

HUMAN ANATOMY & PHYSIOLOGY-II- BP201T

UNIT: 5 (REPRODUCTIVE SYSTEM)

CLASS: 6

TOPIC: **Menstrual cycle**

Menstrual cycle is defined as cyclic events that take place in a rhythmic fashion during the reproductive period of a woman's life. Menstrual cycle starts at the age of 12 to 15 years, which marks the onset of puberty. The commencement of menstrual cycle is called menarche.

Permanent cessation of menstrual cycle in old age is called menopause. Duration of

menstrual cycle is usually 28 days. But, under physiological conditions, it may vary between 20 and 40 days. During each menstrual cycle, series of changes occur in ovary and accessory sex organs.

These changes are divided into 4 groups:

1. Ovarian changes
2. Uterine changes
3. Vaginal changes
4. Changes in cervix.

OVARIAN CHANGES

Changes in the ovary during each menstrual cycle occur in two phases:

A. Follicular phase: Follicular phase extends from the 5th day of the cycle until the time of ovulation, which takes place on 14th day. Maturation of ovum with development of ovarian follicles takes place during this phase. Each follicle consists of the ovum surrounded by epithelial cells, namely granulosa cells. The follicles gradually grow into a matured follicle through various stages.

Different follicles: 1. Primordial follicle 2. Primary follicle 3. Vesicular follicle 4. Matured follicle or graafian follicle.

Primordial Follicle: Each primordial follicle has an ovum, which is incompletely surrounded by the granulosa cells. Granulosa cells also secrete the oocyte maturation inhibiting factor, which keeps ovum in the immature stage. All the ova present in the ovaries are formed before birth.

Primary Follicle: Primordial follicle becomes the primary follicle, when ovum is completely surrounded by the granulosa cells. During this stage, the follicle and the ovum increase in size.

Vesicular Follicle: Primary follicles develop into vesicular follicles. Under the influence of FSH, about 6 to 12 primary follicles start growing and develop into vesicular follicles.

Changes taking place during the development of vesicular follicle i. Changes in granulosa cells ii. Changes in ovum iii. Formation of capsule.

- i. Changes in granulosa cells
 - a. First, the proliferation of granulosa cells occurs
 - b. A cavity called follicular cavity or antrum is formed in between the granulosa cells
 - c. Antrum is filled with a serous fluid called the liquor folliculi
 - d. With continuous proliferation of granulosa cells, the follicle increases in size
 - e. Antrum with its fluid also increases in size
 - f. Ovum is pushed to one side and it is surrounded by granulosa cells, which forms the germ hill or cumulus oophorus
 - g. Granulosa cells, which line the antrum form membrana granulosa
 - h. Cells of germ hill become columnar and form corona radiata.
- ii. Changes in ovum
 - a. First, the ovum increases in size and its diameter increases to 100 to 150 μ
 - b. Nucleus becomes larger and vesicular
 - c. Cytoplasm becomes granular
 - d. Thick membrane is formed around the ovum, which is called zona pellucida
 - e. A narrow cleft appears between ovum and zona pellucida. This cleft is called perivitelline space.
- iii. Formation of capsule

Spindle cells from the stroma of ovarian cortex are modified and form a covering sheath around the follicle. The covering sheath is known as follicular sheath or theca folliculi. Theca folliculi divides into two layers:

 - a. Theca interna
 - b. Theca externa
 - a. Theca interna Theca interna is the inner vascular layer with loose connective tissue. This layer also contains special type of epithelial cells with lipid granules and some delicate collagen fibers. Epithelial cells become secretory in nature and start secreting the female sex hormones, especially estrogen. Hormones are released into the fluid of antrum.
 - b. Theca externa Theca externa is the outer layer of follicular capsule and consists of thickly packed fibers and spindle-shaped cells

Graafian Follicle: Graafian follicle is the matured ovarian follicle with maturing ovum. It is named after the Dutch physician and anatomist, Regnier De Graaf.

- i. Size of the follicle increases to about 10 to 12 mm. It extends through the whole thickness of ovarian cortex
- ii. At one point, the follicle encroaches upon tunica albuginea and protrudes upon surface of the ovary. This protrusion is called stigma. At the stigma, the tunica albuginea becomes thin
- iii. Follicular cavity becomes larger and distended with fluid
- iv. Ovum attains maximum size
- v.

Zona pellucida becomes thick vi. Corona radiata becomes prominent vii. Small spaces filled with fluid appear between the cells of germ hill, outside the corona radiata. These spaces weaken the attachment of the ovum to the follicular wall viii. Theca interna becomes prominent. Its thickness becomes double with the formation of rich capillary network. ix. On the 14th day of menstrual cycle, graafian follicle is ready for the process of ovulation.

B. Luteal phase: Luteal phase extends between 15th and 28th day of menstrual cycle. During this phase, corpus luteum is developed and hence this phase is called luteal phase. Corpus luteum is a glandular yellow body, developed from the ruptured graafian follicle after the release of ovum. It is also called yellow body. Soon after the rupture of graafian follicle and release of ovum, the follicle is filled with blood. Now the follicle is called corpus hemorrhagicum. The blood clots slowly. Corpus hemorrhagicum does not degenerate immediately. It is transformed into corpus luteum.

Functions of Corpus Luteum

1. Secretion of hormones Corpus luteum acts as a temporary endocrine gland. It secretes large quantity of progesterone and small amount of estrogen. Granulosa lutein cells secrete progesterone and theca lutein cells secrete estrogen. LH influences the secretion of these two hormones.
2. Maintenance of pregnancy If pregnancy occurs, corpus luteum remains active for about 3 months, i.e. until placenta develops. Hormones secreted by corpus luteum during this period maintain the pregnancy.

Ovulation occurs in between these two phases.

UTERINE CHANGES:

During each menstrual cycle, along with ovarian changes, uterine changes also occur simultaneously. Uterine changes occur in three phases:

1. Menstrual phase: After ovulation, if pregnancy does not occur, the thickened endometrium is shed or desquamated. This desquamated endometrium is expelled out through vagina along with blood and tissue fluid. The process of shedding and exit of uterine lining along with blood and fluid is called menstruation or menstrual bleeding. It lasts for about 4 to 5 days. This period is called menstrual phase or menstrual period. It is also called menses, emmenia or catamenia.

2. Proliferative phase: Proliferative phase extends usually from 5th to 14th day of menstruation, i.e. between the day when menstruation stops and the day of ovulation. It corresponds to the follicular phase of ovarian cycle. At the end of menstrual phase, only a thin layer (1 mm) of endometrium remains, as most of the endometrial stroma is desquamated.
3. Secretory phase: Secretory phase extends between 15th and 28th day of the menstrual cycle, i.e. between the day of ovulation and the day when menstruation of next cycle commences. Secretory phase is the preparatory period, during which the uterus is prepared for implantation of ovum. Changes in Endometrium during Secretory Phase i. Endometrial glands become more tortuous. Because of increase in size, the glands become tortuous to get accommodated within the endometrium ii. Cytoplasm of stromal cells increases because of the deposition of glycogen and lipids iii. Many new blood vessels appear within endometrial stroma. Blood vessels also become tortuous iv. Blood supply to endometrium increases v. Thickness of endometrium increases up to 6 mm. All these uterine changes during secretory phase occur due to the influence of estrogen and progesterone. If a fertilized ovum is implanted during this phase and if the implanted ovum starts developing into a fetus, then further changes occur in the uterus for the survival of the developing fetus. If the implanted ovum is unfertilized or if pregnancy does not occur, menstruation occurs after this phase and a new cycle begins.

CHANGES IN CERVIX

Mucus membrane of the cervix also shows cyclic changes during different phases of menstrual cycle. Proliferative Phase: During proliferative phase, the mucus membrane of cervix becomes thinner and more alkaline due to the influence of estrogen. It helps in the survival and motility of spermatozoa.

Secretory Phase: During secretory phase, the mucus membrane of cervix becomes more thick and adhesive because of actions of progesterone.

VAGINAL CHANGES

Proliferative Phase: Epithelial cells of vagina are cornified. Estrogen is responsible for this.

Secretory Phase: Vaginal epithelium proliferates due to the actions of progesterone. It is also infiltrated with leukocytes. These two changes increase the resistance of vagina for infection.

Menstrual Cycle

