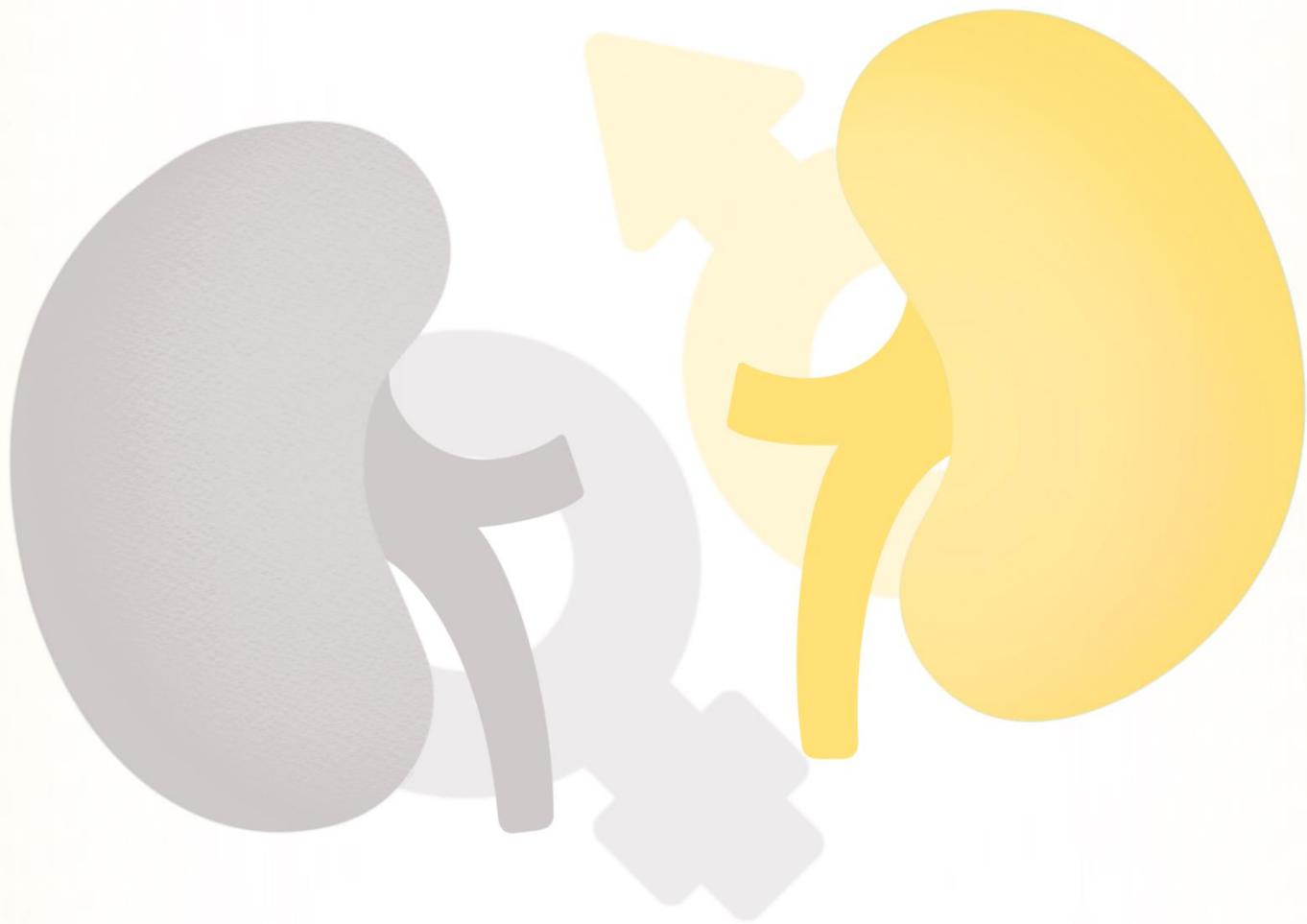


# G.U.S.



3

# Physiology



Sheet: Endometrial cycle

Writer: Amal Awwad

S.corrector: Tala Khamis

F.corrector: Hadeel Abdullah

Doctor: Ebaa M Alzayadneh

We'll discuss the endometrial cycle the changes that take place in uterus endometrium that influence the ovaries functions & hormones:

- Two main female sex hormones: ESTROGEN, PROGESTERONE

### 1- Effects of estrogen:

- A primary function is to induce cellular proliferation and growth of sex organs tissues (ovaries, fallopian tubes, uterus, and vagina; all increase several times in size) and other reproductive tissues.
- Inducing proliferation of endometrial stroma and glands (provide nutrition to the implanted ovum). Similarly, in the fallopian tubes, it causes the glandular tissues to proliferate, and it causes the number of ciliated epithelial cells -that line the fallopian tubes- to increase to facilitate the transportation of a fertilized ovum into the uterus.

#### -Effect on Breasts:

(1) Development of the stromal tissues of the breasts.

(2) Growth of ductile system.

(3) Deposition of fat.

\*\*Breast lobules and alveoli develop slightly under estrogens alone, but progesterone and prolactin that cause the ultimate role in growth and function.

Estrogens inhibit osteoclastic activity in bones stimulating bone growth and cause uniting of long bones epiphyses with shafts. That is why the growth of females usually ceases earlier than growth of males.

\*\* After menopause, when estrogen levels are low, there will be high chance of osteoporosis. (we can give estrogen supplement as prophylaxis).

- Estrogens slightly increase protein deposition (mainly due to sexual organs & bones growth). The enhanced protein deposition caused by testosterone is more general and powerful.

-Increase Body Metabolic rate (slight effect, 1/3 as much as that caused by testosterone).

-Increase fat deposition (females have more fat deposition), which effects body fluid amount.

-Little effect on hair distribution (adrenal androgens have a greater effect on female hair after puberty)

-Estrogen makes skin texture soft, usually smooth but thicker than that of a child.

-Estrogens cause the skin to become more vascular, often associated with increased warmth which promotes greater bleeding of cut surfaces than is observed in men.

-Effect on electrolyte balance; just like aldosterone and other adrenocortical hormones, it causes Na<sup>+</sup> and water retention by kidney tubules, (significant during pregnancy due to placenta estrogens).

### 2. Effects of progesterone:

- Progesterone promotes secretory changes in the uterus during the second half of female cycle (**luteal phase**), thus, preparing the uterus for fertilized ovum implantation.

- Progesterone decreases the frequency and intensity of uterine contractions, thereby helping to prevent expulsion of the implanted ovum.

- Progesterone promotes increased secretion by the mucosal lining of the fallopian tubes. These secretions are necessary for nutrition of the fertilized, dividing ovum.

- Progesterone promotes development and proliferation of breast lobules and alveoli, causing the alveolar cells to become secretory (not for milk secretion). It also causes the breasts to swell (due to the secretory development in the lobules and alveoli, and due to fluid deposition).

- Monthly endometrial Uterine cycle and menstruation:

The endometrial cycle is associated with monthly cyclical production of estrogens & progesterone by ovaries in uterus lining.

It has 2 phases (between the two phases, ovulation takes place):

## **1-Proliferative phase (estrogen phase) (11 days) (parallel to the pre-ovulatory in the ovarian cycle)**

- At the beginning of each cycle, most of the endometrium has been desquamated by menstruation, after which, only a thin layer of endometrial stroma & the deeper portions of glands & crypts remain.
- Under the influence of estrogens, stromal & epithelial cells proliferate rapidly.
- The endometrial surface re-epithelializes within 4-7 days after the beginning of menstruation. Before ovulation, the endometrium increases greatly in thickness, due to increasing numbers of stromal cells and progressive growth of glands and new blood vessels.
- **At time of ovulation**, the endometrium is 3-5 mm thick.
- The endometrial glands (especially those in the cervical region) secrete a thin, stringy mucus which helps to guide sperm in the proper direction from the vagina into the uterus.

## **2- Secretory phase (pregestational phase) (parallel to post ovulatory in ovarian cycle; it lasts for 12 days)**

-**After ovulation**, progesterone & estrogen are secreted in the latter part of the monthly cycle by corpus luteum (luteal phase). Estrogen causes slight proliferation in the endometrium, whereas progesterone causes marked swelling & secretory development. The glands increase in tortuosity, excess secretory substances accumulate in the glands. Also, the blood supply increases and become more tortuous.

- The cytoplasm of the stromal cells increases, lipids and glycogen deposits increase in these cells.
- 1 week after ovulation, the endometrium is about 5-6 mm thick.

•**Secretory changes prepare the endometrium** for implantation and growth of fertilized ovum (BY storing nutrients). The "**uterine milk**" (the uterine secretions) provide nutrition for the dividing ovum. The trophoblastic cells of the implanted ovum begin to digest the endometrium and absorb the endometrial stored substances. That is how these cells get their nutrition from the endometrial glands and lining.

## **3- Menstruation (last phase):**

-If the ovum is not fertilized (about 2 days before the end of the monthly cycle), the corpus luteum in the ovary suddenly involutes and the ovarian hormones (estrogens and progesterone) decrease to very low levels of secretion; this initiates necrosis in the endometrial blood vessels, due to:

- 1) Blood vessels vasospasm.
- 2) Decrease in the nutrients to the endometrium.
- 3) Loss of hormonal stimulation.

- The mass of desquamated tissue & blood plus the contractile effects of prostaglandins, together, initiate uterine contractions which expel the uterine contents (desquamated tissue and blood vessels).

- In normal menstruation, about 40 ml of blood and an additional 35 ml of serous fluid are lost.

\*\* menstrual blood is normally non-clotting due to the presence of fibrinolysin. If there is any clot during menstruation with an increased blood volume (i.e., excessive bleeding) this indicates that fibrinolysin is lost → pathological condition.

\*4- 7 days after menstruation, the loss of blood ceases & the endometrium become re-epithelialized.

**Leukorrhea during menstruation:** leukocytes are released with the necrotic material & blood, so the uterus is highly resistant to infection during menstruation (a protective mechanism).

## **To sum up:**

- Ovarian cycle is parallel to endometrium cycle (hormones secreted by ovaries influence the endometrial cycle)
- **Estrogen is the main hormone that handles the endometrial proliferative phase.**
- **Progesterone is the main hormone in the secretory phase for the lining endometrium.**

## • Menopause:

At 40- 50s, the sexual cycle becomes irregular, ovulation fails to occur & the cycle ceases. The sudden loss of estrogens causes marked physiological changes in the body functions:

1. Hot flushes, characterized by extreme flushing of the skin.
2. Psychic sensations and dyspnea.
3. Occasionally various psychotic states.
4. Fatigue.
5. Anxiety.
6. Increased irritability
7. Decreased strength and calcification of bones. (increased risk of osteoporosis).

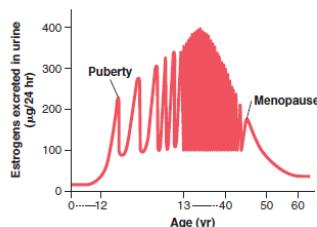
Rates of secretion of gonadotrophic hormones throughout the sexual lives females and males

Before puberty, very low levels in males and females

After puberty, levels increase in both males and females.

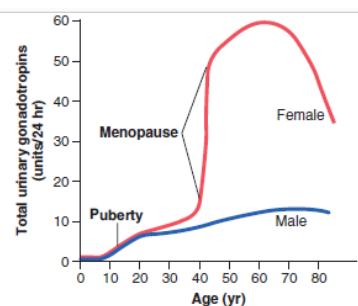
After menopause period starts, females have a sudden increase due to the loss of estrogens and progesterone negative feedback.

In males, after the age of 40, levels increase slightly while aging because levels of testosterone are still high enough not to induce the negative feedback.



← Levels of estrogen decrease progressively before menopause.

the total secretion of gonadotrophic hormones in the urine (y axis) and age (different sexual activity) (x axis)



## Abnormalities of secretion by the ovaries:

### 1- Hypogonadism-Reduced Secretion by the Ovaries:

It can result from poorly formed ovaries, lack of ovaries, or genetically abnormal ovaries that secrete the wrong hormones because of missing enzymes or other problem in the secretory cells. When ovaries are absent from birth or when they become nonfunctional before puberty, female eunuchism occurs.

### 2- Hypersecretion by the ovaries: (clinically rare)

Sex hormones hypersecretion (as a result of having a tumor). This inhibits the production of gonadotropins by the pituitary, which limits production of ovarian hormones.

## Some common Disorder of menstruation:

• **Amenorrhea**: absence of menstrual period, it's either:

1-**Primary**: in which menstrual bleeding has never occurred.

2-**Secondary (cessation)** of cycles in a woman with previously normal periods, **main causes**:

\*Pregnancy (most common). \*Emotional stimuli and environment changes.

\*Hypothalamic diseases (decrease of GnRH pulses). \* Pituitary disorders. \*Primary ovarian disorders and various systemic disease.

• **Menorrhagia**: refers to abnormally heavy or prolonged bleeding.

• **Hypomenorrhea**: refers to scanty flow.

• **Dysmenorrhea**: painful menstruation (cramps due to accumulation of prostaglandins in the uterus which can be treated with inhibitors of prostaglandin synthesis).

Good luck.