



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2022; SP-11(7): 2659-2662  
© 2022 TPI

[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 14-04-2022

Accepted: 06-06-2022

#### Mahendra Kumar Saini

Department of Veterinary  
Anatomy, College of Veterinary  
and Animal Science, Navania,  
Vallabh Nagar, Udaipur,  
Rajasthan University of  
Veterinary and Animal Sciences,  
Bikaner, Rajasthan, India

#### Pankaj Kumar Thanvi

Department of Veterinary  
Anatomy, College of Veterinary  
and Animal Science, University  
of Veterinary and Animal  
Sciences, Bikaner, Rajasthan,  
India

#### Devendra Singh

Department of Veterinary,  
Anatomy Shekhawati Veterinary  
College, Sikar, Rajasthan, India

#### Aruna Panwar

Department of Veterinary  
Anatomy, College of Veterinary  
and Animal Science, University  
of Veterinary and Animal  
Sciences, Bikaner, Rajasthan,  
India

#### Corresponding Author

#### Mahendra Kumar Saini

Department of Veterinary  
Anatomy, College of Veterinary  
and Animal Science, Navania,  
Vallabh Nagar, Udaipur,  
Rajasthan University of  
Veterinary and Animal Sciences,  
Bikaner, Rajasthan, India

## Gross morphological study on the epididymis of camel (*Camelus dromedarius*)

**Mahendra Kumar Saini, Pankaj Kumar Thanvi, Devendra Singh and  
Aruna Panwar**

### Abstract

The present study was conducted on 6 pairs (left and right) of epididymis of recently dead animals. The ductus epididymis was highly convoluted and comprised the epididymal tubules. The epididymis had three distinct region *viz.* head, body and tail. The ductus epididymis was surrounded by circular smooth muscle fibres and a thin loose connective tissue of epididymis along with embedding blood and lymph vessels.

**Keywords:** Gross, morphology, epididymis, Camel

### Introduction

The highly coiled ductus epididymis is the site for accumulation, storage, and further maturation of sperm. When sperm enter the epididymis, they are non-motile and incapable of fertilizing an oocyte. However, about a week later in transit through the ductus epididymis, the sperm acquire motility. The cell wall of epididymis also produces a glycoprotein that inhibits capacitation or the fertilizing ability of the sperm until they are deposited in the female reproductive tract (Singh and Bharadwaj 1980) <sup>[19]</sup>.

### Materials and Methods

The present study was conducted on 6 pairs of testes along with epididymis. The samples of epididymis were procured from TVCC (Training Veterinary Clinical complex) CVA'S RAJUVAS Bikaner, immediately after death of camels. The whole genitalia were carefully dissected out in recently dead animal (Figs 1 and 2) and the measurements for physical parameters like length and thickness, of individual components were carried out on both the left and right epididymis. The length and thickness was measured by digital Vernier's calliper. The thickness was measured at three deferent regions *i.e.* head, body and tail. All recorded data were computed in tubular form. The data was analyzed by standard statistical method for mean ( $\bar{x}$ ), standard error ( $\pm$  SE) and paired "t" test used for depicting significant and non-significant correlation of data. The correlation between each parameter was calculated at 5% level of the significance for conclusion.

### Results and Discussion

#### Topography

The epididymis of camel arose from cranial extremity of testis and faces lateral to the dorsal border (Fig 1, 2 and 3). These findings coincide with the observation made by Smuts and Bezuidenhout (1987) <sup>[21]</sup> in camel, Bravo *et al.* (2000) <sup>[5]</sup> in Camelidae, Hafez and Hafez (2001) <sup>[7]</sup> in camel, Zayed (2012) <sup>[24]</sup> in one-humped camel and Pasha *et al.* (2013) <sup>[13]</sup> in one-humped camel. However Sisson and Grossman (1953) <sup>[20]</sup> reported that the epididymis lies along the lateral part of the posterior border in different animals, Raghavan (1964) <sup>[15]</sup> found epididymis was curved, overlapping a narrow area of lateral surface of the testicle, Ismail (1988) <sup>[10]</sup> resemble that of the epididymis runs along the anterior border of the testis, extending from the ventral pole to a point slightly above the level of the proximal pole one-humped camels, Sellnow (1996) <sup>[18]</sup> found that the epididymis was lightly attached to the upper surface of each testis in stallion's, Utiger (2008) <sup>[23]</sup> said that each epididymis lies on the top surface of the testis in humans, Belloa and Umarub (2013) <sup>[4]</sup> mentioned that the epididymis attaches to the anterior-dorsal point in camel, Pathak *et al.* (2014a) <sup>[14]</sup> described that the epididymis started from the dorsal extremity of the testes in goat, Khan *et al.* (2016) <sup>[11]</sup>

explained that the epididymis was found intimately attached with the testis border which was found long head and curved dorsal boundary in male goat, Saleem *et al.* (2017) [17] observed that the epididymis was located on the dorsomedial aspect of testis in the bird, Bello and Umaru (2020) [3] told that as in other species the epididymis was located along the dorsal border of the testis with the head curving around the cranial pole of the testis male one humped camel and Ibrahim *et al.* (2021) [9] claimed that in the dromedary camel epididymis was located at the cranial border of the testis and extends from the lower end to just above the upper border.

### Shape and colour

The epididymis was highly convoluted duct, which was tightly packed in a thick tunica albuginea and an outer visceral layer of the tunica vaginalis (Fig 3). Result was in harmony with Cosentino and Cockett (1986) [6] in the bovine and Zayed (2012) [24] in one-humped camel and Ibrahim *et al.* (2021) [9] in the dromedary camel. Whereas Sisson and Grossman (1953) [20] further stated that the epididymis consists of a tortuous canal which forms the first part of the efferent duct of testes in different animals, Raghavan (1964) [15] revealed that the epididymis was elongated from above downward in the ox, Hafez and Hafez (2001) [7] noted that epididymis was very convoluted much smaller than in the stallion and bull, in camel, Utiger (2008) [23] mentioned that the epididymis, either of a pair of elongated crescent-shaped structures attached to each of the two male reproductive organs in humans.

The color of camel epididymis was pinkish white. The tunica vaginalis was pigmented in some specimen (Fig 3). However Khan *et al.* (2016) [11] stated that color of the epididymis was found pale to yellowish white in male goat.

### External appearance

The epididymis composed of three distinct parts as head (caput), body (corpus) and tail (cauda). The head was bulbous mass curving around cranial extremity of testis and attached by a fibrous band. Body of epididymis was thick flattened part attached lateral side to the dorsal border. The tail of epididymis was a small part which attached to the caudal extremity of testis by fibrous ligament and latter continuous with vas deference. It also attached to the tunica vaginalis by a ligament (Fig 3). Same observation also revealed by Raghavan (1964) [15] in ox, Cosentino and Cockett (1986) [6] in the mammalian epididymis, Ismail (1988) [10] in one-humped camels, Naggar and Rath (1990) [12] in camel, Zayed (2012) [24] in one-humped camel, Pasha *et al.* (2013) [13] in one-humped camel and Bello and Umaru (2020) [3] in male one Humped Camel. Result could not confirmed with Tingari (1971) [22] mentioned that the avian epididymal region might be regarded as equivalent to the caput epididymis of scrotal mammals. Different regions of the ductus deferens were considered analogous to the corpus and cauda epididymis in the Rooster, Utiger (2008) [23] reported that the body was attached to the anal side of the testis and extends the length of the gland and the smallest region was the tail, which begins at the point of separation of the epididymis from the testis in humans, Bello and Umaru (2013) [4] described that the tail of the epididymis was very closely opposed to the testicular surface by means of the epididymal ligament in camel, Pathak *et al.* (2014a) [14] noted that the epididymis forming a globular

flat rounded caput, which covered almost one fourth of the anterior border of the testis then turned on the lateral border and then descended along the postero-lateral border of the testis as the corpus, the tail was rounded or elongated tubercular like projection in goat, Khan *et al.* (2016) [11] explained that the epididymis body was fine and constricted lies beside the lateral part of the attached border of testicle, tail was long and directly attached at the ventral extremity of the testicle in male goat, Saleem *et al.* (2017) [17] found that the paired ductus deferens were tubular, convoluted and wavy in appearance, extending from caudal end of epididymis to the cloaca in the bird, Rashad *et al.* (2018) [16] stated that the epididymis composed of head, body and tail. The epididymal head was the heaviest and largest part of the epididymal segments. This enlargement in epididymal head were due to the presence of efferent ducts that were received from the testes in dromedary camel and Ibrahim *et al.* (2021) [9] clarified that gross anatomical description of epididymis had distinct regions like head (caput), body (corpus) and tail (cauda) in dromedary camel.

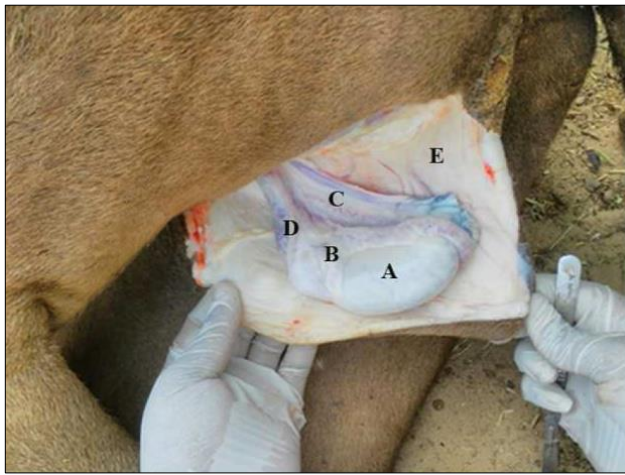
### Length and width

The average lengths of right and left epididymis were 14.03 ±0.78 cm and 14.52 ±0.59 cm respectively (Table 1). The difference was non-significantly higher, represent that left epididymis larger than right. However Cosentino and Cockett (1986) [6] revealed that epididymis was some 3 to 4 meters long in man, while in the bovine it may cover a total length of 40 meters, Ibrahim *et al.* (2012) [9] pointed out the three breeds Balami, Uda and Yankasa shows significant differences ( $p < 0.05$ ,  $p < 0.01$ ) in mean epididymal length the Uda had a significantly higher values ( $p < 0.05$ ) followed by the Balami and the Yankasa, Abdullahi *et al.* (2012) [1] examined that there were no significant difference ( $p > 0.05$ ) a mean epididymal length between the left and right organs, but there were numerical differences found of camels in the semi-arid environment, Rashad *et al.* (2018) [16] claimed that the length and their equivalent ratio from the whole organ varied significantly ( $p < 0.001$ ) between epididymal segments, as the epididymal head was the heaviest and longest part in dromedary camel epididymis and Al-Sadoon *et al.* (2019) [2] noted that the differences between right and left epididymis were non-significant in males of arrabi and awassi sheep.

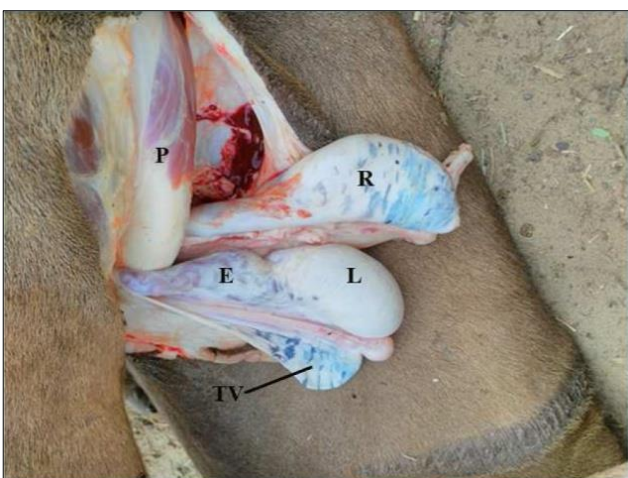
The average width of right and left epididymis was 1.47±0.14 cm and 1.59±0.22 cm at head, 0.68±0.09 cm and 0.73±0.04 cm at body, 1.33±0.04 cm and 1.35±0.05 cm at tail (Table 1). The difference was statistically non-significant between right and left epididymis. While Hafez and Hafez (2001) [7] repored that the epididymis head small external diameter of 2 mm much smaller than in the stallion and bull in camel, Al-Sadoon *et al.* (2019) [2] noted that the differences between right and left epididymis were non-significant in males of arrabi and awassi sheep and Ibrahim *et al.* (2021) [9] epididymis was small tubules with a diameter of 2 mm in the dromedary camel epididymis.

### Acknowledgement

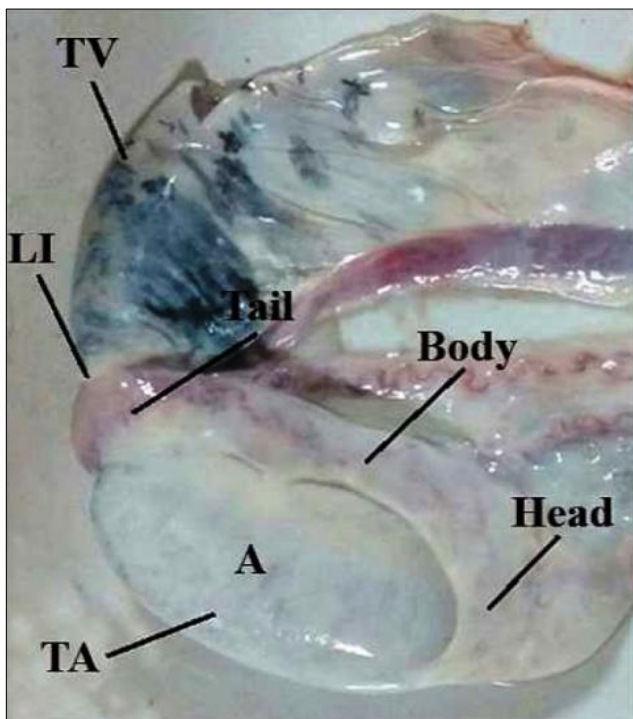
The authors are thankful to the Dean, College of Veterinary and Animal science, Bikaner, RAJUVAS, Bikaner, Rajasthan for providing all the necessary facilities to carry out research work.



**Fig 1:** Lateral surface of left testis (A) of camel in situ, epididymis (B), Vas deferens (C), spermatic cord (D), scrotum (E).



**Fig 2:** The left testis (L), right testis (R) of camel in situ, tunica vaginalis (TV), penis (P), spermatic cord (D).



**Fig 3:** Photograph of the right testis with epididymis showing, lateral surface (A), tunica albuginea (TA), tunica vaginalis (TV) and ligament (LI).

**Table 1:** Statistical analysis of the biometrical observation of various parameters of epididymis of camel (*Camelus dromedarius*).

Character	Testes	Range	Mean± SE	Paired 't' test	
Length of epididymis (cm)	Right	11.8 -16.5	14.03 ±0.78	0.81	
	Left	13 -17.1	14.52 ±0.59		
Width of epididymis (cm)	Head	Right	0.96-1.8	1.47 ±0.14	0.83
		Left	1.02-2.2	1.59 ±0.22	
	Body	Right	0.41-0.92	0.68 ±0.09	0.57
		Left	0.62-0.9	0.73 ±0.04	
	Tail	Right	1.18-1.47	1.33 ±0.04	0.38
		Left	1.19-1.6	1.35 ±0.05	

**Note** \* = P (0.05) ≥ 2.571 was significant and other data were non-significant.

**References**

1. Abdullahi IA, Musa HAH, Jibril A. Scrotal circumference and testicular morphometric characteristics of the camel (*Camelus dromedarius*) in the semi-arid environment of northern Nigeria. *International Journal Morphol.* 2012;30(4):1369-1372.
2. Al Sadoon AA, Al Yasery AJ, Al Khagani IY. Comparative morphological and anatomical study to development of testes and epididymis in males of Arrabi and Awassi sheep. *Plant Archives.* 2019;19(1):181-190 e-ISSN: 2581-6063 (online), ISSN: 0972-5210.
3. Bello A, Umarub MA. An overview on the anatomy and physiology of male one humped camel (*Camelus dromedarius*) reproductive system. *African Scholar Journal of African Sustainable Development.* 2020;17(2):141-152, ISSN: 2010-1086.
4. Bello A, Umarub MA. An over view on the anatomy and physiology of male one humped camel (*Camelus dromedarius*) reproductive system. *Scientific Journal of Review.* 2013;2(12):340-347.
5. Bravo PW, Skidmore JA, Zhao XX. Reproductive aspects and storage of semen in Camelidae. *Animal Reproduction Science.* 2000;62:173-193.
6. Cosentino MJ, Cockett ATK. Review Article: Structure and Function of the Epididymis. *Urological Research.* 1986;14:229-240.
7. Hafez ESE, Hafez B. Reproductive Parameters of Male Dromedary and Bactrian Camels. *Archives of Andrology.* 2001;46:85-98.
8. Ibrahim AA, Aliyu J, Ashiru RM, Jamilu M. Biometric Study of the Reproductive Organs of Three Breeds of Sheep in Nigeria. *International Journal Morphol.* 2012;30(4):1597-1603.
9. Ibrahim ZH, Al Kheraije KA, Singh SK. Morphological and histochemical changes in the dromedary camel epididymis in relation to reproductive activity. *Histol Histopathol.* 2021;36(5):485-504. Doi: 10.14670/HH-18-303.
10. Ismail STT. Reproduction in the male dromedary (*Camelus dromedarius*), Cairo University. *Theriogenology.* 1988;29(6):1407-1418.
11. Khan SA, Kalhoro IB, Gandahi JA, Tunio AN, Vistro WA, Ahmed M, et al. Gross anatomical studies on testis and epididymis at pre-pubertal and pubertal stages of teddy goat. *Academic Research International.* 2016;7(1):51-57.
12. Naggat MAE, Rath D. Described the gross anatomy and histological structure of the camel testes. *Reproduction in*

- camels. F.A.O. Animal Production and Health Paper. 1990;82:1-2.
13. Pasha RH, Qureshi AS, Rehman ZU, Khamas WA. Seasonal anatomical changes in the testis of the one-humped camel. *European journal of anatomy*. 2013;17(3):132-141.
  14. Pathak A, Katiyar RS, Sharma DN, Farooqui MM. Postnatal developmental anatomy of testes and epididymis of gaddi goats. *International Journal Morphol*. 2014a;32(4):1391-1398.
  15. Raghavan D. *Anatomy of ox*. Indian Council of Agricultural Research, New Delhi, 1964, pp 415-419.
  16. Rashad DEM, Kandiel MMM, Agag MA, El Khawagah ARM, Karima GhM, Mahmoud Ahmed YF, *et al*. Histomorphometry of dromedary camel epididymis and its correlation with spermatozoa characteristics during their epididymal transport. *Benha Veterinary Medical Journal*. 2018;35(1):1-11.
  17. Saleem R, Singh B, Khan IM, Singh I, Bharti SK. Gross and biometrical studies on male reproductive system of adult local fowl of Uttarakhand (Uttara Fowl). *International Journal of Pure and Applied Bioscience*. 2017;5(3):634-638.
  18. Sellnow L. *Stallion Anatomy and Physiology*, Colorado State University ("Management of the Stallion for Maximum Reproductive Efficiency), Kansas State University (M.J. Arns, PhD) and A & M University (J. W. Evans, PhD), 1996.
  19. Singh UB, Bharadwaj MB. Histological studies on the testicular seminal pathway and changes in the epididymis of the camel (*Camelus dromedarius*). *Acta Anatomica*. 1980;108:481-489.
  20. Sisson S, Grossman JD. *The anatomy of the domestic animals*. 4th Edn. W. B. Saunders Company. Philadelphia and London, 1953, pp 581-605.
  21. Smuts MMS, Bezuidenhout AB. *Anatomy of the dromedary*, Clarendon Press-Oxford, 1987, pp 134.
  22. Tingari MD. On the structure of the epididymal region and ductus deferens of the domestic fowl (*Gallus domesticus*). *Journal of Anatomy*. 1971;109(3):423-435.
  23. Utiger RD. *Anatomy of the testes and epididymis*, 2008. <https://www.britannica.com>.
  24. Zayed AE, Aly K, Ibrahim IA, Maksoud FMAE. Morphological studies on the epididymal duct of the one-humped camel (*Camelus dromedarius*). *Open Journal of Veterinary Medicine*. 2012;2:245-254.