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Akash
Ph.D Scholar, Division of Veterinary Surgery & Radiology Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

Gulshan Kumar
Assistant Professor, Department of Veterinary Surgery & Radiology, U.P. Pt. Deen Dayal Upadhyay Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Ansundhan Sansthan, Mathura, Uttar Pradesh, India

Mamta Mishra
Ph.D Scholar, Division of Veterinary Surgery & Radiology Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

RP Pandey
Head of the Department, Department of Veterinary Surgery & Radiology, U.P. Pt. Deen Dayal Upadhyay Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Ansundhan Sansthan, Mathura, Uttar Pradesh, India

Corresponding Author:
Akash
Ph.D Scholar, Division of Veterinary Surgery & Radiology Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

Evaluation of ultrasonographic echotexture of adrenal glands: A study in eighteen apparently healthy dogs

Akash, Gulshan Kumar, Mamta Mishra and RP Pandey

Abstract
An ultrasonographic study was undertaken to evaluate the echotexture of adrenal glands in 18 apparently healthy dogs. The animals were divided into three age groups namely, Group I (from 01 month to 09 month), Group II (from 09 month to 6 years) and Group III (above 6 years). Ultrasonographic examination was done in lateral recumbency in all the dogs without using any sedative or anaesthetic agent. Ultrasonographic images of adrenal glands were recorded only in sagittal plane because adrenal glands could not be differentiated from the surrounding structures in transverse plane. The adrenal gland appeared as a peanut shaped (left) and almost oval shaped (right) hypoechoic area, and was homogenous in all the groups. The outline of the adrenal gland was clear. The difference in the echotexture of cortex and medulla were not discernible. The cranial and caudal poles of the left adrenal were easily discernible. The left adrenal gland was the first structure to appear in ultrasonogram beneath the skin, aorta appeared as an anechoic pulsating oblong structure below the left adrenal gland. The right adrenal gland appeared either dorsal to the caudal vena cava or at the level of caudal vena cava. Ultrasonography of adrenal glands in dogs does not require anaesthesia. Subcostal approach is the best approach to scan left and right adrenal glands. The scanning of adrenal glands can be easily done using a 7.5 MHz Linear transducer. The echotexture of the adrenal glands may assist in the diagnosis of pathologies of the adrenals or other organs.

Keywords: Ultrasonography, adrenal glands, echotexture, healthy dogs

Introduction
Ultrasound has quickly become an important modality for the evaluation of adrenal glands in the small animal patient. The adrenal glands are key components of the endocrine system, and their deranged function can produce a wide range of clinical signs. Adrenal glands cannot be detected with radiography (Kealy *et al*., 2012) [1], unless severely enlarged or mineralized. The Ultrasonographic assessment of the glands is now considered part of a complete abdominal scan in dogs. The advantages of ultrasonography include the ability to image both normal and abnormal glands, the ease and rapidity of the procedure, the lack of the need for anesthesia, and the availability of ultrasound to practitioners. However, the challenge of imaging the adrenal glands should not be underestimated. Even for an experienced sonographer, the small size of the glands; the deep and sometimes variable position of the glands are the factors of difficulty in evaluation of adrenal glands. Different parameters such as size, shape, margins, echogenicity and structure can be evaluated with ultrasonography. However, ultrasonography is equipment and user-dependent and multiple influencing factors may disturb the examination (Tidwell *et al.*, 1997) [2]. Ultrasonography is a standard procedure for visualizing the adrenal glands, because they are usually not visible radiographically (Kealy *et al*., 2012) [1]. The main peculiarity of ultrasonography is the possibility of obtaining sectional images in real time, in different spatial orientations, allowing the study of the movement of body structures (Cerri and Rocha, 1993) [3]. Kantrowitz *et al*. (1986) [4] described the clinical use of the Ultrasonographic examination in cases of adrenal disease in small animals. Furthermore, there are other advantages such as accessibility, low cost and rare need for anaesthetizing the animal for the examination. Alves *et al*. (2007) [5] have reported that the disadvantages such as formation of artifacts and blurring of texture and echogenicity alterations in certain pathophysiological causes can be overcome with technique expertise combined with detailed anatomical knowledge of the region to be analyzed. Kantrowitz *et al*. (1986) [4] have opined that the Ultrasonographic appearance of normal canine adrenal gland was not described till 1986,

due to small size and shape of the canine adrenal glands, overlying abdominal viscera, similar acoustic texture of surrounding tissue, frequent abundant perirenal fat, and lack of patient compliance.

Material and Methods

Place of study

The study was carried out in the department of veterinary surgery and radiology at the Teaching Veterinary Clinical Complex (TVCC), (Kothari veterinary hospital), College of Veterinary Science and Animal Husbandry, U.P. Pt. Deen Dayal Upadhyay Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Ansundhan Sansthan, Mathura-281001(UP)

Subjects of Study

In this study, apparently healthy dogs of all age groups were subjected to Ultrasonographic examination of both adrenal glands. These dogs were divided into three groups as under:

Group I : Animals of 01 month to 09 months of age
Group II: 09 months to 6 years of age
Group III: Above six years of age

There were six animals in each group.

Ultrasound machine

In this study, the Esaote® MyLab30vetGold, Esaote Europe B.V., Philipsweg 1, 6227 AJ Maastricht, The Netherlands with 7.5 MHz transducer LA523, was used for per-cutaneous scanning of the adrenal glands.

Restraint and Anaesthetic protocol

The animals were subjected to Ultrasonographic examination without using any anaesthesia or sedatives with animals restrained in lateral recumbency.

Site preparation

An area immediately behind the last rib, cranially below the tips of lumber transverse process dorsally was shaved neatly, for scanning the left adrenal. Similarly, for right adrenal gland the area extended cranially up to the last intercostal space. The animals were restrained in the lateral recumbency to scan the adrenal glands. Adequate amount of coupling gel was applied over the transducer as well as the area of interest in order to ensure an intimate contact between skin and transducer head. Animals were left undisturbed throughout the examination procedure in order to get optimum results.

Method

The left adrenal gland was scanned by placing the transducer in the subcostal area (immediately behind the last rib) in the dorsal plane (along the body length parallel to the dorsum of the dog) and locating the aorta and caudal vena cava in long axis. The transducer was then slid cranially along to the level of the left kidney keeping the aorta in view and the left renal artery and vein were located. The transducer was rotated 45 degrees clockwise and gently swept cranial to the renal artery and vein to locate the left adrenal gland in long axis. The aorta and kidney were not always visible in the same field of view when the adrenal gland was imaged but in some Ultrasonograms many structures, namely, the adrenal gland along with aorta and kidney were visualized in the same field. For locating of the right adrenal gland, the dog was placed in left lateral recumbency. The transducer was placed behind the last rib in the sub-lumbar area, in all the animal and intercostal approach was not needed to locate the right adrenal gland. The aorta and caudal vena cava were again located in the long axis in the dorsal plane. The transducer was then slid cranially, keeping the caudal vena cava in view. The adrenal gland was located along side and dorsal to the caudal vena cava.

Results and discussion

The left adrenal gland appeared as a peanut shaped hypoechoic area, and was homogenous in all the groups (Figure 1 & 2). The contour of the gland was smooth. The outline of the left adrenal was clear but the cortex could not be differentiated from the medulla. The cranial and caudal poles of the left adrenal were easily discernible. The left adrenal gland was the first structure to appear in Ultrasonogram beneath the skin, Aorta could be seen as an anechoic pulsating oblong structure appearing below or in some cases, adjacent to the left adrenal gland. The cranial mesenteric artery and celiac artery could not be visualised in all the Ultrasonograms but in some Ultrasonograms they were differentiated as having a distinct hypoechoic or anechoic pulsating structures cranial to the left adrenal gland. The phrenicoabdominal vein could not be differentiated in most of the Ultrasonograms but in one animal of Group II, it was clearly visualized as anechoic or hypoechoic oblong area having hyperechoic margins running through the mid-body of the adrenal. Similar findings have been reported by Grooters *et al.* (1996) [6] wherein they observed that the left adrenal gland had a “peanut” shape when imaged in a sagittal plane. The adrenocortical parenchyma was homogenous and less echogenic than the adjacent renal cortex. According to a study performed by Santos *et al.* (2013) [7], the left adrenal gland of puppies and kittens was hypoechogenic to the surrounding fat, limited by a hyperechogenic line and without distinction of cortical and medullary region. In a study done by Choi *et al.* (2011) [8] the adrenal cortex left adrenal gland was hypoechoic to the renal cortex and adjacent fat.

Similarly, Barthez *et al.* (1998) [9] have found that left kidney and aorta are the two abdominal structures which are useful landmarks for searching the left adrenal gland. They have reported that the normal left adrenal gland can be identified as a small, elongated, hypoechoic structure just lateral to the aorta. According to their study the parenchyma can sometimes be separated into a less echoic cortical region and a more echoic central medullary region. The left adrenal appears bilobed and is often referred to as being “peanut” shaped. The phrenicoabdominal vein (ventral) and artery (dorsal) course in the groove between the two lobes and are sometimes visible in cross section on longitudinal images of gland. Hoerauf and Reusch (1999) [10] have also reported the echogenicity of left adrenal gland in their study. According to their study left adrenal gland of healthy dogs was hypoechoic as compared to the surrounding tissue.

The right adrenal gland was almost oval shaped hypoechoic structure as compared to the surrounding tissue, and was homogenous in all groups (Figure 3). The contour of the gland was smooth. The outline of the adrenal was clear but the cortex could not be differentiated from the medulla as in case of the left adrenal. The right adrenal gland appeared either dorsal to the caudal vena cava or at the level of caudal vena cava. Similar findings have been reported by Barthez *et al.* (1998) [9] who found that the right adrenal gland is located just cranial and medial to the hilus of the right kidney and can be identified just to the right of caudal vena cava. Accodrding to their study the right adrenal gland appears as a small,

elongated, hypoechoic structure with its longitudinal axis parallel to the caudal vena cava. According to a study performed by Santos *et al.* (2013) [7] the right adrenal gland of puppies and kittens was hypoechogenic to the surrounding fat, delimited by a hyperechogenic line and without distinction of cortical and medullary region. In a study done by Choi *et al.* (2011) [8] the adrenal cortex of right adrenal gland was hypoechoic to the renal cortex and adjacent fat. Hoerauf and Reusch (1999) [10] also proposed the echogenecity of right adrenal gland in their study. According to their study right adrenal gland of healthy dogs was hypoechoic compared to the surrounding tissue.

Conclusion

Subcostal approach is the best approach to scan left and right adrenals, the scanning of adrenal can be easily done using a 7.5 MHz Linear transducer, in lateral recumbency by placing the probe caudal to the last rib and ventral to the lumbar process. It requires a great degree of patience to scan adrenals because of their size and position. It is difficult to scan right adrenal gland because of its cranial location. The Ultrasonographic images collected in this study can be used as reference image and echotexture of the adrenal glands may help to compare with the abnormal pathologies.

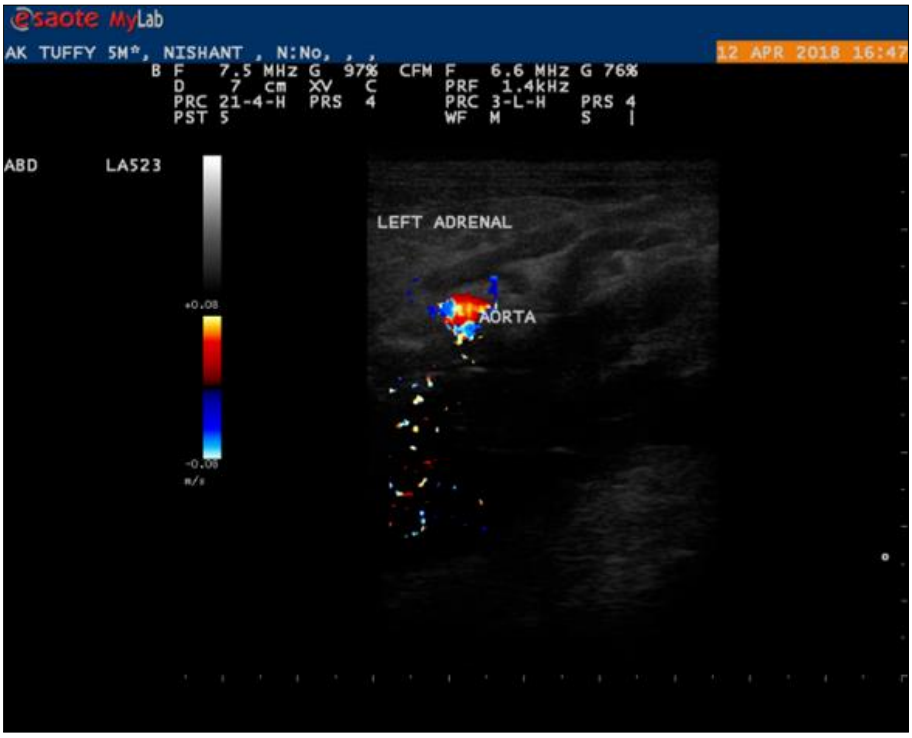

Fig 1: Ultrasonogram of left adrenal gland showing hypoechoic peanut shape left adrenal gland along with aorta shown by colour Doppler.

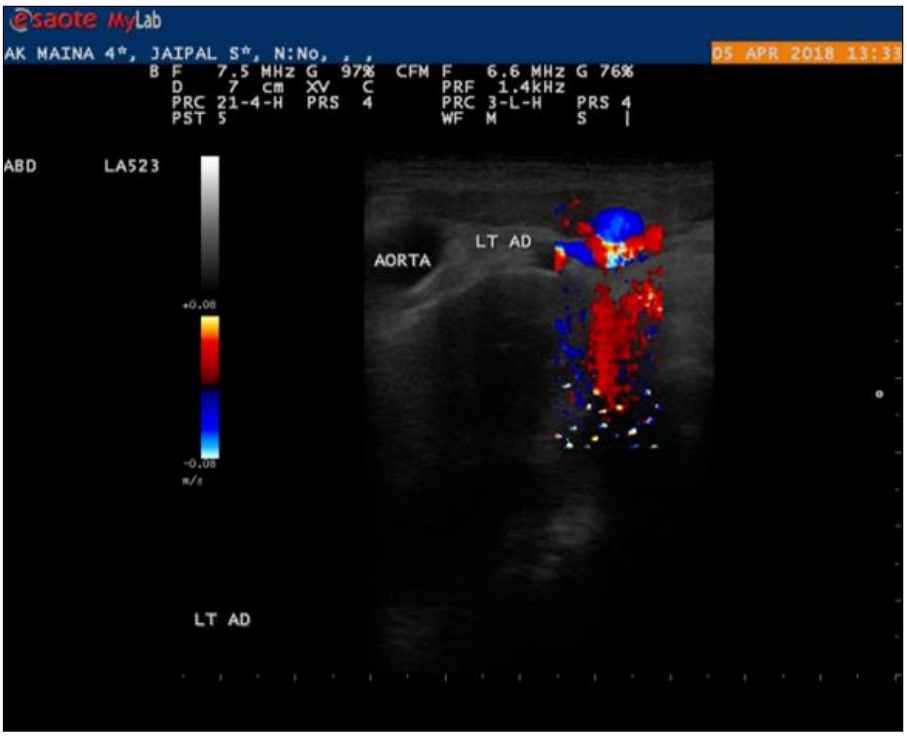

Fig 2: Ultrasonogram of hypoechoic left adrenal gland scanned dorsal to the aorta.

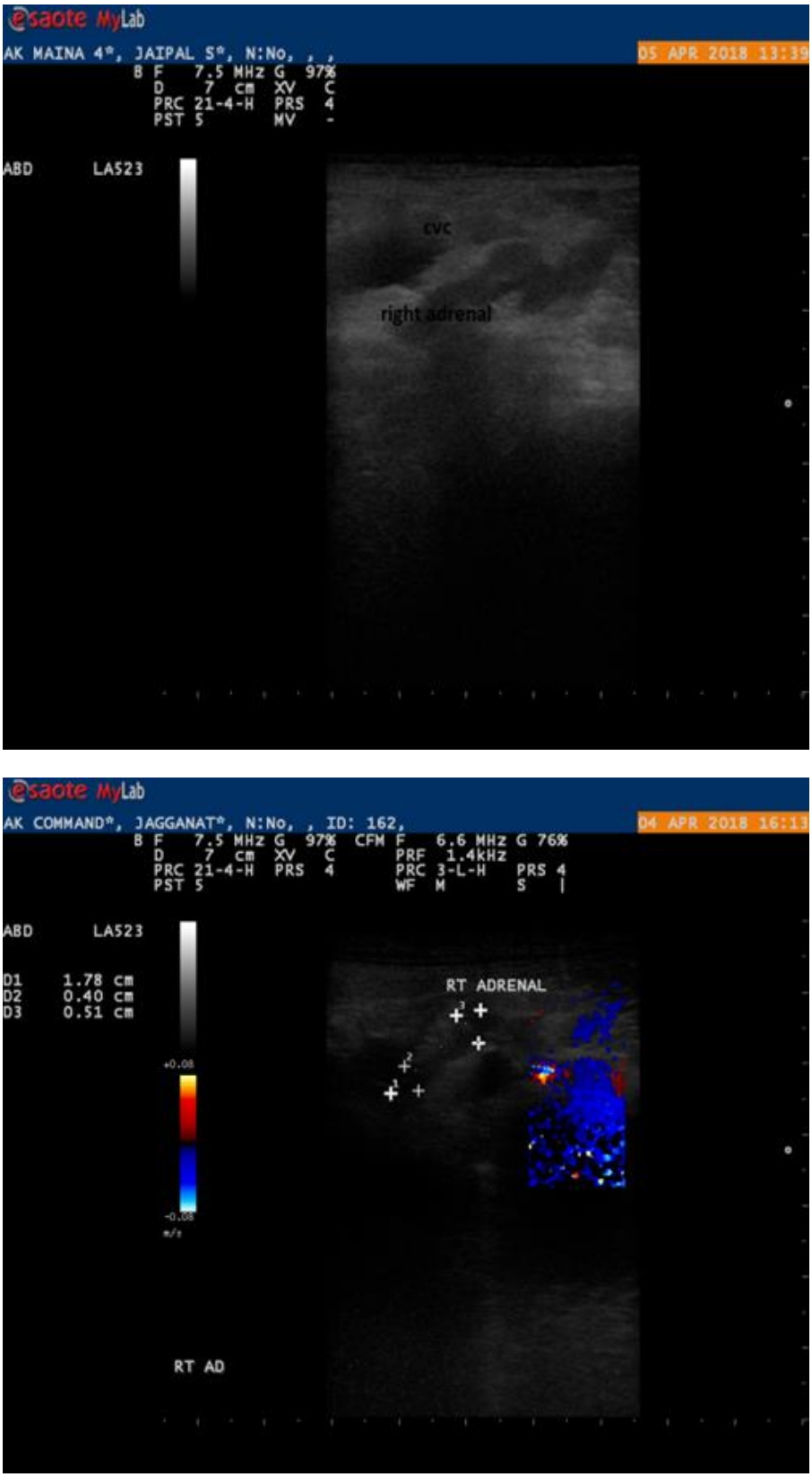

Fig 3: Ultrasonograms showing echotexture of right adrenal gland along with caudal vena cava and right kidney

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