



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 5714-5716
© 2023 TPI

www.thepharmajournal.com

Received: 07-12-2022

Accepted: 15-01-2023

Jupaka Shashank

Ph.D., Department of
Veterinary Medicine, C.V.Sc.,
Rajendranagar, Hyderabad,
PVNR TVU, Telangana, India

K Satish Kumar

Professor and University Head,
Department of Veterinary
Medicine, C.V.Sc.,
Rajendranagar, Hyderabad,
PVNR TVU, Telangana, India

VV Amruth Kumar

Associate Professor and Head,
Department of Veterinary
Medicine, C.V.Sc., Mamnoon,
PVNR TVU, Telangana, India

B Anil Kumar

Assistant Professor,
Department of Veterinary
Pharmacology and Toxicology,
C.V.Sc., Rajendranagar,
Hyderabad, PVNR TVU,
Telangana, India

M Lakshman

Professor and Head,
Department of Veterinary
Pathology, C.V.Sc.,
Rajendranagar, Hyderabad,
PVNR TVU, Telangana, India

Corresponding Author:

K Satish Kumar

Professor and University Head,
Department of Veterinary
Medicine, C.V.Sc.,
Rajendranagar, Hyderabad,
PVNR TVU, Telangana, India

Biochemical and biomarker alterations in bacterial lower urinary tract infection (BLUTI) in geriatric dogs

Jupaka Shashank, K Satish Kumar, VV Amruth Kumar, B Anil Kumar and M Lakshman

Abstract

The present study was carried out to investigate the biochemical and biomarker changes in bacterial lower urinary tract infection (BLUTI) of geriatric dogs. Out of 620 geriatric dogs that were brought to the outpatient ward of VCC, CVSc., Rajendranagar, 184 dogs were showing the clinical signs indicative of bacterial lower urinary tract infection, such as haematuria, pollakiuria, stranguria, dysuria, periuria, abdominal pain, foul smelling urine, depression, loss of appetite, anuria and fever. Blood samples were collected from the study group animals for the estimation of various biochemical and biomarker parameters. Dogs affected with BLUTI had slightly elevated mean values of creatinine (1.54±0.16 mg/dl) and BUN (24.32±0.47 mg/dl). Hypoproteinaemia (4.58±0.29 g/dl) and hypoalbuminaemia (2.21±0.24 g/dl) were significant ($p<0.05$) whereas, ALT (40.18±1.10 IU/L), glucose (104.68 ±1.48 mg/dl) and SDMA (8.23±0.14 µg/dl) were within the reference range. Significant ($p<0.05$) elevation in the mean values of C-reactive protein (47.2±4.6 mg/L) were noticed when compared to apparently healthy adult dogs. Though all these dogs were diagnosed for bacterial lower urinary tract infections, slight but non-significant elevation of serum creatinine and BUN evaluations a careful and periodical monitoring of geriatric dogs to prevent clinical outcome of organ specific infections.

Keywords: Bacterial lower urinary tract, biochemical and biomarker, 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 and Liebelt and Pigott, 2019) [2, 3, 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, UTI occurs in the presence of an anatomic or functional abnormality or comorbidity that may predispose the patient to persistent infection, recurrent infection or treatment failure (Wood, 2017) [5]. The present study was conducted to ascertain the biochemical and biomarker alterations among geriatric dogs with bacterial lower urinary tract infection (Cystitis).

2. Materials and Methods

Geriatric dogs that were showing the clinical signs indicative of bacterial lower urinary tract infection (BLUTI), such as haematuria, pollakiuria, stranguria, dysuria, periuria, abdominal pain, foul smelling urine, depression, loss of appetite, anuria and fever were taken up for detailed study. After a thorough clinical examination, whole blood was collected from cephalic and saphenous vein with the help of sterile disposable syringe and transferred into clot activator coated sterile serum vials. Serum vacutainers were kept undisturbed till serum separation and the serum was transferred to Eppendorf tubes and labeled accordingly and stored in refrigerator at 4°C for biochemical and biomarker analysis. Biochemical samples were estimated with the help of Huma count and whereas, the C-reactive protein and SDMA were analyzed using ELISA reader in the Department of Veterinary medicine, College of Veterinary Science, Rajendranagar, 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 and t- test to determine significant difference among means. However, all these parameters were also evaluated from apparently healthy adult dogs to establish normal values and comparison.

3. Results

The various biochemical and biomarker parameters of the geriatric dogs diagnosed for bacterial lower urinary tract infection were evaluated and comparative analysis of these parameters are presented in table 1 and fig.1. The biochemical findings revealed, slightly elevated mean values of creatinine (1.54±0.16 mg/dl) and BUN (24.32±0.47 mg/dl) that were non-significantly different when comparison with apparently healthy adult dogs. Though there was a mean slight elevation seen in the values of creatinine and BUN in dogs with BLUTI, all the affected dogs did not show elevated values. Hypoproteinaemia (4.58±0.29 g/dl) and hypoalbuminaemia (2.21±0.24 g/dl) were significant ($p<0.05$) in dogs with BLUTI whereas, values of ALT (40.18±1.10 IU/L), glucose (104.68 ±1.48 mg/dl) and SDMA (8.23±0.14 µg/dl) were within the reference range. Another biomarker, the C-reactive protein revealed significant ($p<0.05$) elevation in the mean values (47.2±4.6 mg/L) on '0' day when compared with apparently healthy adult group.

4. Discussion

In the present study, the geriatric dogs with BLUTI showed a slightly elevated creatinine and BUN in comparison with apparently healthy adult dogs. Mild changes in creatinine and BUN might be as a result of post renal uremia due to partial obstruction or interference with the excretory pathway from inflammatory changes in UTI but in complicated BUTI with a comorbidity as CKD showed highly elevated levels of creatinine and BUN. The findings of the present study were similar to the reports of authors Jasim (2012) [7], Kandula and Karlapudi (2015) [8], Focak *et al.* (2017) [9] and Sarma and Kalita (2019) [10]. A significantly ($p<0.05$) decreased serum total protein and albumin in the cystitis affected animals compared to the apparently healthy adult control group could be attributed to the loss of protein and albumin through urine. Decreased production and increased loss of albumin during inflammation due to bacterial actions which causes increased vascular permeability and passage of albumin into interstitial space was responsible for hypoalbuminemia in dogs affected with bacterial lower urinary tract infections (Throop *et al.*, 2013 and Fransson *et al.*, 2007) [11, 12]. This was in accordance with Das *et al.* (2017) [13] and Roopali *et al.* (2018) [14] who recorded significant ($p<0.05$) decrease in mean values of total protein, Andonova *et al.* (2010) [15] and Yogeshpriya *et al.* (2018) [16], who recorded significant ($p<0.05$) decrease in mean values of albumin in dogs affected with bacterial lower urinary tract infections. Other biochemical parameters like ALT and glucose were within the reference range indicating that there was no systemic involvement other than lower urinary tract, whereas in complicated BUTI with comorbidity as diabetes mellitus the glucose levels were increased in the range of 240- 260 mg/dl. Regarding CRP (C-reactive protein) findings, significantly ($p<0.05$) elevated (47.2±4.6 mg/L) values were seen in the present geriatric dogs of BLUTI. Present findings are in agreement with findings of Seo *et al.* (2012) [17] who studied C - reactive protein on experimentally induced cystitis in dogs, noticed increased CRP levels. CRP is

produced rapidly in response to not only tissue damage but also the presence of bacteria in the urinary bladder. This could be explained by the fact that bacterial infection activates a diverse number of cytokines, including interleukin (IL)-6 which primarily stimulates the synthesis of C-reactive protein in the liver, and has a role in c-reactive protein activation of the classical complement system needed for initiating the opsonization, phagocytosis, and lysis of invading microorganisms (Mold *et al.*, 1982, Yamashita *et al.*, 1994, Chuang *et al.*, 2010 and Hsiao *et al.*, 2012) [18, 19, 20, 21]. C-reactive protein is an acute phase protein and elevated after infection, inflammation or tissue damage (Gewurz *et al.*, 1982) [22]. C-reactive protein has been reported to be a suitable marker of infection and tissue damage in dogs and its usefulness for the early diagnosis and therapeutic monitoring of various diseases has been evaluated in veterinary medicine (Fransson *et al.*, 2004, Ceron *et al.*, 2005, Nielsen *et al.*, 2007, Naseri, 2008, Khalil and Humadi, 2020 and Pradeep, 2014) [23, 24, 25, 26, 27, 28].

Table 1: Biochemical and biomarker parameters in healthy and BLUTD of dogs

Sl. No.	Parameters	Healthy adult dogs (n=10)	Bacterial L UTI (n=134)
1	Creatinine (mg/dl)	1.25±0.13	1.54±0.16
2	BUN (mg/dl)	22.14±0.23	24.32±0.47
3	ALT(IU/L)	38.29±1.11	40.18±1.10
4	Total Protein(g/dl)	7.21±0.22	4.58±0.29*
5	Albumin (g/dl)	3.40±0.18	2.21±0.24*
6	Glucose (mg/dl)	80.11±1.73	104.68±1.48
7	SDMA (µg/dl)	8.15±0.21	8.23±0.14
8	C-reactive protein (mg/L)	10.2±2.6	47.2±4.6*

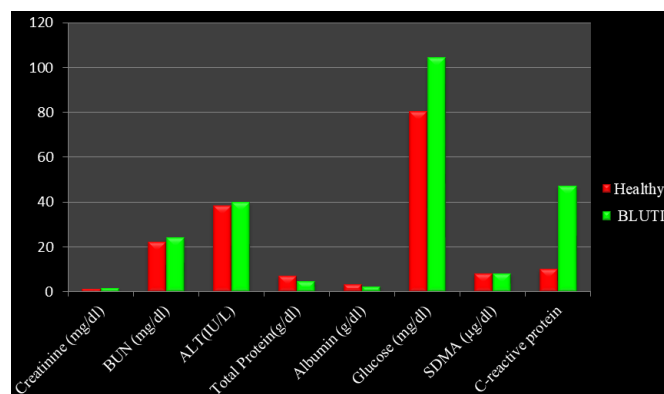


Fig 1: Biochemical and biomarker parameters in healthy and BLUTI of dogs

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. Total protein, albumin and C-Reactive protein were the most significant biochemical and biomarker alterations apart from other non-significant features that is associated with severity, complexity and chronicity of the condition. Biochemical and biomarker evaluation helps the vet to initiate effective treatment and to know its outcome.

6. Acknowledgment

The authors are thankful to PVRNTVU, Rajendranagar, Hyderabad for providing necessary facilities in completion of research work.

7. References

- Greene CE. Infectious diseases of the dog and cat. 4thedn. W. B. Saunders, Philadelphia; c2012 p. 1013-1044.
- Westropp JL, Sykes JE, Irom S, Daniels JB, Smith A, Keil D. Evaluation of the Efficacy and Safety of High Dose Short Duration Enrofloxacin Treatment Regimen for Uncomplicated Urinary tract Infections in Dogs. *Journal of Veterinary Internal Medicine*. 2012;26(3):506-512.
- Wong C, Epstein SE, Westropp JL. Antimicrobial Susceptibility Patterns in Urinary tract Infections in Dogs (2010–2013). *Journal of Veterinary Internal Medicine*. 2015;29(4):1045-1052.
- Liebelt R, Pigott A. The prevalence of positive urine cultures in 100 dogs with an inactive urine sediment. *Veterinary Evidence*. 2019;4(4):87-92.
- Wood MW. Lower urinary tract infections. In: *Textbook of Veterinary Internal Medicine*. 8th edn. Eds S. J. Ettinger, E. C. Feldman and E. Cotte. W. B. Saunders, Philadelphia, PA, USA; c2017. p. 1992-1996.
- Snedecor GW, Cochran WG. *Statistical methods* 8thedn. East west press private Ltd., New Delhi, India; c1994.
- Jasim HM. Haematological, biochemical and urinalysis for the diagnosis of urinary tract infection in german shepherd dogs. *Basrah Journal of Veterinary Research*. 2012;11(2):37-45.
- Kandula S, Karlapudi SK. Prevalence of renal disorders in dogs-a clinical study; c2015.
- Focak M, Haskovic E, Suljevic D, Zahirovic A. Comparative evaluation of biochemical parameters during urinary infection in Maltese and Belgian shepherd dogs. *Cercetari Agronomice in Moldova L*. 2017;3(171):107-114.
- Sarma BK, Kalita D. Changes of haematological and biochemical parameters of canine having urinary system disorders. *International Journal of Chemical Studies*. 2019;7(1):501-504.
- Throop JL, Kerl ME, Cohn LA. Albumin in health and disease: causes and treatment of hypoalbuminemia. *Compendium*. 2013;26:940-948.
- Fransson BA, Bergstrom A, Wardrop KJ, Hagman R. Assessment of three automated assays for C-reactive protein determination in dogs. *American journal of veterinary research*. 2007;68(12):1281-1286.
- Das MR, Patra RC, Das RK, Rath PK, Mishra BP. Hemato-biochemical alterations and urinalysis in dogs suffering from benign prostatic hyperplasia. *Veterinary World*. 2017;10(3):331-335.
- Roopali B, Roy M, Roy S. Haemato-biochemical changes and therapeutic management of urinary tract infection in canines. *The Pharma Innovation Journal*. 2018;7(6):89-92.
- Andonova M, Dimitrova D, Borissov I. Nonspecific defense mechanisms in dogs during experimental staphylococcal infection. *Veterinarski Glasnik*. 2010;65(1-2):25-41.
- Yogeshpriya S, Pillai UN, Ajithkumar S, Unny M. Clinico-Haemato-Biochemical Profile of Dogs with Urinary tract Infection, a Retrospective Study of 32 Cases 2010- 2012. *International Journal of Current Microbiology Applied Science*. 2018;7(9): 2797-2802.
- Seo KW, Lee JB, Ahn JO, Lee HW, Hwang CY, Youn HY, Lee CW. C-reactive protein as an indicator of inflammatory responses to experimentally induced cystitis in dogs. *Journal of veterinary science*. 2012;13(2):179-185.
- Mold C, Du Clos TW, Nakayama S, Edwards KM, Gewurz H. C-reactive protein reactivity with complement and effects on phagocytosis. *Annals of the New York Academy of Sciences*. 1982;389:251-262.
- Yamashita K, Fujinaga T, Miyamoto T, Hagio M, Izumisawa Y, Kotani T. Canine acute phase response: relationship between serum cytokine activity and acute phase protein in dogs. *Journal of veterinary medical science*. 1994;56(3):487-492.
- Chuang YC, Tyagi V, Liu RT, Chancellor MB, Tyagi P. Urine and serum C-reactive protein levels as potential biomarkers of lower urinary tract symptoms. *Urological Science*. 2010;21(3):132-136.
- Hsiao SM, Lin HH, Kuo HC. The role of serum C-reactive protein in women with lower urinary tract symptoms. *International urogynecology journal*. 2012;23(7):935-940.
- Gewurz H, Mold C, Siegel J, Fiedel B. C-reactive protein and the acute phase response. *Advance Internal Medicine*. 1982;27:345-372.
- Fransson BA, Karlstam E, Bergstrom A, Lagerstedt AS, Park JS, Evans MA, *et al*. C-reactive protein in the differentiation of pyometra from cystic endometrial hyperplasia/mucometra in dogs. *Journal of the American animal hospital association*. 2004;40(5):391-399.
- Ceron JJ, Eckersall PD, Martínez-Subiela S. Acute phase proteins in dogs and cats: current knowledge and future perspectives. *Veterinary Clinical Pathology*. 2005;34(2):85- 99.
- Nielsen L, Toft N, Eckersall PD, Mellor DJ, Morris JS. Serum C-reactive protein concentration as an indicator of remission status in dogs with multicentric lymphoma. *Journal of Veterinary Internal Medicine*. 2007;21(6):1231-1236.
- Naseri M. Alterations of peripheral leukocyte count, erythrocyte sedimentation rate, and C-reactive protein in febrile urinary tract infection. *Iranian Journal of Kidney Diseases*. 2008;3(2):137-142
- Khalil RH, Al-Humadi N. Types of acute phase reactants and their importance in vaccination. *Biomedical Reports*. 2020;12(4):143-152.
- Pradeep M. Application of acute phase proteins as biomarkers in modern veterinary practice. *Indian journal of Veterinary Animal Science Research*. 2014;43(1):1-13.