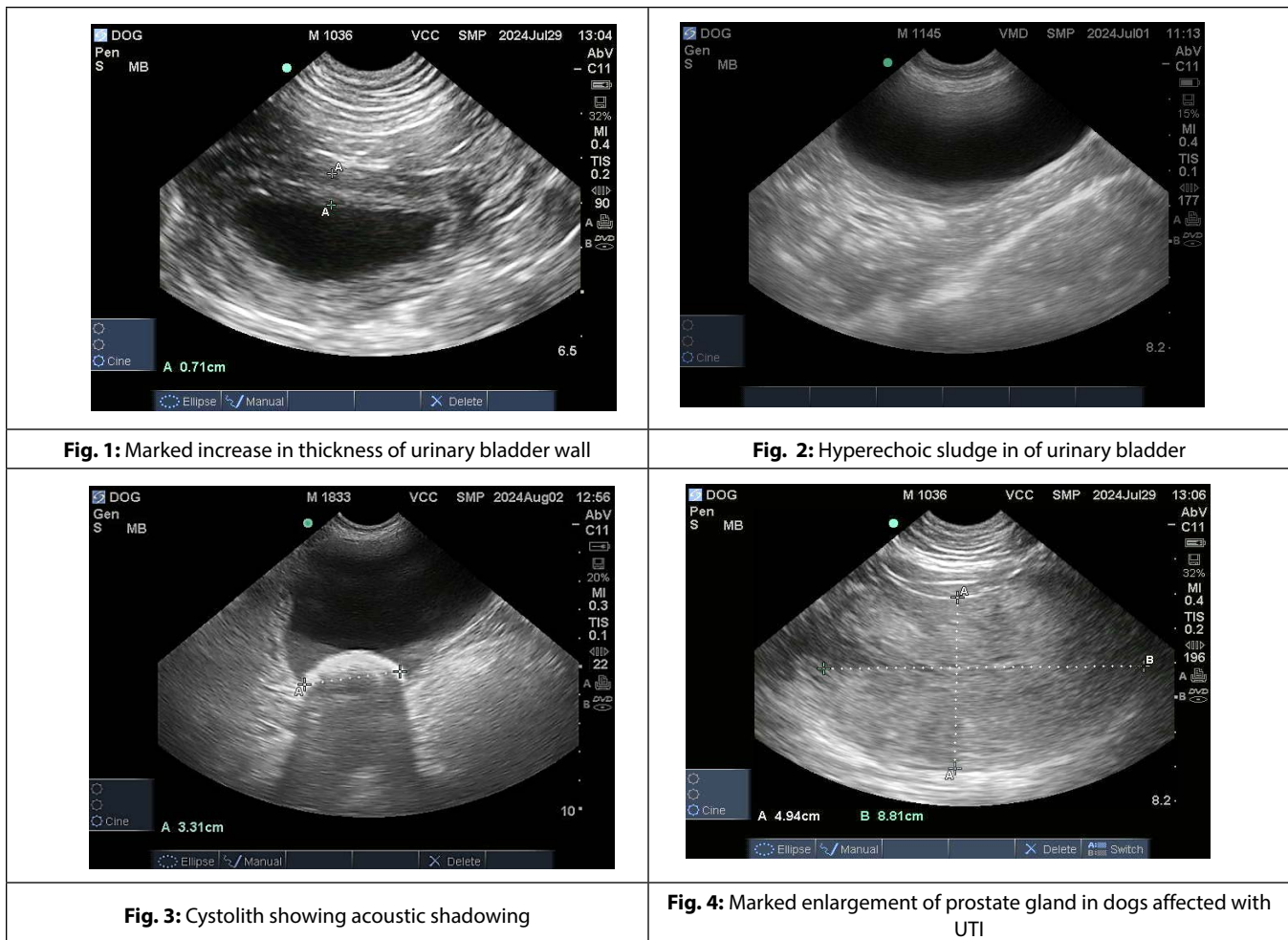
prostate only in 8.57% cases.

CONCLUSION

The study reports that the overall incidence of UTIs in dogs of Navsari was 2.0% (18/895) with hospital based incidence of 48.64% (18/37). Higher incidence was observed in dogs aged 6-10 years, in males (61.1%) and in Labrador Retrievers (27.8%) than their counter parts. The most common clinical signs in UTI affected dogs were inappetance, haematuria and dribbling of urine along with stranguria. Most dogs displayed normal echogenicity and cortico-medullary distinction. Increased urinary bladder wall thickness was the most frequently observed USG findings. Few dogs revealed hyperechoic masses, stones and sludge in bladder, prostatic enlargement and enlarged kidney. These findings outscore the importance of urinalysis along with clinical and USG examination of patients with UTI.

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