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Ultrasound Report in the Diagnosis of Dogs Renal Pathology

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Abstract: The renal pathology for domestic carnivores is very serious. In canine medicine, clinics and biology remain exams of the first intention for the diagnosis of various renal affections. The study aims at specifying and assessing the contribution of ultrasound in the diagnosis of dogs' renal pathology. The study was carried on 250 dogs with different sexes, ages and weighs, presented at the department of canine medicine and general surgery, over the period 2010-2013. It enabled us to analyze the ultrasound features and their modifications in case of renal attack. Among the 250 dogs examined, 40 of them showed bio-clinical variations among which 29 showed ultrasound renal changes, nine others showed ultrasound changes yet with no alteration of the renal function. The ultrasound examination has shown a hypertrophy among 18 dogs, a renal atrophy among 12 dogs, a modification of the echo structure in 24 dogs but no change neither in the anatomic situation nor in the number of kidneys. The ultrasound shows a high sensibility and specificity for the diagnosis of renal affections in the dog. We concluded that sonography may play an important role in diagnosis and characterization of renal affections.

Key words: Ultrasound, dog, renal pathology, sexes, ages

INTRODUCTION

The renal pathology remains a major concern for clinicians in canine medicine from both diagnostic and therapeutic point of view. The majority of renal pathologies end up in a chronic renal failure an early diagnosis of the disease can increase the chances of successful treatment. When kidney diseases are suspected on clinical examination, laboratory tests generally are effective in detecting renal dysfunction. Yet, this diagnosis remains not very clear for assessing the severity some of these affections.

Examination thus needs some imaging methods including ultrasonography. This one allows a morphological analysis of the kidney through its direct visualization. Ultrasound has an important role in the detection, characterization and management of affections involving kidney. It is a painless examination which can be repeated as many times as necessary without any deleterious effect (Felkai *et al*., 1997).

Renal affections are often diagnosed through ultrasound exploration of the organ of humans. The ultrasonographic features of them are less known in the dog with only a few descriptive instances. The aim of this study is to specify and assess the contribution of the ultrasound in the diagnosis of renal affections in the dog and comparison it with results of physical examination and biology.

MATERIALS AND METHODS

It is a prospective and descriptive study over a period of 3 years, between 2010 and 2013 relating to 250 dogs with different sexes, races, ages and weighs, presented for consultation for various reasons at the clinic. For each dog, a clinical exam, a biological exam and an ultrasound exam have been carried.

The ultrasound was conducted over dogs without sedation or anesthesia; the animals were put in dorsal or lateral position. Transverse and sagittal sections of the kidney have been realized with the help of sector probes of 7.5 and 3.5 MHZ. The ultrasound system (Titan Sonosite) makes use of a manual adjustment of the luminosity and gain of the transducers which allowed us to hinder any artifact and take advantage of a better image brightness.

Sonograms were evaluated for renal size, kidney number, anatomic position, cortical, medullar and hilar echogenicity and structure.

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The bioclinic diagnosis of the renal pathologies is set in front of any alteration of the general state, any modification of the kidneys size, any irregularity of the renal surface sometimes embossed, any painful reaction to a palpation, anuria, hematuria, stranguria, pollakiuria, edema and ascites. General non specific signs may be associated such as polyuria, polydipsia, hyperthermia, digestive troubles, skin troubles, nervous troubles as well as an alteration of the renal function (dosage of the creatininaemia, the urea, the proteinemia and a biochemical analysis of the urines) (Littman *et al*., 2013).

The ultrasound diagnosis of the various renal affections is based on the presence of a modification of the kidney size, a modification of the kidney contour, a modification of the echo-structure of the kidney relative to the liver and the spleen.

Bioclinic data have been gathered on an examination sheet for each dog. A statistical survey has also been conducted so as to assess the specificity and the sensibility of this diagnosis tool which would allow differentiating the sick from the healthy individuals.

The validity of this diagnostic test depends on the sensibility and specificity and on the predictive values. To this end, the results of the ultrasound explorations in the detection of the renal pathologies are always statistically compared to the results of the clinic and biology. Statistical computations were run under the XLSTAT.

RESULTS AND DISCUSSION

At the end of the survey, an abdominal ultrasound, a clinical examination and a biological checkup have been carried over two hundred and fifty dogs. The 40 dogs were found subject to bioclinic modifications among which 29 showed renal ultrasound changes. These 40 dogs split into 11 different races, between 1 month of age and 15 years. There also were 22 males and 18 females.

The bioclinic examination allowed us to bring forth different hypotheses in the diagnosis, namely a chronic renal failure, an increase of the kidney size, among them, 2 showed lithiasis and 7 suffered from pyelonephritis.

We have discovered the presence of masses among them 4 dogs showed big kidneys. A tubulonephritis and an acute renal failure were also detected. The results of the bioclinic examination are shown in Table 1. Among forty sick dogs, twenty nine showed ultrasound changes which we have distributed according to four ultrasound evaluation criteria as shown in Table 2.

The ultrasound diagnosis of the hydronephrosis was questioned in five dogs. Pyelonephritis was found in four dogs among which two showed normal size kidneys. Tubulonephritis was found in two dogs. Lithiasis showed in two dogs and the presence of renal masses was shown in four individuals, three of whom were qualified as tumors and the other one with simple renal cysts.

Table 1: Distribution of the sick dogs according to the bioclinic diagnosis

Retained diagnosis	No. of dogs
Acute renal failure	10
Renal hypertrophy	18
Lithiasis	2
Masses	4
Chronic renal failure	12
Tubulonephritis	5
Pyelonephritis	7

Table 2: Distribution of the sick dogs according to ultrasound evaluation criteria

Ultrasound evaluation criteria	No. of dogs
Change in kidneys number	0
Renal situation	0
Change in size	29
Change in structure	24

Table 3: Diagnosis retained by ultrasonography

	No change in the Echo-structure		Change in the Echo-structure	
Variables	Pathology	No.	Pathology	No.
Increased size	Hydronephrosis	5	Cyst	1
	Compensatory hypertrophy	2	Tumor	3
			Tubulonephritis	2
			Pyelonephritis	2
			Lithiasis	2
Decreased size			Chronic renal failure	12
Normal size			Pyelonephritis	2

The twelve kidneys dogs with chronic renal failure were characterized by a change in the echo-structure with a decrease in the cortico-medullary demarcation or a corticomedullary dedifferentiation and a decrease in the kidneys size (Table 3). An increase in the kidneys size was observed in 18 dogs. A change in the echo-structure was observed. No change was seen neither in the positions of the kidneys nor in their number (Table 3). The distribution of the dogs according to the ultrasound diagnosis is shown in Table 3.

The diagnostic hypotheses retained by ultrasound were comparable to those established by the bioclinic diagnosis. The computation of the sensibility, the specificity as well as the positive and negative predictive values have been carried, concerning ultrasound for all the pathologies, then for each one of them. Results are shown in Table 4.

The ultrasound aspects of normal kidneys (Cartee *et al*., 1980; Konde *et al*., 1986) and the existence of sonographic perturbations caused by the renal affections are well described in dogs (Konde, 1985; Konde *et al*., 1986; Walter *et al*., 1987). In many countries such as the United States of America and France, the investigation of kidneys and the study of their affections have provided practitioners with a non invasive, repetitive tool, capable to set a diagnosis and watch the evolution of renal pathologies.

Table 4: Comparison in the distribution of the sick dogs as retained by the two diagnosis: the sensibility of the test is 72.5%, its specificity is 97.14%, the positive predictive value is 82.86% and the negative predictive value is 94.88%

Variables	Hydronephrosis	Renal hypertrophy	Acute renal failure	Chronic renal failure	Lithiasis	Mass	Pyelonephritis	Tubulonephritis
No. of positive dogs by bioclinics	0	17	10	12.00	2.00	4.0	7.00	5.00
Number of positive dogs by ultrasonography	5	17	0	12.00	2.00	4.0	4.00	2.00
Specificity (%)	100	100	100	97.48	99.19	99.6	100.00	100.00
Sensibility (%)	100	100	0	100.00	100.00	100.0	57.14	40.00
Positive predictive value (%)	100	100	0	66.67	50.00	75.0	100.00	100.00
Negative predictive value (%)	100	100	96	100.00	100.00	100.0	98.78	98.79

This study has shown a series of modifications of the ultrasound images during the diagnosis of different renal pathologies. We also could evaluate the number, the size as well as their anatomic reports.

In the study, the renal pathology represented 16%. The appreciation of the kidneys size may vary during the ultrasound examinations and the successive examinations. The measures are depending on the operator (Mareschal *et al*., 2007). In the study, the margin of error was reduced because all measurement was performed by the same operator.

The sensibility and specificity of the ultrasound in evaluate the modification in kidneys size were 100% in the study. Ultrasound is the best technique for an accurate study of this parameter (Walter *et al*., 1987).

A widening of the renal pelves of the renal diverticulum as well as of the ureter has been determined by the ultrasound imaging in the cases of hydronephrosis. These results are similar to those in the literature (Cartee *et al*., 1980; Konde *et al*., 1986; Temizsoylu *et al*., 2006). Among the 5 dogs suffering from hydronephrosis; 3 had unilateral involvement which could not be detected nor by the clinic; nor by biology: only ultrasound examination was able to diagnose these dogs.

Among the seven dogs with pyelonephritis only four showed ultrasonographic changes. Ultrasound revealed marked bilateral dilation of the renal pelves with echogenic material (Tappin *et al*., 2012).

Tubulonephritis was characterized by the presence of hyperechoic areas in the cortex and the medulla. These images were found in two dogs out of the five bioclinically diagnosed. Moon *et al*. (2014) showed that clinical, biology, radiography and ultrasonography were used in the diagnosis of pyelonephritis. The study the imaging features was not much specific for assessing pyelonephritis and tubulonephritis and the diagnosis is usually based in serologic and clinical finding.

The renal cysts may be solitary or multiple, involving sometimes the two kidneys. In the study, the cysts were characterized by the presence of round anechogenic structures with a posterior enhancement. In dogs that showed a cystic kidney, the clinical diagnosis revealed a mass without further details. Ultrasound showed more specificity in the detection of cysts and evaluation of its nature and structure (Cartee *et al*., 1980; Rivers and Johnston, 1986; Temizsoylu *et al*., 2006; Walter *et al*., 1987).

The tumor diagnosis was established in three cases by ultrasound which represents 0.75% with a high sensibility and specificity. They were characterized by hyperechogenic or hypoechogenic lesions (Taylor *et al*., 2014). The presence of tumors was confirmed by surgery. The three tumors reached only one kidney with a normal renal function. This explaines by the fortuitous discovery of these lesions in the study (Bennett, 2004; Konde, 1985; Temizsoylu *et al*., 2006; Walter *et al*., 1987).

The percentage of renal lithiasis in the study was 0.5% which actually agrees with the results of researchers of various epidemiological enquiries that have shown that only 1-10% of the lithiasis have renal or ureteral localization (Ross *et al*., 1999) unlike in humans where these localization reach 90%.

Ultrasound has shown a high sensibility and specificity with regard to the diagnosis of the lithiasis which is characterized by a limited hyperchogenicity, accompanied by a shadow cone (Cartee *et al*., 1980; Konde *et al*., 1986; Ross *et al*., 1999).

In case of acute renal failure, ultrasound has shown kidneys with normal or moderately increased size. However, it was impossible to show any modification in the organ echo-structure. It is actually admitted that ultrasound is not the best choice for acute renal failure. However, it has shown to be useful in the detection of five causes among the ten listed acute renal failure, namely two cases of obstruction of the urinary tracts and three cases of cystitis.

Ultrasound has shown a high sensibility and specificity with regard to the diagnosis of the chronic renal failure. This pathology was characterized in terms of ultrasound by a cortical hyperechogenicity, a decrease in the demarcation or desperation of the limits between the cortex and the medulla and a decrease in the kidney size. The 3% was the rate for the chronic renal failure. In the sample, this percentage is like the one shown by a series of studies with predominance in old dogs' population.

CONCLUSION

Ultrasound is a modern, simple, non invasive, repetitive and reliable tool. The equipment is now modern, accurate, compact and relatively accessible. It results from the study that the renal pathology is a set of variable entities and that the ultrasound examination is important in the diagnosis of renal lesions. It is a technique that allows analyzing the parenchyma, performing the necessary measurements and observing in real time the organ through various sections.

Changes in the renal echo-structure are important signs in the study of the renal pathology. Moreover, ultrasound seems to be a reliable imaging method and complementary to clinics and biology. It is a technique which must be the fundamental examination and of first intention, straight after the clinic examination and anamnesis because it brings a precious help in the building of a positive, differential and sometimes prognosis of an argumentative diagnosis. However, the reliability of ultrasound rests on training, experience, subtlety and skill of the examiner in order to minimize false positive/negative mistakes and avoid bad diagnosis.

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