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Sonoanatomical Studies on Penis of Dog (*Canis familiaris*)

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A B S T R A C T

The present study was conducted to establish normal ultrasonographic features of canine penis testis in 12 healthy male dogs, age ranging from 2 to 10 years. The echo texture of penis observed at pre scrotal and post scrotal in transverse and longitudinal scan was done in non-erected penis. The ultrasonogram at the level of glans of penis showing a strong, hyperechogenic linear structure of *os penis* and above it the corpus spongiosum visualized as a hypoechoic structure due to its acoustic shadow in longitudinal sonogram and hyperechoic round to ovoid shaped structure of os penis and round structure of urethra. The echogenicity of the os penis formed 'V' shaped structure and the urethra was located within a 'V' shaped groove on ventral aspect showing anechoic round structure. The sonoanatomical study revealed that the assessment of penis is easily performed and accurate for the clinical examination, helps to detection of small lesions or those which not accessible by palpation as well as to evaluate breeding soundness of dog.

Introduction

Ultrasonography (USG) has established itself as an invaluable diagnostic aid in veterinary practices. The word sonoanatomy is a combination of two words sonography and anatomy. Sonoanatomy means the study of the anatomy of the internal structures during the sonography. It helps in identification of the structures which are abnormal in the disease condition during the ultrasonographic examination (Walter, 2003). The Penis is a highly vascularized male copulatory organ. It is composed of several parts, including the root (radix penis), the body (corpus penis) and the distal free part (glans penis).

The root and body are made up of the corpora cavernosa penis and the ventrally located corpus cavernosum urethrae which containing

the penile urethra and the enlarged proximal end of the os penis. It aids the detection of small lesions or those in accessible by palpation and provides details tissue that cannot be obtained by radiography (Souza and Silva, 2014). The probe placement site, type of probe useful as well as the normal sonoanatomical study is done in present study.

Materials and Methods

The present study entitled "Sonoanatomical Studies on Penis of Dog (*Canis familiaris*)" was undertaken at Department of Veterinary Anatomy and Histology and Department of Veterinary Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand (Gujarat).

The study was conducted on 12 healthy male dog in non-sedated condition which were presented at Department of Veterinary Surgery and Radiology.

Studies on standardization of probe placement for penis

The high frequency transducer of more 7.5 MHz is used for better visualization and the animals were maintained in ventral recumbency with the frog-leg position of rear limbs for ultrasonographic examination. The hairs were clipped to get better contact between transducer and skin.

The study was done in transverse as well as longitudinal scan. The probe was directly placed on the penis and scanned on its full length after application of coupling gel.

The probe was placed parallels to the penis for longitudinal image and it was rotated 90 degree for taking the observations in transverse scan (Payan-Carreira and Bessa, 2008).

Results and Discussion

Selection and preparation of the site for in vivo sonoanatomical examination of penis

The animals were selected medium to large body size which were presented at Department of Veterinary Surgery and Radiology. The animals were maintained in dorsal recumbency with the rear limbs in the frog leg position for the sonoanatomical examination.

The sonogram for the study were taken at total four sites for the complete study (Fig. 1). The two ultrasonogram at the part of penis (pre and post scrotal sections) and two ultrasonogram were taken at the part of glans (Fig. 2). The full length study was started from the tip of penis to backward in direction to scrotal position. The study was done in transverse as well as longitudinal sections to evaluate the os penis and urethra in both the sections. The ultrasound images were compared with normal anatomy of the dog penis.

In vivo B-mode ultrasonography of penis

The present study was done using linear probe and micro convex probe. The animal was placed in the dorsal recumbency with frog leg position which was as suggested by Payan-Carreira and Bessa (2008) for the assessment of penis. The sonographic study was done on penis throughout its length on pre and post scrotal part of the penis. The images were taken in transverse and longitudinal sections in non-erected penis using a linear probe (more than 7.5 MHz).

The penis was easily accessible in transverse section of ultrasound. B-mode ultrasonography showed os penis at the part of apex as a small round to ovoid shaped hyperechoic structure. The transducer moved backward on the direction where the echogenicity of the os penis increase and

formed 'V' shaped structure and the urethra was located within a 'V' shaped groove on ventral aspect (Fig. 3) which is in agreement with the study done by Payan-Carreira and Bessa (2008).

The urethra was showing hypoechoic round structure, whereas corpus cavernosum urethrae showed homogenous hyperechoic structure surrounding the urethra. The urethra was observed in the groove of os penis in all cases (Fig. 4); However, Ninomiya *et al.*, (1989) identified the urethra clearly only in 70% cases observed in the dogs.

Longitudinal ultrasound of the penile glans scanned from ventro-dorsal part of the glans. In present study observed the os penis which appears as a strong, hyperechogenic linear structure and above it the corpus spongiosum visualized as a hypoechoic structure due to its acoustic shadow (Fig. 5).

The erectile tissue of the pars longa glandis as a regularly granular structure with medium echogenicity in the longitudinal sonogram (Fig. 6). Small anechoic spaces corresponding to the sinusoids were observed in erectile tissue. The penile tunica albuginea was visualized as a linear, fairly hyperechoic border, covering the erectile tissue of pars longa glandis (Fig. 6). The present observations coincide with findings of Payan-Carreira and Bessa (2008) in his ultrasonographic examination of assessment of the penis of dog.

Transverse sonoanatomical study at the pre-scrotal level demonstrates the two separated corpus cavernosa as a pair of hypoechoic, homogeneous structures (Fig. 7). The corpus spongiosum was difficult to visualize.

Transverse ultrasonograms at the caudal end of the glans, showed the bulbus glandis as a moderately echogenic structure of homogeneous granular echo-texture. It was positioned dorsally and laterally to the hyperechogenic os penis. The slightly hyperechoic structure of the corpus spongiosum was lying on groove of the os penis. Around the tunica albuginea, an anechoic structure corresponding to the preputial cavity was observed. It separates penile structures from the preputial and sub-cutaneous structures (Figs. 4) Payan-Carreira and Bessa (2008), Davidson and Baker (2009) also observed the same sonoanatomical structures in their study on the penis of dog.

The corpus spongiosum appears as a less hyperechoic structure in post scrotal and just cranial to scrotum evaluated in transverse scan. The urethra was not clearly visible because at this level the corpus spongiosum was positioned at a deeper level. The corpora cavernosa penis were seen dorsally to the corpus spongiosum, as homogeneous, coarse hypoechoic structures (Fig. 7). However Golijanin *et al.*, (2007) observed corpus cavernosum penis as a linear hyperechoic structure which in contrast to the present study.

The above observations in present study in line of longitudinal ultrasonograms were in line with the study of Goericke-Pesch *et al.*, (2013) who evaluated on functional anatomy and ultrasound examination of the canine penis.

Longitudinal ventro-dorsal ultrasonographic images (Fig. 5 & 6) were important for the diagnosis of fracture as well as any abnormality in the structure of os penis.

Fig.1 photograph showing cross section of penis at different levels in longitudinal and transverse plan

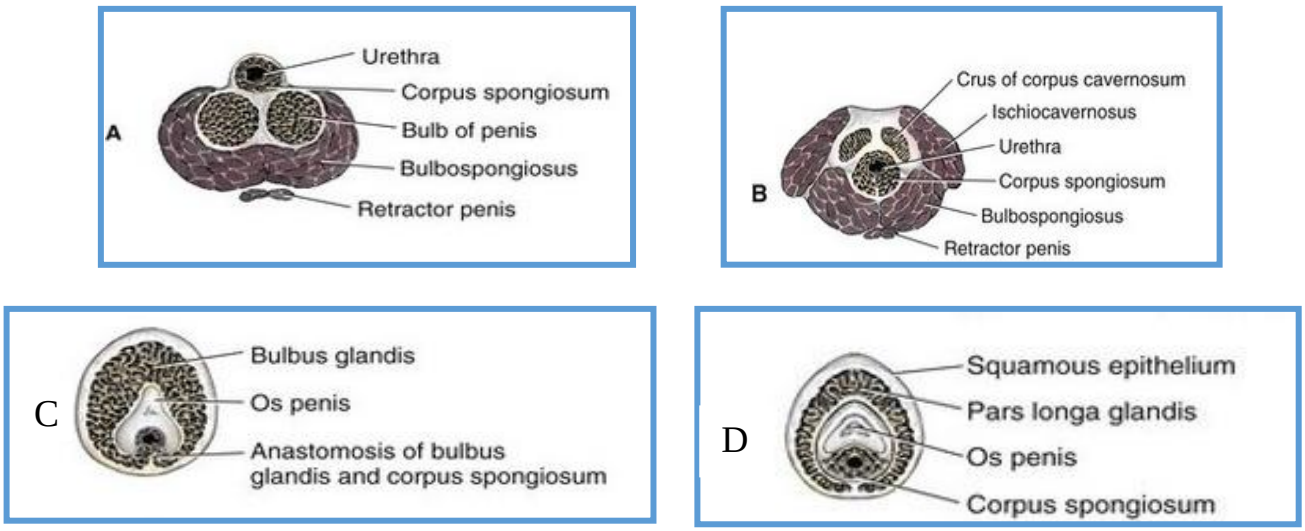


Fig.2 Photograph showing the placement of probe for penis

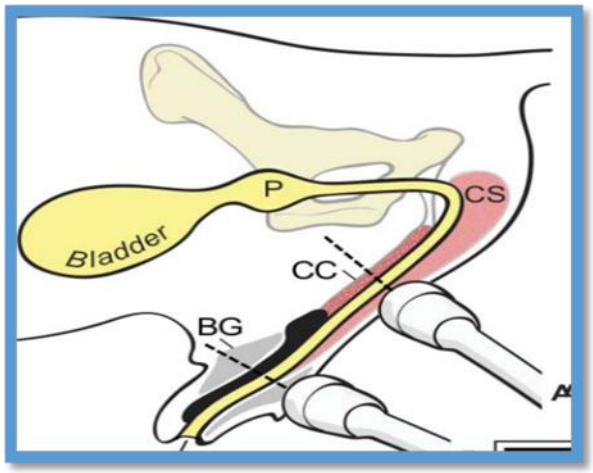


Fig.3(a) Transverse ultrasonogram of the canine penis at the penile apex in non-erected condition using linear probe and scanned from ventral side and **(b)** showing schematic representation of sonogram. Where, (A) prepuce, (B) tunica albuginea, (C) os penis, (D) urethra and (E) erectile tissue of the Pars longa glandis (corpora cavernosa)

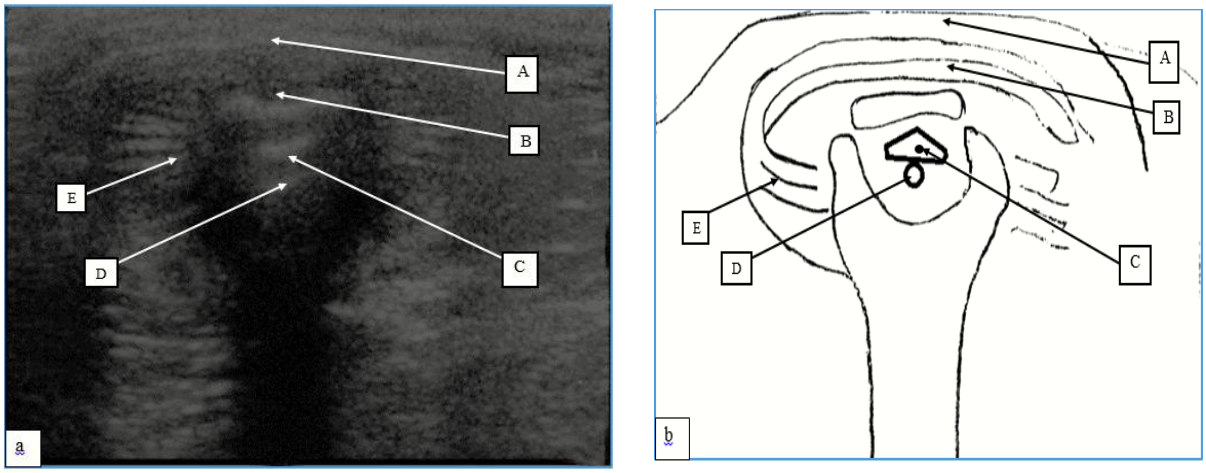


Fig.4(a) Transverse sonogram of the canine penis at the middle of the pars longa glandis in B-mode ultrasound examination and in non-erected penis scanned from ventral **(b)** showing schematic representation of sonogram. Where, (A) prepuce, (B) tunica albuginea, (C) os penis, (D) urethra, (E) erectile tissue of the Pars longa glandis (corpora cavernosa) and corpus spongiosum

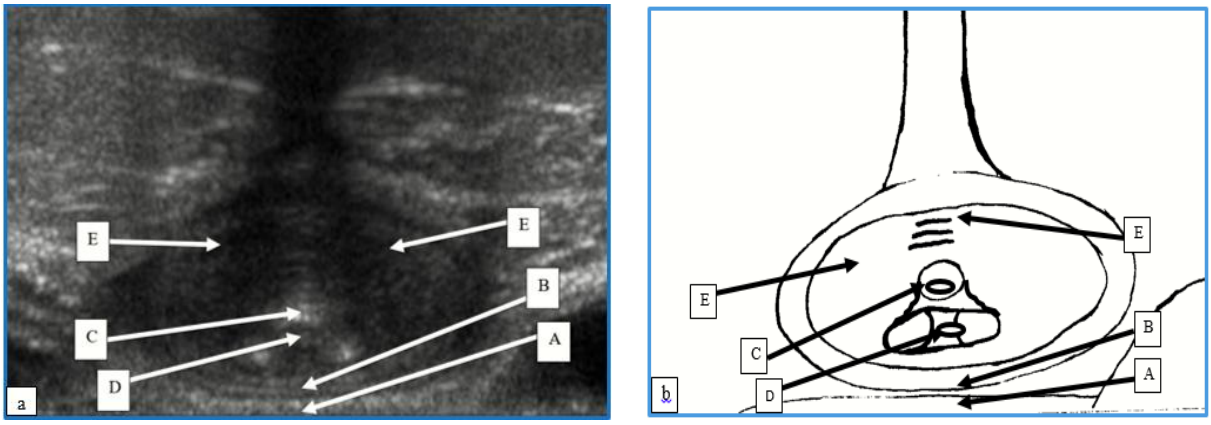


Fig.5 Longitudinal ultrasound of the penile glans showing echogenic structure of the (A) corpus spongiosum (B) showing the os penis which appears as a strong, hyperechogenic linear structure that impairs the erectile tissue visualization due to its acoustic shadow

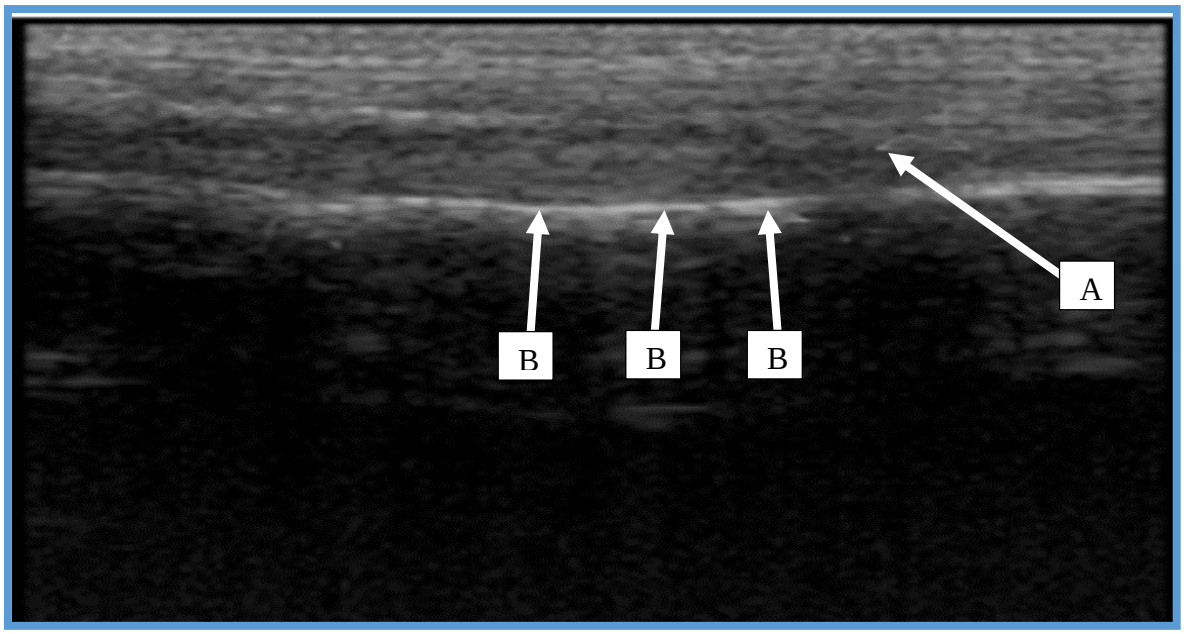


Fig.6(a) Longitudinal section of the canine penis using B-mode ultrasound from dorsal view in non-erected penis with linear probe and **(b)** schematic representation of the sonogram showing (A) prepuce , (B) tunica albuginea, (C) os penis, (D) urethra, (E) erectile tissue of the pars longa glandis (corpora cavernosa) and (F) corpus spongiosum

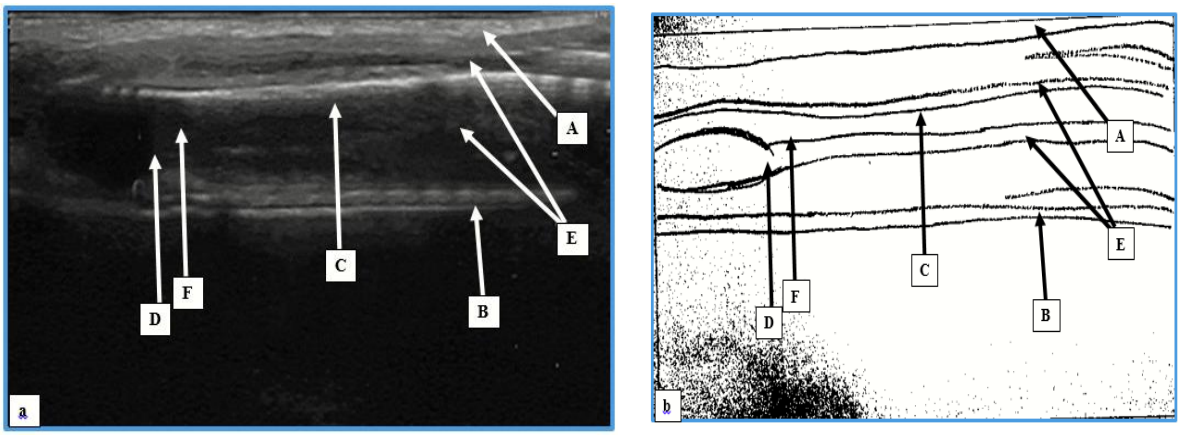
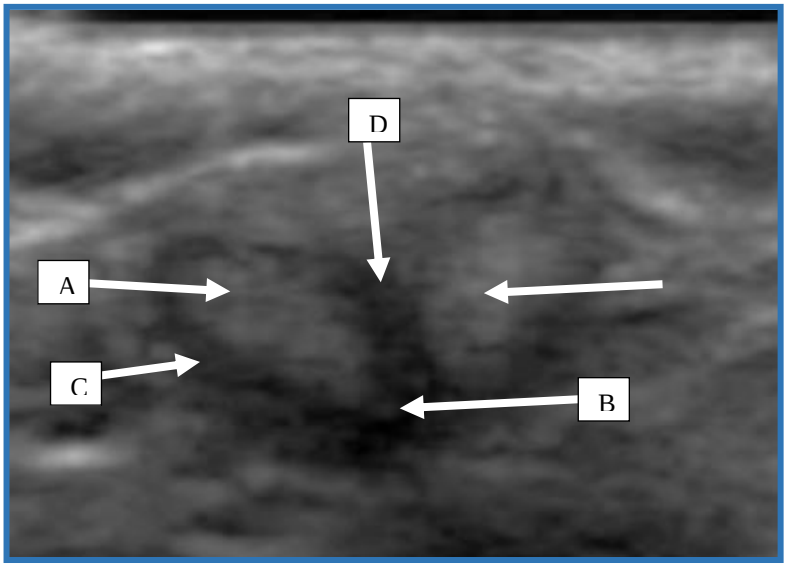


Fig.7 Transverse sonogram of the mid-penile urethra at a level just cranial to the scrotum. The urethra cannot be delineated but is located within the (A) corpus cavernosum, (B) urethra, (C) tunica albuginea and (D) septum penis



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