



## Histomorphological and Histochemical Investigation of the penis in Porcupine (*Hystrix crestate*)

Abdulrazzaq B Kadhim<sup>1</sup>, Eman F. Albaghdady<sup>2</sup>, Eman Ibrahim Al hachem<sup>3</sup>

Anatomy and histology department /Veterinary collage /Al-Qadisiya University

Email: [Abdulrazzaq.alrabei@qu.edu.iq](mailto:Abdulrazzaq.alrabei@qu.edu.iq)

ORCID: <https://orcid.org/0000-0001-6356-42>

Received:2/12/2022. Accepted:2/27/2023. Published:12/9/2023

### Abstract:

This research investigates the essential histomorphological and histochemical features of five male porcupines. The tail of the penis was noticed. Loosen the column's rod. There is no difference in the external color of the body and the glans penis, as it is pink in both Keratinized papillae enveloping the penis and body of a glans. In the glans, there are tiny nail-like features. The urethra is situated in the connective tissue behind the hand the glans of the penis and beneath the penis. The inner and outer layers are made of connective tissue and keratin, respectively. According to histologically, the porcupine penis is likewise vascular. This study began by examining the morphology of a porcupine rod. Our findings will help us understand the similarities and differences between porcupine and rodent reproduction and those of mammals. Our results concluded that the penis in porcupines is very similar to most other species of porcupine and to some rodents such as mice and guinea pigs. It also resembles a dog's penis of its orientation and internal structure. It is also different from most mammals.

**Keywords:** ospenis, morphology, histology, porcupine

### Introduction

Porcupine quills deter potential predators. Either the Hystricidae or the Erethizontidae family contains porcupines. Both species belong to the clade Hystricognathi within the extraordinarily diverse order Rodentia and have comparable quill coats, but they are not related. Porcupines inhabit southern Europe, Asia, and the majority of Africa. Large, terrestrial, and active at night, they are members of the Hystricidae family. Hystricidae. *Hystrix cristata* is the world's major porcupine. The name of the crested porcupine originates from the black and white quills that cover the head and the back (1,2,3). These 35-centimeter-long, sharp quills with alternating bright and dark patterns deter predators well. It is native to Italy, Sicily, northern Zaire, Tanzania, and lab animals (4,5,6). Fossils indicate that *H. cristata* had been present in Europe since the Upper Pleistocene when the Romans brought it as a game animal. Europe Balkans easily could have lost them. Males lack a scrotum, and

their penis is posteriorly located. Male. bifid prepuces describe the male perineum (B). The penis resides in the preputial area. The penis is adorned by a distal bifid structure. It contains a cartilage core. The MUMP cartilage's distal bifid extension begins distally and extends proximally to cover the os penis dorsally. Line-measured male mouse penile structures. Mouse trains have identical specifications. The adult mouse penis contains diagnostic physical traits of the function of estrogen receptors in the human embryonic male exterior genitals (7,8,9). In addition, 50% of all mammals are rodents (Rodentia), the most abundant placental order. Porcupine goes to the family Hystricidae, a minor group of rodents (9,11). The penile anatomy of the lab animals was thoroughly comprehended (12). Our literature search for porcupine penis anatomical information found no results. In order to advance this topic, porcupine penis anatomy was investigated for the first time (3,4).



## Material and Method

The histology and morphological structure of the porcupine penis was investigated in 5 mature male *hystix crestate*. The erection of the penis was delivered manually, and the current was raised until the penis was erect; this took between 3 and 5 minutes. The erected penis was then captured on film. After being trimmed, the penises were fixed in a 10% formalin, routinely cleared in a 5% formic acid

## Results

The urogenital penis was pointed at its base (Fig. 1). Statistically the sum of the glans and shaft of the penis was  $0 \pm 0.12$  and  $3.5 \pm 0.65$  mm. respectively, the glans penis was the pink column penis. The corpus penis was pale pink. It was possible to feel the raphe preputial on the urethra of the corpus penis. Cornified papillae covered the dorsal surfaces of both the corpus penis and the glans penis in this specimen. A bigger number of cornified papillae can be found in the glans penis. When the penis was not in an upright position, two tiny penile nails measuring approximately 1-2 millimeters in length and 0.5–1 millimeters in width on both the right and left sides were covered by connective tissue cushions immediately after the glans penis. Blood flows into the areas surrounding the connective tissue in the erectile penis where the nails are located while an erection is taking place. The os penis appears in the shape of a ridged catheter in Figs. 2 and 3, and it is located directly underneath the lamina interna of preputial in the dorsal region of the transverse section of the shaft penis. The Os penis contains spongy bone within and compact bone without (Fig. 7). In cartilage the chondrocytes appeared blue after the demise of the Massontrichom stain

## Discussion

The hystrix produces a caudally-directed penis, in accordance with (13) but not (14). The direction of the penis of the *hystic*

solution for decalcification via adding 0.10 mL of formic acid + 1000m H<sub>2</sub>O, and paraffin-embedded. Hematoxylin and eosin (H & E), PAS stain, alcian blue (ph.2.5), and Masson Trichrome stain were used to stain serial sagittal and vertical slices (10).

**Ethical Consideration:** Ethical review and approval were granted by the Scientific Board of the college of Veterinary Medicine, University of Al Qadisyah, Iraq.

(Fig.4.A,B), indicating that the glans penis os penis rupture was cartilaginous. Sulcus urethra were positioned beneath Os penis. In the longitudinal sections, the glans penis widens urethra below the sulcus urethral (Figs. 5,8). Under the corpus cavernosum penis, the urethra mucosa, which contained stratified squamous -nale epithelium, developed into a rich smooth muscle with collagen threads (Fig.5). In longitudinal portions of this connective tissue, penis nails were observed. During this expansion, the penis nails were lined with stratified squamous epithelium (Fig.6). Erythrocyte-laden urethral pars spongiosa cells. Cavens were enclosed by muscles and elasticity strands. The corpus cavernosum and the corpus spongiosum are surrounded by the penis epidermis. The penis epidermis was encircled by the preputium the lamina interna. In longitudinal slices, corpus spongiosum penis was beneath a connective tissue region beneath the urethra epithelium (Fig.7). The corpus cavernosum penis featured abundant erectile tissue (cavens), collagen-rich endothelial cells, and a keratinized outer layer after this region (Fig.9). Penis cross-sections revealed urethral penis arteries.

*crestat* directed caudally like domestic cat. (15).. It has the physiognomies of most rodents. The porcupine penis is vascularized,



and no other animal species has ever been known to have nails of this type. They may ascribe to vagina of females throughout the copulation. These creatures possess a midsection os penis. The glans penises of rats and mice have proximal and distal os penises (16,17). As with carnivores, porcupines have a cartilaginous glans penis and a ridged os penis. In herbivores, the os penis is located on the penis' dorsal side. (18) discovered the glans and corpus penis of Equidae and carnivores are detached by the collum penis. (19,20) reported similar rabbit results. Similar to rabbits and carnivores, porcupines have a collum penis. Also, porcupines have a black glans penis and a white corpus penis. This helps establish the

limits of both portions. Histologically the penis of the porcupine consists of fibrous tunica albuginea, like boar (6) . It is also described as a vascular rod, as in humans(22).The tissues of the penis gave a reaction to each of Alicain, Masson's Trichom and PAS dyes, which indicates that it contains neutral and acidic sugars, in addition to the presence of significant amounts of collagen fibers as boar(6) and rat (19).

**Conclusion:** The porcupine's penis does not differ from the rodent's penis in terms of histological structure, but there are only morphological differences, and it differs histologically and morphologically from mammals.



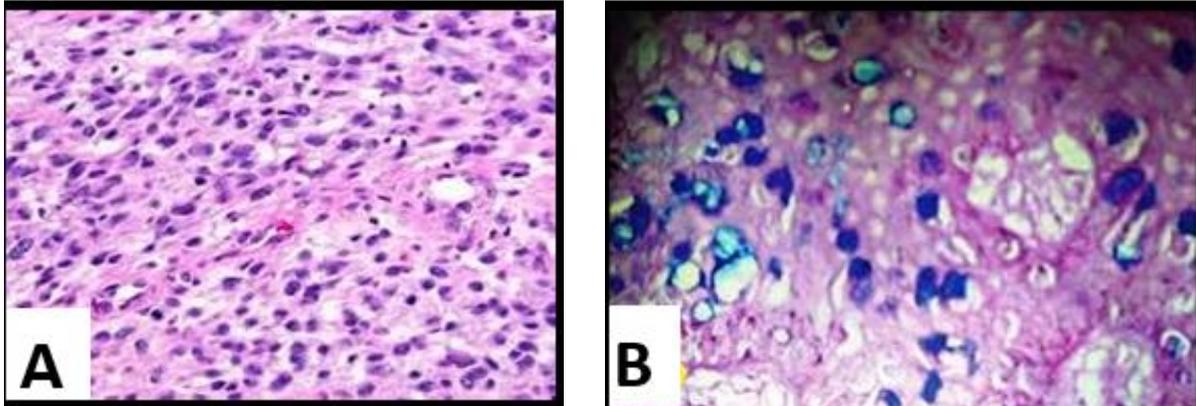
**Fig. 1.** morphological section shows: the caudal direction of the penis.



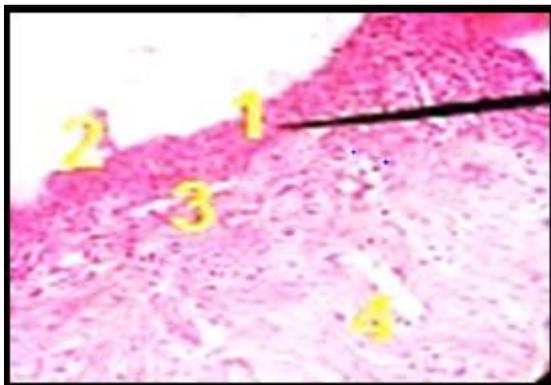
**Fig. 2.** Grosse anatomical section shows, the lateral appearance of non-erectile penis a and b glans penis, c. column penis, d. prepuce



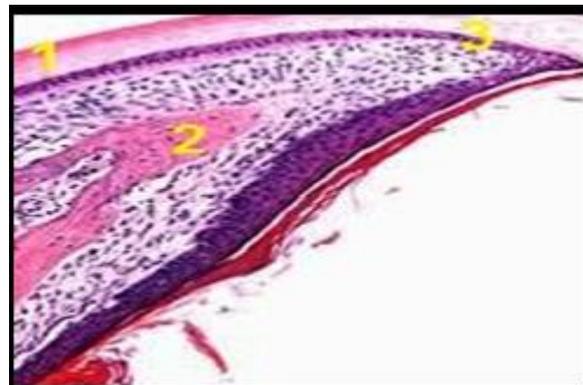
**Fig.3** Morphologically Erectile penis shows glans(a), nail penis(b) corpus penis(c). cornified papillae(d).



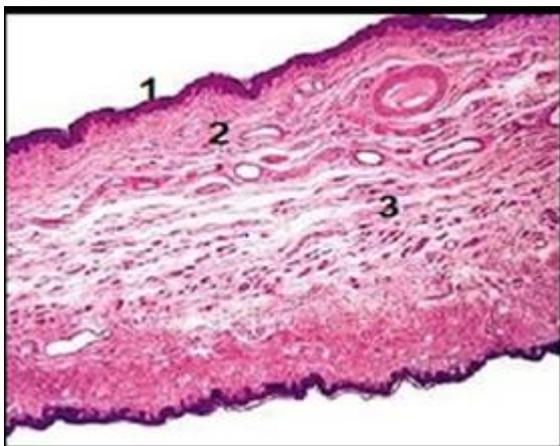
**Fig. 4.** The histological section shows A. Corpus penis osteocytes (H&E)100x. B. Glans penis chondrocytes (alcian blue)400x



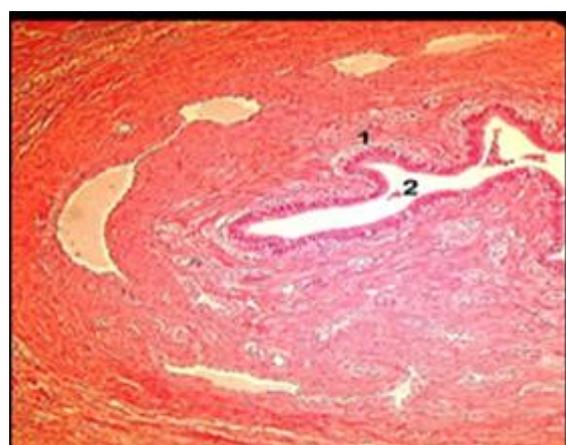
**Fig.5** Histological section of urethra exhibits stratified transitional epithelium at the mucosa (1), stratified squamous epithelium (2), pars spongiosa (3), corpus spongiosum penis(4) (H and E) 100X.



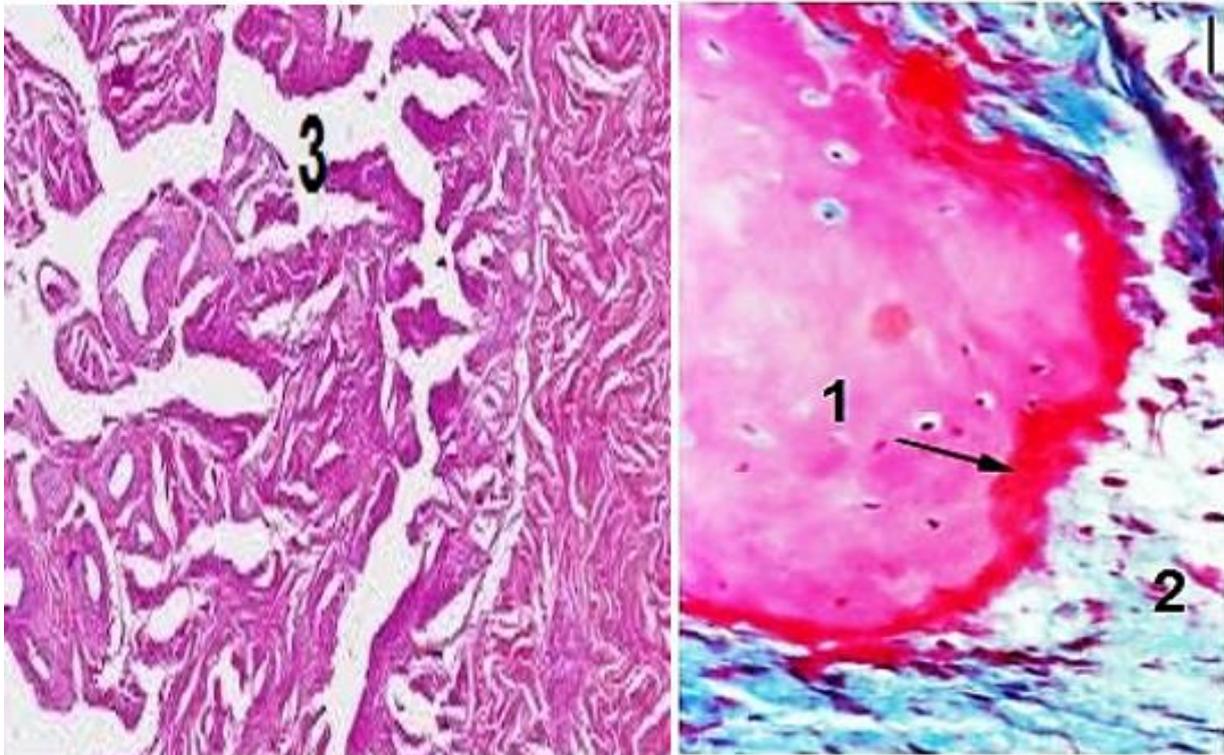
**Fig.6.** Longitudinal nail segment (H & E): keratinized layer(1), connective tissue(2), and squamous epithelium (3).PAS.stain 40X.



**Fig.(7)** Histological section of Outer sides of ethenis: lamina interna of preputium (1)epidermis of the penis(2) corpus-cavernosum penis(3).PAS stain 40X.



**Fig. (8)** Histological section shows: Urethra lumen, (1) pars spongiosa (2) (H&E)100x



**Fig. (9) Os penis histological section displays compact bone (1), spongy bone (2), and erectile tissue (3) masson trichom 400X.**

**Conflict of Interest:** The authors declare publication of this paper.

no conflicts of interest regarding the

## References

- 1 .Atalar O, Ceribasi AO. The Morphology of the Penis In Porcupine (*Hystrix Cristata*). *Vet Med-Czech*. 2006 Feb;51(2):66.<https://doi.org/10.17221/5520-VETMED>
- 2 .Banks WJ. *Applied Veterinary Histology. Male Reproductive System*. 2nd ed. London: Williams & Wilkins; 1986. p. 502-505.
- 3 .Barros M, Martins VO, Samoto VA, Nataliagonc A, Celinaa LF, Anafil A, Carlose D. Marsupial Morphology of Reproduction: South America Opossum Male Model. *Microsc Res Tech*. 2013;76:388-397.<https://doi.org/10.1002/jemt.22178>
- 4 .Cook MJ. *The Anatomy of The Laboratory Mouse*. London, New York: Academic Press; 1965. p. 105-139.
- 5 .Demirsoy A. *Rodentia Yasamin Temel Kurallari*. Ankara: Meteksan Anonim Sirketi; 1992. p. 695-729.
- 6 .Dinc G, Yilmaz S, Girgin A, Aydin AA. Light Microscopic Study On The Os Penis In Rat. *Firat Univ J Health Sci*. 1996;10:149-152.
- 7 .Dursun N. *Veterinary Anatomy II. Penis*. Ankara: Medisan Yayinevi; 1996. p. 153-159.
- 8 .Green EC. *Anatomy of The Rat*. New York: Hafner Publishing Company; 1963. Vol. XXVII, p. 117-121.
- 9 .Kuru M. *Omurgali Hayvanlar*. Erzurum: Ataturk University Basimevi; 1987. p. 551-564.
- 10 .Luna LG. *Manual Of Histologic Staining Methods Of The Armed Forces Institute Of Pathology*. London: McGraw-Hill Company; 1968. p. 34-98.
- 11 .McLaughlin C, Chiasson RB. *Laboratory Anatomy of the Rabbit*. 2nd ed. Iowa: W.C. Brown Company; 1979. p. 80-86.
- 12 .Murakami RA. *Histological Study of the Development of the Penis Of Wild - Type And*



- Androgen Intensive Mice. *J Anat.* 1987;153:223-231.
- 13 .Nickel R, Schummer A, Seiferle E. *The Anatomy of the Domestic Animals. Male Genital Organs. Vol. 2.* Berlin: Verlag Paul Parey; 1981. p. 304-348 .
- 14 .Popesko P, Rajtov V, Horak J. *Colour Atlas of the Anatomy of Small Laboratory Animals. Vol. I.* London: Wolfe Publishing Ltd.; 1990. p. 119-222.
- 15 .Rasmussen KK, Vilmann H, Juhl M. Os Penis of the Rat. V.-The Distal Cartilage Process. *Acta Anatomica.* 1988;125:208-212.<https://doi.org/10.1159/000146163>
- 16 .Vilmann A, Vilmann H. Os Penis of the Rat. IV.- Proximal Growth Cartilage. *Acta Anatomica.* 1986;117:136-144.<https://doi.org/10.1159/000145779>
- 17 .Vilmann H. Os Penis of the Rat. III.-Formation and Growth of the Bone. *Acta Morphol Neerl Scand.* 1982;20:309-318.
- 18 .Weichert CK. *Rodentia. Anatomy of The Chordates.* London: McGraw-Hill; 1970. p. 500-538.
- 19 .Yamamoto M. Histology of The Os Penis of the Rat. I.-Light Microscopic Study of the Distal Segment and Possible Origin of Its Osteocytes. *Teikyo Med J.* 1987;10:303-313.
20. Yamamoto M, Umekita S, Nishimura M. Studies On The Os Penis Of The Rat And Japanese Macaca. *Teikyo Med J.* 1990;13:375-383.