MORPHOLOGICAL STUDY OF THE DEVELOPMENT OF THE PROSTATE IN THE DROMEDARY DURING THE POSTNATAL PERIOD OF ONTOGENESIS

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ABSTRACT

This study was conducted to investigate the morphological development of the prostate gland in the dromedary during the postnatal period of ontogenesis in the El Oued region of southeastern Algeria, under the guidance of the Laboratory of Life Sciences and Techniques of the Taoura Veterinary Sciences Institute of Souk Ahras University. Forty-five prostates of male dromedaries of six different age groups were examined to study topography, morphometry (length, width, and thickness), and to weigh the mass of the organs. In the dromedary, the prostate, consisting of a corpus prostatae (body) and a pars disseminata prostatae (pars disseminata), is round or oval in shape, attached to the dorsal wall of the initial part of the pelvic urethra where two main excretory ducts terminate on each side of the crest of the colliculus seminalis. The pars disseminata prostatae surrounds the pelvic urethra, starting immediately behind the body and extending caudally along the pelvic urethra almost to its terminal end. Thus, the results showed that the prostate undergoes significant morphological changes during the postnatal period: during the first few weeks of life up to the first year, the prostate is a small primitive organ with a pelvic position. In the following months, at puberty, the organ reaches an ideal image of the prostate gland. In conclusion, the results revealed that the morphological changes were associated with advancing age.

Key Words: dromedary, morphometry**,** ontogenèse, prostate gland.

INTRODUCTION

The prostate is a glandular complex developed in all mammals from the wall of the urogenital sinus of the embryo, near the end of the mesonephric ducts (Barone, 2001). Its morphological characteristics vary considerably from one species to another (Abou-Elhamd et al., 2013). It is the most important gland of the male reproductive system. It produces seminal fluid, which is essential for reproduction. This fluid neutralizes the acidity of the vagina and aids in the movement of sperm (Eurell & Frappier, 2007; Hafeez, 1987). It also secretes two main proteins that play an active role in its physiological and pathological functions (Mounkoro, J. (2020)). Furthermore, it can be the site of three conditions: prostate cancer, benign prostatic hyperplasia (BPH) or prostate adenoma, and prostatitis (Dr. G. Latteux). These conditions are the primary issues related to the prostate in both veterinary and human medicine.

According to H. A. ALI et al. (1977), despite numerous in-depth studies on the male accessory glands of reproduction in many animals being available in the literature, the camel's prostate has received little attention. Until now, morphological studies on the accessory glands of this animal have been limited to a few general descriptions of the gross anatomy of the prostate (Leese, 1927; Tayeb, 1952; El-Jack, 1970) and a brief report on the bulbourethral glands (Perk, 1962). The presence of urethral glands in the pelvic part of the urethra has been reported by El-Jack (1970). Recent studies by El-Wishy, Mubarak & Fouad (1972) provided an insight into the microscopic structure of the accessory glands (ALI, M.A., 1977).

Given their importance in reproduction and urination, it was decided to conduct a detailed morphological study of the development of the prostate in the dromedary during the postnatal period of ontogenesis in our study.

MATERIALS AND METHODS

In this study, the prostates were collected from newborns who suffered pathologies and even road accidents during the transhumance of animals from zone to zone, and also from clinically healthy camels after slaughter, out of six groups at the age of 12, 24, 36, 48 and 60 postnatal months and newborns (aged 1 to 7 days), during the year 2022, at the regional slaughterhouse of El Oued, in Algeria, according to table 01:

Age	1± 6,87	12± 7,23	24± 5,76	36± 7,87	48± 7,16	60± 6,34
Number of samples	05	07	09	06	08	10

The characteristics of the material studied are presented in Table 1. A total of 45 animals were studied. To study the morphology of camel prostates in the postnatal period, a set of measurements was carried out, including various research methods:
The macro morphometric study began by determining the age according to the breeding assessment sheets, the weight and the length of the animal's body. Then, the topography of the organs and their relationship to other organs in the abdominal cavity were recorded intact after fixation and removal of fat and fascia. While the morphometric study is done after the isolation of the organ using an electronic caliper model "Tamo professional" 34 with a division scale of 0.05 mm. The absolute mass of the organs and their proportions were determined on a "CAS 0.2 HFS" electronic balance.

Statistical analysis

The statistical processing of the numerical indicators was carried out on a personal computer, using standard “MS Excel” software packages. The difference in indicators was considered statistically probable
*P<0.05; **P<0.01; ***P<0.001.

RESULTS

Anatomy and topography of the prostate in the dromedary

Descriptive analysis ;

It has a cream-colored prostate composed of a corpus prostatae (body) and a pars disseminata prostatae (pars disseminata). The corpus prostatae is a rounded or oval disc-shaped structure attached to the dorsal wall of the initial part of the pelvic urethra where two main excretory ducts terminate on either side of the colliculus seminalis crest. The pars disseminata prostatae surrounds the pelvic urethra beginning immediately behind the body and extending caudally along the pelvic urethra almost to its terminal end (10–20 mm from its caudal end). The urethral muscle, composed of skeletal muscle, surrounds the ventral surface of the pars disseminata prostatae

After the pelvic organs of the dromedaries were placed on an examination tray, the prostate was found to be composed of two parts: a compact or external part called the body of the prostate, and an internal part called the disseminated part. The disseminated part surrounds the pelvic urethra. The bulbourethral glands were also observed. These glands consist of right and left independent lobes that lie on the dorsal surface of the caudal part of the pelvic urethra at the level of the ischial arch. They are covered by a layer of fibro-muscular tissue.

In one-year-old young dromedaries, the prostate body is absent. It's only after one year that the body begins to form. At this stage, white tissue is present under a fibrous cord that attaches the two vesicular glands to the junction of the bladder and the pelvic urethra. The urethral muscle is also observed, being thin dorsally and ventrally and thick on the sides. During the second year of the animal, the organ continues its development to reach the ideal form of the prostate. It is observed that in the cranial part of the pelvic urethra, the glandular tissue is particularly prominent in the dorsal wall only. It is relatively rare in the lateral and ventral walls of the pelvic urethra. In animals over two years old, it is noted that in the middle part of the pelvic urethra, the distribution of the gland is almost the same and surrounds almost the entire pelvic urethra.

In animals over three years old, the distribution of glandular elements is limited to half of the pelvic urethra. It is worth noting that in some specimens, the prostatic body is observed as a mass of white color under the cord connecting the two distinct vesicular glands.

Mass results;

According to the observation and the analysis of the table, it is noted that the absolute and relative masses of the prostate of the dromedary vary along the postnatal period.

Reaching the age between the twelfth and the twenty-fourth month after birth, we found a sum of 5.31 ± 3.45g as absolute mass, we note that this value is limited between 5.73 and 4, 89 g, the relative mass found with an average of 0.0245±3.43%, the maximum value of which was 0.02348% and the minimum value of 0.02548%, arriving at the age between 24 and 36 months, we found an average absolute mass of 6.32±3.43 g, with a maximum sum of 6.91 g and a minimum sum of 5.73 g, the values of the relative mass with an average of 0, 0162±2.55%, limit between 0.01518% as maximum figure and 0.01718% as minimum figure. At the age of 36 to 48 months after parturition, the mean absolute mass was found to be 11.34±2.54 g, with a range of 11.86 g as the maximum value and 10.82 g as the minimum value, noted that the average relative mass was 0.0135±3.23%, ranging between a maximum sum of 0.01249% and 0.01449% as minimum value. Eventually reaching the forty-eighth month of age through the 60th month, a mean absolute mass of 15.87±2.65g was found, with a maximum value of 16.46g and 15.28g as the minimum value. , concerning the relative mass of the organ in this postnatal period, a sum of 0.0156±2.87% was found, whose maximum and minimum limits were 0.01457 and 0.01657% successively.

months	Absolute mass (g)		Relative mass (%)	
	M±m	max- min	M±m	max- min
0-12	3,65±2,16	4,35-2,95	0,0232±2,65	0,02217-0,02417
12-24	5,31±3,45	5,73-4,89	0,0245±3,43	0,02348-0,02548
24-36	6,32±3,43	6,91-5,73	0,0162±2,55	0,01518-0,01718
36-48	11,34±2,54	11,86-10,82	0,0135±3,23	0,01249-0,01449
48-60	15,87±2,65	16,46-15,28	0,0156±2,87	0,01457-0,01657

The morphometric study

the morphometry of the organ in gradual accentuation after farrowing, double increases are observed. In the first year after birth, we found an average length of 21.55 ± 1.41 mm, the maximum

interval of which was 22.17 mm and a minimum of 20.88 mm, the width had a sum of 14.53 ± 0.55 mm with a maximum value of 15.72 mm and a minimum sum of 13.34 mm, the thickness of this organ in this period was 7.67 ± 0.56 mm with a maximum of 8.56 mm and a minimum of 6.78 mm.

At the age of the twelfth to twenty-fourth month after parturition, it was found that the length of the prostate reached a value of 25.54±0.86 mm with a range of 26.45 mm as the maximum and of 24.62 mm as a minimum, the width was 19.52 ± 0.34 mm with a maximum value of 20.78 mm and 18.26 as minimum value, we also found a thickness of 9.59 ± 0.45 mm with a maximum limit of 10.84 mm and 8.34 mm as minimum value. To reach the age of 24-36 months, we found a value of 29.43±0.56 mm in length with a maximum sum of 30.74 mm and 28.13 as minimum value, the found width of this organ at this age of ontogenesis was 21.98 ± 0.76 mm, with an interval of 23.76 mm and 20.21 mm, the thickness of this organ was 11.57 ± 1.78 mm, the maximum value was 12.73 mm and 10.41 as minimum value.

Then at the age of 36-48 months the prostate reaches an average value of 36.25 ± 0.34 mm in length with a maximum of 37.14 mm and 35.35 mm as a minimum, so we found a value of 22.55±1.45 mm in width, with a maximum limit range of 23.65 mm and 21.52 mm as minimum, in this age also an increase in the thickness of the organ was found and reached 13.81±1.54 mm with a maximum value of 14.75 mm and a minimum value of 12.87 mm,

Arriving at the period of 48-60 months, where the values present a sum of 42.76±1.87 mm in length, with an interval of 43.24 mm as maximum and 42.27 mm as minimum value, a width of the organ was found in this age with a value of 39.69±1.87 mm with a maximum of 40.84 mm and 38.53 mm as a minimum value, the thickness had a sum of 21.67± 1.76 mm and as maximum value found, was 22.67 mm and 20.67 mm as minimum value.

Months	Length		Width		Thickness	
	M±m	max- min	M±m	max- min	M±m	max- min
0-12	21,55±1,41	22,17-20,88	14,53±0,55	15,72-13,34	7,67±0,56	8,56-6,78
12-24	25,54±0,86	26,45-24,62	19,52±0,34	20,78-18,26	9,59±0,45	10,84-8,34
24-36	29,43±0,56	30,74-28,13	21,98±0,76	23,76-20,21	11,57±1,78	12,73-10,41
36-48	36,25±0,34	37,14-35,35	22,55±1,45	23,65-21,52	13,81±1,54	14,75-12,87
48-60	42,76±1,87	43,24-42,27	39,69±1,87	40,84-38,53	21,67±1,76	22,67-20,67

DISCUSSION

According to bibliographical research, the prostate is present in all domestic animals. It is a single gland about the size of a chestnut, located outside the urethra just behind the excretory ducts of the seminal vesicle (Frandson and Spurgeon 1992, Dyce et al. 1987, and Nickel et al. 1973). In reality, it is an aggregate of multiple glands with as many excretory ducts, and consists of a conglomerated part and a disseminated part (Barone.R.2001).

In the present study, the camel's prostate is composed of a corpus prostatae (body) and a pars disseminata prostatae (disseminated part);

The corpus prostatae is a rounded or oval disk-shaped structure attached to the dorsal wall of the initial part of the pelvic urethra where two main excretory ducts terminate on either side of the ridge of the colliculus seminalis. These results are similar to observations in camels (Ali et al., 1978), (El-Wishy et al. 1972), (Leese, A.S. 1927) and (Tayeb, M. 1948). and in other domestic animals; cattle (Dellmann and Wrobel, 1976) and) and (Gitaindro N.A et all 2016), carnivores; the dog (Hussin, A. M 2016) and (Barone.R.2001), the cat (Dimitrov, 2007) ; and in contrast to (Lesbre, 1906) compared to that of the horse; in the horse, the prostate includes two lateral lobes joined by an isthmus. However, the corpus prostaticus is absent in small ruminants, as noted by (Sisson, 1975 and Dellmann and Wrobel, 1976). In addition, this finding has been confirmed by (Kundu, 1980), as well as by (Gupta and Singn, 1982) and (Gupta, 1989).

The pars disseminata prostatae surrounds the pelvic urethra, starting immediately behind the body and extending caudally along the pelvic urethra almost to its terminal end (10 to 20 mm from its caudal end). The same results for the camel were reported by (Abdullahi M.M et al. 2016) and (Ali et al., 1978).

This observation was found in the prostates of other mammals; it is scattered in the wall of the pelvic urethra, between the stratum spongiosum and the urethral muscle, which covers it in total in the dog, but in the cat the disseminated part is limited to the dorsal face of the pelvic urethra (Barone.R.2001). And it extends to the vicinity of the urethral isthmus, or scattered along it in bulls (Mahmud, M. A et al. 2016) and (Barone.R.2001). In contrast to small ruminants (ram and goat), the disseminated part is very developed and composed of numerous tubular glands located in the lamina propria of the pelvic urethra and extending approximately from the point of entry of the seminal vesicle ducts to the level of the bulbo-urethral glands. (Aitken, R. N. C. 1959) (Barone.R.2001). In the ram, it does not extend to the ventral face of the urethra; while it completely surrounds it in the goat (Barone.R.2001).

The mass of the prostate in the camel undergoes a substantial increase during postnatal ontogeny. In our study, we demonstrated a consistent growth trajectory, with the prostate gradually increasing in mass over time ; from 3.65 g at one year of age or less to 11.34 g at puberty to reach its maximum size of 15.87 g at 60 months of age.

Postnatal development of the prostate in the camel involves not only an increase in mass, but also changes in its length, width and thickness. According to the research of (Tayeb, M. A. F.1952); the adult camel prostate measures 3.7 cm and 5 cm in its longitudinal and transverse diameters, respectively, or it measures 4 cm and 5 cm according to (El-Wishy et al. 1972), these results were found in our research ; we found that the camel prostate measures 2x1x0.7 cm for one-year-old animals to reach 4 x 4 x 2cm in the adult. Unlike cattle which their prostate is composed of two lobes of 3 to 5 centimeters wide each and 6 to 10 centimeters long, and not more than 3 to 4 cm from left to right, not more than 1.5 cm from head to tail and not more than 12 to 15 mm thick in bulls, while in the cat it has a body about one centimeter long (Barone.R.2001).

CONCLUSION

The results revealed that the animals examined shared some similarities as well as distinct morphological characteristics when compared to other domestic mammals, both in terms of overall morphology and overall morphometrics of their prostate. It is found that the morphological development of the prostate in the camel during the postnatal period of ontogenesis revealed significant information on the growth trajectory of this gland. Initially, the camel prostate has a rudimentary structure at the age of one year of 3.65 g and 2x1x0.7 cm, to reach the classical aspect at adulthood with 13 g and 4 x 4 x 2 cm in measurement. These changes in morphometric parameters, such as the length, width, and thickness of the prostate, are indicators of the overall structural changes of the organ; the length and width of the prostate can increase to accommodate the growth of surrounding tissues, while the thickness may be related to glandular density and functional requirements. In conclusion, we found that the camel prostate is topographically identical to that of the bovine, anatomically, differs from those of canines, and the morphometry of the dromedary prostate is in excess compared to other mammals.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the research and publication of this study.

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