Available online at www.jpsscientificpublications.com
Volume – 2; Issue - 2; Year – 2016; Page: 580 – 592

Indo – Asian Journal of Multidisciplinary Research (IAJMR)
ISSN: 2454-1370

ANATOMICAL AND HISTOMORPHOMETRIC STUDY OF TESTES AND PROSTATE GLANDS UNILATERAL ORCHIECTOMY IN LOCAL RABBITS (*Oryctolagus cuniculus* L.)

Ahmed J. Al-Yasery[1*], Mahdi A. Al-Waaley[1] and Abdalbari A. Alfaris[2],
[1]*Department of Anatomy and Histology, College of Veterinary Medicine, University of Baghdad, Iraq.*
[2]*Department of Medicine, Surgery and Obstetric, College of Veterinary Medicine, University of Basrah, Iraq.*

Abstract

The present study was designed to investigate the anatomical and histological and biological alteration that taken placed in testis and prostate glands to puberty age after orchidectomy in local rabbit (*Oryctolagus cuniculus*). The animals of study are divided into two groups are: (1) Control group (A) containing 15 male rabbits not removed either left or right testis. (2) Experimental (treated) group (B) containing 30 male rabbits. The experimental group (B) also sub-divided into two sub-groups, each one containing 15 male rabbits as following: (A) Group; (B1) animals in this group removed the left testis (castrated) in 1 month age; (B) Group: (B2) animals in this group removed the right testis (castrated) in 1 month age. Hemi - castration or unilateral or chiectomy was done surgically under the anesthesia. The results in this study included the effect of hemicastration on the: remained testis and prostate glands anatomical structure, the (Anatomical results). The Anatomical results of Testis: The Anatomical results of Testis in first month before performing the Unilateral Orchid.

Key words: Anatomy, Morphology, Orchidectomy and *Oryctolagus cuniculus*.

1. Introduction

The rabbits have proven to be a voluble animal in biomedical researches and testing. While, the scientific name of the rabbits is *Oryctolagus cuniculus*, an adult male is called buck and female was doe. The immature rabbit is called kit or kitten (Suckow and Schroeder, 2010). Orchidectomy can be defined as operation of removal of one (Unilateral) or both testis (Bilateral) in animals or man, also called the Testactomy used commonly in the male, while castration occur in women is the surgical operation to removal of one or both ovaries are called Unilateral or bilateral oophorectomy (Ivany *et al.*, 2002). The unilateral orchidectomy is required when further breeding potential is important. It is sometimes necessary to remove a single testis in a matured animals for the therapeutic reasons, such as testicular tumors, varicocele, hydrocele, the testicular trauma, orchitis, periorchitis, spermatic cord torsion and most cases of scrotal hernia, or performed in an matured animals for the educational and experimental purpose (Bergh and Damber, 2008).

Orchidectomy is the most common surgical procedure performed by the veterinarians. The reason most often cited for castration in animals is to reduce masculine behavior in animals unsuitable for the genetic pool and, less commonly, due to testis neoplasia , trauma, inguinal hernias or the torsion of the spermatic

*Corresponding author: **Ahmed J. Al-Yasery**
E-mail: vetedu2013@gmial.com
Received: 10.03.2016; *Revised*: 03.04.2016;
Accepted: 20.04.2016.

cord (Maxwell, 2005). This study was conducted to knowledge the effect of unilateral orchidectomy on animal life (fertility, lipido, potency, virility and sexual traits) and the ability of animals the sexual life by one testis only and which can be application in the farm animals for the economical production programs and showing the changes occurs in remaining testis following unilateral orchidectomy.

2. Material & Methods

Experimental animals

The present study was designed to investigate the anatomical and histological and biological alteration that taken placed in testis and prostate glands to puberty age after orchidectomy in local rabbit (*Oryctolagus cuniculus*). The male local rabbit (*Oryctolagus cuniculus*) are used in the present study (45 animals) were purchased from a commercial Baghdad markets and Al-Razi center for Biological researches in Baghdad/Abu – Ghrib aged approximately one and two months and weight 700 – 1100 gram. The experimental rabbits are housed in the animals house followed to the college of veterinary medicine in large wood cages (110 × 70 × 100 cm) in healthy biological and physiological conditions were selected for this study as shown in picture 1 which was represented by water source by typical containers for drinking the healthy water and typical temperature (20 – 32 °C) for daytime and night and year seasons also the natural light circle (12 hours light – 12 hours dark). The animals nourished on the typical food represented by green fodder and concentration mixture pellet *ad libitum*. Also the animals to submitted to veterinarian treatment and vaccination protective program to control of the veterinary health, this program including the clinical protective examination of all animal for all body to ensure the clinical safety from diseases and drenched by albendazole and Ivermactine and other vaccinations and treatments and multivitamins and minerals. All animals were maintained and housed under similar conditions of feeding and management with consideration the carefulness with handling with these animals. The animals of study are divided into two groups are: (1) Control group (A) containing 15 male rabbits not removed either left or right testis; (2) Experimental (treated) group (B) containing 30 male rabbits. The experimental group (B) also sub-divided into two sub-groups, each one containing 15 male rabbits as following: A. Group (B1): animals in this group removed the left testis (castrated) in 1 month age; B. Group (B2): animals in this group removed the right testis (castrated) in 1 month age.

Unilateral Orchiectomy

The surgical operation of removal one testis (Orchiectomy) performed in Group B (B1 and B2) in male rabbits in two ages the first and two months male age of experimental rabbits were performed by the Routine opened surgery.

Unilateral Orchiectomy by Open surgery

In the first we must being done a careful palpation of the scrotum and testes of each rabbit confirmed the presence of two normally descended testes. The scrotum and the testes were normal in size and the testes were freely movable inside the scrotum. On the day of surgery the male rabbit were kept away from food and water from the previous night. They were restrained in lateral recumbency. The upward hind limb was held in cranially fixed position to allow sufficient working area in the inguinal region. Scrotal circumference and length of each testis were recorded using a caliper vernia. The scrotum was prepared (shaved) for aseptic surgery using chlorhexidine scrub solution. With 10 ml of 2 % lidocaine hydrochloride a ring block was given at the proximal third of the scrotal neck.

Hemi - castration or unilateral orchiectomy was done surgically under the anesthesia of xylazin 2 % at dose 0.01 mg/kg B.W (CEVA Tierhesudheit Kanzlerstr, Germany). Local anesthesia by lidocain at dose 1 ml/1 cm area, (Holden medical, Leyslan, Netherlands) at the site of injection. An incision parallel to the median raphe was made on the cranial aspect of the scrotum of the left or right testis. The incision was passed through the whole layers of the scrotum

and the parietal tunic of the testis. The scrotum was opened at the site of spermatic cord and the testis was draw from the scrotum. The testis was prolapsed through this incision and pulled away from the rabbit body. The vascular portion of Spermatic cord was ligated by double rows of trans fixation technique (placement of catgut number 1). Ligature into the crushed zone of the spermatic cord. After ligation, the testis was removed with a scissor and then the spermatic cord was cut between the two legations. After removal of the testis, the dead space of the scrotal sac in this side was obliterated with a simple continuous suture pattern using No. 3. The subcutaneous tissue was also closed in same technique. The skin was sutured with simple interrupted sutures using No. l. A piece of gauze was applied through the distal end of scrotal wound to allow drainage of the exudates; this drain was changed daily for the first three days following operation.

The Semen evaluation by two methods

The Grossly examination

The quantitative evaluation of semen included the volume of semen that founded in the testis, while the specific evaluation included the observation and recording the color, consistency, density and presence of blemishes, oddity odder and blood and pus in semen.

The Microscopic examination of semen

After getting to semen, the evaluation of the physical properties of semen was saved in water bath at the temperature of 37 °C to be measured. This type of motility was seemed as a dark waves caused by the sperm motion in one direction. This lead to appearance of undulating curves as a dark colors differed in strength according to the motile sperm percentage (Evans and Maxwell, 1990) these test carried out as placed drop of fresh semen on a warm slide fixed on thermal theater at 37 °C, then examined by using 10 x objective and motility calculated according to the following table.

Table – 1: Estimation of collective motility of male sperm

Motility type	Degree	Percentage
Semen with intensive dark waves	5	90 -100
Semen with moderate dark waves	4	70 - 85
Semen with simple waving motion	3	45 - 65
Semen with strong personal motion without waves	2	20 - 40
Semen with simple personal motion without waves	1	10
Not found motion	0	0

The Individual motility of sperm

This motility measured by examination the semen under (40 X) to observation motion and direction of once sperm which referred to the indicator of sperm vitality, the once sperm has four types of motility are: 1) Progressive frontal motility, 2) Progressive hind motility, 3) Vibrating lateral motility and 4) Circular motility (Elliot, 1985). The individual motility measured by placed drop of diluted semen on a warm slide with drop of warm sodium citrate 2.9 % and putting the cover slip to calculated the individual motility by taking the percentage of motile sperm in Progressive frontal motility only according the following Table - 2.

Table – 2: Estimation of individual motility of male sperm

Motility type	Degree	Percentage
All sperms in Progressive frontal motility	5	90 -100
Four of Sperms fifths motile	4	70 - 85
Three of Sperms fifths motile	3	45 - 65
Two of Sperms fifths motile	2	20 - 40
One of Sperms fifths motile	1	10
Not found motion	0	0

The Concentration of sperm

In this test used, the Improved heamocytometer chamber to calculated the sperm concentration in semen by placed 0.1 ml of fresh semen and complete the volume to 19.9 ml of sperm count solution consisting from sodium citrate 2.9 % and 0.01 ml of mercuric chloride with some drops of Eosin stain 5 % to facilitating the sperm recognizing under microscope after good mixing and calculating the concentration. according following equality.

The Ratio of living sperm

This test carried out by placing a drop of fresh semen on warm slide with adding 1 - 2 drops of eosin stain with drop of Negrosin stain and mixing all drops to making smear on the slide, the slide let to dry in air fresh, then examined under microscope by using 40 X. The live sperm looks in white color (not stained with red eosin stain) while the dead sperm stained by eosin stain. Calculating 400 sperm in slide and calculating the percentage of live and dead sperms (Chemineau *et al.*,1991).

Dilution of semen and sperm vitality estimation

After getting the semen and evaluation, the semen diluted to ten time (1 semen + 9 Teris solution 3) for examination the sperms vitality and staying alive, the dilution added gradually to avoided any shock getting to sperms in tube, the diluted semen divided into two parts in tubes, the first part placed in water path in 37 °C, while the another part was cooled gradually for 10 - 15 minutes then placed in cooler at 4 °C, the individual motility and vitality of sperms were examined each 6 hours (and each 1 hour to water path sperms) to study cooling test until the sperms death (Roy and Hasnath, 1981).

The Anatomical procedure

The Biometric study and measurements of testes including the physical examination and recording the normal form and alterations occurred after the unilateral orichectomy monthly to shape and color of testis and calculation of the dimensions which including testicular weight (TW) with and without the epididymis (testicular length (TL), testicular width (TW), testicular thickness (TT). The testis length was taken from the cranial pole to the caudal pole of the testis, while the width was taken at the extremities and middle of the testis. The volume of the testis was calculated from ellipsoid equation by water displacement methods. The length, width and thickness of scrotum were calculated. The volume of residual testis in the fifth months of study was compared with its volume at control group of the experiment. The difference in weights between the two testes was statistically studied. The dimensions of the remained testis were measured by caliper vernier weight of the removed testis and epididymis was estimated and semen liberated from the epididymal tail was treated as the first one.

The morphometric measurements

Different histological parameters were used to study the measurements of seminiferous tubules, determination of germinal epithelium, thickness of *Tunica albuginea*, capsules, the number of leydig cells per interstitial area. The following incidences were used in this work.

Measuring of the seminiferous tubules

The measuring of the differential cell count seminiferous tubules diameter dimentions and Cellular changes is done by using the ocular micrometer. Measurement includes 20 tubules from each sample of selected 5 testes to reach the total number 100 tubules (x40). Counting of arithmetic mean was done by 40x objective power.

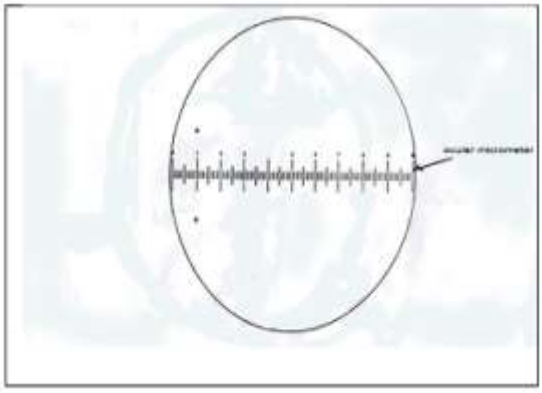
The determination of germinal epithelium

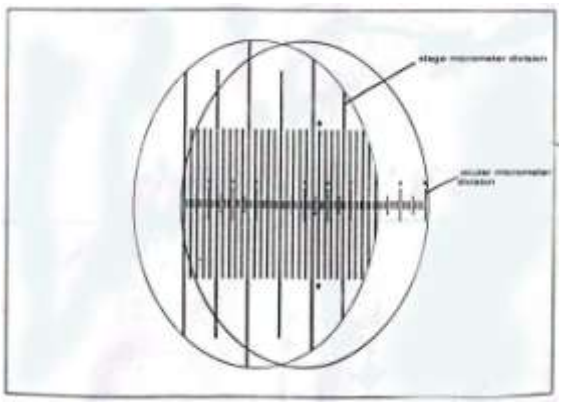
Using different stained sections are examine in light microscope and using the ocular micrometer by objective lens of 10 and 40 magnification and expressed in μm at 100x magnification with using image by ocular lens and program associated to an Olympus BX - 40 microscope. The thickness of *Tunica albuginea*,

capsules: the fields from the testis of each experimental groups are selected. For each parameter in each animal 10 micrometric measurement at the random were taken by using calibrated micrometer eyepiece.

The number of leydig cells

The numbers of leydig cells per interstitial area are measure with calculation of the mean value. The thickness of the lamina propria and the epithelial height are measure (Ali Omar *et al.*, 2013). The stage micrometer is placed on the object table and the scale was brought into focus. The ocular micrometer was rotated until both scales overlap. The micrometric stage was moved until the scales are aligned with the zero line. The line of the ocular micrometer which was exactly aligned with middle of thick object scale line of the stage micrometer must be chosen. The calibration must be worked out separately for each microscope because the real magnification always differs from one microscope to another. The mean and stander error of each data were calculated (Albert and William, 1981).





3. Results and Discussion

The present study was carried out to investigate the effect of unilateral orchidectomy in the young male rabbits (*Oryctolagus cuniculus*) in the College of Veterinary Medicine, Baghdad University. The results in this study included the effect of hemi castration on the remained testis and prostate glands anatomical structure.

The Anatomical results of Testis

The Anatomical results of Testis in first month before performing the Unilatera Orchidectomy. The anatomical results for testis in first months included the following:

The testis in Group (A)

The testis of control group (A) in the first month age have the elongated heart or bean shaped with the yellowish - pink color placed in a vertical direction in the abdominal cavity, a little in front of the inguinal region. The two testes of the same rabbits are a symmetrical as one of them, more often the left is larger and longer. Each testis has two surface (Lateral and Medial surfaces), two border (Anterior and Posterior borders), and two extremities (Ventral and Proximal extremities). The lateral surface is convex and the medial surface is flattened owing to its contact with the septum scroti. The anterior border is free and convex; the posterior border has the epididymis closely attached to it. The ventral extremities were slightly thicker than the proximal one and are covered by the tail of the epididymis which was attached to it by the ligament of the epididymis. The testis was suspended by the proximal extremity to which the spermatic cord is attached (Fig - 1) (the left testis is significant with right testis from 0.05). The average dimensions of the left testis of the rabbits in first months age are (Length 23.52 ± 0.47 mm, Width 4.88 ± 0.07 mm and Thickness 4.10 ± 0.08 mm, volume 0.86 ± 0.002 mm^3, weight 0.61 ± 0.001 gm) (Table - 2). While, the average dimensions of the right testis of the rabbits in first months age are (Length 23.17 ± 0.44 mm, Width 4.84 ± 0.08 mm,

Thickness 4.07 ± 0.09 mm, Volume 0.84 ± 0.003 mm³ and Weight 0.59 ± 0.002 gm) (Table - 3).

B. The testis in Group (B1) : The testis of group (B1) in the first month age have the elongated heart or bean - shaped with the yellowish - pink color, placed in a vertical direction in the abdominal cavity, a little in front of the inguinal region. The two testes of the same rabbits are a symmetrical as one of them, also more often the left is larger and longer. The gubernaculums which extendes through the iguinal canal to groin become short and swelled. The ventral extremities was slightly thicker than the proximal one, and was covered by the tail of the epididymis which was attached to it by the ligament of the epididymis. The testis was suspended by the proximal extremity to which the spermatic cord is attached (Fig - 1). The average dimensions of the right testis of the rabbits in first month age are (Length 22.73 ± 0.28 mm, Width 4.81 ± 0.10 mm, Thickness 4.07 ± 0.08 mm, Volume 0.81 ± 0.002 mm³, Weight 0.60 ± 0.001 gm) (Table - 3).

C. The testis in Group (B2): The testis of group (B2) in the first month age have the elongated heart or bean - shaped with the yellowish - pink color placed in a vertical direction in the abdominal cavity, a little in front of the inguinal region. The two testes of the same rabbits are a symmetrical as one of them, more often the left was larger and longer (Fig - 1). The testis enlarged rapidly as thick to provide the space into which the testis was descent later through the superficial ring of the inguinal canal, the testis in first month age was near or situated in trainguinal canal. The average dimensions of the left testis of the rabbits in first month age are (Length 22.92 ± 0.39 mm, Width 4.80 ± 0.04 mm and Thickness 4.10 ± 0.06 mm, Volume 0.80 ± 0.001 mm³ and weight 0.60 ± 0.003 gm) (Table - 2).

The Anatomical results of Testis in second month after performing the Unilateral Orchidectomy

The anatomical results for testis in second months included the following:

A. The testis in Group (A):

The testis of control group (A) in the second month age have a slight increase in their weight and grow sharply in their volume, about six times compare in the first month. The testis have elongated shape and located at these period in the inguinal canal and through the inguinal opening near to the developing scrotum and extra abdominal, the gubernaculums still connected to the caudal end of testis. The average dimensions of the left testis of the rabbits in second months age are Length 26.46 ± 0.45 mm, Width 5.76 ± 0.08 mm, and Thickness 5.72 ± 0.09 mm, Volume 1.18 ± 0.001 mm³, Weight 0.99 ± 0.002 gm) (Table - 2). While the average dimensions of the right testis of the rabbits in second months age are (Length 26.27 ± 0.35 mm, Width 5.74 ± 0.05 mm, Thickness 5.70 ± 0.08 mm, Volume 1.16 ± 0.002 mm³, Weight 0.97 ± 0.001 gm) (Table 3) .

B. The testis in Group (B1)

The average dimensions of the right testis of the rabbits in first month age are length 27.87 ± 0.42 mm, Width 6.69 ± 0.06 mm, Thickness 6.05 ± 0.06 mm, Volume 1.26 ± 0.002 mm³, Weight 1.08 ± 0.002 gm) (Table 4).

C. The testis in Group (B2)

The average dimensions of the left testis of the rabbits in first months age are Length 27.47 ± 0.37 mm, Width 5.96 ± 0.05 mm and Thickness 6.06 ±0.08 mm, Volume 1.23 ± 0.001 mm³, Weight 1.03 ± 0.002 gm) (Table 4).

The Anatomical results of Testis in Third month after performing the Unilateral Orchidectomy: The anatomical results for testis in Third months included the following :

A. The testis in Group (A):

The testis of control group (A) in the Third month age observed the rapid growth about seven

folds to the second month age. The testis become more bulky and has elongated oval shape. The testes completely situated within the scrotum, but pass easily between scrotum and abdominal cavity through the inguinal canal. The gubernaculum become more short and thick attach the caudal end of testis with the vaginal process. The average dimensions of the left testis of the rabbits in Third month age are Length 29.11 ± 0.39 mm, Width 6.76 ± 0.07 mm and Thickness 6.58 ± 0.06 mm, Volume 1.78 ± 0.003 mm^3, Weight 1.69 ± 0.002 gm) (Table 2). While, the average dimensions of the right testis of the rabbits in Third months age are Length 28.91 ± 0.36 mm, Width 6.74 ± 0.06 mm, Thickness 6.57 ± 0.04 mm, Volume 1.76 ± 0.002 mm^3, Weight 1.67 ± 0.001 gm (Table 4). The Anatomical results of Vesicular glands in first month before performing the Unilateral Orchidectomy.

The anatomical results for Vescular glands in first months included the following

A. The Vesicular glands in Group (A)

The anatomical structure of Vescular glands (seminal vesicle) in first months appears as short hallow sac like transparent membranous form, grey – yellowish in color. The gland located dorsally to the neck of bladder. The gland appears divided into two lobes by longitudinal groove which extend crainally and dorsally, internally most of the gland is unpaired, but there is narrow septum which divided the crainal end of the gland into two parts. The dorsal and cranial wall of the gland is thicker than ventral wall. The gland is dorsally related with rectum and ventrally with vas deferens. The caudal unpaired body of the gland narrowed caudally to form single ejaculatory duct which open into urethra. This part of gland was covered dorsally with proprostate gland.

The Anatomical results of Vesicular glands in Second month after performing the Unilateral Orchidectomy:

The anatomical result for Vescular glands in second months included the following

A. The Vesicular glands in Group (A)

The anatomical structure of Vescular glands (seminal vesicle) in second months appears as semi - transparent membranous form, pale yellowish – cream in color. The septum which present internally in the cranial part was slightly increased with the progressive months of age to extend caudo – dorsally. The cranial external groove becomes deeper than the fourth months age. The caudal part of the gland is covered by proprostate gland. The external surface of the gland is smooth and resembles the bladder, the internal septum becomes longer.

The Anatomical results of Vesicular glands in Third month after performing the Unilateral Orchidectomy. The anatomical results for Vescular glands in Third months included the following:

A. The Vesicular glands in Group (A)

The anatomical structure of Vescular glands (seminal vesicle) in Third months appears rapid growth compared to the second months about 23 fold because of accumulation of large amount of fluid in the lumen of gland due to a highly secretary activity. The present observations indicate that till this age, the seminal vesicles of rabbits are dormant but this exclusive increase indicating the onset of puberty. The gland in this age shows rubbery like structure, yellowish – grey in color and loss its transparency due to thickening the wall of the gland and proliferation of glandular epithelium. The gland grows cranially to cover most of the urinary blaader and ampulla of ductus deferens, especially when the urinary blaader is empty. The prostate gland covered about caudal half of the seminal vesicle. The internal septum gradually increase to reach the cranial third of the gland, therefore these third appears separated into two lobes and bulging, while the other part is present unpaired, flattened and narrowed to form the ejaculatory duct which open into the urethra. The current results are consistent with the results of Holtz and Foote (1978) and Kurtul *et al*. (2001) in the rabbits.

Anatomical results for Vescular glands in Fifth months included the following. The Anatomical results of Prostate Glands. The Anatomical results of Prostate glands in first month before performing the Unilateral Orchidectomy. The anatomical results for Prostate glands in first months included the following.

A. The Prostate glands in Group (A)

The Prostate glands in rabbits consisted from three parts which were the cranio dorsal proprostate (coagulative), the caudo dorsal prostate and the lateral paraprostate which were indistinct and located on the neck of bladder and urethra between seminal vesicle gland cranially and bulbourethral gland caudally. These results coincides with the results of Dyce *et al*. (2010) who referred that the prostatic complex in rodents. The proprostate gland in first month before performing the unilateral orchidectomy appears yellowish in color and seems very small lobe about (dimentions). Its located on the urethra between seminal vesicle cranially and prostate caudally, dorsally related with rectum and ventrally with urethra and ductus deferens. The cranial part of proprostate is covering the caudal part of seminal vesicle. The gland is surrounded by connective tissue when removed the dorsal surface appears smooth and has shallow longitudinal groove dividing the gland externally into two halves. This result coincides with Kurtul *et al*. (2001) which obtained the similar results in the rabbits accessory sex glands.

While the prostate gland in first month before performing the unilateral orchidectomy appears is cylindrical structure, light yellow in color and longer than proprostate gland, has (dimentions). The prostate gland located between proprostate cranially and separated from the bulbourethral gland caudally by deep groove. The cranial part of the gland overlying the caudal part of proprostate gland. These observations support the observations of Vilamairo *et al.* (2006) which showed the initial growth and form of prostate gland of adult wistar rat before resting period started from the fourth week.

The Anatomical results of Prostate glands in second month after performing the Unilateral Orchidectomy. The anatomical results for Prostate glands in second months included the following.

A. The Prostate glands in Group (A)

The proprostate gland in second month after performing the unilateral orchidectomy appears bilobed but it is difficult to distinguish between their two lobes because they are tightly adhered together and surrounded by the connective tissue capsule. In gland there is longitudinal groove extends along its dorsal surface regarded as the separator between these lobes. The (dimentions) (Table - 5). These results coincide with Al-saadi (2013) which showed the similar results of proprostate gland in male rabbits. While, the prostate gland in second month after performing the unilateral orchidectomy appears is pair of two lateral lobes compact together and surrounded by the same connective tissue capsule and has rectal impression along the dorsal surface of the prostate gland.

The Anatomical results of Prostate glands in Third month after performing the Unilateral Orchidectomy. The anatomical results for Prostate glands in Third months included the following.

A. The Prostate glands in Group (A)

The proprostate gland in third month after performing the unilateral orchidectomy appears is light yellow in color and glandular in structure. The development of dimentions in this age considered the indicator of preparation of puberty and high activity of the gland which affected by high level of androgen. These results which support the results of Cunha (1972) which showed the effect of androgen in development of proprostate gland male mice. While the prostate gland in third month after performing the unilateral orchidectomy appears is yellow color separated from proprostate gland cranially and bulbourethral gland caudally by connective tissue septum. These results that agrees with the results of Dimitrov (2010) in the male rabbits (Table - 5).

Table - 3: Body weight and measurements of rabbit testes at different months age of study groups (n=15)

Traits	Groups	Age (months)				
		1	2	3	4	5
Body weight (gm)	Control	707.13 ± 5.33 a	996.87 ± 7.48 a	1194.60 ± 6.18 b	1340.93 ± 9.26 b	1511.07 ± 12.20 b
	B1	702.60 ± 8.42 a	987.00 ± 10.13 b	1300.27 ± 9.37 a	1495.40 ± 12.12 a	1695.40 ± 13.03 a
Testis weight (gm) Right	Control	0.59 ±0.002 a	0.97±0.001 b	1.67±0.001 b	2.04±0.001 b	2.33±0.002 b
	B1	0.60 ±0.001 a	1.08 ±0.002 a	1.84 ±0.001 a	2.27 ±0.001 a	2.77 ±0.001 a
Testis vol. $(mm)^3$ Right	Control	0.84± 0.003 a	1.16 ± 0.002 b	1.76 ± 0.002 b	2.09 ± 0.001 b	2.40 ± 0.002 b
	B1	0.81 ± 0.002 a	1.26 ± 0.002 a	1.89 ± 0.003 a	2.40 ± 0.002 a	2.72 ± 0.002 a
Testis length (mm) Right	Control	23.17±0.44 a	26.27±0.35 b	28.91±0.36 b	33.11±0.40 b	40.43±0.47 b
	B1	22.73±0.28 a	27.87±0.42 a	30.51±0.33 a	36.60±0.38 a	51.51±0.41 a
Testis width (mm) Right	Control	4.84±0.08 a	5.74±0.05 b	6.74±0.06 b	7.80±0.09 b	8.54±0.05 b
	B1	4.81±0.10 a	6.69±0.06 a	7.50±0.08 a	8.68±0.05 a	9.68±0.07 a
Testis Thick (mm) Right	Control	4.07±0.09 a	5.70±0.08 b	6.57±0.04 b	7.73±0.06 a	8.95±0.07 a
	B1	4.07±0.08 a	6.05±0.06 A	7.61±0.06 a	7.97±0.09 a	8.74±0.06 b

The different small letters refer to significant differences at ($p \leq 0.05$) among groups in vertical column. The similar small letters refer to Non-significant differences at ($p \leq 0.05$) between groups in vertical column. 'n' refer to the number of the animals in each group. Values represent mean ± S.E.

Table – 4: Measurements of rabbit testes scrotum at different months age of study groups (n=15)

Traits	Groups	Age (months)				
		1	2	3	4	5
Scrotum weight (gm) Right	Control	0.12± 0.001 a	0.22± 0.001 a	0.39± 0.001 b	0.62± 0.001 b	0.83 ± 0.002 b
	B1	0.12± 0.001 a	0.28 ± 0.001 a	0.54 ± 0.001 a	0.89± 0.001 a	1.10± 0.002 a
Scrotum length (mm) Right	Control	4.11±0.06 a	26.01±0.40 b	27.08±0.42 b	29.49±0.55 b	39.54±0.44 b
	B1	4.10±0.05 a	26.84±0.37 a	30.32±0.39 a	35.83±0.42 a	47.67±0.46 a
Scrotum width (mm) Right	Control	2.07±0.03 a	5.42±0.05 b	6.49±0.08	7.11±0.09 b	7.83±0.08 b
	B1	2.09±0.06 a	6.02±0.07 a	6.55±0.09	7.94±0.07 a	8.94±0.08 a
Scrotum thick (mm) Right	Control	1.07±0.02 a	1.23±0.03 a	1.38±0.04 b	1.50±0.03 b	1.74±0.02 b
	B1	1.07±0.03 a	1.38±0.01 a	1.86±0.02 a	2.08±0.01 a	2.95±0.02 a

The different small letters refer to significant differences at ($p \leq 0.05$) among groups in vertical column. The similar small letters refer to Non-significant differences at $p \leq 0.05$ between groups in vertical column. 'n' refer to the number of the animals in each group. Values represent mean ± S.E.

Table - 5: Body weight and measurements of rabbit testes at different months age of study groups (n=15)

Traits	Groups	Age (months)				
		1	2	3	4	5
Body weight (gm)	Control	707.13 ±7.02 a	996.87 ±6.98 a	1194.60 ±7.44 b	1340.93 ±10.05 b	1511.07 ± 13.43 b
	B2	724.33±6.55 a	983.47±8.38 a	1216.80±8.49 a	1485.40 ± 11.17 a	1685.40 ± 12.27 a
Testis weight (gm) Lift	Control	0.61± 0.001 a	0.99± 0.002 a	1.69± 0.002 b	2.04 ± 0.003 b	2.35± 0.002 b
	B2	0.60 ± 0.003 a	1.03± 0.002 a	1.80± 0.001 a	2.18± 0.002 a	2.61± 0.002 a
Testis vol. $(mm)^3$ Lift	Control	0.86± 0.002 a	1.18± 0.001 b	1.78± 0.003 b	2.10± 0.002 b	2.41± 0.002 b
	B2	0.80± 0.001 a	1.23± 0.001 a	1.88± 0.002 a	2.30 ± 0.002 a	2.56± 0.001 a
Testis length (mm) Lift	Control	23.52±0.47 a	26.46±0.45 b	29.11±0.39 b	33.41±0.40 b	40.77±0.42 b
	B2	22.92±0.39 b	27.47±0.37 a	30.22±0.38 a	36.15±0.40 a	51.13±0.39 a
Testis width (mm) Lift	Control	4.88±0.07 a	5.76 ±0.08 b	6.76±0.07 b	7.82±0.10 b	8.57±0.08 b
	B2	4.80±0.4 a	5.96±0.05 a	7.39±0.05 a	8.54±0.04 a	9.57±0.05 a
Testis thick (mm) Lift	Control	4.10±0.08 a	5.72±0.09 b	6.58±0.06 b	7.75±0.09 a	8.97±0.07 a
	B2	4.10±0.06 a	6.06±0.08 a	7.47±0.06 a	7.79±0.07 a	8.57±0.05 b

The different small letters refer to significant differences at ($p \leq 0.05$) among groups in vertical column. The similar small letters refer to Non-significant differences at ($p \leq 0.05$) between groups in vertical column. 'n' refer to the number of the animals in each group. Values represent mean ± S.E .

The Anatomical results of Testis in first month before performing the Unilateral Orchidectomy

Fig. 1 for testes (a) 1 month age for (B1) group through orchidectomy by laparoscopy intra abdominal

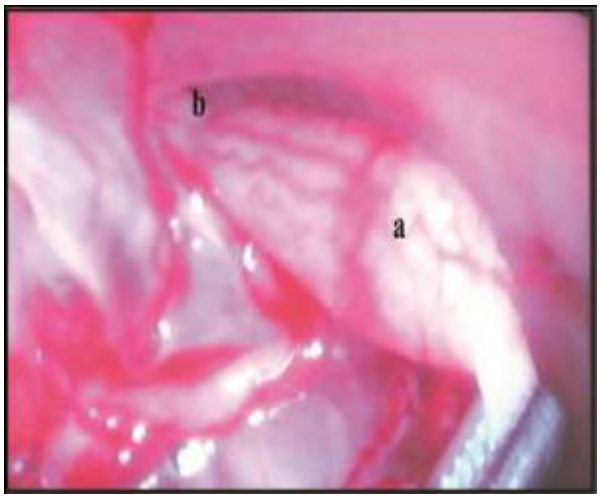


Fig. 2 for testes (a) 1 month age for (B2) group through orchidectomy by laparoscopy intra abdominal shows descending of testis in inguinal canal (b).

Fig. 3 for testes (a) 1 month age for (A) group shows kidney (b), urinary bladder (c), gubernaculum (d), part of inguinal canal (e).

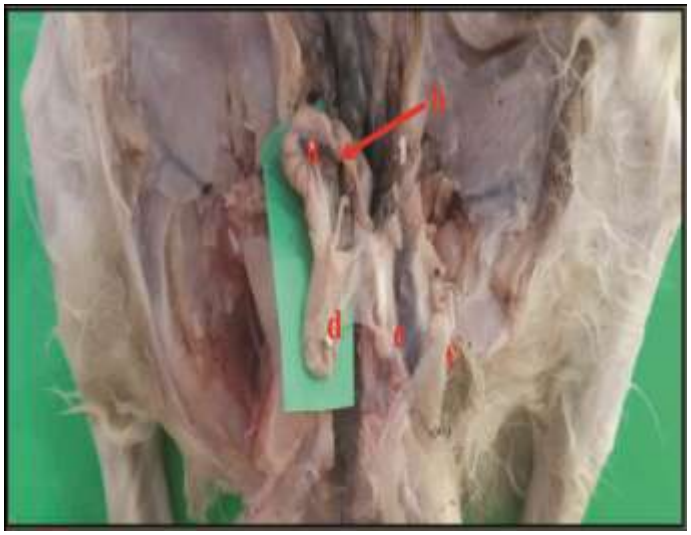


Fig. 4 for testes (a) 1 month age for (A) group shows epididymus (b), urinary bladder (c), gubernaculum (d), part of inguinal canal (e).

Fig. 5 for testes (a) 1 month age for (B1) group shows epididymus (b), urinary bladder (c), gubernaculum (d), Bulbourethral glands (e), rectum (f).

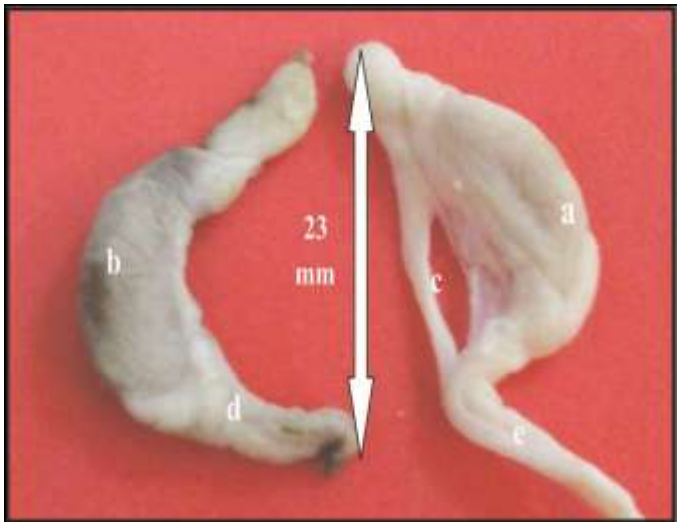


Fig. 6 for testes 1 month age for (A) group shows right testis (a) left testis (b), epididymus (c) , gubernaculum (d), ductus deferens (e).

4. References

1) Al - Khuzae, B. A. 2007. Study of seminferous epithelium and spermatogensis in adult (indogenous) ram. M. Sc. Thesis submitted to the College of Veterinary Medicine, University of Baghdad, Baghdad, Iraq.
2) Ali Omar, M. M., Hassanein, K. M. A., Abdel -Razek, A. K and Hussein, H. A. Y. 2013. Unilateral orchidectomy in donkey (*Equus asinus*): Evaluation of different surgical techniques, histological and morphological changes on remaining testis. *Veterinary Research Forum*, 4 (1): 1 – 6.
3) Archetti, I. G., Tittarelli, C. M., Cerioli, M. S., Brivio, R. N., Grilli, G. F. and Lavazza, A. H. C. 2008. Serum chemistry and hematology values in the commercial rabbits: preliminary data from industrial farms in the northern Italy. *American Journal of Physiology, Endocrinology and Metabolism*, 286: E909 - E915.

4) Ayfer, A. K., Yusuf, N. G. and Murat, A. N. 2007. The effect of Unilateral and Bilateral Epididymectomy on the Tastis of rats . *Biology Journal of Anatomy, Physiology and Reproduction,* 27 (3): 48 - 52.
5) Bacha, W. J and Wood, L. M. 1990. Color Atlas of Veterinary Histology. Lea and Febiger. Philadelphia, USA, pp. 189 - 191.
6) Bergh, A and Damber, J. E. 2008. Does unilateral orchidectomy influence blood flow, microcirculation and vascular morphology in the remaining testis. *International Journal of Science,* 14 (6): 453 – 460.
7) Boockfor, F. R., Barnes, M. A., Kazmer, G. W., Halman, R. D., Bierley, S. T., Dickey, J. F. 1990. Effects of unilateral castration and unilateral cryptorchidism of the Holstein bull on plasma gonadotropins, testosterone and testis anatomy. *Journal of Animal Science,* 56: 1376 – 1385 .
8) Danmaigoro, A. M., Onu, J. E., Sonfada, M. L., Umaru, M. A. and Oyelowo, F. O and Haggendal, J. 2014. The histology and histometric anatomy of the male reproductive system in the Bat (*Eidolon helvum*). Hindawi Publishing Corporation. *Journal of Histology,* 34: 59 - 68.
9) Dellmann, H. D. and Eurell, J. A. 1998. A Textbook of Veterinary Histology. 5th edition, Williams and Wilkins, A Waverly Company, Philadelphia, USA. pp. 226 - 235.
10) Hoagland, T. A., Ott, K. M., Dinger, J. E., Mannen, K., Woody, C. O., Riesen, J. W and Daniels, W. 1986. Effects of unilateral castration on morphologic characteristics of the testis in one, two and three year old stallions. *Theriogenology,* 26: 397 – 405.
11) Ivany, J. M., Anderson, D. E., Ayars, W. H., Monke, D. R., Wittum, T. E., Hull, B. I., Frazer, G and Jean, S. G. 2002. Diagnosis, surgical treatment before and after unilateral castration in breeding bulls: 21 cases (1989 - 1999). *Journal of Veterinary Medicine Association,* 15 (8): 1198 – 1202.
12) Johnson, L. F and Neaves, W. B. 2001. Enhanced daily sperm production in the remaining testis of the aged rats following the hemicastration. *Journal of Biology and Andrology,* 4: 162 – 166.
13) Kassab, M. F., Yanai, T. D., Ito, K. I., Sakai, F. H., Mesegi, T. A and Yanagisawa, M. S. 2009. The morphology and Lectin histochemistry study of the testes of brown - banded bamboo shark (*Chiloscyllium punctatum*). *Journal of Veterinary Anatomy, Histology and Embryology,* 2 (1): 49 – 66.
14) Marty , M. S., Chapin, R. E., Parks, L. G and Thorsrud, B. A. 2003. The development and structure of male reproductive system in the farm animals. *Biological Journal of Reproduction and Anatomy,* 10 (2): 125 – 136.
15) Maxwell, J. A. L. 2005. Equine hemi castration: Review of the condition, prevalence, etiology, diagnosis and surgical management. *Australian Journal of Veterinary and Animal Science,* 83: 203 - 207.
16) Morton, D. F. 1988. The use of rabbits in male reproductive toxicology, environmental health perspective. *Veterinary Journal of Immunology and Immunopathology,* 77 (4): 5 – 9 .
17) Morton, D. F. 1988. The use of rabbits in male reproductive system and toxicology. *Environmental Health Perspectives,* 32 (2): 5 - 9.
18) Oner , O. K and Mehmet, K. F. 2008. The histological investigation of testicular and accessory sex glands in ram lambs castrated or immunized against the recombinant GNRH fusion protein. *European Journal of Genetic Medicine,* 5 (1): 21 – 26 .
19) Robert, J. Y., Padley, A. D., Douglas, B. H., Dixon, M. G and Ruth, W. U. 2002. Effect of castration on endothelin receptors and the prostate glands. The Biochemical Society and the Medical Research Society. Clinical Sciences (2002). 103 (Suppl. 48), 442S – 445S (Printed in Great Britain). *Veterinary Medicine,* 92: 1061 - 1072.

20) Setchell, B. P. and Breed, W. G. 2006. The Anatomy, Vasculature and innervations of the male reproductive tract in mammals. Knobil & Neills physiology of reproduction. Third edition, Chapter – 17, 1: 771 - 817.
21) Suckow, M. A and Schroeder, V. G. 2010. The laboratory rabbits, Second edition, CRC Press, Taylor and Francisco Group, Indiana, U.S.A, pp. 1- 4.