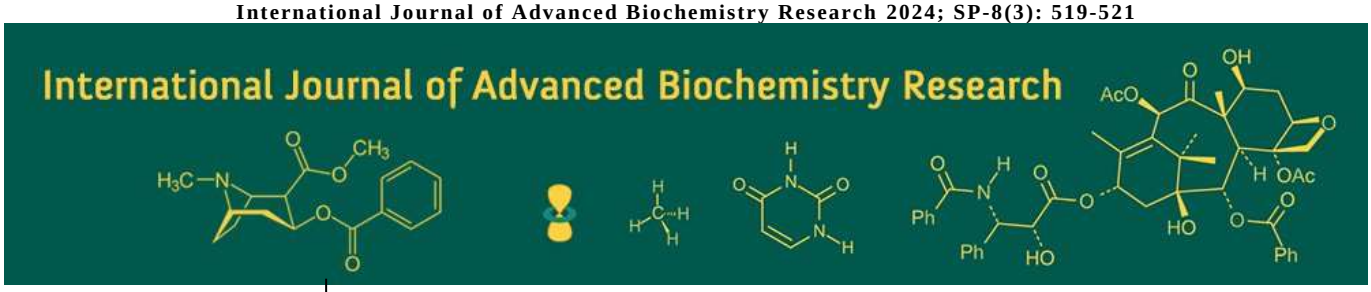

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(3): 519-521
www.biochemjournal.com
Received: 04-12-2023
Accepted: 10-01-2024

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Urinalysis of dogs suffering from chronic renal failure

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DOI: https://doi.org/10.33545/26174693.2024.v8.i3Sg.803

Abstract
Renal failure is the loss of ability of kidneys to excrete waste products, concentrate urine, electrolytes and fluid balance leading to retention of creatinine, urea and other metabolic waste products that are normally excreted by the kidney. It is of two types, acute renal failure (ARF) or acute kidney injury (AKI) and chronic renal failure (CRF) or chronic kidney disease (CKD). Jacob *et al*., (2005) [5] reported that initial high UPC determination i.e. more than 1.0 in dogs with CRF was associated with greater risk of developing uremic crisis and death, compared to dogs with UPC less than 1.0 and thus concluded that UPC determination in dogs with CRF could be prognostic value. And also stated that determining urine specific gravity in a dehydrated patient quickly reveals its renal status. If the specific gravity is <1.015 in the dogs the animal had inadequate renal The investigation was carried out on 24 clinical cases suspected of renal failure in dogs on the basis of clinical signs admitted at Veterinary Clinical Complex (VCC), Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar. The urine pH of 24 dogs in the present study was in range of 5- 7.5. Various types of casts were seen in urine sediments. 5 dogs had granular casts and 2 had hyaline cast. Crystaluria was found in 11 out of 24 dogs, combining 3 bilirubin crystal and 8 had amorphous crystals each.On chemical examination of urine severity of proteinuria was observed as (58.3%) ++, (20.83%) +++, (16.66%) + and trace (4.16%) cases respectively. Two dogs were tested positive for bile pigments and bile salts.

Keywords: Renal failure, dog, specific gravity, urine

Introduction
Renal failure is the loss of ability of kidneys to excrete waste products, concentrate urine, electrolytes and fluid balance leading to retention of creatinine, urea and other metabolic waste products that are normally excreted by the kidney. It is of two types, acute renal failure (ARF) or acute kidney injury (AKI) and chronic renal failure (CRF) or chronic kidney disease (CKD). Jacob *et al*., (2005) [5] reported that initial high UPC determination i.e. more than 1.0 in dogs with CRF was associated with greater risk of developing uremic crisis and death, compared to dogs with UPC less than 1.0 and thus concluded that UPC determination in dogs with CRF could be prognostic value. And also stated that determining urine specific gravity in a dehydrated patient quickly reveals its renal status. If the specific gravity is <1.015 in the dogs the animal had inadequate renal function.
Chandler *et al.,* (2007) [12] studied 37 dogs and found urine specific gravity values were normally distributed and the mean value was 1.012 (range 1.005 to 1.022). Urine cultures were negative in 21 of the dogs. Positive urine cultures were obtained in nine dogs: Escherichia coli were cultured from the urine of eight dogs and Staphylococcus was cultured from the urine of one dog. Mrudula *et al.,* (2013) [13] was found proteinuria in18.33%, specific gravity ranged from1.002 to1.040. It was above 1.030 in two animals and less than 1.015 in 51.6% animals. They also found bile pigment, pus cell granular cast and struvite crystal Kandula and Karlapudi (2015) [6] in 29 adult sick dogs performed urinalysis and found urine colour dark yellow or blood tinged, ammoniac in odour, hazy in appearance, and specific gravity ranged between 1.024to1.034.Microscopic and dipstick test showed presence of erythrocytes, leucocyte, epithelial cell, pus cell and crystal of various types.

Material and Methods
The investigation was carried out on 24 clinical cases suspected of renal failure in dogs on the basis of clinical signs admitted at Veterinary Clinical Complex (VCC), Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar.

The clinical cases showing signs of inappetance/ anorexia, vomition/ hematemesis, melena, halitosis, ascites, oral ulcerations, and hematuria were subjected to clinical, urinalysis and haemato-biochemical examination for diagnosis Urine samples collected aseptically in sterile container were streaked on routine agar medium for the culture examination and rest was used for chemical and microscopic examination and a part for estimation of SDMA. Isolates obtained were purified and identified upto genus level. Long incubation of plates was done before ruling them negative. All the pure isolates were subjected for antimicrobial susceptibility testing using the disk diffusion method. (Urine collection by catherization fig. 1)
Chemical testing of urine was done using dipstick urinalysis method. For microscopic examination, urine was centrifuged at 3000 rpm for 5 min and pellet obtained after discarding supernatant was observed under microscope at 10X and 40X for various cells, crystals and casts.

Fig 1: Urine collection by catherization

Results and Discussion

1 Physical examination

The urine pH of 24 dogs in the present study was in range of 5- 7.5. Twenty dogs (83.3%) had acidic urine with (pH 5-6.5), two dogs (8.3%) had alkaline urine pH (pH>7) and 2 (8.3%) had neutral pH (pH 7). The mean value of urinary pH was 6.19±0.57.The color of the urine was colourless (37.5%), pale yellow (33.33%), dark yellow (16.66%) and reddish yellow (12.6%). The urine of tweleve dogs had specific gravity below 1.015, nine dogs 67.6% had specific gravity between 1.015-1.030 and three of the dogs had a urine specific gravity greater than 1.030. The mean value of specific gravity was found to be 1.017±0.008. Oburai *et al.*, (2015) [8] and Sharma *et al.*, (2015) [7] reported specific gravity in ranges of 1.007-1.012, 1.020-1.036, 1.012-1.028 respectively Dogs suffering from CKD are unable to produce concentrated urine in the presence of dehydration leading to below normal specific gravity (i.e. <1.015) (Wallace 2010) [9]. Smilarly to Anthley *et al.*, (2018) [1] reported mild to severe proteinuria in renal failure dogs. Proteinuria may be due to the severe glomerular injury with nephrotic syndrome documented by Cowgill and Francey, 2005 [10].

Chemical examination

On chemical examination of urine severity of proteinuria was observed as (58.3%) ++, (20.83%) +++, (16.66%) + and trace (4.16%) cases respectively. Two dogs were tested positive for bile pigments and bile salts. There was significant increase in UP/UC (1.99±1.17.vs 0.40 ±0.11), UP: UC ≥ 1.0 in dogs with CRF is associated with greater risk of development of uremic crises and death, compared with dogs with UP: UC < 1.0. Thus, initial 91 determinations of UP: UC in dogs with naturally occurring CRF is of value in defining prognosis of renal failure Jacob *et al.*, (2005) [5]. The most widely proposed cause of renal tubular injury in protein losing diseases of the kidney is excessive tubular uptake of filtered proteins or protein-bound substances Meyer (2003) [11], Amico and Bazzi (2003) [2]. microalbuminuria (260±1.84vs 30±1.41), protein (0.53±0.28 vs 0.35±0.31) and SDMA (344.57±1.31 vs 200±1.51) in dogs suffering from renal failure.

Microscopic examination

Microscopic examination of centrifuged urine samples of dogs admitted in current study revealed presence of renal epithelial cells in 15 (62.5%), increased number of RBC and pus cells in 5 dogs. Various types of casts were seen in urine sediments. 5 dogs had granular casts and 2 had hyaline cast. Crystaluria was found in 11 out of 24 dogs, combining 3 bilirubin crystal and 8 had amorphous crystals each. Presence of bacteria and white blood cells indicate inflammation anywhere in urinary tract (Osborne *et al.*, 1972) [15] while possible reason for significant haematuria include renalinfarcts, calculi and infection of any part of urinary system. Significant increase in epithelial cell countis indicative of the disease process in kidney and was inconclusive (Osborne *et al.*, 1972) [15]. Because of activepathologic process at loop of henle, distal tubule and collectingtubule there was significant hyaline and epithelial cast on microscopic examination however, absence of cast does notrule out the disease and number is not a reliable index ofseverity, duration and reversibility or irreversibility of disease (Osborne and Finco, 1995) [14]. Occasional renal epithelial cells may be normal while larger numbers indicate acute inflammation, infection, or neoplasia of the renal pelvis (DiBartola, 2010) [3]. Significant pyuria which can be confirmedby observing bacteria and white blood cells on sediment examination indicate inflammation or infection anywhere in the urinary tract (Osborne *et al.*, 1972) [15]. Previously, Kumar (2013) [4] also observed moderate to severe leucocytes in urine of dogs suffered from renal failure. Results of microscopic urine examination show resemblance with Sharma *et al.* (2016) [7].

Bacteriological examination

Out of all cases studied three cases of dogs suffering from renal failure had shown growth on culture media in antibiotic culture sensitivity examination. The cases were showing single infection of *Staphylococci* spp., *E. coli* and *Pseudomonas* spp.

Table 1: Gross and chemical examination of urine

Parameters	Grading	No of dogs affected
Ph	Acidic<6	20
	Neutral 7	2
	Alkaline >7	2
Colour	Raddish yellow	3
	Dark yellow	4
	Pale Yellow	8
	Colourless	9
Specific gravity	<1.015	9
	1.015-1.030	14
	>1.030	1
Protein	3+	5
	2+	14
	1+	4
	Trace	1
Ketone bodies		Absent
Bile pigment and bile salt		2

Table 2: Microscopic examination of urine

S.no	Parameter	No. of animal
1	Pus cell	3
2	RBC	5
3	Epithelial cell	15
4	Hyaline cast	2
5	Granular cast	5
6	Bilirubin crystals	3
7	Amorphous crystal	8

Table 3: Chemical examination of urine

Parameter	Mean± SD	Mean ± SD control
Urine creatinine (g/l)	0.277±0.05	0.10±0.89
Microalbuminuria (mg/dl)	260±1.84	30±1.41
Protein (g/l)	0.53±0.28	0.35±0.13
UP/UC	1.99±1.17	0.40±0.11
SDMA (µg/dl)	344.57±1.31	200±1.51

Conclusion

In conclusion, the comprehensive examination of dogs with renal failure revealed significant alterations in various urinary parameters, chemical composition, microscopic characteristics, and bacteriological findings. The majority of dogs exhibited acidic urine with varying specific gravity. Proteinuria severity varied, with a notable association between elevated UP:UC ratio and poor prognosis. Microscopic analysis demonstrated the presence of renal epithelial cells, casts, crystals, and signs of inflammation, indicative of renal pathology. Bacteriological examination identified bacterial growth in a subset of cases, highlighting the potential for secondary urinary tract infections. These findings underscore the complexity of renal disease in dogs and emphasize the importance of multi-modal diagnostic approaches for accurate assessment and management. Further research in this area is warranted to enhance our understanding and treatment of canine renal failure.

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