ABSTRACTS

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INVESTIGATION OF PROSTATIC VASCULARISATION USING CONTRAST-ENHANCED DOPPLER ULTRASOUND IN THE DOG

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Introduction - The ultrasonographic appearance of the normal canine prostate gland has been well described. Common canine prostatic diseases including acute and chronic inflammation, neoplasia and benign hyperplasia, have similar ultrasonographic appearances making differentiation between them impossible. Therefore, a biopsy is usually indicated unless the diagnosis is obvious from other clinical information. Recently, ultrasound contrast media such as microbubble-based contrast agents have been explored, in the hope of enhancing the imaging of tumour vessels by providing a stronger Doppler signal. The purpose of the present study was to describe the normal perfusion pattern and dynamics in the canine prostate gland. Data on perfusion kinetics in the normal canine prostate were generated to provide a basis for comparison for later studies in clinical patients with diffuse or focal prostatic disease.

Material and methods - Five clinically normal adult intact experimental male dogs (4 mixed breed and a German Shepherd dog) mean age approximately 2.4 yrs, weighing between 6.5 and 37 kg were used in this study. Ethical approval for the study was gained through the University’s normal procedure. Prior the ultrasonographic evaluation a complete physical examination including rectal palpation of the prostate gland, abdominal radiographs, serum chemistry profile, complete blood cell count and urinalysis were performed. All patients underwent general anaesthesia with diazepam 0.2 mg/kg i.v. and propofol 4 mg/kg i.v., which was given until tracheal intubation was possible. Anaesthesia was maintained with isoflurane (1-3% in oxygen). Haemoglobin oxygen saturation, heart rate, blood pressure, and CO2-saturation were monitored continuously throughout anaesthesia. Ultrasound examination of the caudal abdomen was undertaken with a 5-7.5 MHz linear with coded harmonic capability and a 5-8 MHz microconvex probes (Mylab 30 Esaote-CnTI system). A second generation contrast agent SonoVue® (Sulphur hexafluoride microbubbles; Bracco Imaging S.p.a., Milan, Italy) with a dedicated contrast –enhanced ultrasound analytical software ( Contrast Tuned Imaging-CnTI) was used. Throughout the examination the ultrasound machine was set at 40 Kpascal and a mechanical index (MI) of 0.10 to avoid an early rupture of the micro bubbles. Longitudinal and transverse views of the prostate diameters were measured and the colour Doppler examination was performed at a frame rate of 0.7 to 1.4 frames/second. Once the prostate was visualized the power Doppler were applied in order to follow the prostatic branches of the urogenital artery that enter the prostate gland at the dorso-lateral surfaces. Power Doppler examinations were undertaken before and after the contrast study. The contrast medium was injected into the cephalic vein at the dose of 0.03 ml/kg of prepared solution (5mg/ml) followed by a rapid bolus of 5 ml of saline solution and both the phases of wash in and wash out were recorded. Thereafter the dogs underwent ultrasound-guided Tru-Cut biopsy with a 16 G spring loaded biopsy needle. Using a commercial programme (Qontrast) the ROIs were manually drawn in the longitudinal view around the ventral part of the prostate, the dorsal part of the prostate and the urethra. In transverse view they were drawn around the right prostatic lobe, the left lobe and the area of the urethra and time intensity curves were calculated. Peak intensity (SI) expressed as percentage, time to peak (TTP) and relative curves were calculated.
Results - No physical, laboratory, radiographic, ultrasonographic or histopathological abnormalities were present in any of the dogs; confirming that the prostate glands were normal. All the recorded images were reviewed and the enhancement pattern was subjectively described.

The ultrasonographic appearance of the prostate appeared as a hyperechoic butterfly-shaped region on transverse images with hypoechoic areas on the dorsal and ventral surfaces of the gland. The urethra was always visible as a anaechoic/hypoechoic linear (in longitudinal view) and round (in transverse view) area, surrounded by a hyperechoic wall. The ultrasonographic vascular supply of the prostate was difficult to visualise but very enhanced after the injection of micro bubbles. The contrast studies were reviewed and all the studies showed that the prostatic branches entered the prostate gland on the dorso-lateral surfaces, tunnelled into the prostatic capsule and branched into many small parenchymal arteries which were directed inwardly towards the urethra to supply the body of the prostate gland. There was a homogenous enhancement of the prostatic parenchyma during the wash-in phase. During the wash-out phase a homogenous decrease of the echogenicity was visible in all cases. The urethra was constantly seen as a small linear or round hypoechoic area within the prostate, surrounded by a hyperechoic rim. The capsule of the gland appeared hyperechoic compared with the prostatic parenchyma at all times during the study. The colour and power Doppler examinations demonstrated almost no detectable signal in the plain studies, whilst the signal was much stronger after the injection of the SonoVue®.

In the longitudinal view the mean peak intensity and the TTP were respectively 16.74% (SD 4.39) and 35.64 (SD 3.28) for the dorsal area of the prostate, 15.50% (SD 6.01) and 29.94 (SD 5.16) for the ventral area of the prostate and 30.06 % (SD 6.68) and 33.46 (SD 4.79) for the urethral area.

In the transverse view the peak intensity and TTP were respectively 17.60% (SD 7.03) and 37.50 (SD 3.40) for the right prostatic lobe, 17.28% (SD 7.15) and 28.82 (SD 3.55) for the left prostatic lobe, and 29.70% (SD 6.77) and 34.83 (SD 6.69) for the area of the urethra.

Discussion - To our knowledge, this is the first study to compare normal prostatic vascularisation using either contrast-enhanced ultrasound or colour and power Doppler examination. The findings of this study may provide a basis for clinical investigations to differentiate different types of prostatic disease, for the detection of early prostatic disease, or for assessing the response to treatment.