



### **Reproduction Module - I**

### 2<sup>nd</sup> Year MBBS(LGIS) Development of Genital ducts in males



### Presenter: Prof.Dr. Ifra Saeed

### Date: 00-00-25

First Ten Minutes

### Prof. Umar's Model of Teaching Strategy Self Directed Learning Assessment Program

Objectives : To cultivate critical thinking, analytical reasoning, and problemsolving competencies.

To instill a culture of self-directed learning, fostering lifelong learning habits and autonomy.

### How to Assess?

- Ten randomly selected students will be evaluated within the first 10 minutes of the lecture through 10 multiple-choice questions (MCQs) based on the PowerPoint presentation shared on Students Official WhatsApp group, one day before the teaching session.
- The number of MCQs from the components of the lecture will follow the guidelines outlined in the **Prof. Umar model of Integrated Lecture**.

Component	Core	Horizontal	Vertical	Spiral
of LGIS	Knowledge	Integration	Integration	Integration
No of MCQs	6-7	1-2	1	1

## Professor Umar Model of Integrated Lecture



### **Learning Objectives**

### At the end of the session, student will be able to

- Describe development of male genital ducts
- Relate physiology and biochemistry with development of reproductive system
- Discuss congenital abnormalities
- Correlate and build core knowledge on the basis of latest research
- Bioethics and Family medicine related to male reproductive system
- Artificial Intelligence related to azoospermia

### Male Genital Ducts



Core Concept

### **Gastrulation and Formation of Urogenital ridge**



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## **Genital Ducts**

During the fifth and sixth weeks, the genital system is in an indifferent state, and two pairs of genital ducts are present.

- The Mesonephric ducts (Wolffian ducts)
- The Paramesonephric Ducts (Mullarian Duct)



Core Concept 7

### **Development Of Paramesonephric Ducts**

- The paramesonephric ducts develop lateral to the gonads and mesonephric ducts on each side from longitudinal invaginations of the mesothelium on the lateral aspects of the mesonephroi
- The edges of these paramesonephric grooves approach each other and fuse to form the **paramesonephric ducts**



Core Concept

# Paramesonephric ducts

- The funnel-shaped cranial ends of these ducts open into the peritoneal cavity
- Caudally, the paramesonephric ducts run parallel to the mesonephric ducts until they reach the future pelvic region of the embryo.
- Here they cross ventral to the mesonephric ducts, approach each other in the median plane, and fuse to form a Y-shaped uterovaginal primordium.



# Sinus Tubercle

• This tubular structure projects into the dorsal wall of the urogenital sinus and produces an elevation-the **sinus tubercle** 





## Mesonephric ducts

- The Wolffian ducts, or mesonephric ducts, are paired embryonic structures that serve as progenitors of the male internal genitalia and are involved in the incipient development of the renal system in both sexes.
- The Wolffian ducts (WDs) develop in male and female embryos but are only maintained in males by testosterone, and they give rise to the
- epididymis,
- vas deferens, and
- seminal vesicles



### Further development of Male genital ducts



### Further Development of Male Genital Ducts

- The proximal part of each mesonephric duct becomes highly convoluted to form the epididymis
- As the mesonephros degenerates, some mesonephric tubules persist and are transformed into efferent ductules. These ductules open into the duct of the epididymis
- Distal to the epididymis, the mesonephric duct acquires a thick investment of smooth muscle and becomes the ductus deferens



# In Male Embryo:

Mullerian duct degenerate (except the uppermost part which forms appendix testis & lowermost part which forms prostatic utricle).



Core Concept

# Wolffian Duct

under the influence of testosterone

- Its upper part becomes markedly convoluted forming the epididymis.
- The middle part forms the vas deferens.
- The lower part forms a small pouch which forms the seminal vesicle.
- The terminal part forms the ejaculatory duct.
- (The upper most part of the duct forms
- appendix epididymis).
- Mesonephric tubules opposite
- the developing testis forms efferent
- ducts which become connected to rete testis.

# Mesonephric duct remnants in Males

- Cranial end may persist = appendix of epididymis
- Caudal to efferent ductules paradidymis

### Female

- Epoophoron = corresponds to efferent ductules and duct of epididymis
- Paroophoron = Close to the uterus some tubules persists
- Gartner's cyst = Parts corresponding to ductus deferense and ejaculatory ducts



## Derivatives And Remnants Of Ducts

	Mesonephric tubules	Mesonephric duct	Paramesonephric duct
Males	Efferent ductules Appendix of epididymis	Uretric bud: Collecting system of kidney & Epididymis Ductus deferens Seminal vesicle Ejaculatory duct	Appendix of testis Prostatic utricle
Females	Epoophoron Paraphoron	Uretric bud: Collecting system of kidney & Gartner's duct/cyst	Uterine tubes Uterus Upper 2/3 <sup>rd</sup> of vagina

Core Concept

## Seminal Vesicle

- Lateral outgrowths from the caudal end of each mesonephric duct gives rise to the seminal glands (vesicles). These glands produce a secretion that makes up the majority of the fluid in ejaculate and nourishes the sperms.
- The part of the mesonephric duct between the duct of this gland and the urethra becomes the ejaculatory duct.



## Prostate

Multiple endodermal outgrowths arise from the prostatic part of the urethra and grow into the surrounding mesenchyme The glandular epithelium of the prostate differentiates from these endodermal cells, and the associated mesenchyme differentiates into the dense stroma and smooth muscle of the prostate.





#### Core Concept

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## **Bulbourethral Glands**

- These pea-sized structures develop from paired outgrowths from the spongy part of the urethra
- The smooth muscle fibers and the stroma differentiate from the adjacent mesenchyme. The secretions of these glands contribute to the semen.



### Physiological/Biochemical Aspects of Genital Ducts

The epididymis has several functions.

- 1 Sperm conduit. Epididymal passage takes about 12 days in man, with sperm propelled by spontaneous rhythmic contractions of the duct.
- 2. Fluid resorption. About 99% of fluid entering caput is resorbed during epididymal passage.
- **3.Sperm reservoir**. The cauda is a major site of sperm storage.
- 4. Sperm maturation. Fertilizing ability of sperm improves from caput to corpus to cauda. Motility improves as well.





#### Horizontal Integration

### Physiological/Biochemical Aspects of Genital Ducts

Vas Deferens

- is a single straight duct lined by pseudostratified columnar epithelium with stereo cilia.
- The vas is 35-45 cm long, transporting sperm through the upper scrotum and inguinal canal, to form the dilated ampullae of the vas and then join the seminal vesicles to form the ejaculatory ducts
- The vas provides rapid transport of sperm during ejaculation.



Vas Deferens

### Physiological/Biochemical Aspects of Genital Ducts

Seminal vesicles Elongated saccular organs with an irregular branching lumen. Pseudostratified epithelium. Seminal vesicle fluid notable for high fructose and prostaglandin content.

**Prostate** Weighs about 20 grams, with multiple excretory glands which empty into the urethra. A normal human ejaculate has a volume of 2-5 cc and contains 150-200 million sperm.



Horizontal Integration

# Congenital bilateral absence of the vas deferens

occurs in males when the tubes that carry sperm out of the testes (the vas deferens) fail to develop properly. Although the testes usually develop and function normally, sperm cannot be transported through the vas deferens to become part of semen.



Vertical Integration

### Persistent Mullerian duct syndrome

(PMDS) is a rare form of internal male pseudohermaphroditism in which Mullerian duct derivatives are seen in a male patient. The syndrome is caused either by an insufficient amount of Mullerian inhibiting factor (MIF) or due to insensitivity of the target organ to MIF.



# Prostatic Carcinoma in patients with persistent Mulleian duct syndrome

Authors: Umair, Muhammad; Khan, Ahsan U.<sup>1</sup>; Arruda, John B.<sup>2</sup>; Lakhani, Dhairya A.<sup>1</sup>; Adelanwa, Ayodele<sup>3</sup>*Urology Annals* <u>14(4):p 398-402</u>, <u>Oct–Dec</u> 2022. | DOI: 10.4103/ua.ua\_74\_21

#### Abstract:

Persistent Müllerian duct syndrome (PMDS) is a form of disorder of sexual differentiation caused by a defect in the coding of AMH or its receptors. Patients are phenotypically male and usually present with unilateral or bilateral cryptorchid testes

The testes can be located anywhere from the retroperitoneum to the scrotum; cryptorchidism and transverse testicular ectopia have been associated with this condition.<sup>[5]</sup> Internal genitalia, however, consist of structures that are derived from the persistence of the Müllerian ducts, i.e., fallopian tubes, uterus, cervix, and upper vagina. Familial cases have been reported with a probability of sex-limited autosomal recessive or X-linked recessive inheritance.

Spiral integration Research A Machine Learning Approach for the Prediction of Testicular Sperm Extraction in Nonobstructive Azoospermia: Algorithm Development and Validation Study

An ML algorithm based on an appropriate approach can predict successful sperm retrieval in men with NOA undergoing TESE, with promising performance. However, although this study is consistent with the first step of this process, a subsequent formal prospective multicentric validation study should be undertaken before any clinical applications.

As future work, we consider the use of recent and clinically relevant data sets (including seminal plasma biomarkers, especially noncoding RNAs, as markers of residual spermatogenesis in NOA patients) to improve our results even more.

Reference: J Med Internet Res. 2023 Jun 21:25:e44047. doi: 10.2196/44047.

# Update on bioethical, medical and fertility issues in gender incongruence during transition age

- Abstract Based on this scientific evidence and given the sensitivity of the topic, the recent version of the "Standard of Care for the Health of Transgender and Gender Diverse People" recommends health care providers to inform transgender youth about the known effects of hormone therapies/surgery on future fertility.
- The potential effects of therapies on gametes are not well studied; in particular, we do not know yet the timing of the spermatogenesis and ovogenesis recovery.
- Reference: Conflitti AC, Spaziani M, Pallotti F, Tarsitano MG, Di Nisio A, Paoli D, Lombardo F, Journal of Endocrinological Investigation. 2023 Sep;46(9):1725-36.

Spiral Integration Bioethics

# Learning Resources

- KLM Embryology Developing Human 11th Edition Clinically oriented embryology by Keith Moore, T. V. N. Persaud, Mark Torchia
- Langman's Medical Embryology 15th Edition by Dr. T.W. Sadler PhD
- Google scholar
- Google images