

Computed Tomographic Study On the Pelvic Urethra in the Male Rabbit

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Abstract: The aim of the study was visualization and determination of some anatomic details of the pelvic urethra in the domestic rabbit, via computed axial tomography (CAT).

The study was performed on 6 sexually matured and clinically healthy male New Zealand rabbits at age 18 months, with body mass 2.8 to 3.2 kg.

As contrast matter was used OPTIRAY 350 (HEALTHCARE LTD. UK), applied parenterally (iv 1ml/kg m in vena cephalica), and the study was performing immediately. The second, used contrast material was UROGRAFIN 76% 20 ml (SCHERING LTD. GERMANY), applied perorally (per os) as 1.52 % water solution (30 ml/ kg, fractionally), the study was performed after three hours. We used axial computed tomograph SIEMENS, SOMATOM, ARTX.

The computed tomographic scan was marked cranially – by the caudal part of the body of ilium, in front of the acetabulum (laterally), in front of the pelvic brim (ventrally) and 1st sacral vertebra (S1 – dorsally), and caudally – by the body of ischium (laterally), behind pelvic arc (ventrally) and the end of 2nd coccygeal vertebra (Cg 2 – dorsally).

The thickness of the cuts was 2mm.

The pelvic urethra of the male rabbit was depicted during the scan of the pelvis from the caudal part of 2nd sacral vertebra (dorsally), the middle of pubic symphysis (ventromedially) and the acetabular parts of corpus ossis ischii (dorsolaterally) to the 1st coccygeal vertebra (dorsally), the middle of ischial symphysis (ventrally) and the middle parts of the bodies of ischium (laterally).

Key Words: rabbit, pelvic urethra, computed tomography.

Erkek Tavşanlarda Pelvik Üretra Üzerinde Kompüterize Tomografik Bir Çalışma

Özet: Bu çalışma ile, evcil tavşan urethra'sının pars pelvina'sının anatomik detaylarının CAT kullanılarak görüntülenmesi ve tanımlanması amaçlanmıştır.

Çalışma, seksüel olgunluğa ulaşmış ve klinik olarak sağlıklı 18 aylık 6 adet erkek Yeni Zelanda tavşanında uygulanmış olup, tavşanların ortalama vücut ağırlıkları 2,8 ile 3,2 kg arasındadır.

Kontrast madde olarak OPTIRAY 350 (HEALTHCARE LTD. UK) parenteral olarak (vena cephalica'dan i.v. 1 ml/kg) uygulanmış ve derhal çalışmaya geçilmiştir. İkinci olarak, kontrast madde olarak UROGRAFİN %76 20 ml (SCHERING LTD. GERMANY) %1.52 sulu solüsyonu oral (per os) olarak (30 ml/kg, azar azar) uygulanmış ve çalışma 3 saat sonrasında gerçekleştirilmiştir. ACT olarak SIEMENS, SOMATOM, ARTX cihazı kullanılmıştır.

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Bilgisayarlı tomografi taraması için cranial'den; corpus ossis ilii'nin caudal'i, acetabulum'un önü (lateral'den), apertura pelvis cranialis'in önü (ventral'den) ve birinci vertebra sacralis (dorsal'den) ile caudal'den; corpus ossis ischii (lateral'den), arcus pelvis (ischadicus)'in gerisi (ventral'den) ve ikinci vertebra caudalis'in sonu (dorsal'den) işaretlendi.

Kesit kalınlıkları 2 mm. olarak alındı.

Erkek tavşanda urethra'nın pars pelvina'sı tarama sırasında ikinci vertebra sacralis'in caudal bölümünden (dorsal'den) symphysis pubis'in ortasına kadar (ventrolateral'den) ve corpus ossis ischii'nin acetabulum'un oluşumuna katılan kısmından (dorsolateral'den) birinci vertebra caudalis'e (dorsal'den) ve corpus ossis ischii'nin orta bölümünde tanımlanmıştır.

Anahtar Kelimeler: Tavşan, urethra'nın pars pelvina'sı bilgisayarlı tomografi.

Introduction

The reconstruction and regeneration of the defects in the wall and lumen of the male rabbit urethra are followed through computed axial tomography. These anomalies can be restored by tissue product from the submucosa of swine small intestine. The rabbit here is presented as animal model for tissue reconstruction and uroplastic of anatomic anomalies in the wall of male human urethra^{11,16,4}.

A good regeneration of rabbit urinal defects is observed after implantation of buccal mucosa, penile skin and urinary bladder's mucosa. The rabbit is used again as animal model for investigation of the human urethral reconstruction, via implantation of tissue from the other organs in the urethral wall⁵.

The diseases in the male rabbit urethra are manifested as inflammations, fibroses, fistules, squamous metaplasia, corpora aliena, urilitiasis and urinal dilatation. Many of them require catheterization or urethrostomia¹⁸.

The urethral defects' reconstruction in the rabbit are performed via implantation of peritoneal and fascial fragments and application of bioactive tube – like polimer. The last is used for urethroplastic, which is connected with the regeneration of the human urethral defects. This process is observed histologically and radiologically. In this case, the rabbit is presented again as a right biologic species about investigation of the human urethral reconstruction^{12,7,17}.

The male feline urethra is studied rentegenologically and endoscopically about miction disorders, caused by disorders in the low urinary tract⁶.

The normal male sex organs in the pelvis are studied via computed tomography and magnetic resonance imaging. The both methods' definitive possibilities about visualization of the soft tissue pelvic findings are proven^{13,15}.

The most frequently used methods for visualization of the male human pelvic urethra are conventional and retrograde contrast urethrogra-

phy. These methods are suitable about observation of the normal and changed pathologically profile of the urethral lumen, which could be caused by traumas, inflammations and strictures. Recently serial images of transverse sections are used, obtained by ultrasound, computed tomography and magnetic resonance imaging. They find a big application in the settlement of urethral and periurethral anomalies. These studies are most suitable about patients with anatomic disorders as innate anomalies, bulbomembranous urethral woundings, fistules, calculi and urethral and periurethral tumors. These methods are applied as via normal excretion as via retrograde injection of contrast matter, with regard to the better visualization of the urethral lumen¹⁰.

Rontgenologically, the human male pelvic urethra is studied about visualization of urethral bulbar narrowing - Cobbs collar and the front congenital diverticul with lithiasis^{8,14}.

The compression of the bulbar urethra by the bulbourethral glandular cysts are investigated in the man via the methods of the retrograde urethrography, computed tomography and magnetic resonance imaging^{9,3,1}.

The scarce data about computed tomographic visualization of the normal pelvic urethra in the domestic rabbit, motivated us to make visualization of this organ. The results could be used as data for imaging anatomic differentiation of the normal from altered pathologically or obstructed rabbit pelvic urethra. The data, obtained by us can add the knowledges about the rabbit urethra, with aim its use as animal model in human urethroplastic.

Materials and Methods

We studied 6 clinically healthy and sexually matured male New Zealand rabbits at age 18 months, with body mass 2.8 to 3.2 kg. The animals were anesthetized with Zoletil 50 (Virbac, France), at 15 mg/kg m, iv.²

As contrast matter were used OPTIRAY 350 (HEALTHCARE LTD. UK) applied paren-

terally (i. v. 1 ml/ kg m in vena cephalica). The study was performed immediately. The second contrast material was UROGRAFIN 76% 20 ml (SCHERING LTD. GERMANY), applied perorally (per os) as 1.52 % water solution (30 ml/ kg m, fractionally), and the study was performed after three hours. The study was done on axial computed tomograph SIEMENS, SOMATOM, ARTX with table height 125 cm, FOV=250, filter 1, supply current 70 mA, anode tension 110 kV and scanning time – 3 sec. A high resolution – 512 and gentry (GT) - 0° were employed.

We used window (W) - 280 and center – 53. The scanning levels were 2 mm away, and the imaging reconstruction was performed in three – dimensioned model (3D).

The computed tomographic scan was marked cranially – by the caudal part of the body of ilium, in front of the acetabulum (laterally), in front of the pelvic brim (ventrally) and 1st sacral vertebra (S1) (dorsally), and caudally – by os ischii, before the beginning of tuber ischiadicum (laterally), behind pelvic arc (ventrally) and the end of 2nd coccygeal vertebra (Cg 2).

Two of the animals were positioned dorsoventrally (ventral recumbancy), and the other four in ventrodorsal position. The urinary bladders of two individuals were catheterized with physiological saline (5 ml) via urethral catheter without metal mandren. In two individuals a native study was performed (without contrast amplification). In the other two was applied a contrast amplification with OPTIRAY 350, and in the last two – with UROGRAFIN 76%.

The transversal CT pelvic scans included the transverse plane between the 1st and 2nd coccygeal vertebrae to the plane between the 3rd and 4th coccygeal vertebrae, with thickness of cuts of 2 mm.

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Results

In the visualization of the rabbit pelvic urethra, we chose as bone markers the respective vertebra – dorsally, the pelvic symphysis – ventrally and ossa ischii – laterally, and as soft tissue marker – the distinctly visualized native or contrasted rectum and parts of the accessory (dorsally).

The computed tomographic transverse image of the cranial part of membranous urethra was found during the pelvic scan through the caudal part of the 2nd sacral vertebra, the middle of pelvic symphysis (ventromedially) and the acetabular part of the body of ischium (dorsolaterally). The urethral lumen wasn't contrasted and it was located in close vicinity to the pelvic symphysis, from whom it was separated by adipose tissue (negative density). The urethral wall was hypodense towards the muscles of the pelvic diaphragm. Above the urethra it was observed the connective part between the caudal part of the prostate and the cranial one of the bulbourethral gland. The urethral wall was with soft tissue density. It was relatively hypodense and homogenous, similarly to the density of the rectal wall, located dorsally. The results motivate us to confirm that the first appearance of computed tomographic image of male rabbit pelvic urethra is in the transverse plane, through the 2nd coccygeal vertebra, the caudal parts of ossa pubis and behind the hip joints (Fig. 1 and Fig. 2).

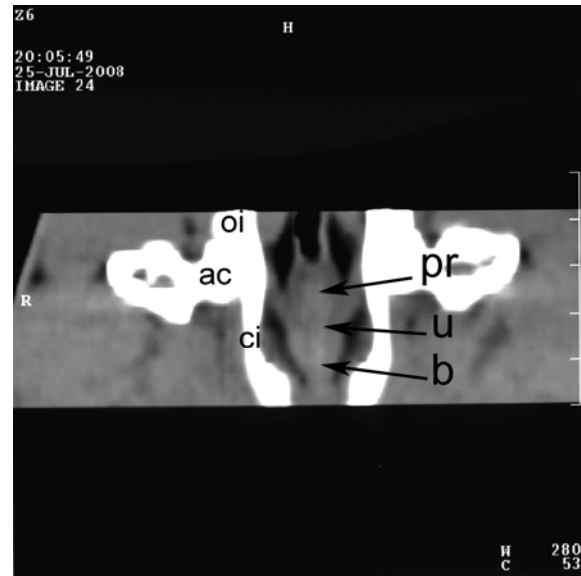


Fig. 1.

A reconstructed image of accessory sex glands and pelvic urethra of the rabbit – prostatic complex (pr), pelvic urethra (u), bulbourethral gland (b), body of ilium (oi), acetabulum (ac), body of ischium (ci).

Şekil 1.

Tavşan'da glandula genitales accessoria ve urethra'sının pars pelvina'sı – prostata (pr), urethra'sının pars pelvina'sı (u), gll.bulbourethralis (b), corpus ossis ilii (oi), acetabulum (ac), corpus ossis ischii (ci).

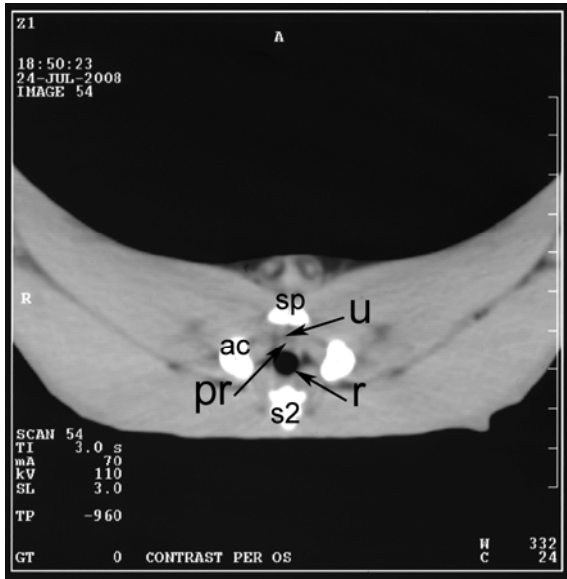


Fig. 2.

A transversal computed tomographic image of rabbit pelvis (dorsal recumbancy) through the 2nd sacral vertebra (s2) – urethra (u), prostatic complex (pr), rectum (r), acetabulum (ac), pubic symphysis (sp). (thickness of the cut 2mm.)

Şekil 2.

Tavşan pelvis'inin ikinci vertebra sacralis'ten (s2) transversal bilgisayarlı tomografi görüntüsü (sırt üstü) - urethra (u), prostata (pr), rectum (r), acetabulum (ac), symphysis pubica (sp). (kesit kalınlığı 2mm.)

The computed tomographic transverse scan of the middle part of membranous urethra was observed during the pelvis scan in the plane through the 3rd sacral vertebra (dorsally), the end of pubic symphysis (ventrally) and the cranial parts of the bodies of ischial bones (laterally). The urethral lumen was contrasted (hyperdense) and was visualized between the hypodense retropubic fat depot (ventrally) and the hypodense rectal lumen (dorsally). The urethral wall possessed a soft tissue dense features and was relatively hypodense than the rectal wall. Its margins were adequately distinguishable from the adjacent soft tissues (Fig. 1 and Fig. 3).

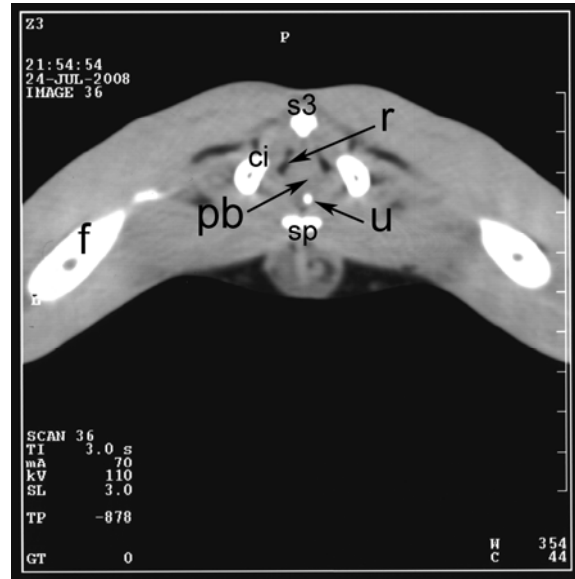


Fig. 3.

A transversal computed tomographic image of rabbit pelvis (ventral recumbancy) through 3rd sacral vertebra (s3) – urethra (u), connection between prostatic complex and bulbourethral gland (pb), rectum (r), body of ischium (ci), pubic symphysis (sp), bone of femur (f). (thickness of the cut 2mm.)

Şekil 3.

Tavşan pelvis'inin üçüncü vertebra sacralis'ten (s3) transversal bilgisayarlı tomografi görüntüsü (yüz üstü) - urethra (u), prostate ile gll. bulbourethralis bağlantısı (pb), rectum (r), corpus ossis ischiü (ci), symphysis pubica, femur (f). (kesit kalınlığı 2mm.)

The computed tomographic scan image of the caudal part of the membranous urethra was found during the scan of the pelvis through the 1st coccygeal vertebra, (dorsally), the middle part of ischiadic symphysis (ventrally) and the middle parts of the bodies of ischial bones (laterally). The urethral lumen wasn't contrasted (hypodense), compared to the rectal one, who demonstrated a finding with X – ray positive contrast (hyperdensity). The urethral wall showed a relatively close hyperdensity to this of the rectal one and possessed a soft tissue density (Fig. 1 and Fig. 4).

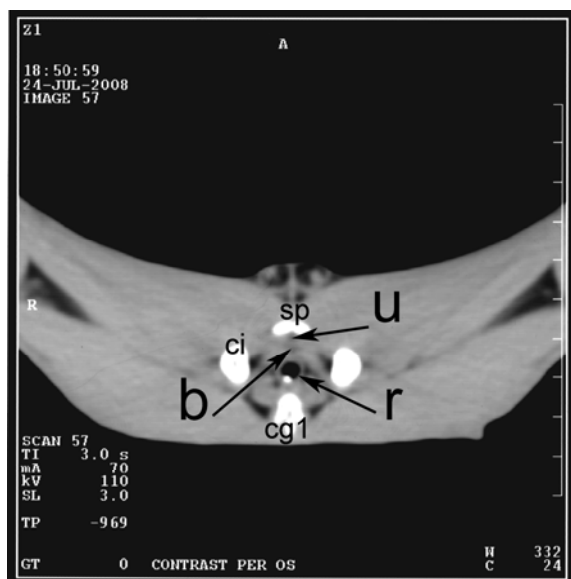


Fig. 4.

A transversal computed tomographic image of rabbit pelvis (dorsal recumbancy) through Istcoccygeal vertebra (cg1) – urethra (u), bulbourethral gland (b), rectum (r), body of ischium (ci), ischiadic symphysis (sp). (thickness of the cut 2mm.)

Şekil 4.

Tavşan pelvis'inin birinci vertebra caudalis'ten (cg1) transversal bilgisayarlı tomografi görüntüsü (sırt üstü) - urethra (u), gl. bulbourethralis (b), rectum (r), corpus ossis ischii (ci), symphysis ischiadica, . (kesit kalınlığı 2mm.)

Discussion

The CT visualization gives information about anatomotopographic details of the pelvic urethra and its lumen in the rabbit, compared to the retrograde urethrography and urethroscopy, via whom the peculiarities of its mucosa are found⁶.

At the second place, the computed tomography gives data as about the soft tissue features of the urethral wall, in its separate topographic zones, as about their communications with the adjacent soft tissue structures^{11,16,4,5}.

On the other part, our results correspond with the studies of many authors, about the visualization of the urethral lumen, who are connected with luminal reductions and obstructive lesions in the domestic rabbit¹⁸.

The data of our investigation about the computed tomographic morphology of the rabbit pelvic urethra, add the studies of^{12,7,17} about the urethral reconstruction in this animal species, in

connection with its use as an animal model for urethral plastic in the man.

As in the man, as in the rabbit, the CT study of the membranous urethra, can be applied about investigation of its anatomic peculiarities and appeared anomalies – diverticules, constrictions, lithiasis, constraints and valves^{13,15,9,8,14,3,1}.

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