DIAGNOSTIC IMAGING OF THE CANINE PROSTATE GLAND 
SUBJECT TO ITS LOCATION AND SIZE

PIOTR DĘBIAK AND IRENEUSZ BALICKI

Radiology and Ultrasonography Laboratory, 1Department and Clinic of Veterinary Surgery, 
Faculty of Veterinary Medicine, University of Life Sciences in Lublin, 
20-612 Lublin, Poland 
debiap@gmail.com

Received for publication January 14, 2009

Abstract

The objective of the present research was to assess the usability of three diagnostic imaging modalities for canine prostate gland evaluation. The studies included 33 male dogs of various breeds. A radiographic diagnostic procedure was employed as well as dual modality ultrasound imaging, i.e. transabdominal (TAUS) and transrectal (TRUS). Radiograms were studied to evaluate the prostate gland size and localisation. Both ultrasound imaging techniques were compared regarding the imaging of various prostate parenchyma areas. It was found that a suitable USG modality should be tailored to the prostate size and localisation. The TRUS technique proved to be most helpful in visualising the gland localised in the pelvic cavity, while the TAUS scanning for the enlarged, displaced cranially prostate.

Key words: dog, prostate, transabdominal ultrasound, transrectal ultrasound.

The most common clinical manifestation of canine prostatic diseases is prostate gland enlargement (3). The gland changes its position to become more cranial (2, 9). The diagnosis of prostatic disorders requires a gland assessment by physical and imaging examinations. Most frequently, radiographic and ultrasonographic diagnostic procedures are applied to confirm the presence, absence or progression of the disease.

In the lateral radiographs of the normal canine prostate, it is visualised as extending cranially from the pelvic bones. A lateral view allows evaluating the prostate size, which according to Feeney et al. (6) should not exceed 70% of the distance between the sacral promontory and pubic brim of a healthy dog.

The ultrasonographic appearance of the prostate gland provides information on the shape, dimensions, lobular structure, and echotexture of the gland parenchyma. It also shows the prostate urethra and is feasible for an assessment of the gland capsule and adjacent tissues (1, 4, 6, 12, 13). The most widely applied diagnostic tool to scan the prostate gland is transabdominal ultrasound (TAUS). Another imaging modality used for prostate gland evaluation is transrectal ultrasound (TRUS). The latter technique was introduced in the 1970s for diagnosing prostatic disorders in men and is a routine clinical practice nowadays (12). However, its implementation as the ultrasonographic imaging technique for the canine prostate gland evaluation is known to have very limited applicability. A comparative study by Zohil et al. (13) was conducted in ten dogs to assess the usefulness of dual modality ultrasound imaging for the examination of echogenicity changes in the enlarged prostate gland. Still, no relationship was determined between the availability of some prostate regions to undergo the ultrasound evaluation in relation to the size and location of the gland and the diagnostic procedure applied.

The objective of the present study is to compare three diagnostic imaging modalities employed to examine the canine prostate gland, subject to its location and size.

Material and Methods

The investigations included 33 male dogs of German Shepherd (14), crossbreds (10), Boxer (3), Doberman Pinscher (2), Spaniel (2), and Rottweiler (2) breeds, aged between 4 and 15 years, and with a body weight of 16-47 kg. The animals were presented for radiologic and ultrasonographic evaluation with a history of recurring signs of urinary hesitancy and a difficult defecation or urinary tract infection. The urinary bladder of the examined dogs was moderately filled with urine. The prostate gland of the animals was examined rectally and by means of radiography and ultrasonography. The lateral right-sided radiographic images were taken with a Philips X-ray generator (Super 80CP-D) equipped with a Bucky grid. The distance between the focus of x-ray tube and cassette centre was constant – 1 m. The obtained radiograms served to
evaluate the prostate’s location and the character of its margins. In case when the prostatic length measurements could not be taken, the length or depth of the gland was measured from radiographic images. The measurements were performed with a measuring tape with an accuracy of 1 mm. The gland’s size was determined using the Feeney et al. (5) model, i.e. the prostatic length or depth was compared to the distance between the front rim of the sacral bone and pubic brim. According to these calculations, the present study has followed the threshold for the enlarged prostate gland; its dimensions exceed 70% of the pubic-sacral promontory distance.

The ultrasound imaging included two diagnostic techniques: one was the transabdominal approach TAUS – a handheld probe head placed above the pubic symphysis of an animal positioned dorsally or dorsolaterally, and the other was the- transrectal imaging technique TRUS performed on a laterally positioned dog. Prior to the TAUS evaluation, animal hair on both side of the penis was removed and coupling gel was applied between the probe and the skin surface to improve contact. The ultrasonographic examination was performed with a Honda 4000 ultrasound scanner with an electronic convex probe of 7.5 MHz for transabdominal studies and an endorectal microconvex transducer of 7.5 – 9 MHz frequency. The transrectal ultrasound transducers were provided with a protective latex sheath.

The prostate parenchyma was exposed in the longitudinal and transverse planes and the scans obtained registered in the ultrasound unit memory. The ultrasound study evaluation aimed at the possible visualisation of the prostate gland regions – the capsule and subcapsule region.

Prior to the transrectal ultrasound imaging of the prostate, the animals were premedicated with an intramuscular administration of atropine sulfate at a dose of 0.05 mg/kg and an intramuscular injection of xylazine (Sedazin) at a dose of 2 mg/kg body weight.

The animals were assigned into three groups on the grounds of the prostate gland’s localisation in relation to the pelvic bones on the lateral radiographic images: group I – the prostate obscured by pelvic bones in 50% (8 dogs), group II – the prostate obscured by pelvic bones below 50% (16 dogs), group III – the prostate outside the pelvis, with full localisation in the posterior abdominal cavity (9 dogs).

**Results**

The measurements of the prostate gland on the radiograms gave evidence of gland enlargement in 18 dogs: nine animals from the group II and all the dogs from the group III. In all of the patients from the group I and the other seven dogs from the group II, prostate enlargement was not recorded (Table 1).

The full assessment of the entire prostate gland shape, margin, and contours was made on the basis of the radiographic studies of all the animals from the group III. The evaluation of the radiographic findings showing the posterior contour of the prostate of the dogs from the groups I and II were hindered due to the partial obscurity of the gland by the pelvis bones. Besides, it was confirmed that the cranial prostatic margin was identified most easily in the survey radiographs in all the groups (31 dogs) (Table 1).

An examination of the radiograms for the prostate gland region in all the dogs with the enlarged prostate in the group II showed the narrowing of the rectum lumen and its dorsal displacement by the enlarged gland. However, such signs were not observed in the animals from the group III, whose radiographic images did show prostate enlargement but with no pressure placed on the rectum (Fig. 1).

![Fig. 1. Lateral radiograph of the caudal abdomen. Enlarged and displaced cranially prostate.](image)

In all the animals, the implementation of the ultrasound transrectal modality allowed for a detailed analysis of the caudal-dorsal prostate image. The scans obtained from the transrectal examination showed good image definition and quality of echo details of the whole parenchyma and prostate capsule in all the patients from the group I. The application of transabdominal imaging technique also produced images with good quality details from the cranial prostate region in all the examined animals from the groups I and II in the cases with a normal size of the prostate gland (Table 2).

Using this imaging modality the entire caudal region of the gland in the group I was found in only two dogs with the lowest body weight – under 20 kg, in which the ultrasound beam penetration inside the pelvic canal was not disturbed. In the other six dogs from the group I and the four animals with a recognised normal, i.e. non-enlarged, prostate from the group II, the transabdominal scanning in the sagittal plane revealed the presence of an acoustic shadow created by the pubic bones overlapping the caudal region of the gland (Fig. 2).
Fig. 2. Transabdominal ultrasound image of a non-enlarged prostate. Acoustic shadow hinders the evaluation of caudal prostate.

Fig. 3. Ultrasound image of enlarged and displaced ventrally prostate. Transrectal ultrasound examination. Loss of detail precision in cranial prostate area (arrows).

Good quality precision of the details of the structure of the capsule and subcapsule region in the craniodorsal part of the prostate was obtained with the TRUS imaging technique applied in all the animals with the normal gland. A similar effect was obtained in the ten cases of dogs with an enlarged prostate – seven animals from the group II and three from the group III. In these cases however, a radiologist was expected to perform a hand assisted backward displacement of the gland in order to position it close to the rectum. In the other eight cases with the enlarged prostate gland (two from group II and six from group III), the obtained images exposing the craniodorsal region of the prostate were not of satisfactory quality (Fig. 3), which was likely to result from the prostate gland dimensions and size in the examined animals (over 40 kg).

The poor quality of the anatomic detail precision of the capsule and subcapsule part of parenchyma in the cranioventral region of the gland was observed on the sonograms showing the ultrasound transrectal examination of all the dogs with the enlarged prostate, and in the two animals with a normal one from the group II. In the transrectal imaging of the caudoventral region, the loss of detail precision in the image visualising the peripheral zone of the prostate was found in a total of 16 of the patients examined with a recognised enlarged gland, i.e. seven from the group II and eight from the group III.

The use of the TAUS image technique modality facilitated the expanded view of the entire ventral region of the prostate in all the animals with the enlarged gland. The imprecise quality of the detail visualisation was observed only in the transabdominal scanning of the prostate dorsal part in two cases of patients with the enlarged prostate (group III) (Table 2).

The application of all imaging methods identified one case of a dog in the group III with some mineralisation visible in the prostate background, as well as a marked enlargement of the lymph nodes that belong to the iliosacral lymph centre. Apart from that, in two dogs from the group II with the enlarged prostate gland, the studies revealed the presence of paraprostatic cysts in the cranial region of the gland (Table 1).

Table 1
Results of radiological evaluation

<table>
<thead>
<tr>
<th>Group</th>
<th>Prostate enlargement*</th>
<th>Feasibility of margin evaluation</th>
<th>Prostate mineralisation</th>
<th>Enlarged lymph nodes in the sublumbar region</th>
<th>Rectal elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (n=8)</td>
<td>0</td>
<td>8/0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>II (n=16)</td>
<td>9</td>
<td>14/0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>III (n=9)</td>
<td>9</td>
<td>9/9</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

* - examined according to the Feeney et al. (5) method
TAUS – transabdominal ultrasound; TRUS – transrectal ultrasound

The present findings are consistent with the localisation in the posterior portion of the abdominal cavity. The present findings however, have shown that in 66.6% cases of patients with a normal prostate gland, the reported accuracy for the caudal prostatic border assessment was limited. It was most likely to arise from the markedly attenuated penetration of ultrasound beam back part, as a consequence of the echo absorption by the pubic bones. This ultrasonographic artefact is referred to as acoustic shadowing. It seems that, due to the widespread application of this diagnostic technique for canine prostate evaluation, this artefact needs to be taken care of when scanning the patients suspected of chronic prostatitis, which is associated with a decrease in the gland size (10). Some other technical limitations of the TAUS evaluation technique of the prostate gland should be taken into account owing to the potential occurrence of paraprostatic cysts located caudally to the prostatic gland (11).

The present research findings revealed that in two cases of dogs from the group III, the TAUS images showed imprecise detail quality of the visualised dorsal part of the substantially enlarged prostate localised in the abdominal cavity. Therefore, the transabdominal imaging technique used to assess the prostate gland structures may yield some difficulties in the case of the great distance between the inspected gland region of interest and the site where the USG transabdominal probe is placed.

In Zohil’s et al. (13) study comparing two techniques of ultrasound imaging (TAUS and TRUS) for the prostate gland scanning, reported that the more satisfying diagnostic effects with the TRUS evaluation were observed solely at the scanning of the caudal regions of the gland localised in the pelvis. There were single cases when the transrectal imaging technique identified some changes in the echotexture and capsule in the caudal portion of the prostate, which had not been visualised at the transabdominal scanning evaluation.

Table 2
Utility of both ultrasound imaging modalities for the evaluation of the prostate parts

<table>
<thead>
<tr>
<th>Prostate enlargement</th>
<th>Accessibility for the evaluation of the prostate gland regions</th>
<th>Prostate mineralisation</th>
<th>Enlarged lymph nodes in the sublumbar region</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cranially-dorsal</td>
<td>Cranially-ventral</td>
<td>Caudally-dorsal</td>
</tr>
<tr>
<td>I (n=8)</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>II (n=16)</td>
<td>0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>III (n=9)</td>
<td>9</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>

Discussion

The current body of radiologic literature evidences that radiology has been the first-choice imaging modality available to assess the general size, location, and contour of the prostate gland (1, 5). The authors mentioned above, agree that the evaluation of the gland’s dimensions, margin, and contour is easiest when the prostate is visualised on the lateral radiographic view in the case of the gland being localised in the posterior portion of the abdominal cavity. The present findings are consistent with the observations of Feeney et al. (5) and Johnston et al. (7) who found that the cranial prostatic margin can be identified very quickly. A good image contrast of this region is attributed to the presence of fat between the cranial prostatic border and the urinary bladder and abdominal cavity wall (14). The present investigations have shown that if the caudal portion of the prostate is obscured by pelvic bones to a small or high extent, the evaluation of the posterior prostatic margin is significantly hindered. Therefore, the estimation of the prostate gland size should also include the measurements of the gland depth, which was acceptable to Feeney et al. (5).

Recent clinical and radiographic studies emphasised the potential obstructive voiding signs (impaired defecation) associated with prostate enlargement (9, 10). The analysis of the radiographic studies obtained from the dogs with the enlarged gland revealed that the narrowing of the rectal lumen pushed dorsally by the enlarged gland was detected only in the animals whose enlarged prostate was localised in the pelvis. This fact implies that the narrowing of the rectal lumen due to the prostate gland enlargement is mainly related to the localisation of the enlarged prostate.

The current research reporting the discussions about the ultrasound estimation of the prostate gland are predominantly based on transabdominal imaging that provides relatively easy access to the posterior part of the abdominal cavity (1, 10). This technique was applied to estimate, among others, the prostate dimensions (4) and volume (8). There was presented a relationship between the size of the prostate gland and the animal’s body weight (3), as well as the correlations of the ultrasonographic image with the morphological changes identified in the gland parenchyma (6). In only a few cases did the transabdominal ultrasound used to image the prostate gland appear to present potential confusion in evaluating the caudal margin echogenicity of the gland, i.e. the case of intrapelvic prostate location (4, 13).
The present research results have confirmed the high efficiency of the TRUS assessment of the capsule and subcapsule region of the caudal portion of the gland. Furthermore, the analysis of the ultrasonograms obtained by the present authors highlights the additional considerable effectiveness of the TRUS technique for the reliable assessment of the caudodorsal area of the prostate, irrespective of its varying size and localisation. The high technical accuracy of this ultrasound imaging is attributed to the better quality of probe heads applied. The other benefit of the TRUS technique application, which has not been reported in the available ultrasonographic literature, is the potential to visualise the enlarged lymph nodes in the sublumbar region.

The radiologic procedure has been applied to assess the character of the prostate margins to a small extent, yet it facilitates the general identification of the gland size and localisation. Hence, a suitable USG modality should be tailored to the prostate size and location. Both the ultrasound imaging techniques - TAUS and TRUS, provide detailed ultrasound images of different prostate areas. The TRUS imaging technique is most useful in visualising each region of the gland localised in the pelvic cavity. In the case of the enlarged prostate displaced cranially, the ultrasound evaluation should rely on the TAUS imaging, which is a routinely used diagnostic tool. However, the use of dual modality transabdominal and transrectal ultrasound imaging techniques may be necessary to establish the appropriate diagnosis.

References