ULTRASONOGRAPHICAL STUDIES OF RENAL DEFECTS IN CANINE

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Based on the ultrasonographic structural characterization, the affections of kidney leading to acute or chronic renal insufficiency in majority of dogs. These affections included end-stage kidneys (*n* = 208), chronic pyelonephritis (*n* =36), unilateral hydronephrosis (*n* = 32), bilateral hydronephrosis (*n*= 22), urethral calculi (*n* = 19), renomegaly (*n* = 12), Acute pyelonephritis (*n* = 07), nephrocalcinosis (*n* = 5), renal cyst (*n* = 4), nephrolithiasis (*n*= 4) and renal neoplasia (*n*=02). In 112 cases mild loss of corticomedullary differentiation was noted without any other structural changes and therefore these cases could not be differentiated as specific condition, whereas in 90 cases, the ultrasound failed to detect any measurable changes in size, shape or echogenecity of kidneys.
Keywords: Canine, Renal Diseases, Ultrasound, Azotemia.

The ultrasonography of the upper urinary tract in veterinary medicine is a routine procedure which can provide important anatomic information regarding size, shape and internal architecture of the kidneys. Ultrasound can offer more information than conventional radiography, especially in the presence of emaciation, retroperitoneal and peritoneal effusion, and impaired renal function. Ultrasound can also be used to guide invasive procedures such as fine-needle and core biopsy, percutaneous pyelocentesis, and antegrade pyelography.

Ultrasonography is the most common modality for visualizing aberration in the number, size, and texture and position of the kidneys (Bahr *et al.***,** 2000;) and related structures as well as the presence of mineralizing densities (Kruger *et al.*, 1996*).* Lamb (1990) described indications for renal ultrasonography as abnormal kidney size or shape as detected by palpation or abdominal radiographs, uraemia, haematuria and flank pain. In animals with clinical signs of renal disease, inability to palpate the kidneys or identify them on survey abdominal radiographs is another indication for ultrasonography.

Materials and Methods

In the study, dogs presented at Teaching Veterinary Clinical Complex (TVCC), Nagpur Veterinary College, Nagpur and having age of 6 years and above with suspected renal failure on the basis of clinical observations were subjected for blood urea nitrogen and serum Creatinine estimations. In cases where the azotemia was recorded, detailed ultrasound examinations were carried out. During the period of study, total 553 dogs were diagnosed with clinical manifestations of renal failure.

The ultrasound examination in the present investigation was carried out in all the cases using a Toshiba, Justvision 200 ultrasound scanner, with triple frequency transducer having 3.5 - 5.00 MHz convex and 5.0-7.5 MHz linear transducer. The selection of the transducer of appropriate frequency and routine preparations for ultrasound viz. administration of luxative a day prior to examination, wherever possible, cleaning of ventral abdomen, close clipping and application of couplin gel allowed proper visualization of the renal images. The distended urinary bladder provided adequate acaustic window and permitted proper visualization of details of kidneys in most of the cases.

Results and Discussion

Based on the ultrasonographic structural characterization, the affections of kidney leading to acute or chronic renal insufficiency could be identified in majority of dogs. These affections included end-stage kidneys (*n* = 208), chronic pyelonephritis (*n*

=36), unilateral hydronephrosis (n = 32), bilateral hydronephrosis (n= 22), urethral calculi (n = 19), renomegaly (n = 12), Acute pyelonephritis (n = 07), nephrocalcinosis (n = 5), renal cyst (n = 4), nephrolithiasis (n= 4) and renal neoplasia (n=02). In 112 cases mild loss of corticomedullary differentiation was noted without any other structural changes and therefore these cases could not be differentiated as specific condition, whereas in 90 cases, the ultrasound failed to detect any measurable changes in size, shape or echogenecity of kidneys.

The common findings included hyperechoic cortex, loss of corticomedullay differentiation, dilated pelvis, anoechoic cyst, heperechoic calculi, and either renomegaly or end stage kidney; in agreement to our study various researchers have described the sonographic findings in cases of acute or chronic renal failure as reported by Tripathi and Mehta (2010) found loss of architectural detail, hyperechoic periphery and indistinct contour. Similar findings were also demonstrated by Ross, 2011 and Mugford *et. al*., 2013. Kumari and Haque (2013) while performing ultrasound examination opined that the utrasonography can contribute much information towards the diagnosis of renal failure cases in dogs and its inclusion and frequent use will be of great value in Veterinary medicine. However, they also expressed that in few cases of dogs suffering from acute renal failure ultrasonographic images of kidney did not showed major abnormalities and having almost normal architecture and cortices with normal echogenicity. Similar finding were also observed earlier by Stanley and Langston (2008). Although describing all the ultrasound features recorded in the present investigation are beyond the scope of this work, some typical cases have been described hereunder-

1. ***Chronic End-Stage kidney***- The kidneys were small in size with loss of architectural details on ultrasound examination. The sonographic observations of decreased size of kidneys could be related to chronic renal failure and the loss of architectural details has been a significant feature of renal diseases due to gradual loss of functional nephrons, over a few months to several years simillarly Felaki, 1992 and Miyamoto *et al.* 1997 also reported small size kidney as end stage kidney in renal dysplasia. Complete loss of corticomedullary definition observed in the present study might be due to chronic nephritis which is a major cause of end-stage kidneys with sonographic observations of small sized kidneys and loss of corticomedullary detail which makes their differentiation from surrounding tissue difficult.

2. ***Acute pyelonephritis***- Right kidney measured 4.33cms X 2.39cms X 3.11cms and showed hyperechoic cortex, dilated pelvis and loss of corticomedullary differentiation. There was free fluid adjoining the right kidney surrounding the renal fossa of caudate lobe of liver. The left kidney measured 5.31cms X 2.54cms X 3.57cms and showed hypoechoic cortex, however, the calyceal system and corticomedullary differentiation could be seen. The features were suggestive of renal failure due to acute pyelonephritis (Plate 16).

3. ***Chronic pyelonephritis***- The left kidney measured 4.01 X 3.01 X 2.90cms and showed normal shape, size and echogenic pattern. However, the right kidney seemed to be shrunken, irregularly shaped and measured 3.00 X 2.86 X 2.26cms. The medulla was hyperechoic with dilated renal pelvis and there was free fluid around the kidneys. The ultrasound features suggested renal failure due to chronic pyelonephritis (Plate 17).

Pyelonephritis is an inflammatory condition of the renal parenchyma most often caused by bacterial infection. Generally the condition affects both the kidneys and most of the cases are associated with an ascending urinary tract infection due to vesico-ureteral reflux. However, hematogenous infection can occur if there is pre-existing tissue damage or urinary obstruction which interferes with elimination of bacteria. Inflammation and suppuration of kidney is followed by tissue

destruction and fibrosis leading to chronic renal failure.

4. ***Bilateral hydronephrosis***- The left kidney measured 8.32 X 4.28 X 4.71cms whereas the right kidney measured 8.75 X 3.51 X 3.70cms. Both the kidneys showed dilated anechoic pelvis with distal enhancement and loss of corticomedullary architecture. The transverse scan showed enlarged, anechoic ureters. The features were suggestive of bilateral hydronephrosis resulting in chronic renal failure (Plate 18 & 19).

Hydronephrosis can occur in a kidney due to partial or complete obstruction of urinary passage. Back pressure of urine on kidneys causes dilatation of the renal pelvis with progressive ischemic atrophy and necrosis of renal parenchyma. This can result in a grossly enlarged, fluid-filled kidney with a much-reduced mass of functional tissue.

In the present study, hydronephrosis was observed secondary to urethrolithiasis in 4 cases as Kumar *et al.* 2011, also reported the same. However, in other cases cause of hydronephrosis could not be ascertained on ultrasound examinations. The hydronephrosis is said to be caused due to ureteric obstruction due to calculi. However, gas filled intestines do not always permit visualization of entire course of ureters visible and thereby makes diagnosis difficult.

5. ***Unilateral Hydronephrosis***- The left kidney measured 6.32 X 4.36 X 3.79cms and showed hyperechoic cortex and dilated anechoic pelvis. The corticomedullary differentiation was slightly distorted suggesting hydronephrosis resulting chronic renal failure (Plate 20).

6. ***Renal neoplasia***- Left kidney measured 6.61 X 3.3 X 5.58cms and showed hypoechoic cortex and hyperechoic pelvis fat. Medulla was moderately dilated. The right kidney was enlarged and measured 6.97 X 3.51 X 4.06cms. There was a hypoechoic mass extending from anterior pole and total disruption of renal architecture. The feature suggested renal neoplasia of right kidney leading to chronic renal failure (Plate 21 & 22).

7. ***Renomegaly***- The renomegay and associated nephritis causing renal failure was diagnosed in 12 clinical cases.

8. **Nephrocalcinosis**- Nephrocalcinosis was diagnosed in 05 cases during the present investigation. The ultrasound features were diffuse, small, multiple hyperechoic structures in the renal parenchyma with distal acoustic shadowing. Kumar *et al.*, 2011 reported similar findings in a dog. Konde, 1985 also documented nephrocalcinosis as focal or diffuse hyperechoic areas with or without distal acoustic shadowing which may be recognized ultrasonographically before being visualized radiographically. A fine hyperechoic medullary rim observed on the left kidney is a unique sonographic feature of nephropathy..

9. **Renal cyst-** Cortical renal cysts were diagnosed in 4 cases. The ultrasound examinations in these cases revealed small spherical structures in the renal cortical region which contained anechoic fluid with distal acoustic enhancement as also reported by Konde (1985) and Kumar *et al* (2011). It has been postulated that presence of solitary or multiple renal cysts without clinical symptoms are usually of congenital origin and in most cases are incidental findings while carrying out ultrasonographic examination.

10. **Nephrolithiasis-** Renal calculi were noticed in 04 cases. The sizes varied from 2 to 4 mm. In all the cases the calculi were observed in the renal pelvis. is rare in dogs since most canine uroliths form in the bladder. When present, however, they may obstruct urine outflow

Plate 1 : Acute Pyelonephritis

Plate 2 : Chronic Pyelonephritis

Plate 3 : Bilateral Hydronephrosis

Plate 4 : Bilateral Hydronephrosis

Plate 5 : Chronic renal failure with Hydornephrosis

Plate 6 : Renal Neoplasia

Plate 7 : Renal neoplasia

leading to ARF or hydronephrosis, predispose to pyelonephritis, and cause local damage to renal parenchyma. Surgical removal is indicated if more urgent removal of the calculi is required.

The findings of ultrasound examinations are similar to the findings of Gonenci *et al.*, (2003) who have also indicated use of ultrasound examination for various renal affections and described various

ultrasonographic findings in dogs suffering from various renal insufficiency. The ultrasound study in the present investigation proved handy in detecting the ultrastructural changes and parenchymal alterations and avoided the use of more laborious, time consuming excretory urography in animal with poor body condition. Renal biopsy was however recommended for ascertaining the nephropathy.

References

Bahr, A., R., Wrigley and M. Salman. (2000). Quantitative evaluation of imagent as an abdominal ultrasound contrast medium in dogs. *Vet. Radiol. Ultrasound*, **41**: 50-55.

Felkai, C.S., K., Voros., T., Vrabely and F., Karsai. (1992). Ultrasonographic determination of renal volume in the dog. *Vet. Radiol. and Ultrasound*, **33**(5): 292-296.

Gonenci, R., R., Durgut, S., Erdogan., M.E., Altug and R., Bal. (2003). EvaIuation of kidney abnormalities in mongrel dogs using clinical, ultrasonographical and biochemical examinations. *Ankara Univ. Vet. Fak. Derg*., **50**: 97-102.

Konde, L.J. (1985). Sonography of the kidney. *Vet. Clin. North Am. Small Anim. Pract*., **15**: 151.

Kruger, J.M., C.A., Osborne, R.F., Nachreiner and K.R., Refsal. (1996). Hypercalcemia and renal failure. Etiology, pathophysiology, diagnosis, and treatment. *Vet. Clin. North Am. Small Anim. Pract.*, **26**: 1411-1445.

Kumar, V., A., Kumar and A.C. Varshney. (2011). Ultrasonographic imaging for structural characterization of renal affections and diagnosis of associated chronic renal failure in 10 dogs. International Scholarly Research Network (IRSN) Veterinary Science, Hindawi Publications (doi:10.5402/2011/901713).

Kumari, L. and S. Haque. (2013). Comparative therapeutic evaluation of nephroliv in respect of ultrasonographic changes in renal failure cases of dogs. *Indian Journal of Canine Practice*, **5**(1): 122-124.

Lamb, C.R. (1990). Abdominal ultrasonography in small animals Intestinal tract and mesentery, kidneys, adrenal glands, uterus and prostate. *J. Small Anim. Pract*., **31**: 295-304.

Miyamoto, T., S., Wakizaka, S., Matsuyama, E., Baba, F., Ohashi, M., Kuwamura, J., Yamate and T.. Kotani. (1997). A Control of a Golden Retriever with Renal Dysplasia. *J. Vet. Med. Sci.,* **59**(10): 939–942.

Mugford, A., R. Li and K. Humm (2013) Acute kidney injury in dogs and cats1. Pathogenesis and diagnosis. In Practice. 35: 253-264.

.Ross, S.J. (2011). Anticoagulation in intermittent Hemodialysis: pathways, protocols, and pitfalls, *Vet. Clin. Small Anim.*, **41**: 163-175.

Stanley, S.W. and C.E., Langston. (2008). Case report – Hemodialysis in a dog with acute renal failure from currant toxicity. *Can. Vet. J.*, **49**: 63-66.

Tripathi, R. and H., Mehta. (2010). Diagnosis of renal disorders in dogs using ultrasound technique. Biosci. Biotech. Res. Comm., **2** (2): 213-214.