



## Haemato-Biochemical Alterations in Dogs Afflicted with Urinary Tract Infection

Manisha Punia, Ashok Kumar, Gaurav Charaya, and Neelesh Sindhu\*

*Department of Veterinary Medicine, LUVAS, Hisar, Haryana, INDIA*

*\*Corresponding author: N Sindhu; Email: drneeshsindhu@gmail.com*

**Received:** 03 June, 2018

**Revised:** 15 Sept., 2018

**Accepted:** 24 Sept., 2018

### ABSTRACT

The present study was carried out to determine haemato-biochemical alterations in dogs suffering from urinary tract infection. Blood samples were collected from suspected cases of urinary tract infection and subjected to haemato-biochemical examination. Major haematological alterations observed were significant decrease in the hemoglobin level ( $10.25 \pm 0.72$  g/dl) and significant increase in the total leukocyte count ( $12.91 \pm 1.31 \times 10^3 / \text{mm}^3$ ) as compared to the reference values. On biochemical examination, major changes observed were significant increase in the values of blood urea ( $97.94 \pm 19.32$  mg/dl), creatinine ( $1.65 \pm 0.17$  mg/dl), phosphorous ( $5.61 \pm 0.40$  mg/dl) and potassium ( $5.32 \pm 0.26$  mmol/L). The present study concludes alteration in hemato-biochemical parameters in affected dogs. Further study concludes that blood urea and creatinine values can be used as prognostic indicators in dogs affected with UTI.

**Keywords:** Leukocytosis, dog, urinary tract infection, urea, creatinine.

Urinary system main function is to excrete the metabolic waste products from the body, to maintain the electrolyte, water, other solute balance and to regulate the acid-base balance of the body. It helps in maintaining the plasma potassium, calcium and phosphate ion levels; secretion of hormones like erythropoietin and renin and also takes active part in the metabolism of vitamin D3 (Sarkar, 2013).

Infection of urinary tract (UTI) refers to the microbial colonization of the urinary tract or any urinary tract organ, except the distal urethra, which has a normal bacterial flora. UTI is thought to be the most common infectious disease in dogs. It has been estimated that as many as 10% of all canine patients seen by veterinarians for any reason have UTI in addition to the problems for which they are presented (Ling, 2000; Cetin *et al.*, 2003; Somu *et al.*, 2015). The patient with UTI may show a number of clinical signs like pollakiuria, dysuria, stranguria, urinary incontinence, haematuria, frequent licking of the vulvar or preputial area, dribbling of urine and various systemic signs like fever, depression, anorexia, renal pain and vomiting.

Urinary tract infection induces changes in haematological

and biochemical parameters. In renal dysfunctions, there is an abnormal increase in concentration of non-protein nitrogenous wastes in the blood leading to azotaemia and when their concentration exceeds the functional reserve of the kidney, renal failure supervenes. Estimation of blood urea and serum creatinine concentrations are widely used for evaluation of glomerular filtration rate and renal function in dogs as stated by Mrudula *et al.* (2005). Serum urea nitrogen and serum creatinine levels increase in nephritis but their values are not very specific to renal damage alone (Chew and Dibartola, 1989), since the levels also increase in the other conditions like hypovolemic shock and congestive cardiac failure. Alteration in the haemato-biochemical parameters helps in establishing the prognosis of diseased animal.

Therefore, the present investigation/study was designed to study the hemato-biochemical changes in dogs afflicted with UTI.

### MATERIALS AND METHODS

The present study was conducted at Veterinary Clinical Complex (VCC), Lala Lajpat Rai University of Veterinary

and Animal Sciences (LUVAS), Hisar on the clinical cases presented with clinical signs such as inappetance/anorexia, anaemia, emaciation, vomiting, hematuria, polyuria, polydipsia, depression, weight-loss, weakness, dehydration, nausea, anuria, stranguria and oliguria. Blood samples for haemato-biochemical examination was collected from animals which found positive on cultural examination of urine samples. For cultural examination of urine samples Blood agar, Macconkeys lactose agar and Nutrient agar were used.

For haematological examination, two millilitres of blood was collected aseptically in potassium EDTA coated sterile vials from cephalic/saphenous vein of the affected dogs and another four millilitres of blood was collected in clot activator coated sterile serum vials and serum was separated by centrifugation at 3000 rpm for 7 min for biochemical analysis and stored at -20°C until use.

Complete hematological examination was carried out using fully automated haematology cell counter (MS4s, Melet Schloesing Laboratoires, France),

Serum samples were analyzed using fully automated random access clinical chemistry analyzer (EM Destiny 180, Erba Diagnostics Mannheim GmbH-Germany). The electrolytes Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> were estimated in mmol/L by fully automated Easylyte® expand Na/K/Cl/Ca/Li analyser using kits procured from the same company.

The haemato-biochemical values of group A and B were compared with standard values available in literature (Kaneko *et al.*, 2008). The results obtained were analyzed using SPSS 20 Software for calculation of mean and standard error.

## RESULTS AND DISCUSSION

### Haematological parameters alterations in dogs suffering from UTI

The values of Hb, TEC and PCV in the present study were 10.25±0.72 g%, 4.77±0.33×10<sup>6</sup>/µl and 33.35±2.35%, respectively in dogs suffering from UTIs (Table 1). These values were found to be lower than the reference values. The similar findings were also reported by Mrudula *et al.* (2005), Thirunavukkarasu *et al.* (2010), and Sarkar (2013) in their study. These findings suggest that affected dogs were suffering from anaemia possibly due to deficiency

of erythropoietin production by the diseased kidneys as reported by Silverberg *et al.* (2002). Chalhoub *et al.* (2011) stated that the acute and chronic inflammation contributed to anaemia of renal disease by production of inflammatory cytokines and substances such as hepcidin that will decrease erythropoietin function, RBC survival and iron availability. Anaemia can also be attributed due to loss of blood in gastrointestinal tract as melena and haematoemesis, loss from urinary tract in haematuria due to poor platelet production as mentioned by Castaldi *et al.* (1966), shortened survival period and haemolysis of red blood cells due to uremia as mentioned by Eschbach and Adamson (1989); Marticorena and Donnelly, (2004) also contribute to anaemia.

**Table 1:** Haematological alteration in dogs (n=22) suffering from urinary tract infections

Parameter	Mean ± SE	Reference values (Kaneko <i>et al.</i> , 2008)
Hb	10.25±0.72 g/dl*	15.5 (12-19) g/dl
PCV	33.35±2.35%	46 (35-57)%
TEC	4.77±0.33×10 <sup>6</sup> /µl	6.45 (5-7.9)×10 <sup>6</sup> /µl
TLC	12.91±1.31×10 <sup>6</sup> /mm <sup>3</sup> *	9.55 (5-14.1)×10 <sup>3</sup> /mm <sup>3</sup>
N	70.95±1.26 %	71.5 (58-85) %
L	22.72±0.91 %	14.5 (8-21) %
E	2.18±0.28 %	4.5 (0-9) %
B	1.09±0.19 %	0.5 (0-1) %
M	3.04±0.39 %	6 (2-10) %

\*indicates significant alteration in values (p<0.05)

Values of TLC count i.e. 12.91±1.31×10<sup>3</sup>/µl was higher than the reference mean value of 9.55×10<sup>3</sup>/mm<sup>3</sup>. These findings were similar to the findings of Thirunavukkarasu *et al.* (2010). Neutrophil was observed in affected dogs to be on higher side which was in accordance with the findings of Mrudula *et al.* (2005) and Thirunavukkarasu *et al.* (2010). Leucocytosis with increased neutrophil count might occur due to variable extent of stress as in cystitis and nephritis in dogs, as well as sign of induction of body defence mechanism against bacterial infection. There was not much alteration seen in values of monocytes, basophils and eosinophil's in dogs affected from UTIs whereas lymphocyte values was found normal but on upper side that may be due to existence of chronic inflammation.

### Biochemical parameters alterations in dogs suffering from UTI

It was observed that dogs suffering from UTI showed hyponatremia, hyperkalemia, elevated blood urea, elevated creatinine, hyperproteinemia, hyperalbuminemia, hypocalcemia, hyperphosphatemia whereas values of chloride, globulin, glucose, SGOT and SGPT were within the reference range as shown in Table 2.

**Table 2:** Biochemical alteration in dogs (n=22) suffering from urinary tract infections

Parameters	Mean±SE	Reference values (Kaneko <i>et al.</i> , 2008)
Sodium	141.75±1.23	147 (142-152) mmol/L
Potassium	5.32±0.26*	4.5 (3.9-5.1) mmol/L
Chloride	117.57±1.18	117 (110-124) mmol/L
Urea	97.94±19.32*	15 (10-20) mg/dl
Creatinine	1.65±0.17*	1 (0.5-1.5) mg/dl
Protein	7.74±0.31	6.45 (5.4-7.5) g/dl
Albumin	3.43±0.17	2.7 (2.3-3.1) g/dl
Globulin	4.31±0.22	3.4 (2.4-4.4) g/dl
Calcium	7.51±0.26	10.4 (9.1-11.7) mg/dl
Phosphorous	5.61±0.40*	4.1 (2.9-5.3) mg/dl
Glucose	79.31±6.77	97.5 (76-119) mg/dl
SGOT	13.45±1.13	14 (13-15) U/L
SGPT	32.04±3.07	59.5 (10-109) U/L

\*indicates significant alteration in values (p<0.05).

The dogs affected with UTIs were showing elevated mean value of urea and creatinine i.e. 97.94±19.32 mg/dl and 1.65±0.17 mg/dl, respectively as compared to mean reference value of 15mg/dl and 1mg/dl, respectively (Kaneko *et al.*, 2008). Similar to present study findings, higher values of urea and creatinine was reported by Birnbaum *et al.* (1998), Cetin *et al.* (2003), Jasim, (2012), Kandula and Karlapudi, (2015) and Focak *et al.* (2017). This marked increase in values was attributed due to decreased filtration of NPN substances through the damaged glomeruli as suggested by Kerlin and Winkle, (1995) and Devaux *et al.* (1996).

Mean values of phosphorous were slightly elevated i.e. 5.61±0.40 mg/dl in the dogs suffering from UTIs. Similar findings of elevated phosphorous level in UTIs were reported by Birnbaum *et al.* (1998); Kandula and

Karlapudi (2015) and Focak *et al.* (2017). Suggestive reason for hyperphosphatemia can be declining kidney function because the kidneys are the primary route of phosphorus excretion and its consequences results in phosphorus retention.

Non significant increase in mean values of total protein has been observed in present study which can be due to cumulative effect of increase in albumin and globulin values which were found to be on higher side of normal reference range. This increase in values can be related with the progress of an infection leading to marked changes in the serum proteins, production of globulins mostly (Kaneko *et al.*, 2008).

Mean glucose level i.e. 79.31±6.77 mg/dl was observed within the reference range of 76-119 mg/dl in dogs affected from UTIs. However, the values were on lower side of the range which might be due to prolonged inappetance, anorexia and poor nutrition status of dogs and poor renal insulin clearance in UTIs.

Mean value of calcium (7.51±0.26 mg/dl) was found to be decreased in the dogs suffering from urinary tract infection as compared to reference mean value of 10.4 mg/dl. Similar findings were reported by Kandula and Karlapudi (2015). Lower calcium levels may be attributed to less absorption of calcium in the intestines which occurs due to less production of calcitriol from the damaged kidney as reported by Nagode *et al.* (1996).

Mean serum potassium value (5.32±0.26 mmol/L) of the dogs affected with UTIs was on higher than the reference mean value of 4.5 mmol/L which was in accordance with Kandula and Karlapudi, (2015). This increased level of serum potassium might be due to the blockage of glomerular filtration of potassium due to damaged glomeruli because of infection. Sodium values were found to be on lower side in dogs suffering from UTIs and this decrease can be attributed to reduced absorption ability of kidneys in cases of UTIs. No alteration was found in chloride, AST and ALT levels in cases of dogs suffering from UTIs.

### REFERENCES

- Birnbaum, N., Barr, S.C., Center, S.A., Schermerhorn, T., Randolph, J.F. and Simpson, K.W. 1998. Naturally acquired leptospirosis in 36 dogs: serological and clinicopathological features. *J. Small Anim. Pract.*, **39**: 231.



- Castaldi, P.A., Rosenberg, M.C. and Stewart, J.H. 1966. The bleeding disorder of uremia. A qualitative platelet defect. *Lancet*, **2**: 66-69.
- Cetin, C., Senturk, S., Kocabiyik, A., Temizel, M. and Ozel, E. 2003. Bacteriological Examination of Urine Samples from Dogs with Symptoms of Urinary Tract Infection. *Turk. J. Vet. Anim. Sc.*, **27**: 1225-1229.
- Chalhoub, S., Langston, C. and Eatroff, A. 2011. Anemia of Renal Disease: What it is, what to do and what's new. *J. Feline Med. Surg.*, **13**(9): 629-640.
- Chew, D.J. and Dibartola, S.P. 1989. Diagnosis and Pathophysiology of renal disease. In: Text book of Veterinary Internal Medicine, Ettinger, S.J. and Feldman, E.C. 3<sup>rd</sup> Ed., W.B. Saunders Company, Philadelphia, U.S.A. pp. 1734-1759.
- Devaux, C., Plozin, D.J. and Osborne, C. A. 1996. What role does dietary protein restriction play in the management of CRF in dog. *Vet. Clin. North Am. Small Anim. Pract.*, **26**(6): 1247-1267.
- Eschbach, J.W. and Adamson, J.W. 1989. Guidelines for recombinant human erythropoietin therapy. *Am. J. Kidney Dis.*, **14**(1): 2-8.
- Focak, M., Haskovic, E., Suljevic, D. and Zahirovic, A. 2017. Comparative evaluation of biochemical parameters during urinary infection in Maltese and Belgian shepherd dogs. *Cercetari Agronomice in Moldova*, **L3**(171): 107-114.
- Jasim, H.M. 2012. Haematological, biochemical and urinalysis for the diagnosis of urinary tract infection in german shepherd dogs. *Bas. J. Vet. Res.*, **11**(2): 37-45.
- Kandula, S. and Karlapudi, S.K. 2015. Prevalence of renal disorders in dogs—a clinical study. *Int. J. Agric. Sc. Vet. Med.*, **2**(3): 146-148.
- Kaneko, J.J., Harvey, J.W. and Bruss, M.L. 2008. Serum proteins and dysproteinemias. In: Clinical biochemistry of domestic animals. Academic press, New York.
- Kerlin, R.L. and Winkle, T.J.V. 1995. Renal dysplasia in Golden Retrievers. *Vet. Pathol.*, **32**(3): 327-329.
- Ling, G.V. 2000. Bacterial infections of the urinary tract. In Textbook of Veterinary Internal Medicine. Ettinger, S.J. and Feldman, E.C. 5<sup>th</sup> Ed., W.B. Saunders Company, Philadelphia, U.S.A. pp. 1678-1686.
- Martcorena, R. and Donnelly, S. 2004. Red blood cell survival in chronic renal failure. *Am. J. Kidney Dis.*, **44**: 715-719.
- Mrudula, V., George, V.T., Balachandran, C. and Muralimanohar, B. 2005. Haemato-biochemical, urinalysis and urinary enzyme alterations in canine nephritis. *Indian Vet. J.*, **82**: 826-829.
- Nagode, L.A., Dennis, J.C. and Podell, M. 1996. Benefits of calcitriol therapy and serum phosphorus control in dogs and cats with chronic renal failure. *Vet. Clin. of North Am. Small Anim. Pract.*, **26**: 1293-3129.
- Sarkar, M. 2013. Bacterial nephritis in dogs with special reference to its herbal therapy thesis submitted to the West Bengal University of Animal and Fishery Sciences, 37 & 68, Kshudiram Bose Sarani, Kolkata-700037.
- Silverberg, D.S., Wexler, D. and Blum, M. 2002. The correction of anemia in severe resistant heart failure with erythropoietin and intravenous iron prevents the progression of both the heart and the renal failure and markedly reduces hospitalization. *Clin. Nephrol.*, **58**(1): 37-45.
- Somu, Y., Pillai, U.N., Kumar, A. and Alex, P.C. 2015. Evaluation of physicochemical and microscopical changes of urine in dogs with urinary tract infection. *Int. J. Food, Agril. & Vet. Sci.*, **5**(3): 14-17.
- Thirunavukkarasu, P.S., Srinivasan, S.R., Vijayalakshmi, P., Vijaykumar, G., Nambi, A.P., Vairamuthu, S. and Prathaban, S. 2010. Clinical evaluation of ceftriaxone and tazobactam in canine urinary tract infection. *Intas Polivet*, **11**(1): 84-85.