# Stereological study of the mid piece of ductus epididymis *In human and other animal species*

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**الخلاصة**

دراسة مصلية للجزء الوسطي لقناة البربخ مابين الانسان البالغ ،الثيران،الخرفان،الماعز،الجاموس حيث تمت باستخدام التقنيات النسيجية الاعتيادية.

العوامل المصلية التي حدثت هي كالتالي : ارتفاع الخلايا النجمية الهدبية ،ارتفاع الخلايا الطلائية ، سمك جدار العضلة ،قطر التجويف والانبوب البرزخي.

كان ارتفاع الخلايا النجمية الهدبية في الانسان لقناة البربخ اقصر مما هو عليه في الماعز فقط واعلى بالمقارنة مع الثيران والماعز في كلا عاملي ارتفاع الخلايا الطلائية وسمك الجدار للعضلة اما قطر القناة في الانسان اصغر مقارنتا في الحيوانات الاخرى.

استنتج من هذا ان كل العوامل المدروسة لهذا الجزء من البربخ في الانسان يختلف بصورة معنوية عن الحيوانات الاخرى بتركيبه الدقيق ومحتوى التجويف .

الدراسة الحالية ايضا بينت كيفية الحصول على نتائج تركيبية من خلال القياسات الدقيقة النسيجية للانسجة والخلايا التي يمكن تمييزها عن الخلايا في الانسان او الحيوانات الاخرى لقناة البربخ.

**Abstract**

A stereological study of a (middle piece) of ductus epididymis between normal adult human, bulls, rams, goats and buffalos was conducted using routine histological techniques. The following stereological parameters were determined; Stereocilia height, epithelial height, muscular wall thickness, lumen and tube diameters. The human epididymal stereocilia height is shorter than in goat only and higher than bulls and goats in both the epithelial height and muscular wall thickness. Human ductile diameter is smaller than in other animals. In conclusion, all human epididymal mid piece parameters in the present study differ significantly than in the other animals. Because human epididymis differs from other animals in fine structure and luminal contents, the present stereological study shows how structural data obtained from histological micrographs of the intact tissue and cells can be different between human and other animals mid peiece ductus epididymis.

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## Introduction

The epididymis is part of the male reproductive system and is present in all male mammals. It is a narrow, tightly coiled tube connecting the efferent ducts from the rear of each testicle to its vas deferens ‹**1**›. The animal epididymis was known to play an essential role in the acquisition of motility and fertilizing capacity of testicular spermatozoa‹**2**›.The epididymal functions of transporting, concentrating, maturing, and storing sperm are important to male fertility and their absence or significant impairment can be a factor in male infertility ‹**3**›. The histogenesis of the wall of the tubules of the epididymis completed earlier as compared to the histogenesis process in the calves testis by the age of eight months ‹**4**›. The epididymal epithelium of most species has at least 6 different cell types: principle cells, clear cells, narrow cells, apical cells, and halo cells, all of which differ in relative abundance depending on the epididymal region and species studies ‹**5**›. The true epididymal tubule in the middle piece has a columnar epithelium with microvilli projecting into the tubule lumen. Microvilli provide a huge increase in luminal membrane surface area that may be important in providing area for cell surface receptors, transport channels, and even membrane for endocytotic events ‹**6, 7**›. Even thought the human epididymis differs from that other animals in fine structure and luminal contents, its function is similar in that spermatozoa gain motility and fertilizing capacity during their passage through it ‹**8, 9**›**.** The epididymis of mammalian was divided into initial, middle, and terminal segments, according to ‹**10**›. Each of these regions has structural and cytological characteristics that differentiate one segment from the other ‹**11**›. In contrast to many laboratory animals, the epididymides of monkeys and man have less variation in the diameter of the duct ‹**12**›.

This stereological study is concerned with attempts to measurement of epididymis mid piece in human and ruminants, which has not been reported previously with some histological features.

## Material and Methods

Epididymis of twenty sexually mature Bulls, Rams, Buffalo and Goats were obtained from Al-Ashar- Basra Center Slaughterhouse during winter season. Representative samples were removed from epididymis, middle piece region and fixed in solution of 10% Formaldehyde buffered as shown in this diagram.

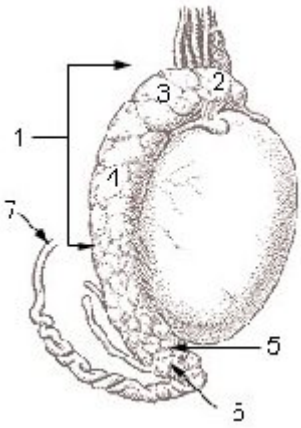


**Diagram* shows;**
**Mid. piece of Epididymis (1)**
**Head 2&3. Tail 6&5. Tail 7.**
*** taken from Wikipedia**

A major difficulty in obtaining specimen of human epididymal tissue, in our country that is suitable for this research, therefore human epididymal samples were taken from the different sets of histology slides (mid piece) already present in the department for teaching purposes. The samples were dehydrated, embedded in paraffin, and sectioned at (3-5µ), stained by methylen blue, hematoxylen and eosin and obtained for examination by light microscope with screen (Reichert Austria Nr. 381 116), and scientific plastic ruler as follow:

1- Transparency paper was placed over the screen of the microscope.
2- By using rotting variant pen (0.1) the cross section of the whole wall of the ductus epididymis was drown.
3- The wall, lumen and thickness of the muscular wall, sterocilia height

were also drowning. All measurements are relative to a cubic centimeter.

**Results**

The general structure of the human epididymis is similar to that in other animals. The true epididymal tubule of the middle segment is large in diameter; it has a tall, columnar epithelium of regular height. Epididymis is lined by pseudostratified columnar epithelium composed of rounded basal cells and principal columnar cells. Dense regular microvilli line the lumen and spermatozoa as shown in the figure below.

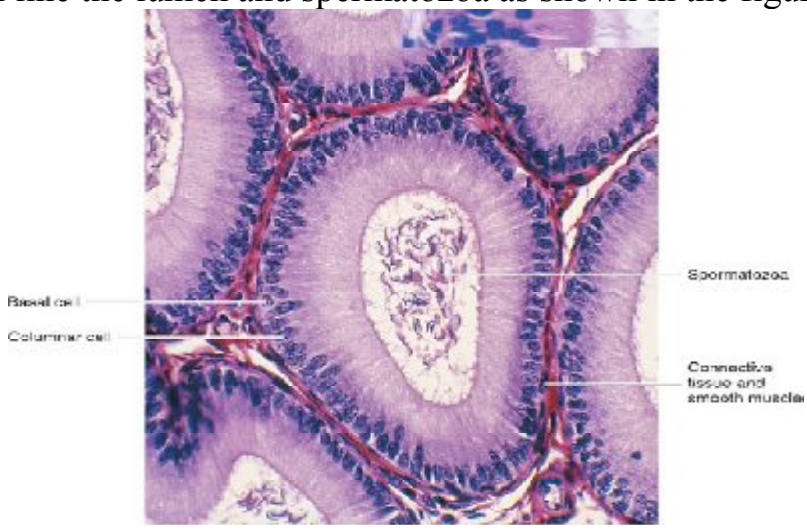


**Figure: shows human epididymis (mid piece), Philip Harris Biological.**

The following stereologic measurements of mean values and standard deviation of human and (20) samples of different animals taken from mide-pieces of epididymis were determined as shown in following table.

**Table: Stereological measurement of mid-piece of epididymis of human and other animals. Mean values in (μ).**

| Species | Sterocilia height Mean±S.D | Epithelia height Mean±S.D | Muscular wall Mean±S.D | Lumen diameter Mean±S.D | Mean±S.D |
|---|---|---|---|---|---|
| Human | 17.02±1.9* | 57.52±2.6* | 25.88±2.2* | 117.9±3.1* | 318.8±3.1* |
| Buffalo | 15.13±1.4 | 55.69±2.9 | 24.59±1.3 | 160.8±3.4* | 351.1±3.8* |
| Bull | 15.08±2.2 | 37.71±2.7* | 19.86±2.7* | 152.7±2.1* | 293.9±3.1 |
| Goat | 22.98±2.5* | 38.21±2.4* | 20.85±2.8* | 171.2±4.1* | 335.3±4.2* |

| | | | | | |
|---|---|---|---|---|---|
| Ram | 19.20±1.4 | 55.63±2.8 | 22.27±2.6 | 164.2±3.9* | 358.4±2.6* |

*** Significant (p <0.05)**

Long and slender stereocillia projection from the apical borders of the cells in the middle segment in human and other animals were shown. Stereologically the mean and standard deviation (Mean±S.D) of Stereocilia height (middle-piece) of human epididymis are (17.02±1.9) and show significant decrease than in goats (22.98±2.5), (p <0.05). While, significantly increased in epithelial height (57.52±2.6) as compared with bulls and goats (37.71±2.7 &38.21±2.4), (p <0.05) respectively. Human muscular wall of epididymis (middle piece) contained three layers of smooth muscle cells and measured (25.88±2.2) and significantly thicker than in bulls & goats (19.86±2.7 & 20.85±2.8), (p <0.01) respectively. Both diameter of (lumen & tube) in human epididymis were significantly lesser than in all other animals (p <0.05) except the tube diameter in bulls.

## Discussion

Moore and Pryor‹**12**›, and Pryor, ‹**8**›, reported in their studies, that human epididymis differs from the other animals in fine structure and luminal contents, even their function is similar in that spermatozoa gain motility and fertilizing capacity during their passage through ductus epididymis. To confirm these differences, stereological measurement of the length of stereocilia, epithelial height, muscular wall thickness, diameter of lumen of the (middle piece) of epididymis were established in present study.

The Mean and S.D of human stereocilia height was significantly shorter than in goat, while it was similar to other animals. As mentioned by Tingari**,** ‹**13**› the interspaced between the microvillus were micropinocytotic vesicles, which commonly become detached from the surface and lodged, in the apical cytoplasm in the proximal part of the middle segment for absorption of excess of fluid. In a number of laboratory species, 75%-95% of fluid reabsorbed by the time the transported spermatozoa in epididymis ductile ‹**14, 15**›. Although direct measurements of fluid reabsorption have not been made in the human epididymis, histological evidence substantiates that the human efferent

ducts and proximal epididymis also concentrate spermatozoa in the tubule lumen. Our explanation indicates that, the absorptive rate in the epididymus was lower in human and other animals as compare to goat.

The principal cells were the main component of the epithelial lining of the epididymis (middle piece). These cells, which extended from the basal lamina to the lumen, were very thin and exceedingly long. Heights of these cells were significantly longer in human and bulls than the other animals as shown in the table. These variation may explained the high degree of maintenance of these tissues in human and bull with regard to both form and function requires lumicrine secretions of the testis as mention by **‹14, 15›**. In addition, human leyding cells of the testicular interstitium produce androgens, which are required for the support of many epididymal features from morphology to individual gene expressions **‹5›** that could be made a variation in different species.

Our result indicate the (Mean±S.D) of human muscular wall thickness were significantly greater than in other animals, while the (Mean±S.D) of lumen diameter and the tube of epididymis of human were less significant than the other animals. These results goes with the finding of Turner, **‹3›,** that the rate of sperm movement through the epididymis might be more important than is generally recognized because the concentration of secreted or absorbed molecules in any luminal fluid is a function of epithelial transport activities of epididymis and the time the intraluminal fluid is exposed to those activities. In human, the sperm transport time spends in the epididymis is relatively short as compared with the other animals **‹5›**. These finding is in agreement with studies with the present stereological measurements of epididymis as related with the physiological processes.

In conclusion, these observations shows that although there are n some similarities between human epididymis (middle part) and that of other animal species, there are differences in stereological measurements that emphasis the need to verify animal observations in the human.

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