

## ULTRASONOGRAPHIC FEATURES OF PROSTATE GLAND IN THE DOMESTIC RABBIT (*ORYCTOLAGUS CUNICULUS*)

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### Abstract

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The prostate gland of ten sexually mature, healthy male white New Zealand rabbits at the age of 12 months, weighing 2.8 - 3.0 kg, was studied by ultrasonography. Following anesthesia, the urinary bladder was filled with physiological saline. The three glandular parts were observed only on the sagittal ultrasonographic plane. The proprostate and paraprostate parts were visualized as a solid, homogenous structure with a relatively higher echogenicity, as compared with the more caudally situated prostate part. On the transversal ultrasonographic plane, the whole prostate gland was seen as a solid, ovoid, heterogeneous and entirely hyperechoic structure. The sagittal and transversal ultrasonographic images of the postmortally extirpated prostate glands immersed in an isotonic liquid medium corresponded completely to the glandular findings observed in vivo. The results of our investigations motivated us to propose the use of the prepubic ultrasonography, with a filled urinary bladder, as a useful method for visualization of the rabbit prostate gland.

*Key words:* prostate gland, ultrasonography, imaging anatomy, rabbit

### Introduction

The accessory reproductive organs of the male rabbit, which are often ambiguously and incompletely described in morphological papers, include paired vesicular and bulbourethral glands and a prostate complex consisting of proprostate, prostate and paraprostate parts (Barone, 2001; Holtz and Foote, 2005; Mollineau et al., 2009). The proprostate part is localized caudal to the vesicular gland and cranial to the prostate part. The latter part is situated cranial to the bulbourethral glands. These two parts are connected ventrally with the pelvic urethra and laterally with the deferent ducts. Both paraprostate parts (right and left) are observed ventrolateral to the proprostate. The separated parts of the rabbit prostate glandular complex demonstrate anatomic, histological and histochemical differences, which indicate

that every glandular part may have a specific role in the reproductive process (Vasquez and Del Sol, 2002; Holtz and Foote, 2005).

Ultrasonography is a popular, safe and non-invasive method useful for prostate visualization in both man and animals (Barr, 1997, Dimitrov and Stamatova, 2011). In humans, the transrectal ultrasonography permits an excellent visualization of the gland (Hammerer and Huland, 1989), whereas in small animals it is used only for experimental purposes (Zohil and Castellano, 1995). In animals, the prostate gland is examined for evaluation of the shape, size, symmetry, echogenicity and cystous findings. In dogs prior to puberty, the prostate encircles the urethra, is small with scarcely visible lobes and is hyperechoic (Selcer, 1995; Basinger et al., 1997). The adult prostate is symmetrically homogenous and echoic. After castration, the

gland involutes and its lobes are hardly distinguishable (Barr, 1997).

Fornage (1985) has investigated the human prostate gland via transrectal ultrasonography to demonstrate the normal anatomic parameters of the gland. Many authors claim that the three zones of the human prostate gland, i.e. the peripheral, central and transitional zones, can be visualised by endorectal ultrasonography (Hammerer and Huland, 1989). This method is applied for investigation of the prostate capsule and glandular carcinoma (Grenier and Devonec, 2006). Complete ultrasonographic observation for imaging the human prostate in three planes (sagittal, transversal and dorsal) depends on the fullness of the urinary bladder (Chakarski et al., 1996). In rabbits with urinary obstruction, Schoor et al. (2005) have visualized the hypertrophic urinary bladder wall by means of ultrasonography.

The aim of this study was to describe and illustrate the normal imaging anatomy of the rabbit prostate gland by means of transabdominal ultrasonography.

## Material and Methods

Ten sexually mature, healthy male white New Zealand rabbits at the age of 12 months and weighing 2.8–3.0 kg were ultrasonographically studied. The animals were anesthetized with 15 mg/kg i.m. Zoletil® 50 (tiletamine hydrochloride 125 mg and zolazepam hydrochloride 125 mg in 5 mL sterile isotonic solution; Virbac, France).

The urinary bladder was catheterized via the urethra and 10 mL of sterile saline solution - Natrii chloridum 0.9% (Sodium chloride 9.0g in 1000 mL water solution; Balkanpharma, Bulgaria) was applied. The distended urinary bladder was used as an acoustic window (Chakarski et al., 1996; Barr, 1997; Dimitrov and Russenov, 2006).

The study was performed with CHISON 600 VET (China) Micrus ultrasonic equipment, a 7 MHz multi frequent, microconvex transducer C20605 and front length 20 mm. The findings were documented with a Mitsubishi P91E printing device. After clipping the hair of the ventral abdominal wall, Contact gel (Eko-gel® Lessa, Espana) was applied and the prostate was observed ultrasonographically - in the sagittal and transversal planes by transabdominal prepubic approach.

After ultrasonographic examination, four of the studied animals were euthanized with intravenous injection of 150 mg Thiopental® (50 mg/kg i v) (thiopental sodium 1000 mg in 5 mL sterile isotonic solution; Biochemie, Austria) into the cephalic vein (Posner and Burns, 2009) according to Guidelines of the American Veterinary Association Panel on Euthanasia. The prostate complex was extirpated and investigated in a liquid isotonic medium, with the purpose to compare ultrasonographic and topographic features.

**The institutional committee of animal care approved the study.** The experiments were made in strict compliance with European convention for vertebrate animals' protection, used for experimental and other scientific purposes (Stasbourg /16<sup>th</sup> May 1986), European convention for companion animals' protection (Stasbourg /13<sup>th</sup> November 1987) and animal protection's law in Republic of Bulgaria (section IV-Experiments with animals, art. 26, 27 and 28, received on 24<sup>th</sup> January 2008 and published in Government Gazette, № 13, 2008).

## Results

**Sagittal ultrasonographic plane:** The proprostate and paraprostate parts are visualized as a single, solid, heterogenous structure with a relatively higher echogenicity, compared to the caudally situated prostate part. Both glandular parts were ovoid and well defined from the other adjacent structures. The prostate part was equally well visualized as an elongated hyperechoic structure, parallel to the collum of the urinary bladder and the beginning of the urethra, caudal to the other two parts of the rabbit's prostate gland. The glandular stroma was hyperechoic, as compared to the parenchyma (Figure 1).

**Transversal ultrasonographic plane:** The completely prostate glandular complex was seen through the filled urinary bladder (acoustic window) as a solid, ovoid, heterogeneous and entire hyperechoic structure (Figure 2).

The sagittal ultrasonographic image of the postmortally extirpated prostate glandular complex immersed in an isotonic liquid medium demonstrated the separate glandular parts, as observed in vivo (Figure 3).

On the transversal ultrasonographic image, the extirpated prostate gland was visualized as a hyperechoic,

heterogenous, ovoid glandular structure, situated dorso-lateral to the hypoechoic pelvic urethra (Figure 4).

## Discussion

For the first time some imaging ultrasonographic characteristics of the domestic rabbit prostate gland were presented and compared with ultrasonographic images of the postmortally extirpated prostate glandular complex immersed in an isotonic liquid medium.

The results of the latter study corresponded completely to the glandular findings, as observed *in vivo*.

Our results confirmed the anatomic studies of Villers et al. (1991), Vasquez and Del Sol (2002), and Holz and Foote (2005) about the differentiation of the separate glandular parts. Like Grenier and Devonec (2006), who demonstrated the zonal differentiation of the human prostate gland, we confirmed the separated parts of rabbit prostate by transabdominal sagittal ultrasonography. This information could be used for imaging investiga-

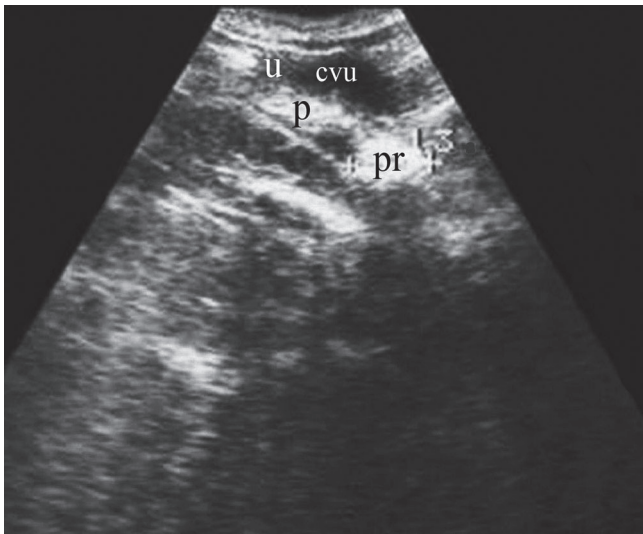


Fig. 1.

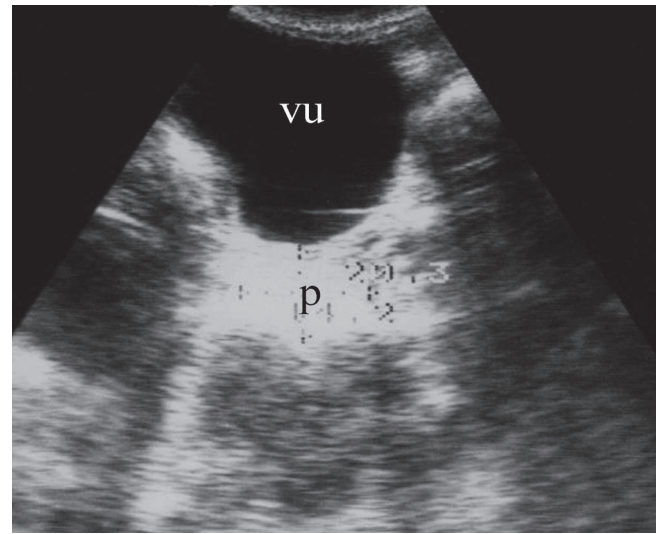


Fig. 2.

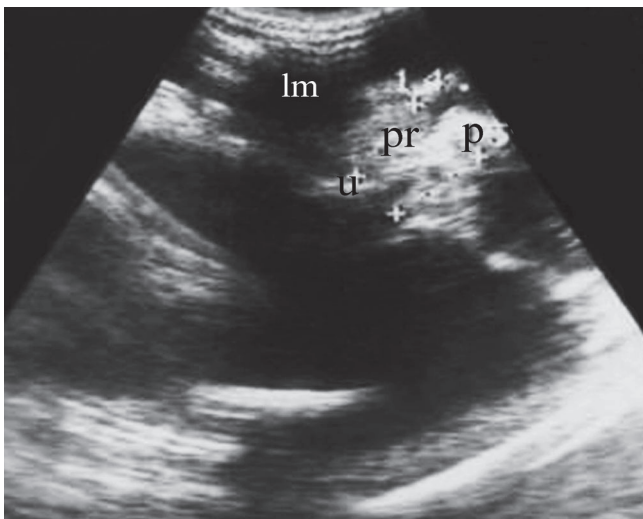


Fig. 3.

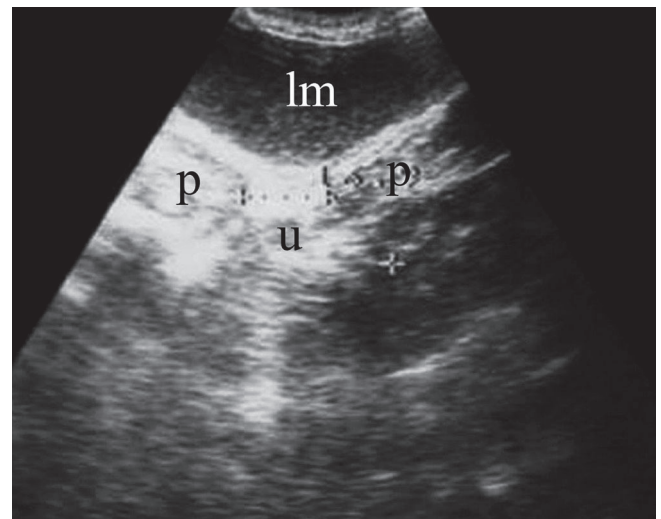


Fig. 4.

tion of the normal prostate and the diagnosis of prostate hyperplastic lesions (Schoor et al., 2005).

Transrectal prostatic ultrasonography as described in man and dog (Zohil and Castellano, 1995) can hardly be performed in the rabbit, because of the small rectal lumen, the cranioventral abdominal position of the distended urinary bladder and the relatively well developed prostate glandular complex in the rabbit.

We concluded that the prepubic transabdominal ultrasonographic approach was useful for evaluation of the shape and echoic structure of the normal rabbit prostate, as also reported by Selcer (1995), Basinger et al. (1997), and Dimitrov and Stamatova (2011) for the prostate gland in the dog and rabbit.

With the present study, conform to the investigations in dogs, cats and rabbit by Barr (5), Dimitrov and Russenov (2006), and Dimitrov and Stamatova (2011) we observed that the filled urinary bladder formed an acoustic window for observation of the rabbit prostate gland only in the transversal plane. The ultrasonographic investigation of the rabbit prostate gland could be used in clinical practice for the diagnosis and assessment of the male rabbit's reproductive properties, and as a biological model for investigations of the human and canine prostate (Chakarski et al., 1996; Barr, 1997; Dimitrov and Russenov, 2006; Dimitrov and Stamatova, 2011).

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