

COMPARATIVE STUDY OF PROSTATIC UTRICLE IN RAT, RABBIT, DOG AND MAN

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ABSTRACT:

The prostatic utricle is one of the auxiliary glands associated with the genital duct systems in males. In man it is described as a blind pouch about 6mm long, situated in the median lobe of prostate, opens into the urethra in the median line of colliculus seminalis; and contains mucous glands and smooth muscle fibres. It is a vestigial structure representing the lower fused segments or remnants of Mullerian or paramesonephric ducts and analogous to uterovaginal canal in female.

There is no constant view about the presence and the structure of prostatic utricle in different animals so it is essential in the field of research of genital accessory glands to have an accepted view about the presence, the structure and the nature of secretion of prostatic utricle in animals.

The present work simply provides general architecture, level of opening and nature of secretion of the prostatic utricle by histological observations with various stains on total 15 animals. The prostatic utricle was identified in all the studied animals; however it varied in its size, shape and structure. Proportionally the largest prostatic utricle was found in rabbit where it was a large elongated pouch with mucosa, submucosa and muscular coats; situated behind the prostate and opened at the median line of posterior wall of prostatic urethra. The prostatic utricle in man and dog was in the form of an elongated cavity with numerous glands; embedded in the urethral crest and opened at the median line of posterior wall of prostatic urethra. In rat it was a minor structure in the form of a few tubules in the substance of urethral crest and opened at the either side of median line of posterior wall of prostatic urethra. The secretion of mucoprotein nature was seen in the prostatic utricle and its glands; in all these studied animals.

Key words: Utricle, pouch, utriculus, vesicular, ampullary

INTRODUCTION

The auxiliary glands associated with the genital duct system in males are the prostate, the prostatic utricle, the seminal vesicle, the bulbourethral or Cowper's gland, the coagulating gland and the ampullary glands. All these accessory sex glands are not present in all mammals. The only accessory gland present in males of all species of mammalians is the prostate but there is no constant view about the presence and the structure of the prostatic utricle. The **prostatic utricle** (*sinus pocularis*) forms a cul-de-sac about 6 mm. long, which runs upward and backward in the substance of the prostate behind the middle lobe. Its walls are composed of fibrous tissue, muscular fibers, and mucous membrane, and numerous small glands open on its inner surface. It was called by Weber the **uterus masculinus** from its

being developed from the united lower ends of the atrophied Mullerian ducts, and therefore homologous with the uterus and vagina in the female¹. When present it may be very small as in boar dog and cat or may be well developed as in stallion and bull. It may end blindly or may open on the colliculus seminalis. Its structure may be quite simple or well developed having all the layers of uterus². The prostatic derivatives have been the source of much confusion due to the grouping together of glands of quite different structure and function³. If only two accessory glands are present in previously uninvestigated species, one is designated the prostate and the other the seminal vesicle, without careful exploration of the connection of ducts or of gland structure⁴. By different authors the prostatic utricle has been named as *sinus pocularis*, utriculus prostaticus, vesicular prostatica, uterus masculinus and vagina masculina etc.

Considering the variations at all levels it seemed worthwhile to take up this study as a prelude

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to any type of experimental work. Though the present work simply provides the first hand knowledge about general architecture, level of opening and nature of secretion of the prostatic utricle but it will definitely form a base for undertaking further experimental studies.

MATERIALS AND METHODS

The study was done in sexually mature young rat, rabbit, dog and man. Total 15 animals were used, comprising 7 rats (albino), 3 rabbits, 3 dogs and 2 men. The prostate and prostatic utricle was studied separately in the common specimens.

The prostate along with associated parts of urinary bladder, urethra, seminal vesicles and vas deferentia was dissected out from suprapubic approach in men aging 25-30 from the autopsy cases soon after their death. The same specimens from rats, rabbits and dogs were obtained again from the suprapubic approach after sacrificing them by using anesthesia, the injection of thiopentone sodium to dogs and anesthetic ether to rats and rabbits, opening their chest wall and heart, infusing them by 10% formal saline after washing blood with normal saline.

The specimens were grossly observed and then photographed before subjecting them to routine histological processing. Because of large size, the prostate in man was divided into three parts by two sagittal sections one on each side of the urethra, and middle part was taken for processing. The tissues collected in this manner were fixed in 10% formalin, dehydrated in ascending grades of alcohol, cleared in methyl benzoate overnight and then for ½ an hour in benzene prior to wax impregnation. To get transverse sections blocks were cut craniocaudally at the microtome at 7 micron thickness and every 4th section was taken for microscopic examination.

Hematoxylin and Eosin stained slides were examined craniocaudally under binocular light microscope to study the general architecture of prostatic utricle and other associated structures. The other stains used were Van Gieson's and Masson's trichome to study the proportion of the collagen and the muscle fibres in the connective tissues; and PAS, Toluidine blue and Alcian blue to study the nature of the secretions.

OBSERVATION

Rat- Macroscopically the lower posterior aspect of urinary bladder showed vas deferentia,

seminal vesicles and prostate. No gross lobation of the prostate was observed (Fig.1). Microscopically in craniocaudal examination the upper slides showed urinary bladder, vas deferentia and seminal vesicles from before backwards. Caudally the vas deferens and seminal vesicle united to form common ejaculatory duct on each side. The ducts of various lobes of prostate were seen converging caudally towards the posterolateral parts of prostatic urethra to open into it (Fig.2). The urethral crest was seen as a conical projection from the posterior wall of prostatic urethra. This urethral crest contained prostatic utricle in the form of few small tubules lined by the simple cuboidal epithelium. These tubules gradually approached towards the apex of urethral crest and ultimately opened on its both sides at or slightly below the level of opening of common ejaculatory ducts. Some of these prostatic utricle tubules showed acidophilic secretion in their lumen (Fig.3).

Rabbit- Macroscopically one notable feature was that no seminal vesicle like structure was associated with the vas deferentia on the posterior aspect of urinary bladder, instead there was a median large thick cylindrical structure or elongated pouch with apical notch behind the prostate. Between the cylindrical structure and the posterior aspect of urinary bladder were lying vas deferentia. No gross lobation of prostate was observed (Fig.4). Microscopically in craniocaudal examination the upper slides showed urinary bladder and vas deferentia only. Caudally the prostatic utricle appeared behind the vas deferentia as a median large bilobed chamber with a thin connective tissue septum but little caudally septum disappeared and a common chamber was seen having mucous, submucous & fibromuscular coats from within outside. The lining epithelium of this chamber was simple columnar showing frequent dipping into the subendothelial tissue forming simple and branched tubular mucosal glands. Caudally with the appearance of prostatic lobes posterior to this chamber, the cavity of the chamber was seen reducing in size and flattening anteroposteriorly (Fig.5). More caudally the cavity of the prostatic utricle showed a projection anteriorly into the tissue between two vas deferentia, into which both vas deferentia gradually merged and then opened one on each side (Fig.6). Ultimately the cavity of prostatic utricle opened at the median line of posterior wall of prostatic urethra at the level just cranial to the openings of prostatic ducts. The cavity of prostatic utricle showed acidophilic secretion in its lumen.

Dog: Macroscopically no seminal vesicle like structure was associated with the vas deferentia on the posterior aspect of urinary bladder. Grossly two pairs of prostatic lobes were observed (Fig.7). Microscopically in the prostatic part of urethra the urethral lumen was seen 'U' shaped with convexity anteriorly due to prominent urethral crest. Central region of the urethral crest was traversed by an elongated lumen of the prostatic utricle in the median line, between the terminal parts of two vas deferentia and their glands (Fig.8). There was no clear distinguishing demarcation between the fibromuscular tissue subjacent to mucosa of prostatic utricle and that of urethral crest; and so it seemed that the wall of prostatic utricle in dog has only mucosa. Caudally near the colliculus seminalis the prostatic utricle was seen surrounded by a group of mucosal glands (Fig.9). Ultimately more caudally the prostatic utricle opened at the posterior wall of prostatic urethra just lateral to the summit of colliculus seminalis at the level of openings of vas deferentia. The lining epithelium of prostatic utricle and its glands was stratified cuboidal. Some of the glands of prostatic utricle showed acidophilic secretion in their

lumen.

Man: Macroscopically lower posterior aspect of urinary bladder showed vas deferentia, seminal vesicles and prostate. No gross lobation of the prostate was observed (Fig.10). Microscopically in the prostatic part of urethra the urethral lumen was seen 'U' shaped with convexity anteriorly due to prominent urethral crest. Central region of the urethral crest was traversed by an elongated lumen of the prostatic utricle in the median line, between the terminal parts of two common ejaculatory ducts (Fig.11). There was no clear distinguishing demarcation between the fibromuscular tissue subjacent to mucosa of prostatic utricle and that of urethral crest; and so it seemed that the wall of prostatic utricle in man has only mucosa. The prostatic utricle showed the numerous mucosal glands. Caudally the prostatic utricle opened at the median line of posterior wall of prostatic urethra, on the summit of colliculus seminalis at the level of opening of common ejaculatory ducts. The lining epithelium of prostatic utricle and its glands was stratified columnar. Some of the glands of prostatic

Conclusion: Comparative study of the prostatic utricle in tabular form:

Sl.No.	Features	Rat	Rabbit	Dog	Man
1.	Structure and Size-	In the form of very small tubules.	Large median elongated pouch with apical notch.	Small median elongated cavity with numerous mucosal glands.	Small median elongated cavity with numerous mucosal glands.
2.	Situation-	Embedded in the urethral crest.	A separate entity whose only lower part is surrounded by prostate.	Embedded in the urethral crest.	Embedded in the urethral crest.
3.	Wall of utricle showed-	Only mucosa.	Mucosa, submucosa and fibromuscular coats.	Only mucosa.	Only mucosa.
4.	Lining epithelium-	Simple cuboidal.	Simple columnar.	Stratified cuboidal.	Stratified cuboidal.
5.	Level of opening-	At or slightly below the level of opening of common ejaculatory ducts on both sides of median line.	Slightly cranial to the level of opening of prostatic ducts on the median line.	At or slightly below the level of opening of vas deferentia beside the median line.	At or the level of opening of common ejaculatory ducts on of median line.
6.	Seminal Vesicle-	Present	Absent	Absent	Present
7.	Secretion and its nature-	Present and mucoprotein in nature.	Present and mucoprotein in nature.	Present and mucoprotein in nature.	Present and mucoprotein in nature.

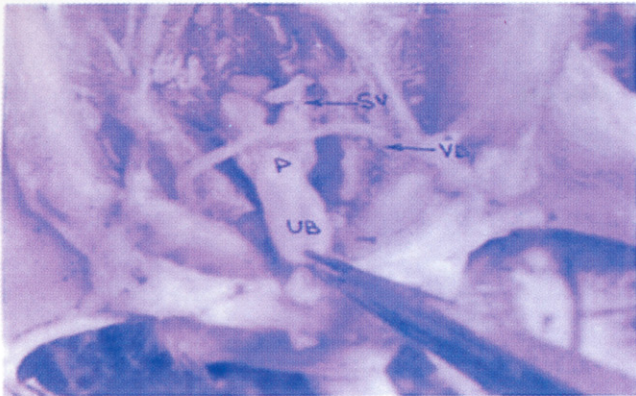


Fig.1 Dissection of lower abdomen of rat showing posterior aspect of prostate (P), urinary bladder (UB), vas deferentia (VD) and seminal vesicles (SV)

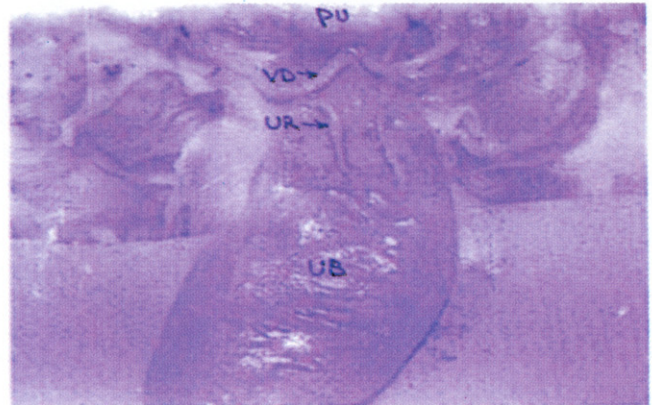


Fig.4 Dissection of lower abdomen of rabbit showing posterior aspect of urinary bladder (UB), ureters (UR), vas deferentia (VD) and a large median prostatic utricle (PU).

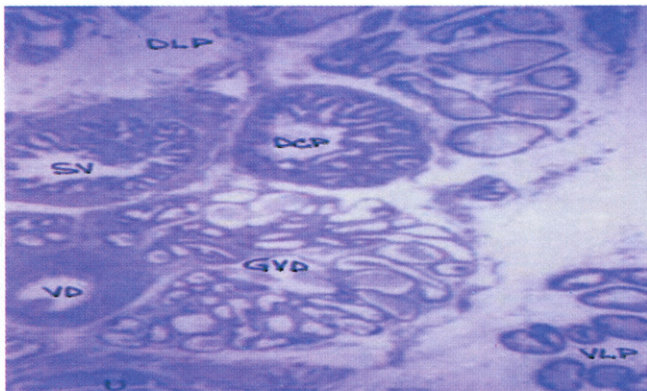


Fig.2 Photomicrograph showing parts of dorsocranial (DCP), dorsolateral (DLP) and ventrolateral (VLP) lobes of prostate, seminal vesicle (SV), vas deferens (VD) with its associated glands (GVD) and urethra (U). (Rat, H&Ex100)

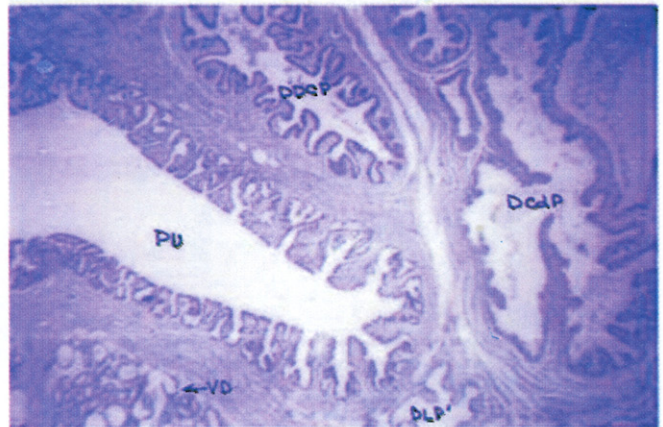


Fig.5 Photomicrograph showing ducts of dorsocranial (DDCP) & lateral prostate (DLP'), parts of dorsocaudal prostate (DCdP), prostatic utricle (PU) and vas deferens (VD). (Rabbit, H&Ex100).

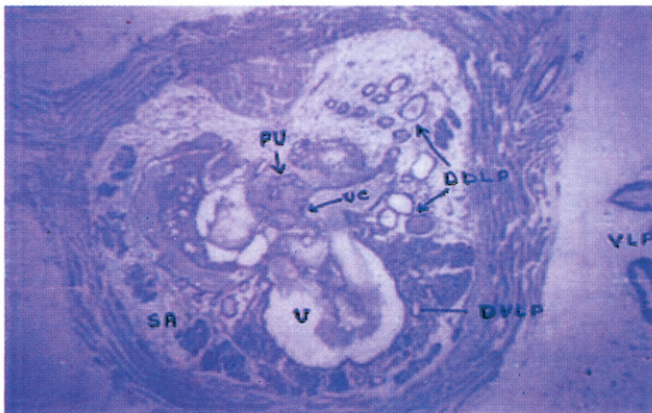


Fig.3 Photomicrograph showing prostatic utricle (PU) in the form of few tubular structures in the urethral crest (UC), common ejaculatory ducts (CED) merging in the urethra (U), ducts of dorsolateral (DDLp) & ventrolateral prostate (DVLp) and serous acini (SA) around the urethra. (Rat, H&Ex100).

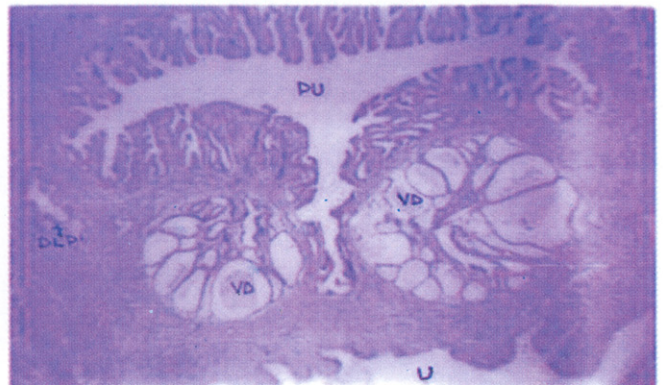


Fig.6 Photomicrograph showing vas deferentia (VD) merging into prostatic utricle (PU), duct of lateral prostate (DLP') and a part of urethra (U). (Rabbit, H&Ex100)

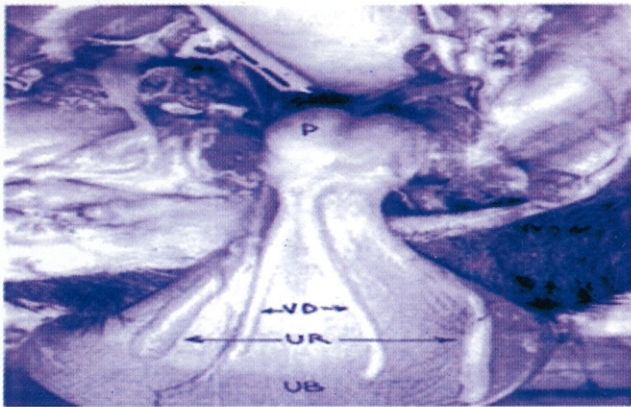


Fig.7 Dissection of lower abdomen of dog showing posterior aspect of prostate (P), vas deferentia (VD), ureters (UT) and urinary bladder (UB)

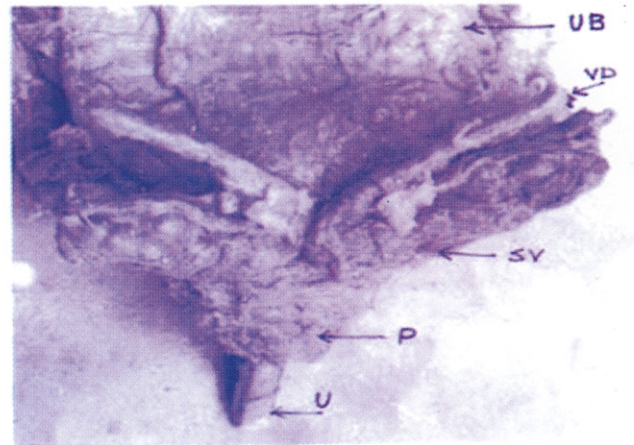


Fig.10 Dissection of lower abdomen of man showing posterior aspect of urethra (U), prostate (P), seminal vesicles (SV), vas deferentia (VD) and urinary bladder (UB).

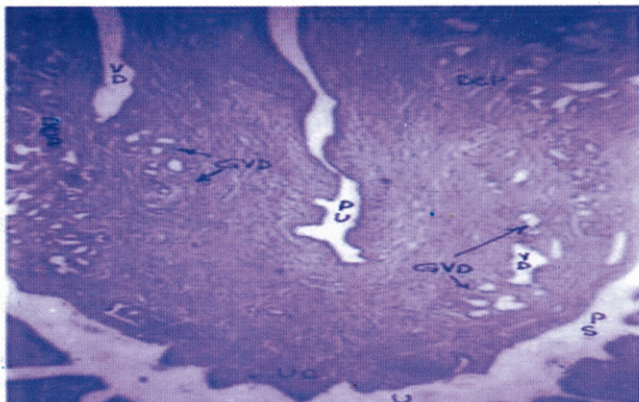


Fig.8 Photomicrograph showing part of urethra (U), prostatic sinus (PS), vas deferentia (VD) & its glands (GVD), dorsocranial prostate (DCP) and prostatic utricle (PU) as an elongated cavity in the urethral crest (UC). (Dog, H&Ex100).

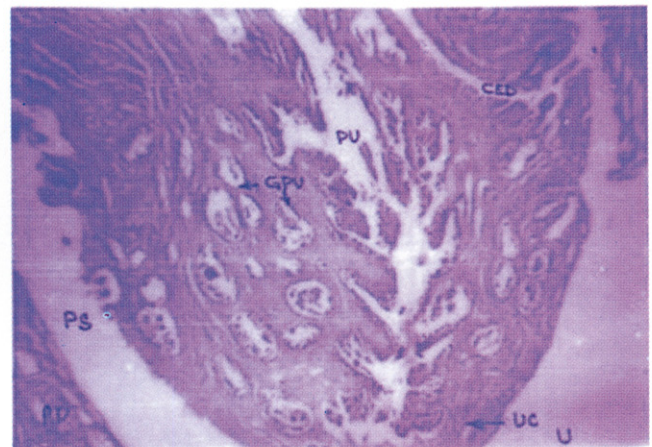


Fig.11 Photomicrograph showing an elongated cavity the prostatic utricle (PU) & its glands (GPU) in the urethral crest (UC), opening of common ejaculatory duct (CED) & prostatic ducts (PD) in the urethra (U) in the prostatic sinus (PS). (Man, H&Ex100)

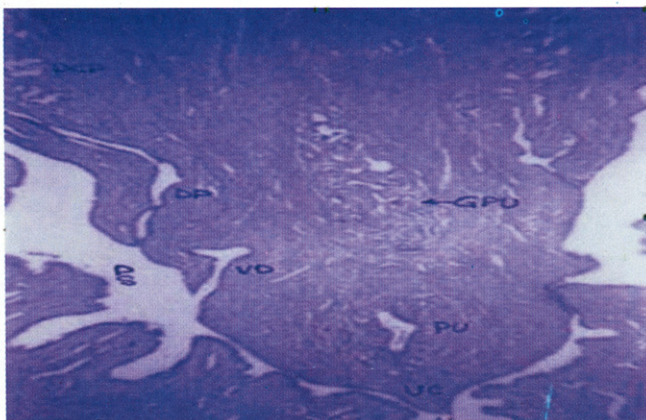


Fig.9 Photomicrograph showing part of urethra (U), dorsocranial prostate (DCP) & its duct (DP), opening of vas deferens (VD) in prostatic sinus (PS) and shifting of prostatic utricle (PU) and its glands (GPU) towards summit of urethral crest (UC) to open. (Dog, H&Ex100).

utricle showed acidophilic secretion in their lumen.

The Van Gieson's & Masson's trichome stains showed the proportion of collagen & muscle fibres more or less equal in the connective tissue surrounding the prostatic utricle and in the fibromuscular stroma of prostate, in all the studied animals.

The secretion in the prostatic utricle as well as its glands in all the studied animals was similar to that present in the prostatic follicles and showed similar staining characteristics with special stains used. The secretion was PAS positive, Alcian blue negative and showed Metachromatic staining with Toluidine blue.

DISCUSSION

The prostatic utricle was identified in all the studied animals in this study however its size, shape and structure differed as mentioned earlier by Cole and Cuppus² although they have not specified about its epithelium, level of opening and secretion. Proportionally the largest prostatic utricle was found in rabbit where it was a large elongated pouch with mucosa, submucosa and muscular coats, situated behind the prostate. The prostatic utricle in man and dog was in the form of an elongated cavity embedded in the urethral crest. In rat it was a minor structure in the form of a few tubules in the substance of urethral crest.

In **rats**, the prostatic utricle was seen embedded in the substance of urethral crest, in the form of a few small tubular structure lined by simple cuboidal epithelium. Caudally these tubules gradually approached the apex of urethral crest and ultimately opened on its both sides at or slightly below the level of openings of common ejaculatory ducts. Some of these tubules showed acidophilic secretion in their lumen. Hebel and Stromberg⁵ in their memoirs on rat had not mentioned about the presence of prostatic utricle in the laboratory rats studied by them but Cole and Cuppus² have commented about the prostatic utricle that when present it may be very small as in boar, dog and cat or may be well developed as in stallion and bull. It may end blindly or may open on the colliculus seminalis and its structure may be quite simple or well developed having all the layers of uterus. Author's finding of prostatic utricle in rats in the form of a few small tubular structures, is in consonance to their comments.

In **rabbits**, the prostatic utricle was seen behind the prostate as a median large thick cylindrical structure or pouch with an apical notch. Its wall presented three coats as mucous, submucous and fibromuscular from within outside. Caudally the prostatic utricle showed an anterior projection into which both vas deferentia gradually merged one on each side. Ultimately the cavity of prostatic utricle opened into the posterior wall of urethra in the median line at the level little cranial to the openings of prostatic ducts. The cavity of prostatic utricle showed acidophilic secretion in its lumen. This median cylindrical structure/pouch/chamber had been labelled as seminal vesicle or utriculus masculinus by

Parker and Haswell⁶ but as this median chamber opened in the posterior median line of prostatic urethra; it must be prostatic utricle/utriculus masculinus and not the seminal vesicle which ought to arise from the vas deferens⁷ and a bilateral structure. Although the lumens of vas deferentia merged into the caudal part of this chamber before it opened into the prostatic urethra but it did not seem that this chamber has arisen from the vas deferentia. The terminal part of this chamber i.e. caudal to opening of vas deferentia did not resemble the vas deferentia structurally and favored author's opinion. If only two accessory glands are present in previously uninvestigated species, one is designated the prostate and the other the seminal vesicle, without careful exploration of the connection of ducts or of gland structure⁴. So according to structure and careful exploration of its duct author was in opinion that this median structure is the prostatic utricle and not the seminal vesicle. The prostatic utricle when present it may be very small as in boar, dog and cat or may be well developed as in stallion and bull. It may end blindly or may open on the colliculus seminalis and its structure may be quite simple or well developed having all the layers of uterus². Their comments have favored Author's opinion. The finding of prostatic utricle in rabbits in the form a median large thick cylindrical structure or pouch is in consonance to their comments.

In **dogs**, the prostatic utricle was seen embedded in the substance of urethral crest between the terminal portions of two vas deferentia, as an elongated median cavity associated with some glands. The cavity was compressed from side to side and lined by stratified cuboidal epithelium. Caudally the prostatic utricle gradually approached the apex of urethral crest and ultimately opened on the posterior wall of urethra just beside the colliculus seminalis, at or slightly below the level of opening of the vas deferentia. Some of the glands of prostatic utricle showed acidophilic secretion in their lumen. The prostatic utricle that when present it may be very small as in boar, dog and cat or may be well developed as in stallion and bull. It may end blindly or may open on the colliculus seminalis and its structure may be quite simple or well developed having all the layers of uterus². They had mentioned the presence of prostatic

utricle in dog in the form of a small compressed sacculle but had not specified its lining epithelium, secretion and level of opening. The author's finding of prostatic utricle in dogs in the form of an elongated median cavity associated with some glands is in consonance to their comments.

In men, the prostatic utricle was seen embedded in the substance of urethral crest between the terminal portions of two common ejaculatory ducts, as an elongated median cavity associated with numerous glands. In man, the authors found no clear distinguishing demarcation between the fibromuscular tissue subjacent to mucosa of prostatic utricle and that of urethral crest and so it seemed that the wall of prostatic utricle in man has only mucosa like in rat and dog; however Susan Standring [1] have described that the utricle is stated to be composed of mucous membrane, muscular fibres and fibrous tissue. Author observed the utricle and its glands lined by stratified columnar epithelium; and caudally the prostatic utricle gradually approached the apex of urethral crest and ultimately opened at the summit of colliculus seminalis at the level of opening of common ejaculatory ducts. Some of the glands of prostatic utricle showed eosinophilic secretion in their lumen. Bloom and Fawcett⁸ and Williams and Warwick⁹ have also mentioned the presence of prostatic utricle & its glands, however the epithelium has been described by Bloom & Fawcett only as similar to that of prostatic follicles i.e. simple columnar with some patches of ciliated columnar. In present study the author found the lining epithelium of prostatic utricle & its glands, similar to that of prostatic ducts i.e. stratified columnar which was inconsonance to finding by Bloom & Fawcett. Comments of Cole & Cuppus² that the prostatic utricle may end blindly or may open on the colliculus seminalis and its structure may be quite simple or well developed having all the layers of uterus, have favored the author's finding of prostatic utricle in men in the form of as an elongated median cavity associated with numerous glands opening on the colliculus seminalis.

In this study the Van Gieson's & Masson's trichome stains showed the proportion of collagen & muscle fibres more or less equal in the connective tissue surrounding the prostatic utricle and in the fibromuscular stroma of prostate in all the studied animals however this finding could not be correlated as there were no specification regarding this point in the available literatures.

The secretion in the prostatic utricle as well as its glands in all the studied animals was similar to that present in the prostatic follicles and showed similar staining characteristics with special stains used. The secretion was PAS positive, Alcian blue negative and showed Metachromatic staining with Toluidine blue. These suggested the mucoprotein nature of the prostatic secretion however Cook¹⁰ has described that the neutral mucin is the major constituent of the prostatic secretion by its orthochromatic staining by Toluidine blue.

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