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A Surgical Perspective on the Physiology of the Female Reproductive System: Exploring Oogenesis and Ovulation

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Abstract: The female reproductive system serves as the cornerstone of both familial and societal well-being, underlining the importance of women's health and understanding the physiology of their reproductive system. At the core of this system lie various organs dedicated to crucial functions. The ovaries, for instance, The Female reproductive system is designed to carry out several functions.It produces the female egg cells necessary for reproduction called the ova or oocytes and process of its formation is known as Oogenesis. The oocytes are then transported to the fallopian tube where fertilization by a sperm may or may not occur. [1] play a central role in producing the ova or eggs necessary for reproduction. These eggs travel through the fallopian tubes, facilitated by the uterus, to reach the site of fertilization.Female sex hormones, notably estrogen and progesterone, orchestrate the intricate processes within the reproductive system. These hormones regulate menstrual cycles, support pregnancy, and influence various aspects of female physiology.
Oogenesis, the process of egg cell development, occurs within the ovaries. Primordial follicles mature into oocytes, which undergo meiosis to form haploid eggs. This process is tightly regulated and crucial for reproductive success.Ovulation marks a pivotal event in the menstrual cycle. It involves the release of a mature egg from the ovary into the fallopian tube, where it awaits fertilization by sperm. Ovulation is influenced by hormonal fluctuations and occurs midway through the menstrual cycle.
Understanding the physiology of the female reproductive system is paramount for promoting women's health and well-being. By delving into the intricate mechanisms governing fertility, menstruation, and pregnancy, healthcare professionals can provide tailored support and interventions to ensure optimal reproductive health. Ultimately, the health of the nation is deeply intertwined with the health of its women, emphasizing the significance of prioritizing women's reproductive health on a societal level**Keywords:**Physiology, Oogenesis,Ovulation and Reproductive organ.

INTRODUCTION:
The female reproductive system produces female sex hormone that maintain the reproductive cycle.It is related to ovulation and the secretion of ovarian hormones (oestrogen and progesterone) which influence the hypothalamopituitary activity to bring about cyclical changes in the endometrium during the female

reproductive period ie between menarche and the menopause.

The time of the first menstrual cycle is called menarche . The period during which the menstrual cycle ceases and the female sex hormone diminish to almost none ie called menopause.

The female reproductive system is made up of the internal and external sex organs. The female reproductive system provides several functions.The various mechanisms underlying female reproduction are numerous and sophisticated,displaying complex functional evolution throughout a woman's lifetime.

There is need for understanding physiology of female reproductive system.. This review offers a summary of physiologic course of female reproductive function wsr to Oogenesis and ovulation.

CONCEPTUAL STUDY:

Female Reproductive organs :

The reproductive organs in female are those which are concerned with copulation, fertilization, growth and development of the fetus and its subsequent exit to the outer world.

The organs are broadly divided into **.**

1. External genitalia.
2. Internal genitalia.
3. Accessory Reproductive organs.[2]

1. **External genitalia/Vulva/Pudendum :** The vulva includes mons pubis, labia majora, labia minora, clitoris, vestibule and conventionally the perineum . These are all visible on external examination.
2. **Internal genital organs :** The internal genital organs in female include vagina, uterus, fallopian tubes and the ovaries.

Vagina :

The vagina is a fibromusculo membranous sheath communicating the uterine cavity with the exterior at the vulva.

Fuction :

It constitutes the excretory channel for the uterine secretion and menstrual blood.

It is the organ of copulation.

It forms the birth canal of parturition.

Uterus :

The uterus is a hollow pyriform muscular organ situated in the pelvis between the bladder in front and the rectum behind.

The uterus measures about 8cm long, 5 cm. wide and 1.25 cm. thick. Its weight varies from 50-80 gm. It has got the following parts.

a) Body/Corpus.
b) Isthmus.
c) Cervix

a) Body : The Body is further divided into

Fundus **:** The part which lies above the openings of the uterine tubes.

Body proper **:** It lies between the openings of tubes and the isthmus.

b) Isthmus : It is a constricted part measuring about 0.5cm, situated between the body and the cervix.

c) Cervix : It extends from the isthmus and ends at the external os which opens into the vagina after perforating its anterior wall.

Function :

It is the organ which protects and provides nutrition to a fertilized ovum, enabling it to grow into a fully formed fetus.

It plays an important role in reproduction.

Characterstic changes in its endometrium during menstrual cycle is responsible for recurrent monthly discharge of blood from female genital canal.

It allows entery of spermatozoa from the vagina into the fallopian tubes for fertilization.

After copulation, uterus store viable sperms for 1-2 days.

During parturition, contractions of its muscle result in expulsion of the foetus from uterus.

Insertion of a foreign body into the uterus can prevent implantation of a fertilized ovum. This is the basic principle underlying the use of various intrauterine contraceptive devices for preventing pregnancy.

Fallopian tubes (oviducts) :

They are tortuous ducts which convey ova from the ovary to the uterus.

Function :

Serve as ducts for ovaries by providing passage, by which ova reach uterus.

Fertilization function : The union of a spermatozoon with an ovum occurs normally in the ampulla of the fallopian tube.

The Ovary :

The ovaries are the female gonads, present in the ovarian fossa on the lateral pelvic wall, behind and below the fallopian tubes.

There are two ovaries, one on each side, behind and below the fallopian tubes.

Function :

To produce ova ie oogenesis.

To discharge ova ie ovulation.

To secrete female hormones called ovarian hormones.(Oestrogen & Progesterone mainly)[3]

Ovarian Hormones :

Oestrogen : Before puberty, oestradiol is secreted in very small amount which has little physiological action. At puberty oestradiol is secreted in large quantities and results in the following changes in body.

A.Promotes the growth of internal genitalia.

1.Changes in the ovary : It is responsible for completion of ovarian cycle characterised by ovulation and corpus luteum formation.

2.Changes in the uterus : In the myometrium, the uterine muscle fibers enlarge and become more active.

In the endometrium, growth of glandular epithelium, stroma and hyperaemia. Cervical mucus secretion becomes copious and watery

.**3.Changes in the vagina :**

Promotes mitotic activity in the epithelium.

Increases vaginal secretions.

Lubrication of vagina during coitus.

B.Promotes the growth of external genitalia.

C.Responsible for the appearance of secondary sexual character in females.

D.Influences the gonadotrophin secretion.

E.Plays a role in pregnancy and parturition.

F.Increases the plasma levels of thyroxine, angiotensinogen.

G.It lowers plasma cholesterol level.

Progesterone :

A.Secretory changes in endometrium.

B.Promotes the growth of lobules and alveolar tissue in the breasts.

C.Increases basal body temperature.

D.Stimulates respiration and thus decreases alveolar Pco_2.

E.To some extent, it antagonizes the action of oestrogen.[4]

3.Accessory Reproductive organ : These are those organ which are accessory to reproductive organ.

The Breast : The breasts are bilateral glandular structures and in female constitute accessory reproductive organs as the glands are concerned with lactation following child birth.

OOGENESIS

Process of formation of ova is called oogenesis.[5]

Before birth : In the female gonads, the germ cells undergo a no. of rapid mitotic division and differentiate into Oogonia. While majority of oogonia continue to divide, some enter into the prophase of first meiotic division and are called primary oocytes.

At Birth : There is no mitotic division and all the oogonia are replaced by primary oocytes, which have finished the prophase of the first meiotic division and remain in the resting phase. These primary oocytes donot finish the first meiotic division until puberty is reached.[6]

At puberty : Some 400,000 primary oocytes are left behind, rest being atretic. Out of these some 400 are likely to ovulate during the entire reproductive period.

Maturation of oocytes : The essence of maturation is reduction of the no of chromosomes to half.

The primary oocytes undergoes first meiotic division giving rise to secondary oocytes and one polar body. The two are of unequal size the secondary oocyte contains haploid number of chromosomes (23,X) but nearly all cytoplasm and the small polar body also contains half of the chromosomes (23.X) but

with scanty cytoplasm. ovulation occurs soon after the formation of secondary oocytes.

The secondary oocyte completes the second meiotic division only after the fertilization by the sperm in the fallopian tube and results in the formation of two unequal daughter cells, each possessing 23 chromosomes (23,X), the larger one is called mature ovum & smaller one is the second polar body containing same no, of chromosome. In the absence of fertilization, the secondary oocyte does not complete the second meotic division and degenerate as such.[7]

The steps of Oogenesis can be easily understand with help Flow chart 1 and Diagram 1 given at end of conceptual view.

DESCRIPTION OF OVULATION:

Ovulation in a woman who has a normal 28 day Female Sexual Cycle occurs14 days after the onset of menstruation.

L.H. is necessary for final follicular growth and ovulation.This LH causes rapid secretion of follicular steroid hormones that contain progesterone.With in a few hours,two events occur,both of which are necessary for ovulation.[8]

1.The theca externa(the capsule of the follicle)begins to release proteolytic enzymes from lysosomes ,and these cause dissolution of the follicular capsular wall and consequent weakening of the wall,resulting in further swelling of the entire follicle and degeneration of the new stigma.

2.Simultaneously there is rapid growth of new blood vessels into the follicle wall and at the same time prostaglandins (local hormones that cause vasodilation) are secreted into the follicular tissues.

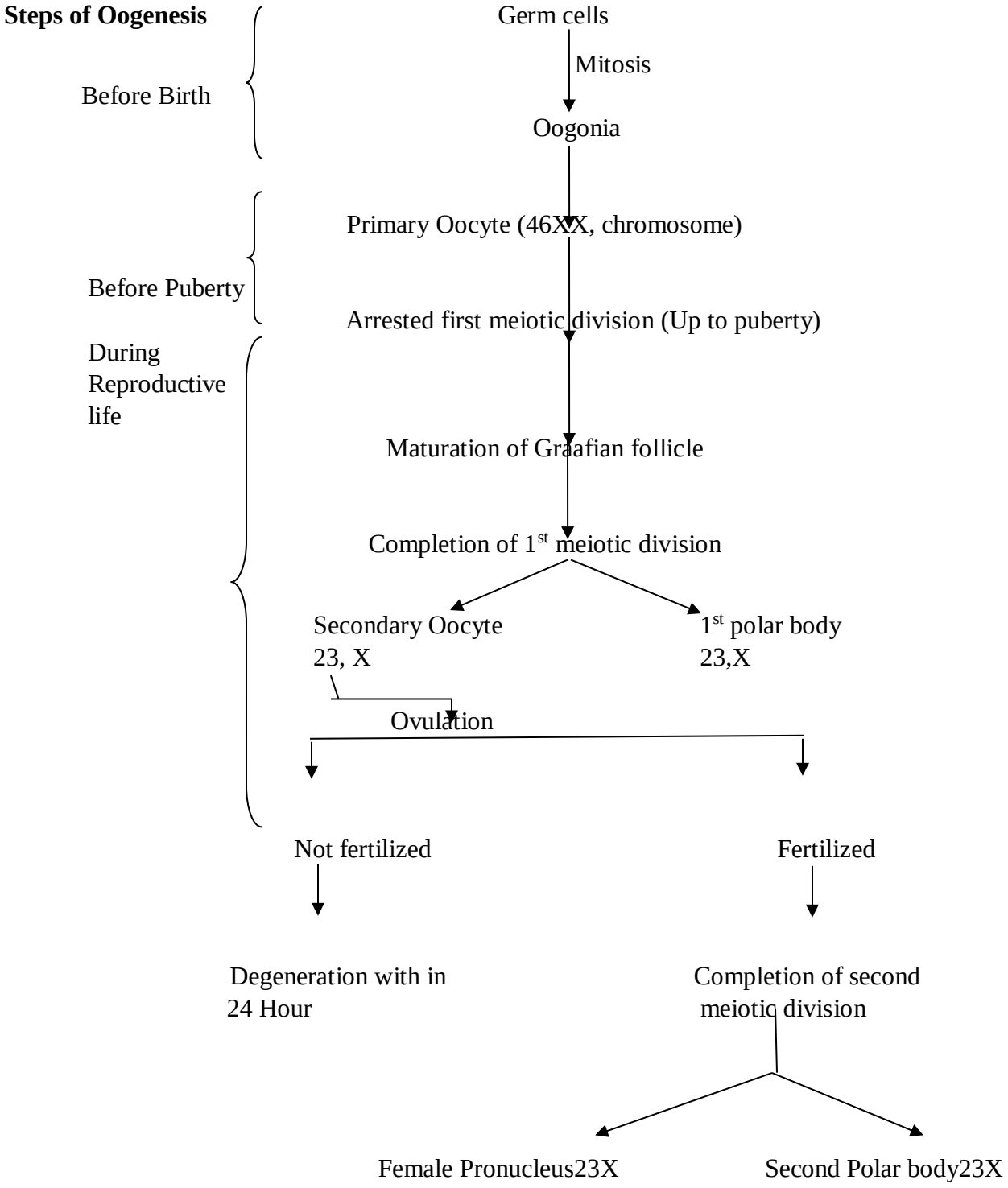
These two effects cause plasma transudation into the follicle,which contributes to follicle swelling.Finally ,the combination of follicle swelling and simultaneously degeneration of the stigma causes follicle rupture with discharge of the ovum.[9]

Shortly before ovulation ,the protruding outer wall of the follicle swells rapidly and a small area in the centre of the follicular capsule called the stigma,protrude like a nipple

In another 30 minutes or so, fluid begins to ooze from the follicle through the stigma and about 2 minutes later ,the stigma ruptures widely ,allowing a more viscous fluid to evaginate outward.

The viscous fluid carries with it the ovum surrounded by a mass of several thousand small granulosa cells ,called the corona radiate.[10]

This can be easily understand by flow chart 2.



FLOW CHART No 1:Steps of Oogenesis

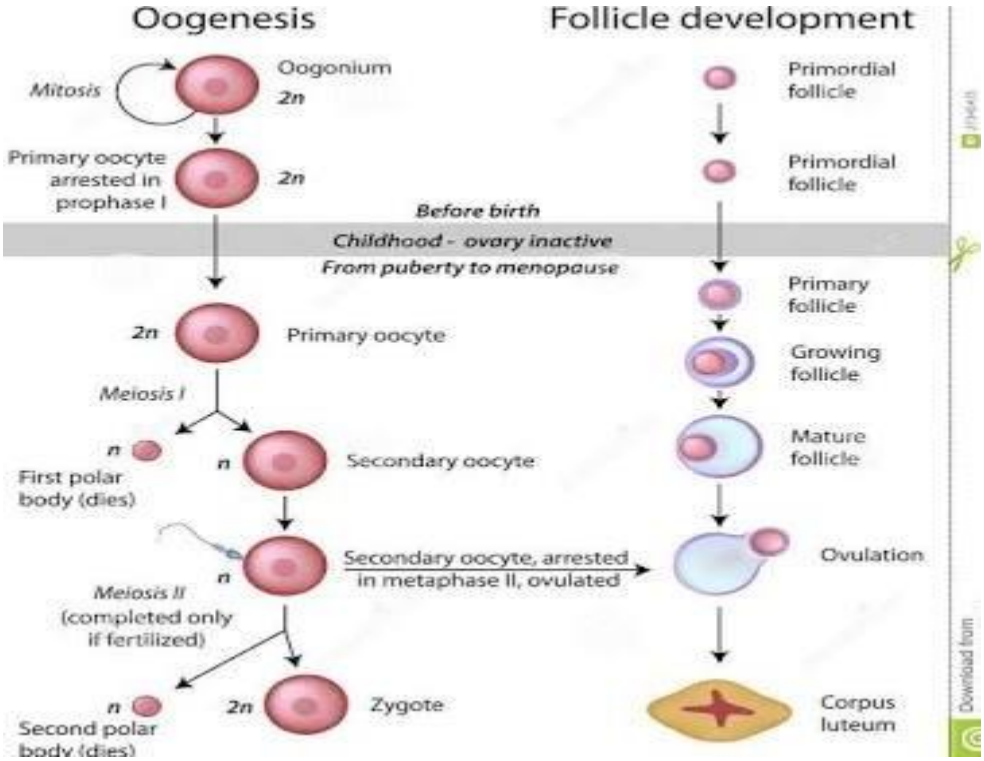


Diagram No 1:Oogenesis

LUTEINIZING HORMONE

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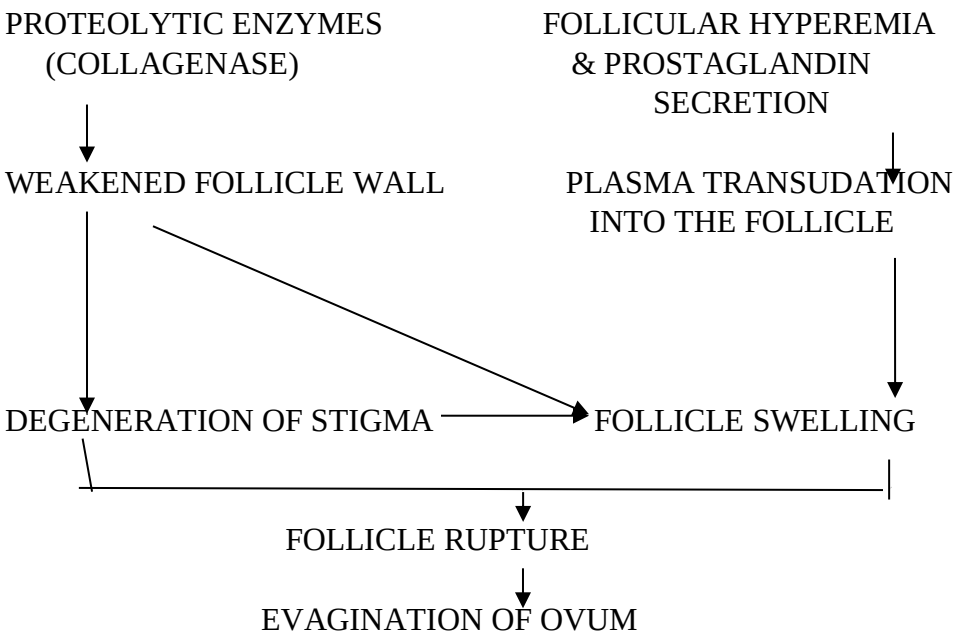
FOLLICULAR STEROID HORMONES
PROGESTERONE



FLOW CHART No 2: Postulated Mechanism of ovulation

RESULT AND DISCUSSION:

A woman's reproductive system is a delicate and complex system in the body .It is important to take steps to protect it from infection and injury and prevent health problems.Taking care of yourself and making healthy choices can help in protecting you and your loved ones..

CONCLUSION: Women occupy a central role within both the family unit and society at large. It is imperative for them to cultivate and nurture the mental, emotional, and spiritual reserves necessary to navigate the multifaceted demands of family life without experiencing burnout or depletion. The well-being of a nation is inherently linked to the well-being of its women. Therefore, there exists a pressing need to delve into and comprehend the intricacies of the female reproductive system.The physiological aspects of the female reproductive system are fundamental to women's health and vitality. By gaining insights into the functioning of their reproductive organs, hormonal balance, and processes such as oogenesis and ovulation, we can better grasp the complexities of female physiology. This understanding enables healthcare providers to offer targeted interventions and support that address women's unique reproductive health needs.

Moreover, recognizing the interconnectedness of women's health with broader societal health underscores the importance of investing in women's reproductive well-being. When women are equipped with the knowledge and resources to manage their reproductive health effectively, they can contribute more fully to their families, communities, and the nation as a whole. Therefore, prioritizing the study and comprehension of the female reproductive system is not only a matter of individual health but also a strategic imperative for promoting societal flourishing and advancement.

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