

Reproduction Module - I 2nd Year MBBS(LGIS) **Development of Testis**



Presenter: Prof. Dr. Ifra Saeed

Date: 00-0-25



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 indifferent stage of gonads
- Relate physiology and biochemistry with development of reproductive system
- Discuss congenital abnormalities of Testis
- Correlate and build core knowledge on the basis of latest research, Family medicine related to development of testes
- Role of Artificial Intelligence in diagnosis & Bioethics related to infertility

Male Genital System





Anterior view

Gastrulation and Formation of Urogenital ridge





Introduction

- Sex of the embryo is determined at the time of fertilization, gonads do not acquire male/female morphological characteristics until seventh week of development
- Initially as a pair of longitudinal ridges
- Germ cells do not appear in these ridges until sixth week of development



Primordial Germ Cells

- Originate in Epiblast
- Migrate through primitive streak
- Reside in yolk sac by third week
- They migrate by ameboid movement along dorsal mesesntry during fourth week
- Arrive at gonads during fifth week
- Invade gonads during sixth week
- If they fail to reach the ridges gonads never develop



Sources of Gonads

The gonads (testes & ovaries) are derived from 3 sources

- 1. Mesodermal epithelium lining the urogenital ridge (posterior abdominal wall)
- 2. Underlying embryonic connective tissue
- 3. Primordial germ cell



Development Of The Gonads (PGCs)

By the arrival of the germ cells the gonadal ridge proliferates



Indifferent stage of gonads

- Genital ridge is thus formed by proliferation of epithelium & underlying connective tissue
- Finger like epithelial cords develop known as
 primary sex cord
- Indifferent gonads now consists of an external cortex & internal medulla
- In XX embryo, cortex differentiates into ovary while medulla regresses
- In XY embryo, the medulla differentiate into testes & cortex regresses



Requirements of Male Phenotype

- A Y chromosome
- The SRY gene for a testis-determining factor (TDF)
- Testosterone, produced by the fetal testes, dihydrotestosterone, a metabolite of testosterone, androstenedione, and
- the Antimullerian hormone (AMH), determines normal male sexual differentiation

Formation of Testis & Ovaries



Development of The Testis

- The primitive sex cords proliferate & anastomose forming "testis/medullary cords" formed of the epithelial cells & the germ cells.
- Testis cords separate from the epithelial lining of the celomic cavity & become surrounded by a fibrous layer which develops to give tunica albuginea of the testis.



Formation of Sertoli and Leydig Cells

- Testis cords bend to form horseshoe tubules in fourth month. Their ends remain straight forming the straight tubules & become connected to rete testis..
- Epithelial cells in the tubules form Sertoli cells.
- Interstitial cells of Leydig are derived from original mesenchyme of gonadal ridge



Interstitial cells of Leydig

- ➢At day 65, Leydig cells (produce T) appear in clusters around the testis cords and are derived from original mesenchyme of the gonadal ridge.
- Leydig cells begin secreting Testosterone (T) at 8 weeks of development & peak at 12-14th week and then decline until puberty

tissue

This masculinizes embryonic structures



tubules

Differentiation

- Sertoli cells constitute most of the seminiferous epithelium in the fetal testis
- the surface epithelium of the testis flattens to form the mesothelium
- The rete testis becomes continuous with 15 to 20 mesonephric tubules that become efferent ductules which are connected with the mesonephric duct, which becomes the duct of the epididymis



Adult Testis



Descent of the testis

- The testis is connected to the scrotal swelling by caudal genital ligament & a fibrous cord called "gubernaculum testis".
- The continuous shortening of the gubernaculum pulls the testis from the upper part of the abdomen to the scrotum.



Descent of the testis

- Processus vaginalis (evagination of peritoneum) develops ventral to gubernaculum & herniates through the abdominal wall
- With the descent of the testis, the neck of the sac is approximated & obliterated so that a small separate sac of peritoneum incompletely surrounds the testis forming **tunica vaginalis testis**.
- This process is controlled by testosterone





- The iliac fossa on the 3rd month of IU life. ullet
- The inguinal canal on the 7th month of IU life
- The superficial inguinal ring on the 8th month of IU life. The scrotum on the 9th month of IU life.
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Physiological and Biochemical Aspects

- The hypothalamic-pituitary-gonadal axis plays a major role in promoting sexual maturity, sperm production and the development of secondary sex characteristics.
- It maintains spermatogenesis and sexual function throughout the male's lifetime.



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Physiological and biochemical aspects



Horizontal Integration

Congenital anomalies of the testis:

- 1) Undescended testis (cryptorchidism).
- 2) Maldescended testis: The testis may be found at the dorsum of penis, the anterior abdominal wall, front of thigh or perineum.
- 3) Congenital inguinal hernia.
- 4) Congenital hydrocele.





ADAM.



Male Psudohermaphroditism

- Have chromatin negative cells
- 46,XY Configuration
- External genitalia as well as internal genitalia are variable due to varying degree of paramesonephric duct development
- Causes are inadequate production of testosterone and MIS



Testicular Masses

- Family physicians often must evaluate patients with testicular pain or masses. The incidental finding of a scrotal mass may also require evaluation. An accurate history combined with a complete examination of the male external genitalia will help indicate a diagnosis and proper treatment.
- Family physicians must keep in mind the emergency or "must not miss" diagnoses associated with testicular masses, including testicular torsion, epididymitis, acute orchitis, strangulated hernia and testicular cancer. Referral to a urologist should be made immediately if one of these diagnoses is suspected.
- Benign causes of scrotal masses, including hydrocele, varicocele and spermatocele, may be diagnosed and managed easily in the primary care office.

Reference: American Family Physician

JENNIFER JUNNILA, CPT, MC, USA, U.S., AND PATRICK LASSEN, MAJ, USAF, MC

Spiral Integration

Artificial Intelligence in Andrology: From Semen Analysis to Image Diagnostics

Al applications, such as machine learning, artificial neural networks, and deep learning, have shown great potential in andrology and reproductive medicine. Al-based tools are poised to become valuable assets with abilities to support and aid in diagnosing and treating male infertility, and in improving the accuracy of patient care.

These automated, AI-based predictions may offer consistency and efficiency in terms of time and cost in infertility research and clinical management. In andrology and reproductive medicine, AI has been used for objective sperm, oocyte, and embryo selection, prediction of surgical outcomes, cost-effective assessment, development of robotic surgery, and clinical decision-making systems.

Reference: World J Mens Health. 2024 Jan; 42(1): 39-61

Spiral Integration

Suggested Research Article

Chronic stress inhibits testosterone synthesis in Leydig cells through mitochondrial damage via Atp5a1

Authors: Qiuhua Wu, Lingyu Zhang, Shanfeng Gao, Rufeng Li, Lin Han,

Abstract

Stress is one of the leading causes of male infertility, but its exact function in testosterone synthesis has scarcely been reported. Study found that adult male rats show a decrease in bodyweight, genital index and serum testosterone level after continual chronic stress for 21 days.

Reference: Journal of Cellular and Molecular Medicine Volume26, Issue2, January 2022, Pages 354-363 https://doi.org/10.1111/jcmm.17085

Modern Assisted Reproductive Technologies and Bioethics in the Islamic Context

Abstract:

During the last few decades, infertility has been discussed as a socio-cultural and medical dilemma. Infertile couples attempt to overcome this problem, including using assisted reproductive technologies (ARTs). Similar to other groups, Muslims struggle with various aspects of infertility and its treatments, trying to reconcile the use of ARTs with the regulations in respect of the socio-cultural, legal, ethical, economic, and political factors of their community.

Religion usually plays a significant role in the governance of medically assisted reproduction. This paper describes the Islamic intellectuals' permissive and restrictive opinions on modern ARTs and ethics in the Islamic context.

Reference: Theol Sci. 2021; 19(2): 146–154

Spiral Integration

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