



Ultrasonographic Findings of Urinary System in Dogs suffering from Chronic Renal Failure

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Received: 28 Sept., 2021

Revised: 08 Nov., 2021

Accepted: 16 Nov., 2021

ABSTRACT

A total of 24 dogs suffering from azoturia on the basis of elevated blood urea nitrogen and creatinine level were subjected to ultrasonographic examination. The examination was performed in sternal recumbancy using 3.5 Mhz transducers with convex probe. Kidney and urinary bladder along with tract were explored for any abnormal changes. Different affections observed in 24 dogs were cystitis in 54.15%, loss of demarcation of kidney medulla and cortex in 37.5% cases, irregular shape and diffused border in 37.5%, nephritis in 25% of cases, hydronephrosis was observed in 20.83% cases and cystolith was also observed in 12.5% cases. Most important ultrasonographic features in these affections included cystitis and small kidneys with loss of corticomedullary demarcation ("end-stage" kidneys). Ultrasonography of urinary system serves as a prognostic and diagnostic marker in cases of chronic kidney disease.

HIGHLIGHTS

- Ultrasonography is important diagnostic tool for detection of urinary system disorders in dogs.
- Cystitis and end stage kidney were the prominent ultrasonography findings in CKD.

Keywords: Chronic kidney disease, ultrasonography, end stage kidney, cystitis, nephritis

Chronic Kidney disease (CKD) or Chronic renal failure (CRF) as structural and/or functional impairment of one or both kidneys that has been present for more than approximately 3 months (Bartges, 2012). Clinical signs encountered in renal failure cases are nonspecific, vague and late in arrival when more than 75% kidney got damaged, therefore a timely diagnosis and management of the disease is important (Bragato *et al.*, 2017). CKD involves irreversible loss of renal function and/or structure that remains stable for some period of time but is ultimately progressive (Bartges, 2012).

Routine diagnostic approaches for evaluation of kidney disorders include clinical examination, haemato-biochemical examination and urinalysis. Advancement in diagnostic and therapeutic approaches in clinical canine practice has improved the life span of pets which in turn has increased the need to identify geriatric diseases

early. Ultrasound is the ideal non-invasive imaging test for evaluating kidney damage (Barella *et al.*, 2012) and it yields several useful data for creating the diagnosis of CKD, exclusion of differential diagnosis, and for defining the prognosis and monitoring the treatment (Bonazzi *et al.*, 2007).

Ultrasound can be used to measure Kidney dimensions and observe parenchymal quality (Chandler *et al.*, 2007; Barella *et al.*, 2012). It is the technique of choice for reliable diagnosis of fluid-filled cystic lesions, renal mass lesions, hydronephrosis, and anatomic localization of uroliths (radiopaque and radiolucent) (Dehmiwal *et al.*,

How to cite this article: Sonu, Kumar, A., Kumar, T. and Charaya, G. (2021). Ultrasonographic Findings of Urinary System in Dogs suffering from Chronic Renal Failure. *J. Anim. Res.*, 11(06): 1039-1042.

Source of Support: None; **Conflict of Interest:** None 

2016). Early diagnosis is essential to stabilize the renal function and prevent the rapid progression of disease condition. Therefore, the current study was planned to perform abdominal ultrasonography focusing on renal system in dogs suffering from chronic kidney diseases.

MATERIALS AND METHODS

Study area, selection of dogs and ethical approval

Twenty four dogs irrespective of age, breed and species presented at Small Animals Clinics, College Veterinary Hospital, Teaching Veterinary Clinical Complex, College of Veterinary Sciences, LUVAS, Hisar, with clinical signs suggestive of chronic renal failure. Uremic condition of dogs was confirmed on the basis of clinical conditions (signs and history of illness) and biochemical alteration (elevated urea nitrogen and creatinine).

Study has been done after prior approval from Institutional animal ethical committee.

Ultrasonographic examination for evaluation of urinary system

Ultrasonography of dogs was done using Siemens Acuson S2000 ultrasonographic machine. Ultrasonographic examination was done with B-mode using a 3.5-5 MH convex transducer. The complete urinary system was scanned in dorsal and lateral recumbency. Left kidney was scanned through the ventral abdominal wall or the flank caudal to the last rib. Right kidney was scanned in dorsal recumbency by placing the transducer caudal to right costo-spinal angle and in the middle of the last inter-costal. Cross section longitudinal and transverse images were recorded to measure the size of kidneys. Renal echogenicity, renal contour and cortico-medullary differentiation was recorded in each case to differentiate between different renal pathological conditions.

RESULTS

Selection of dogs for the present study was based on uremic condition present on the basis of clinical signs and biochemical changes observed. Ultrasonography provides a incredible non-invasive tool for detection of structural and morphological changes in urinary tract of

dogs. Normal sonographic architecture picture contained a mixture of hyperechoic, hypoechoic and anechoic patterns depending on part or urinary system to be imaged. Inside the kidney, Medulla is least echogenic *i.e.* hypoechoic, round in appearance with well-defined cortico-medullary junction. Outside the medulla with zone of intermediate echogenicity similar to liver is renal cortex (Monteriro and Froes, 2009). Renal echogenicity must be slightly hypoechoic or isoechoic in relation to the liver and hypoechoic in relation to the spleen, and a change in this relationship of echogenicity suggests the possibility of a pathologic change (Nyland *et al.*, 2005).

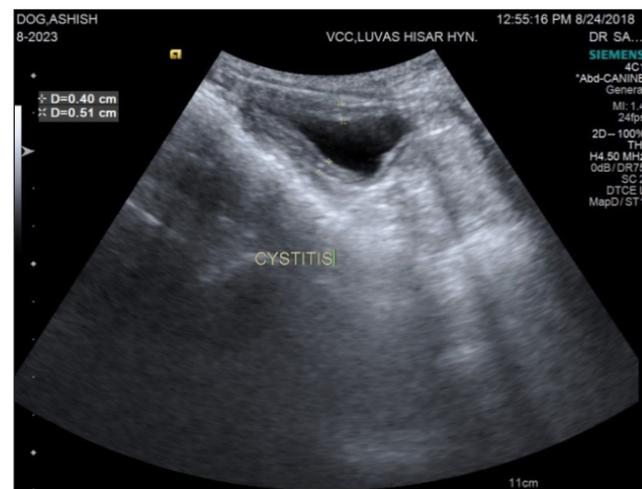


Fig. 1: Cystitis with wall thickness of 0.40 cm and 0.51 cm at two different ends in dogs suffering from CKD

Urinary affections observed in current study using ultrasonography in dogs suffering from chronic kidney disease is shown in Table 1. Cystitis (Fig. 1) was observed in 54.16% (n=13) dogs as major ultrasonographic alteration followed by end stage kidney in 37.5 % (n=9) dogs, irregular shape and border in 37.5% (n=9) dogs, nephritis in 25% (n=6), hydronephrosis (Fig. 3) in 20.83% (n=5) dogs and cystolith in 12.5% (n=3) dogs. In cases of cystitis thickness of bladder was found to be in range from 0.45 cm to 0.59 cm which is way beyond the normal value.

Results pertaining to occurrence of end stage kidney disease (37.5%) obtained in present study were in conjunction with result obtained by Kumar *et al.* (2011) observing end stage disease in 40% cases whereas lesser as compare to other studies of Oburai *et al.* (2015) showing end stage kidney in 78% case and Tripathi and

Mehta (2010) observing same in 57.1%. Size of kidney showing end stage disease was found in range from 4.88 cm to 3.98 cm in length and 3.41 to 3.01 cm which is quite less as compared to standard mean calculated by Barella *et al.* (2012) in 26 healthy dogs.

Table 1: Ultrasonographic findings in dogs with renal failure

Ultrasonographic Observation	No of dogs	Percentage
Cystitis	13	54.16%
End stage kidney (small kidneys with loss of Cortico-medullary demarcation)	9	37.5%
Irregular shape and diffused border	9	37.5%
Nephritis (Increased cortical echogenicity)	6	25%
Hydronephrosis	5	20.83%
Cystolith	3	12.5%

Among nine cases of end stage kidney disease, five were having involvement of both the kidneys whereas four were having only right kidney involved. Finding of small kidneys with irregular, thin and echogenic cortex is indicative of irreversible kidney failure or end-stage kidney disease. These changes observed in any case indicate chronic and irreversible change whether these changes are associated with or without laboratory manifestation confirms diagnosis of chronic kidney disease. Out of thirteen cases of cystolith, five cases were having end stage kidney.

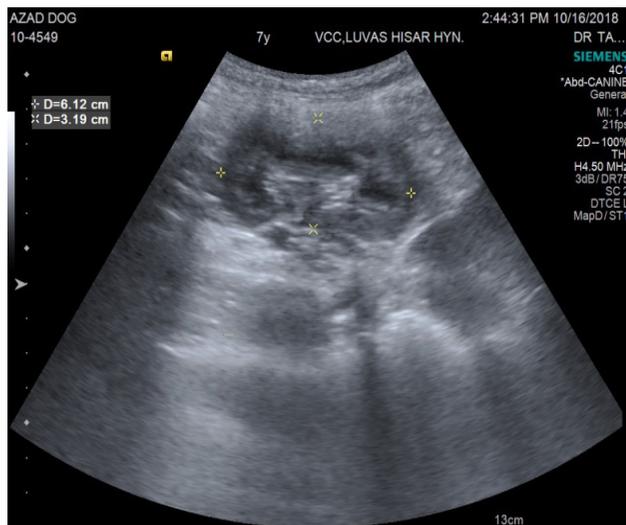


Fig. 2: Irregular shape and diffused border of Kidney in dog suffering from CKD



Fig. 3: Hydronephrosis of right kidney in a dog

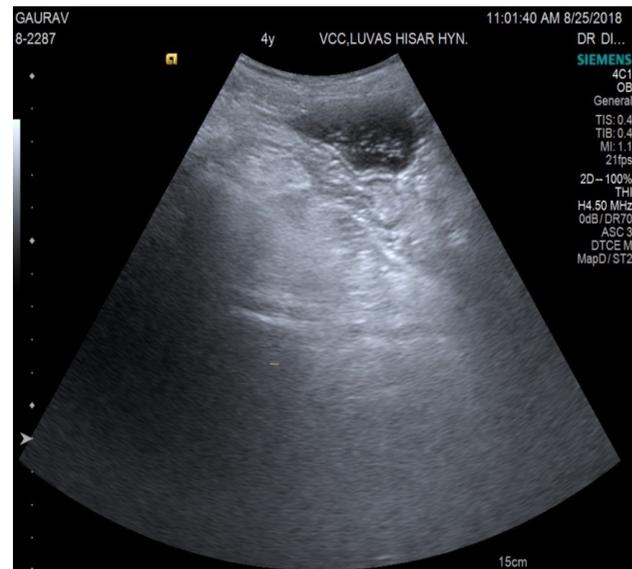


Fig. 4: Presence of cast and crystal in urinary bladder in dogs suffering from CKD

Diseases of the kidney diagnosed by ultrasonography can be divided into diffuse renal diseases, regional renal diseases, and focal or multifocal renal diseases (Monteriro and Froes, 2009). In present study, diffuse renal diseases diagnosed were nephritis and end-stage kidney and regional renal diseases diagnosed were hydronephrosis and nephrolithiasis whereas no multifocal renal disease diagnosed. In present study, hydronephrosis was observed in 20.83% cases while Kumar *et al.* (2011) reported in 10% cases and Dehmiwal *et al.* (2016) in 27% cases in their studies. None of the dogs was found to have renal cyst, polycystic kidney and renomegaly. Absence of renal cyst, polycystic kidney and associated renomegaly is in contraindication to study conducted by Bonazzi (2007).

Care must be taken while performing ultrasonography in small dogs as they may have increased medullary echogenicity without this change being indicative of renal impairment. In cases of primary injury to kidney, where renal ultrasound alone and clinical picture cannot provide confirmatory result renal biopsy may be conducted but in cases of CKD with unfavourable prognosis this becomes contradictable.

ACKNOWLEDGEMENTS

Sonu, TK and GC conducted the clinical examination and ultrasonography part of study. Sonu analyzed the data, gathered figures and written manuscript. AK finally checked the manuscript and data.

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