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Hematological alterations in bacterial lower urinary tract infection (cystitis) of geriatric dogs

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Abstract
The present study was carried out to investigate the hematological changes in bacterial lower urinary tract infection (cystitis) of geriatric dogs. Out of a total 7280 adult (>6yrs) dogs, 620 geriatric dogs were reported with various diseases conditions and out of which, 362 dogs that were showing the clinical signs indicative of lower urinary tract disorders (LUTD), such as hematuria, pollakiuria, periuria, stranguria, dysuria and foul smelling urine were taken up for detailed study. Subsequently, 134 geriatric dogs were diagnosed with bacterial lower urinary tract infections (cystitis). Blood samples were collected from the study group animals for the estimation of various hematological parameters. Dogs affected with BUTI had a haemogram (HB: 11.23±0.18 g/dl, TEC: 5.28±0.17 $X10^6$/µl and PCV: 37.41±0.28%) that was non-significantly reduced when compared to apparently healthy dogs. Significant ($p < 0.05$) elevation of total leucocyte count (16.74±0.24 $X10^3$/µl) and neutrophils (80.16±0.50%) was noticed.

Keywords: Bacterial lower urinary tract infection, cystitis, hematology, geriatric dogs

1. Introduction
Lower urinary tract infection (LUTI) refers to the microbial colonization of the urine or of any portion of the urinary tract (Greene, 2012) [1]. Lower urinary tract infection of bacterial origin is the most common infectious disease of dogs, affecting 14% of all dogs during their lifetime. Most urinary tract infections are the result of ascending bacteria from rectal or fecal contamination or from the distal urogenital tract. The infection is more prevalent in older dogs with a median age of 9 years (Westdropp *et al.*, 2012, Wong *et al.*, 2015, Liebelt, Pigott 2019) [2-4]. Bacterial urinary tract infections can be classified as simple or uncomplicated, which is a sporadic bacterial infection of the urinary tract in another wise healthy individual with normal urinary tract anatomy and function, and it does not occur more frequently than every 4 to 6 months, and complicated, which is defined as a UTI that occurs in the presence of an anatomic or functional abnormality or a comorbidity that may predispose the patient to persistent infection, recurrent infection or treatment failure. Common comorbidities of complicated UTI include diabetes mellitus, CKD, urolithiasis, immune suppression etc. (Wood, 2017) [5]. Pollakiuria, hematuria, stranguria, periuria and fever were the most commonly seen symptoms in bacterial LUTI. The present study was conducted to ascertain hematological alterations among geriatric dogs with lower urinary tract infection (cystitis).

2. Materials and Methods
Geriatric dogs that were showing the clinical signs indicative of lower urinary tract disorders (LUTD), such as hematuria, pollakiuria, periuria, stranguria, dysuria and foul Odour urine were taken up for detailed study. After a through clinical examination, whole blood was collected from cephalic and saphenous vein with the help of sterile disposable syringe and carried into heparin/EDTA coated vials for whole blood. Blood samples were estimated with the help of Huma count in the Department of Veterinary Clinical complex, College of Veterinary Science, Rajendranagar and Hyderabad. The data collected was statistically analyzed as per the methods described by Snedecor and Cochran (1994) [6] by using SPSS package version 20.00. The significance of results was evaluated by applying one way ANOVA to determine significant difference among means ($p < 0.05$).

3. Results
The various hematological parameters of the geriatric dogs diagnosed for lower urinary tract.

disease (cystitis) were evaluated and comparative analysis of these parameters are presented in Table 1 and Fig 1.

Among the cystitis geriatric dogs, haemogram (Hb: 11.23±0.18 g/dl, TEC: 5.28±0.17 $X10^6$/µl and PCV: 37.41±0.28%) was non-significantly reduced when compared to the dogs of apparently healthy adult group indicative of anemia. Though the mean haemogram was non-significantly reduced, all the affected dogs did not show anemia, whereas marked reduction in the haemogram was noticed in the dogs with BUTI which had hematuria as one of the clinical manifestations. There was a significant ($p < 0.05$) elevation of total leucocyte count (16.74±0.24 $X10^3$/µl) and neutrophils (80.16±0.50%) when compared to apparently healthy adult dogs along with non-significantly decreased in lymphocyte count (16.38±0.19%). The mean values of eosinophils (4.36±0.18), monocytes (2.65±0.16), basophils (1.10±0.07) and platelets (220.36±3.7) showed insignificant change when compared to apparently healthy adult dogs and were within the normal range.

4. Discussion

The non-significant reduction in hemoglobin, total erythrocyte counts and PCV that was seen in the present cystitis geriatric dogs might be due to hematuria. The dogs which had hematuria as clinical symptom showed marked anemia when compared to other dogs. Decreased appetite, loss of blood due to damage of mucosal epithelial barrier and inflammation causing leakage of RBC into urinary space. The results of the present study are in close conformity with Merkel *et al.* (2017) [7], Roopali *et al.* (2018) [8], Liebelt and Pigott (2019) [4] who also observed similar findings in dogs with LUTI. Similarly, the significantly ($p < 0.05$) altered neutrophil leukocytosis of the present study, is in agreement with the findings reported by Mrudula *et al.* (2005) [9] and Kralova *et al.* (2010) [10]. Leukocytosis in a geriatric dog with cystitis could be due to tissue damage of mucosal epithelium caused by inflammation leading to the release of bacterial toxins which is in accordance with Roopali *et al.* (2018) [8], Yogeshpriya *et al.* (2018) [11] and Biasibetti *et al.* (2019) [12] who recorded an increase in total leucocyte count in dogs affected with lower urinary tract infections. The authors also opined that the neutrophil among the cystitis dogs might be attributed to cell injury and variable extent of stress induced by bacterial organisms in the urinary tract as well as a sign of manifestation of body defense mechanism against bacterial infection resulting in release of more neutrophils into the blood stream. Apart from these changes, the non-significant decrease in the mean values of lymphocytes that was recorded in the present study is in accordance with Radakovich *et al.* (2017) [13], Roopali *et al.* (2018) [8] and Yogeshpriya *et al.* (2018) [11]. The authors documented that the decrease in lymphocyte count might be due to stressful stimuli caused by bacteria that occurs in lower urinary tract infections. However, the mean values of eosinophils, basophils, monocytes and platelets showed insignificant change when compared to apparently healthy control group and were within the normal physiological range (Roopali *et al.* 2018 and Yogeshpriya *et al.*2018) [8, 11].

Table 1: Hematological parameters in healthy and BLUTD (cystitis) of dogs

SL. No.	Parameters	Healthy adult dogs (N=10)	Bacterial LUTI (N=134)
1	Hb(g/dl)	13.44±0.30	11.23±0.18
2	PCV (%)	42.31±0.34	37.41 ±0.28
3	TEC ($X10^6$/µl)	6.42±0.23	5.28±0.17
4	TLC($X10^3$/µl)	9.76± 0.34	16.74±0.24*
5	Neutrophils (%)	70.44±0.35	80.16±0.50*
6	Lymphocytes (%)	21.67±0.46	16.38±0.19
7	Eosinophils (%)	3.64±0.24	4.36±0.18
8	Monocytes (%)	2.56±0.16	2.65±0.16
9	Basophils (%)	0.62±0.15	1.10±0.07
10	Platelets ($x10^3$/µl)	264.21±12.5	220.36±3.7

* Significant at ($p < 0.05$)

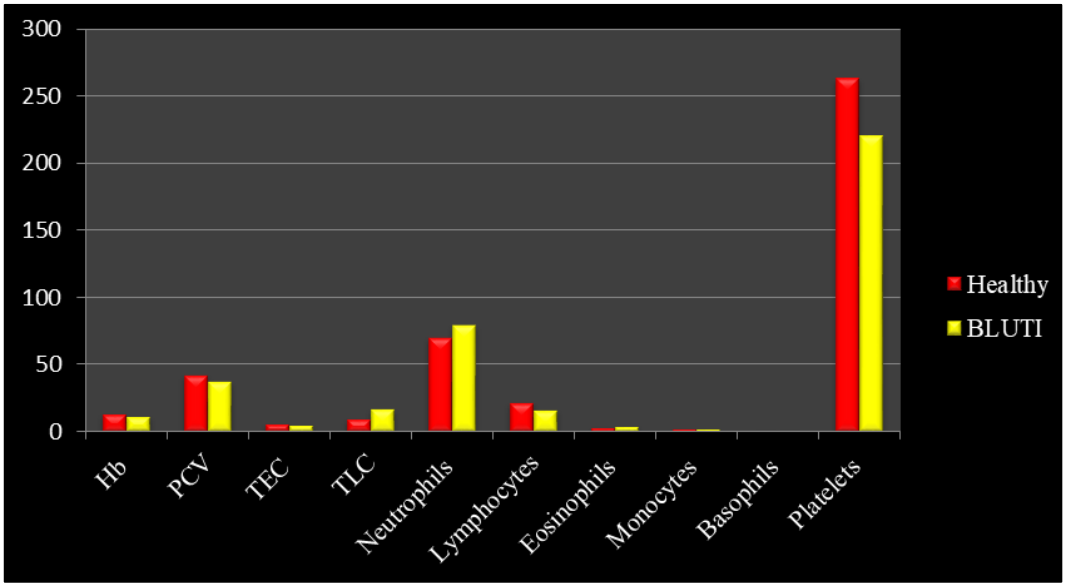

Fig 1: Hematological parameters in healthy and BLUTD (cystitis) of dogs

5. Conclusion
From the present study, it may be concluded that the lower urinary tract infections, particularly, bacterial cystitis are quite common among the geriatric dogs. Neutrophil leukocytosis is the most significant hematological alterations apart from other non-significant features that is associated with severity, complexity and chronicity of the condition. Hematological evaluation helps the vet to initiate effective treatment and to know the outcome.

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