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Urinalysis in dogs affected with urinary tract infection

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Abstract
Urinary tract infection (UTI) is the microbial colonisation of the urinary system or any urinary tract organ. Apart from the distal urethra, which has a normal bacterial flora. Total of 12 dogs affected with urinary tract infection were included in study Urine samples from the dogs positive for urinary tract infection were collected on day '0' by catheterization method and subjected to physical, chemical, and microscopic examination. The color of urine samples of dog presented in study (n=12) was red (n=5, 41.66%), dark yellow (n=2, 16.67%), yellow (n=3, 25.00%), amber (n=1, 8.33%) and pale yellow (n=1, 8.33%). Acidic pH was observed in 33.33 (n=4), alkaline pH was observed in 58.33% (n=7) and neutral pH was observed in 8.33% (n=1) of samples. Haematuria (66.66%), proteinuria (58.33%) and bilirubinuria (41.66%) were the most common findings. microscopic examination of urine samples from dog affected with urinary tract infection revealed presence of pus cells (83.33%), epithelial cells (75.00%), RBCs (66.66%), crystals (58.33%), bacteria (58.33%) and casts (33.33%) cases.

Keywords: Anaplasmosis, incidence, blood smear examination, PCR

Introduction
Urinary tract infection (UTI) is the microbial colonisation of the urinary system or any urinary tract organ. Apart from the distal urethra, which has a normal bacterial flora. The most prevalent infectious disease in dogs is assumed to be urinary tract infection. According to estimates, up to 10% of all canine patients who visit vets for whatever reason also have UTI in addition to the issues they are there for. (Cetin *et al.*, 2003; Somu *et al.*, 2015) [1, 14]. The origin of UTIs can be bacterial, fungal, algal, protozoal, and very rarely viral. (Lulich and Osborne, 2004) [5]. Urinary tract infection (UTI) of bacterial origin is the most common infectious disease of dogs, affecting 14% of all dogs during their lifetime. (Roopali *et al*., 2018) [4]. Diagnosing a bacterial UTIs required a positive urine culture, isolation and identification of the organism and other tests may also be used in the diagnosis such as urine analyses, complete blood counts (CBC), chemistry profiles, rectal examinations, abdominal radiographs, abdominal ultrasounds, contrast radiology, cystoscopy with bladder wall culture tests and prostatic washes (Dokuzeylul *et al.*, 2019) [3].
Urinalysis is the clinical laboratory's third major diagnostic screening test. It is an important check for the occurrence, extent, and length of urinary tract diseases. It is the best way to diagnose kidney dysfunction before renal failure happens (Yadav *et al*., 2020) [28]. If left untreated, urinary tract infections are one of the most common causes of prostatic illnesses in male dogs and may potentially result in renal failure. (Punia *et al*., 2018) [6]. Hence the present study was conducted to determine the changes in urine of dogs affected with urinary tract infection.

Materials and Methods
The study included a total of 28 dogs who had clinical signs of a urinary tract infection and had been brought to the Veterinary Clinical Complex, Department of Veterinary Medicine, Department of Veterinary Surgery of the Veterinary College, Anand, Government polyclinics, and some of the private clinics in the vicinity of Anand. Out of that, twelve cases (n=12) were selected for present study based on haemato-biochemical, urine analysis and positive urine culture which were indicative of urinary tract infection. Urine samples from these dogs were collected on day '0' by catheterization method by placing the animal in lateral recumbency. Approximately 5 ml of urine was collected in 50 ml sterile container and then kept in refrigerator at 4-8 °C for further analysis. The colour and transparency were examined grossly. Physical and chemical examination of urine were done using by dipstick method.

Degree of haematuria, proteinuria, ketonuria, bilirubinuria, glucosuria were divided into mild (+), moderate (++) and severe (+++, ++++) based on severity (Punia *et al.*, 2018) [6]. For microscopic examination, urine sample was centrifuged at 3000 rpm for 7 min and pellet obtained after discarding supernatant was resuspended and examined under microscope at 10x and 40x. The number of erythrocytes, leucocytes, epithelial cells, casts, and crystals per 5-10 different high-power fields was counted and average was recorded (Archer, 2005) [7].

Results and Discussion

Physical Examination of Urine

The color of urine samples of dog presented in study (n=12) was red (n=5, 41.66%), dark yellow (n=2, 16.67%), yellow (n=3, 25.00%), amber (n=1, 8.33%) and pale yellow (n=1, 8.33%) as per Table 1. Similar observations were reported by Jasim (2012) [17], Kandula and Karlapudi (2015) [8], Punia *et al*. (2018) [6], Jacob (2020) [9], Parmar *et al*. (2020) [11] and Madhvi (2021) [10].

In present study the pH of urine samples varied from acidic to alkaline. Acidic pH was observed in 33.33(n=4), alkaline pH was observed in 58.33% (n=7) and neutral pH was observed in 8.33% (n=1) of samples (Table 1) which was in accordance with Swetha (2016) [12] who reported acidic urine in 42.11% cases and alkaline urine in 57.89% cases. Similar observations were reported by Cetin *et al.* (2003) [1] and Punia *et al.* (2018) [6]. However, Ghanem *et al*. (2021) [13] observed acidic (6.5) urine pH in dogs affected with cystitis. In contrast Somu *et al*. (2015) [14] reported no significant change in urine pH in dogs suffering from UTI. According to Barsanti (2006) [15], dogs who had UTIs associated to *E. coli* (rods), *Enterococcus*, or *Streptococcus* (cocci), had acidic urine. The presence of *Proteus mirabilis* (rods) and *Staphylococcus* spp. (cocci) in the urine of dogs with alkaline urine was also detected.

Table 1: Physical urinalysis of dogs (n=12) suffering from UTI using dipstick method before treatment

Sr. No.	Parameters	UTI (n=12) =12)
1	Colour	Red colour 41.66% (5)
		Pale yellow 8.33% (1)
		Dark yellow 16.67% (2)
		Yellow 25.00% (3)
		Amber 8.33% (1)
2	Urine pH	Acidic 33.33% (4)
		Alkaline 58.33% (7)
		Neutral 8.33% (1)
3	Specific gravity	1.019

Chemical Examination of Urine

Chemical examination of urine samples revealed that haematuria, proteinuria and bilirubinuria were the most common findings. Out of 12 cases haematuria was observed in 66.66% (n=8) cases**.** Mild, moderate, and severe haematuria was observed in 16.67% (n=2), 25.00% (n=3) and 25.00% (n=3) respectively as per Table 2. which was in accordance with Jasim (2012) [17] who observed haematuria in dogs suffering from urinary tract infection. Similar findings were reported by Forrester (2004) [16], Somu *et al.* (2015) [14], Punia *et al.* (2018) [6] and Madhvi (2021) [10]. Haematuria might be due to infection and inflammation of urinary tract infection.

Proteinuria was observed in 58.33% (n=7) cases out of which mild proteinuria was present in 16.67% (n=2) cases whereas moderate and severe proteinuria was present in 25.00% (n=3) and 16.67% (n=2) respectively as per Table 2. Which was in consistence with the findings of Somu *et al.* (2015) [14] who reported proteinuria in 67.85% dogs affected with urinary tract infection. Similar observations were reported by Cetin *et al.* (2003) [1], Mrudula *et al.* (2005), Thirunavukkarasu *et al.* (2010) [20], Jasim (2012) [17], Punia *et al*. (2018) [6], Grimes *et al.* (2019) [18] and Madhvi (2021) [10]. In addition to being a sign of renal disease, proteinuria was associated to disease progression and urinary tract inflammation (Raila *et al*., 2011) [19]

Bilirubinuria was present in 41.66% (n=5) cases. Mild, moderate, and severe bilirubinuria was present in 8.33% (n=1), 25.00% (n=3) and 8.33% (n=1) cases respectively. However, glucosuria was observed in 8.33% (n=1) cases. While none of the dog were positive for ketonuria as per Table 2. Present findings are concurred well with Punia *et al.* (2018) [6] who reported bilirubinuria (54.54%) in dogs affected with urinary tract infection. Similar observations were reported by Jasim (2012) [17] and Madhvi (2021) [10]. The presence of bilirubinuria in urine samples might be due to urinary tract infections that cause renal failure and lower the bilirubin threshold.

Table 2: Chemical urinalysis of dogs suffering from UTI using dipstick method before treatment (n=12)

Sr. No	Parameters	Severity level		
		Mild	Moderate	Severe
1	Haematuria	16.67% (2)	25.00% (3)	25.00% (3)
2	Bilirubin	8.33% (1)	25.00% (3)	8.33% (1)
3	Protein	16.67% (2)	25.00% (3)	16.67% (2)
4	Glucose	8.33% (1)	-	-

Microscopic Examination of Urine

In the present study microscopic examination of urine samples from dog affected with urinary tract infection revealed presence of pus cells (83.33%), epithelial cells (75.00%), RBCs (66.66%), crystals (58.33%), bacteria (58.33%) and casts (33.33%) cases on day '0' as per Table 3 and Figure 1

The degree of pyuria and haematuria were classified as 0-5, 5-50 and >50 cells /HPF. Out of total 12 cases pus cells were observed in 10 (83.33%) cases from which 0-5 cells /HPF were observed in 1 (8.33%), 5-50 cells/HPF were observed in 5 (41.67%) and >50 cells /HPF were observed in 4 (33.33%) cases on day '0' as per Table 3 and Figure 8. Which was similar with findings of Yogeshpriya (2012) [2] reported presence of pus cells in dogs affected with urinary tract infection. Similar findings were reported by Blanco and Bartges (2001) [22], Kandula and Karlapudi (2015) [8], Merkel *et al.* (2017) [24], Punia *et al.* (2018) [6], Roopali *et al.* (2018) [4], Byron (2019) [23], Maurey *et al.* (2019) [21] and Parmar *et al.* (2020) [11].

RBCs were present in 8 (66.66%) cases out of which 0-5 cells /HPF were observed in 2 (16.67%), 5-50 cells /HPF were observed in 5 (41.67%) and >50 cells /HPF were observed in 1(8.33%) case as per Table 3 and Figure 5. The results were in agreement with Merkel *et al.* (2017) [24] observed that haematuria (>30 red cells/hpf) in dogs affected with urinary tract infection. Similar observations were reported by Blanco and Bartges (2001) [22], Dunning and Stonehewer (2002) [25], Cetin *et al.* (2003) [1], Jasim (2012) [17], Yogeshpriya (2012) [2], Kandula and Karlapudi (2015) [8], Byron (2019) [23], Maurey *et al*. (2019) [21], Parmar *et al.* (2020) [11] and Madhvi (2021) [10].

Different forms of crystals were found in 7 (58.33%) of the cases, with struvite (Figure 3), calcium oxalate (Figure 2), and bilirubin crystals (Figure 7) being found in 4 (33.34%), 2 (16.67%), and 1 (8.33%) case, respectively as per Table 3. The present findings were matched with the findings of Punia *et al.* (2018b) [6] who reported presence of crystals (54.54%) in dogs affected with urinary tract infection. Similar observations were reported by Gatoria *et al.* (2006) [26], Jasim (2012) [17], Yogeshpriya (2012) [2], Kandula and Karlapudi (2015) [8] and Madhvi (2021) [10].

Hyaline cast (Figure 4) was found in 2 (16.67%) of the total 12 cases, whereas epithelial cast and WBCs cast were found in 1 (8.33%) and 1 (8.33%) of the cases, respectively. Bacteriuria (Figure 9) was evident in 7 (58.33%) cases on day '0'. In 9 (75.00%) cases epithelial cells was identified on day '0' as per Table 3. which was in consistence with the findings of Somu *et al.* (2015) [14] who reported presence of bacteriuria, casts, and epithelial cells in the urine of dogs suffering from urinary tract infection. Similar observation Cetin *et al*. (2003) [1], Seguin *et al.* (2003) [27], Jasim (2012) [17], Yogeshpriya (2012) [2], Kandula and Karlapudi (2015) [8], Punia *et al.* (2018) [6], Maurey *et al.* (2019) [21] and Madhvi (2021) [10].

Table 3: Microscopic urinalysis of dogs affected with UTI (n=12) before treatment

Sr. No.	Parameters		Percent occurrence
1	Pus cells	0-5/HPF	1 (8.33%)
		5-50/HPF	5 (41.67%)
		>50 HPF	4 (43.34%)
2	RBCs	0-5/HPF	2 (16.67%)
		5-50/HPF	5 (41.67%)
		>50 HPF	1 (8.33%)
3	Casts	Hyaline cast	2 (16.67%)
		Epithelial cast	1 (8.33%)
		WBCs cast	1 (8.33%)
4	Crystals	Calcium oxalate	2 (16.67%)
		Struvite	4 (33.34%)
		Bilirubin	1 (8.33%)
5	Epithelial cells	-	9 (75.00%)
6	Bacteria	-	7 (58.33%)

In the current investigation, the presence of RBCs, WBCs, and epithelial casts in urine sediment from affected dogs may be caused by disruption to the uroepithelium's mucosal defence barrier. And presence of crystals might be due to less water intake, oliguria or anuria or concentration of urine due to any reasons. The combination of pyuria (>3–5 WBC/hpf) and bacteriuria on a urine sediment creates a significant of suspicion for UTI. (Byron, 2019) [23] Pyuria, bacteriuria, and haematuria were all connected to an increased likelihood of a positive urine culture, suggesting that they might be helpful indications for a future bacterial culture.

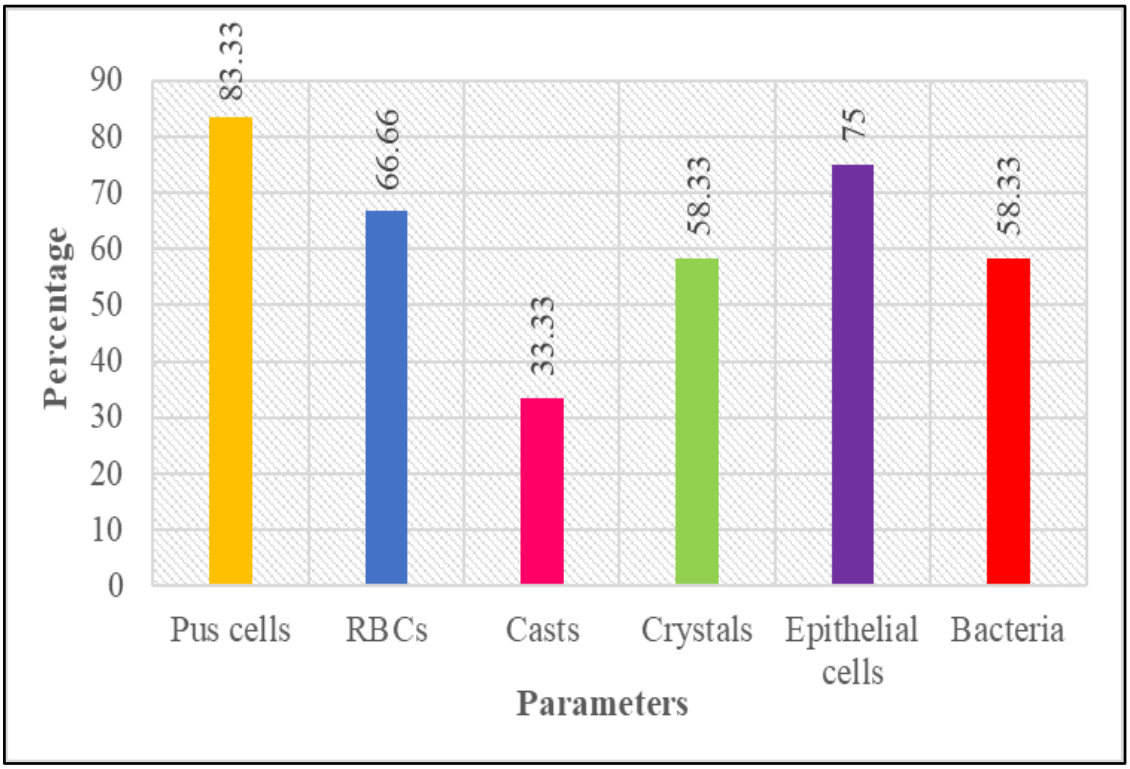

Fig 1: Microscopic urinalysis of dogs (n=12) suffering from UTI before treatment on day '0'

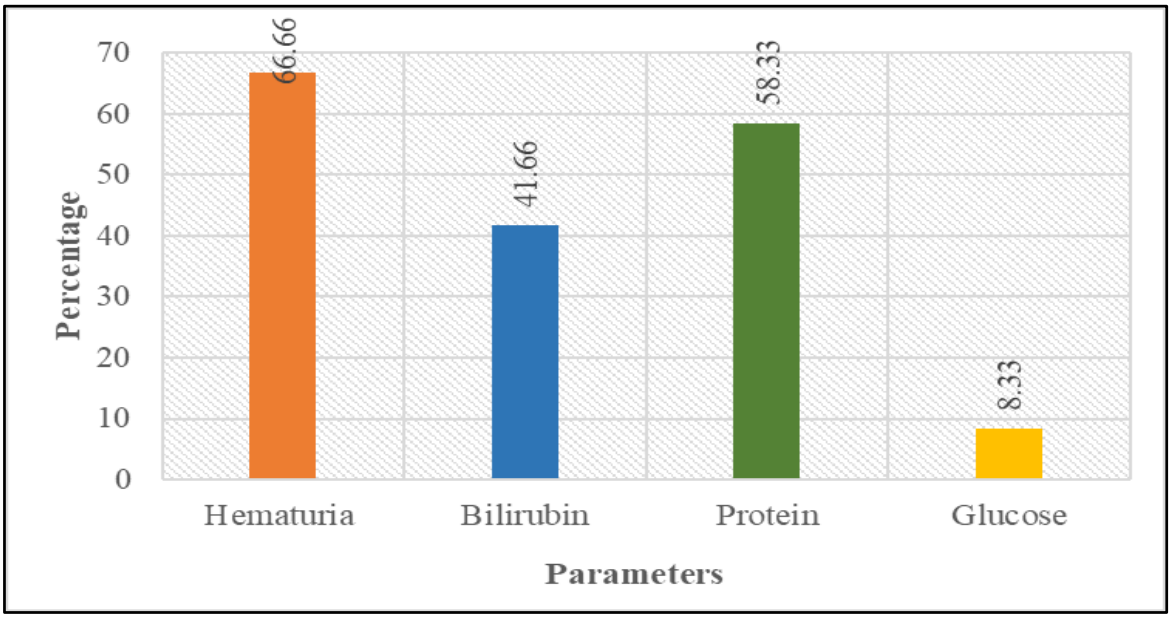

Fig 2: Chemical urinalysis of dogs suffering from UTI before treatment

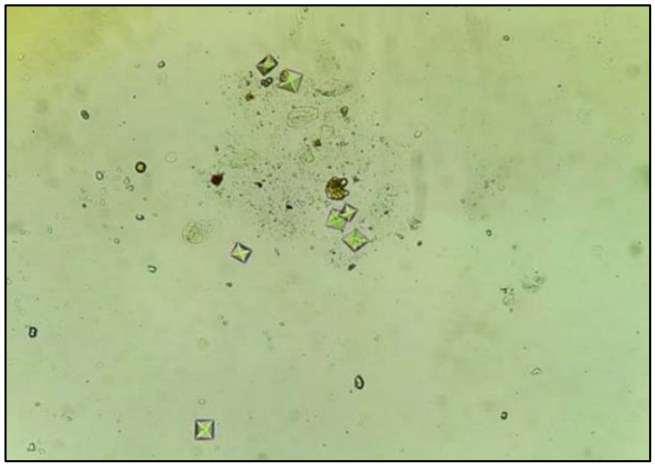

Fig 3: Calcium oxalate crystals in urine sample (10X)

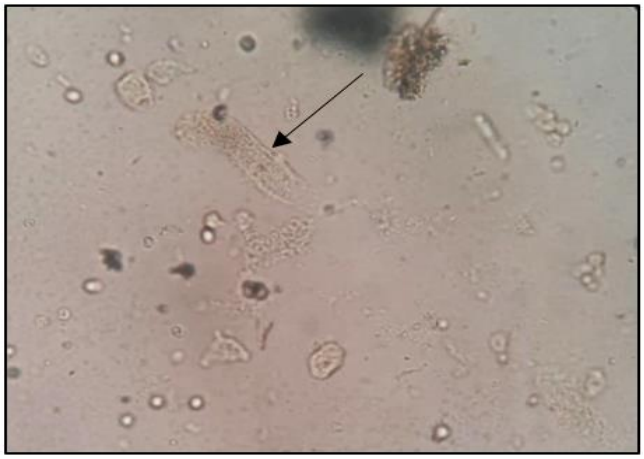

Fig 5: Hyaline cast in urine sample (10X)

Fig 4: Struvite crystals in urine sample (10X)

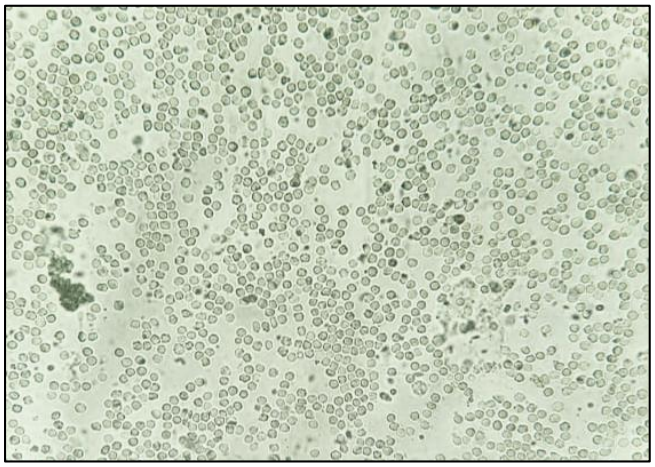

Fig 6: Red blood cells in urine sample (40X)

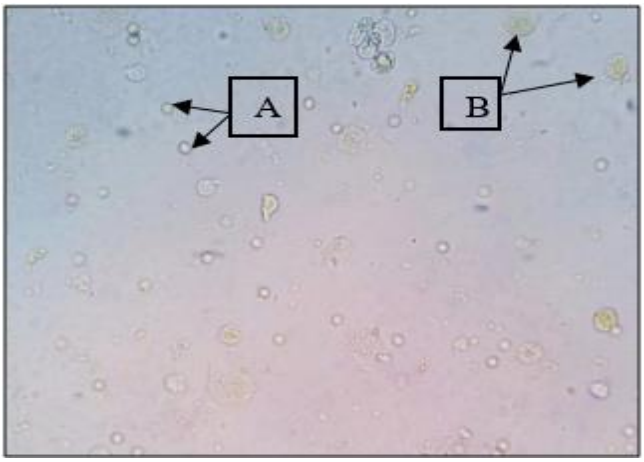

Fig 7: A- White blood cells, B- Renal epithelial cells (40X)

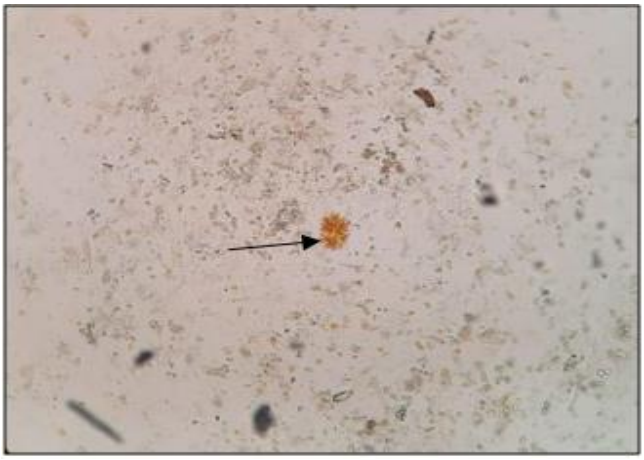

Fig 8: Bilirubin crystals in urine sample (10X)

Conclusion

The evaluation of both normal and abnormal urine contents is known as a urine analysis. For veterinarians, it is a simple, affordable, and crucial first diagnostic procedure. It aids in the diagnosis of urinary tract infection and may be helps in the starting of empirical therapy.

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