

Comparative imaging of the vesicular glands in New Zealand white rabbits (*Oryctolagus cuniculus*)

Rosen DIMITROV*, Kamelia STAMATOVA, Dimitar KOSTOV

Department of Veterinary Anatomy, Histology, and Embryology, Faculty of Veterinary Medicine,
Trakia University, 6000 Stara Zagora, Bulgaria

Received: 31.03.2011 • Accepted: 11.10.2011 • Published Online: 22.01.2013 • Printed: 22.02.2013

Abstract: This study investigated the morphological topographic features of the vesicular glands (*gll. vesiculosae*) in 10 sexually mature and clinically healthy male New Zealand White rabbits, aged 12 months, with body weights from 2.8 kg to 3.2 kg. The glands were observed by ultrasonography in 2 planes, transversal and sagittal. The approach was percutaneous transabdominal prepubic. The rabbit vesicular glands were visualized as a solid heterogeneous echoic finding. Using computed tomography, we scanned the pelvis in the transversal plane through the first sacral vertebra, at a cut thickness of 3 mm. The vesicular glands were visualized as transversally ovoid, homogeneous, and hyperdense soft tissue structures. Our observations on ex vivo frozen sagittal and transversal cuts of the pelvis showed analogous morphological and anatomic characteristics to those obtained by ultrasonography and computed tomography. The imaging features of normal domestic rabbit vesicular glands can be used as a morphological basis for the interpretation of some glandular lesions.

Key words: Vesicular glands, imaging, rabbit

Rabbit vesicular glands (*gll. vesiculosae*) are paired organs with variable size and shape. The ventral glandular surface is connected to the seminal ampullae (*ampullae ductus deferentis*). The cranial part from the dorsal glandular surface touches the colon and rectum. Its caudal part reaches the prostate, as reported by Kürtül et al. (1), Baron (2), Del Sol and Vásquez (3), Holtz and Foote (4), and McCracken et al. (5).

Ultrasonographic and anatomic studies on the vesicular glands of the goat and Brazilian agouti made by Archana et al. (6) and Mollineau et al. (7) show that these glands are localized on the left and right sides of the urinary bladder (*vesica urinaria*) and laterally to the ductus deferens ampullae.

There are few computed tomographic studies on animal vesicular glands. According to Zwicker et al. (8), squamous metaplasia, hyperplasia, and keratinization of the vesicular glands are found in 45% of New Zealand white rabbits.

Transrectal ultrasonographic studies on the vesicular glands in the boar, stallion, deer, giraffe, and bull were carried out by Clark and Althouse (9), Goeritz et al. (10), Pozor (11), Gnemmi and Lefebvre (12), and Lueders et al. (13). These authors confirmed their relationship with

ejaculation disorders and the estimation of reproductive qualities. Variations on the echogenicity of the vesicular glands in stallions, related to reproductive activity in this animal species, were observed. The wall of the vesicular glands in boars and bulls is thin, and the parenchyma is composed of small hypoechoic parts, united in a central duct.

Gil et al. (14), Altunrende et al. (15), Kim et al. (16), and Wu (17) used transversal ultrasonography and computed tomography imaging for the estimation of the status of human vesicular glands with regard to cysts, inflammation, amyloidosis, neoplasms, concrements, and ejaculatory duct obstruction. This is one cause of sterility in men, as reported by Surana et al. (18), Lee et al. (19), and Lawson and MacDougall (20).

The aim of this comparative investigation was to evaluate some ultrasonographic, computed tomographic, and anatomic features of normal rabbit vesicular glands.

Ten sexually mature and clinically healthy male New Zealand white rabbits, aged 12 months and weighing from 2.8 kg to 3.2 kg, were studied. The animals were anesthetized with 15 mg/kg intramuscular Zoletil® 50 (tiletamine hydrochloride, 125 mg, and zolazepam hydrochloride, 125 mg, in 5 mL of sterile isotonic solution; Virbac, France).

* Correspondence: rosiros38@abv.bg

The study was approved by the institutional committee of animal care. The experiments were conducted in strict compliance with the European convention for vertebrate animal protection, used for experimental and other scientific purposes (Strasbourg; 16 May 1986), the European convention for companion animal protection (Strasbourg; 13 November 1987), and the animal protection law of the Republic of Bulgaria (section IV-Experiments with animals, art. 26, 27, and 28, received on 24 January 2008, and published in the Government Gazette, No. 13, 2008).

For the ultrasonographic study, the urinary bladders of the investigated animals were catheterized and filled with 10 mL of a sterile saline solution, *Natrii chloridum* 0.9% (sodium chloride, 9.0 g in 1000 mL of water solution; Balkanpharma, Bulgaria), due to its use as an acoustic window for vesicular gland visualization. An ultrasonic Chison 600VET ultrasound system (China) and multifrequency microconvex transducer (C20605) with a frequency of 7 MHz and a radius of 20 mm were used. The findings were documented using a Mitsubishi P91E thermal printer device. Contact gel (Eko-gel®, Lessa, Spain) was used to establish better contact between the skin and the probe after cutting the hair. The glands were observed in 2 planes, the transversal and sagittal. The used ultrasonographic approach was percutaneous transabdominal prepubic.

A Siemens Somatom ArTx axial computed tomography scanner was used for the computed tomographic study, with a table height of 125 cm, field of view of 250, 1 filter, 70 mA anode force, 110 kV anode voltage, and a scanning time of 3 s. We worked in high resolution (512 pixels) and gentry (0°). A window of 280 and center of +33 were used. Optiray™ 350 (ioversol, 741 mg/mL; Healthcare Ltd., UK) was used as a contrast medium. It was applied parenterally (1 mL/kg

intravenously) into the cephalic vein. The pelvis was scanned in the transverse plane through the first sacral vertebra with a computed tomography slice thickness of 3 mm. For a tomographic determination of the vesicular glands, we used as bone markers the respective vertebra (*vertebra*); dorsally, the body of the ilium (*corpus ossis ilii*), and laterally, the contrasted urinary bladder and noncontrasted rectum (*rectum*) were used as soft tissue markers.

Five of the studied animals were euthanized with 150 mg of Thiopental® (50 mg/kg intravenously) (thiopental sodium, 1000 mg in 5 mL of sterile isotonic solution; Biochemie, Austria), injected into the cephalic vein as described by Posner and Burns (21), according to the Guidelines of the American Veterinary Association Panel on Euthanasia.

We obtained transverse frozen cuts of the pelvic inlet from 3 animals, whose trunks were preliminary frozen at -20 °C. The cut thickness was 10 mm. The vesicular glands of the other 2 animals were prepared after opening the abdominal cavity. The imaging anatomic features of the glands were compared with the frozen cuts, as defined by Zotti et al. (22).

The ultrasonographic findings showed that normal rabbit vesicular glands were solidly heterogeneous, with relatively high echogenicity from the adjacent soft tissues. The capsule demonstrated higher echogenicity than the central hypoechoic parenchyma part, which was observed on sagittal plane. The glands were well-defined from the surrounding structures. In the sagittal and transversal planes, the normal rabbit vesicular glands were visualized dorsolaterally to the caudal half of the urinary bladder. The shape of the vesicular glands was ovoid, craniocaudally elongated, and dorsoventrally flattened (Figures 1 and 2).

The computer tomography findings showed that the vesicular glands were dorsoventrally ovoid in shape,

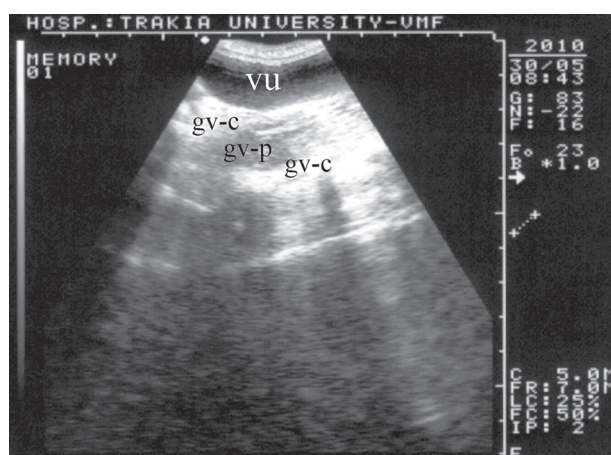


Figure 1. Sagittal ultrasonographic image through the capsule (gv-c) and parenchyma (gv-p) of the vesicular glands, and urinary bladder (vu).

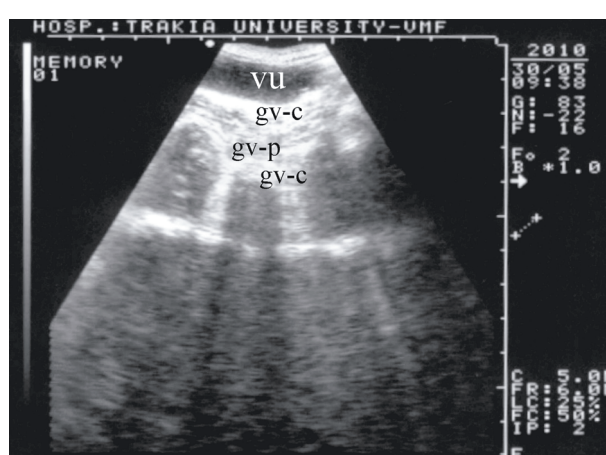


Figure 2. Transversal ultrasonographic image through the capsule (gv-c) and parenchyma (gv-p) of the vesicular glands, and urinary bladder (vu).

homogeneous, hyperdense, and soft tissue. They were situated dorsolaterally to the caudal part of the urinary bladder and ventrally to the rectum. The glands were localized at the pelvic inlet. Their borders were sufficiently distinct. At the level of the first sacral vertebra, the cranial and caudal parts of the vesicular glands were visualized. The contrasted body and neck of the urinary bladder and the rectum were distinguished (Figures 3 and 4).

The frozen sagittal and transversal cuts of the pelvis showed analogous and morphological characteristics of the glands similar to those obtained by ultrasonography and computed tomography (Figures 5 and 6).

The anatomic study of the extirpated ex vivo vesicular glands resulted in similar data as that from previous investigations about gland morphology and localization (Figure 7).

For the first time, some imaging features of the domestic rabbit's normal vesicular glands were presented, and they were compared with those obtained after a conventional anatomic study.

The ultrasonographic and anatomic features of rabbit vesicular gland localization confirmed the data of Archana et al. (6) and Mollineau et al. (7) in the goat and rat.

In contrast to the studies of Kürtül et al. (1), Baron (2), Del Sol and Vásquez (3), Holtz and Foote (4), and McCracken et al. (5), having investigated the morphology of the vesicular glands by ex vivo anatomic methods, the present study showed not only gland localization and shape, but also their relationship in vivo with the other adjacent structures (urinary bladder, rectum, corresponding vertebra, and body of ilium).

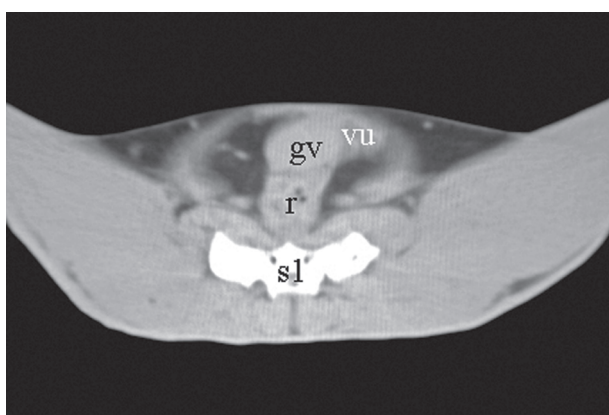


Figure 3. Transversal computer tomographic image of the rabbit pelvis through the beginning of the first sacral vertebra (s1): urinary bladder (vu), vesicular glands (gv), and rectum (r) (computed tomography slice, thickness of 3 mm).

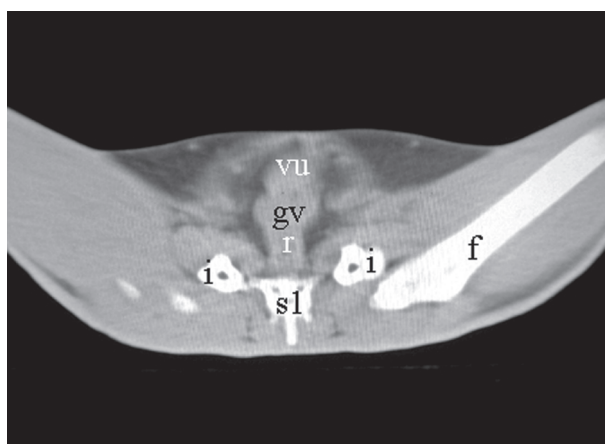


Figure 4. Transversal computer tomographic image of the rabbit pelvis through the first sacral vertebra (s1): urinary bladder (vu), vesicular glands (gv), rectum (r), ilium (i), and femoral bone (f) (computed tomography slice, thickness of 3 mm).

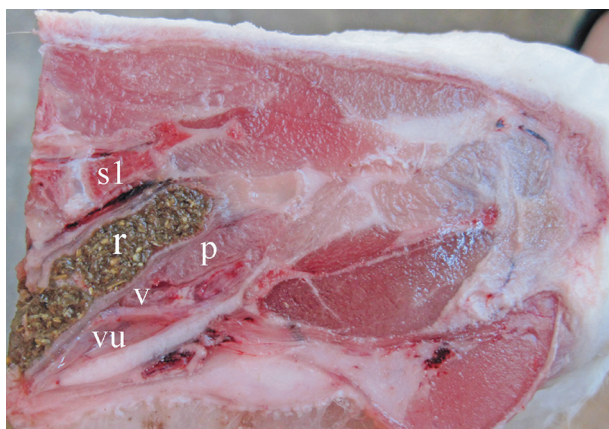


Figure 5. Sagittal cut of frozen rabbit pelvis through the first sacral vertebra (s1): vesicular glands (v), prostate (p), rectum (r), and urinary bladder (vu) (cut thickness of 10 mm).

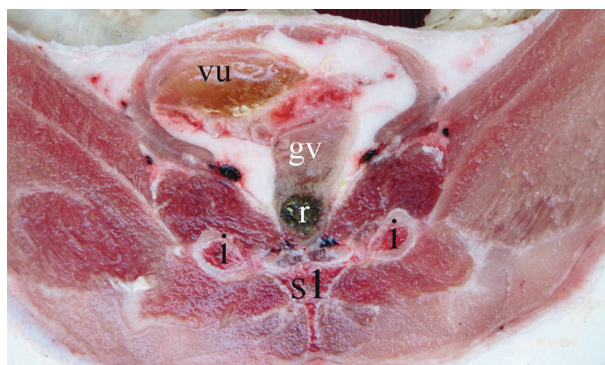


Figure 6. Transversal cut of frozen rabbit pelvis through the first sacral vertebra (s1): vesicular glands (gv), rectum (r), urinary bladder (vu), and ilium (i) (cut thickness of 10 mm).



Figure 7. Dorsolateral view (isolated specimen) of the vesicular glands (gv), prostate (p), and urinary bladder (vu).

Unlike the computed tomography studies of Zwicker et al. (8) on pathologically altered animal vesicular glands, we obtained imaging and anatomic data for normal healthy domestic rabbit vesicular glands (localization, their acoustic features, and echogenicity).

The results allowed us to confirm that the computed tomographic image of the rabbit vesicular glands was found in the transversal plane through the first sacral vertebra.

References

- Kürtül, İ., Özgel, Ö., Dursun, N., Bozkurt, E.Ü.: Morphology of the accessory sex glands and their vascularization in New Zealand rabbits. *Kafkas Üniv. Vet. Fak. Derg.*, 2001; 7: 95–99.
- Barone, R.: Anatomie comparée des mammifères domestiques. Splanchnologie II. Tome quatrième, Troisième édition, Editions Vigot, Paris., 2001; 159–185 (in French).
- Del Sol, M., Vásquez, B.: Mesoscopy and histology of the vesicular gland in the (*Oryctolagus cuniculus*). *Int. J. Morphol.*, 2003; 21: 325–330.
- Holtz, W., Foote, R.H.: The anatomy of the reproductive system in male Dutch rabbits (*Oryctolagus cuniculus*) with special emphasis on the accessory sex glands. *J. Morphol.*, 2005; 158: 1–20.
- McCracken, T.O., Kainer, R.A., Carlson, D.: Color Atlas of Small Animal Anatomy. Revised Edition, Blackwell Publishing, Ames, Iowa, USA. 2008; 61–75.
- Archana, P., Katiyar, R.S., Sharma, D.N., Farooqui, M.M.: Gerontological studies on the gross and histomorphology of the vesicular gland of Gaddi Goat (*Capra hircus*). *Int. J. Morphol.*, 2009; 27: 13–20.
- Mollineau, W.M., Adogwa, A.O., Garcia, G.W.: The gross and micro anatomy of the accessory sex glands of the male agouti (*Dasyprocta leporina*). *Anat. Histol. Embryol.*, 2009; 38: 205–207.
- Zwicker, G.M., Killinger, J.M., McConnel, R.F.: Spontaneous vesicular and prostatic gland epithelial squamous metaplasia, hyperplasia, and keratinized nodule formation in rabbits. *Toxicol. Pathol.*, 1985; 13: 222–228.
- Clark, S.G., Althouse, G.C.: B-mode ultrasonographic examination of the accessory sex glands of boars. *Theriogenology*, 2002; 57: 2003–2013.
- Goeritz, F., Quest, M., Wagener, A., Fassbender, M., Broich, A., Hildebrandt, T.B., Hoffman, R.R., Blottner, S.: Seasonal timing of sperm production in roe deer: interrelationship among changes in ejaculate parameters, morphology and function of testis and accessory glands. *Theriogenology*, 2003; 59: 1487–1502.
- Pozor, M.: Diagnosis applications of ultrasonography to stallion's reproductive tract. *Theriogenology*, 2005; 64: 505–509.
- Gnemmi, G., Lefebvre, R.C.: Ultrasound imaging of the bull reproductive tract: an important field of expertise for veterinarians. *Vet. Clin. North Am. Food Anim. Pract.*, 2009; 25: 767–779.
- Lueders, I., Niemuller, C., Pootoolal, J., Rich, P., Gray, C., Streich, W.J., Hildebrandt, T.B.: Sonomorphology of the reproductive tract in male and pregnant and non-pregnant female Rothschild's giraffes (*Giraffa camelopardalis rothschildi*). *Theriogenology*, 2009; 72: 22–31.
- Gil, A.O., Yamakami, L.Y., Genzini, T.: Cystadenoma of the seminal vesicle. *Int. Braz. J. Urol.*, 2003; 29: 434–436.
- Altunrende, F., Kim, E.D., Klein, F.A., Waters, W.B.: Seminal vesicle cyst presenting as rectal obstruction. *Urology*, 2004; 63: 584–585.

16. Kim, B., Kawashima, A., Ryu, J.A., Takahashi, N., Hartman, R.P., King, B.F. Jr: Imaging of the seminal vesicle and vas deferens. *Radiographics*, 2009; 29: 1105–1121.
17. Wu, H.: Ejaculatory duct obstruction. *Zhonghua Nan ke Xue*, 2010; 16: 3–9 (in Chinese with English abstract).
18. Surana, S.K., Al Refai, D., Baj, M.: Ultrasonographic and computed tomographic diagnosis of seminal vesicle cyst associated with ipsilateral renal agenesis: a case report. *Internet J. Radiol.*, 2006; 4: DOI 10.5580/380.
19. Lee, B.H., Seo, J.W., Han, Y.H., Kim, Y.H., Cha, S.J.: Primary mucinous adenocarcinoma of a seminal vesicle cyst associated with ectopic ureter and ipsilateral renal agenesis: a case report. *Korean J. Radiol.*, 2007; 8: 258–261.
20. Lawson, L., MacDougall, J.: Multilocular cyst of the seminal vesicle. *Br. J. Urol.*, 2008; 37: 440–442.
21. Posner, L., Burns, P.: Injectable anesthetic agents. In: Riviere, J., Papich, M., Eds. *Veterinary Pharmacology and Therapeutics*. 9th edn., Wiley-Blackwell, Ames, Iowa, USA. 2009; 265–287.
22. Zotti, A., Banzato, T., Cozzi, B.: Cross-sectional anatomy of the rabbit neck and trunk: comparison of computed tomography and cadaver anatomy. *Res Vet Sci.*, 2009; 87: 171–176.