

## Female Reproductive System

Has 6 functions:

1. produce ova
2. secrete sex hormones
3. receive sperm
4. provide sites for fertilization, implantation, and development to term
5. facilitate parturition
6. provide nourishment for young via mammary glands

Organs are divided into three functional categories:

1. primary sex organs - ovaries. These produce ova and sex hormones.
2. secondary sex organs - structures essential for all aspects from fertilization to parturition.
  - a. vagina and external genitalia
  - b. uterine tubes
  - c. uterus
  - d. mammary glands
3. secondary sex characteristics - sexual attractants
  - a. body shape
  - b. pattern of body hair
  - c. voice
  - d. breasts
  - e. skin tone

Development: is initially similar to the male. Primordial follicles begin to develop along the 1 sex chords at about 10 weeks. These follicles consist of an oogonium surrounded by a single layer of follicular cells. Thousands of follicles are formed before birth (unlike the sperm in the male).

Uterus and uterine tubes - develop from the paramesonephric (Mullerian) ducts.

Hymen - separates the lumen of the vagina from the urethral sinus.

Clitoris - forms from the phallus.

Labia minora - urogenital folds that remain unfused.

Labia majora - labioscrotal folds which remain unfused.

The external genitalia of the female are formed by the end of the 12th week.

### Membranes

1. Broad ligament - the main supporting membrane of the uterus and uterine tubes. It is really parietal peritoneum.
2. Mesovarium - an extension of the broad ligament that attaches to the ovary.
3. Ovarian ligament - extends from the ovary to the uterus.
4. Suspensory ligament of the ovary - extends from the ovary to the pelvic wall.

Ovaries - produce ova, estrogen, and progesterone. The appearance of the ovary changes with age due to "scars" left by ovulation. The ovaries are found in the ovarian fossa secured by several membranous attachments. Each ovary consists of 4 layers:

1. Germinal epithelium - outermost layer. It is made of simple cuboidal cells.
2. Tunica albuginea - a collagenous CT layer.
3. Cortex - outer
4. Medulla - inner

There is no distinct border between the cortex and the medulla. Throughout the cortex and medulla there is a Stroma. It is the tissue in which the follicles and blood vessels are embedded.

Ovulation - in humans usually occurs about 14 days after the first day of menstruation. During the ovulatory process the following events occur:

1. a Graffian follicle (also known as an antral or vesicular follicle) expels its ovum (secondary oocyte).
2. the granulosa cells become a corpus luteum which will make estrogen and progesterone.
3. if the cycle is infertile the corpus luteum will become a corpus albicans.

#### Secondary sex organs

1. uterine(Fallopian) tubes - transport ova and are the site of fertilization.
  - a. infundibulum = funnel shaped end with fimbria.
  - b. ampulla = shaft of the tube
  - c. isthmus = narrow portion that opens into the uterus.

The uterine tube has three layers:

- a. internal mucosa - is ciliated columnar epithelium to move sperm. It also provides nutrients to the ova.
- b. muscularis - Has contractions for movement of the ova.
  1. thick circular layer
  2. thin outer layer
- c. serous layer - part of the visceral peritoneum.

The uterine tubes receive their blood supply from both ovarian and uterine arteries.

The uterine tubes receive both sympathetic and parasympathetic innervation.

2. Uterus - for development and delivery of the baby. It is a hollow, thick walled structure shaped like an inverted pear. The nonpregnant uterus is about 2.8" long, 2" wide, and 1" in diameter (about the size of your two thumbs).

The uterus has three regions:

- a. Fundus - is the dome shape
- b. Body - usual site of implantation
- c. Cervical region - is actually a canal that has an opening into the vagina (external os) and an opening into the uterine cavity (internal os).

The uterus is supported by 4 paired ligaments:

- a. Broad ligament - is actually peritoneum which attaches the pelvic walls and floor to the uterus.
- b. Uterosacral ligament - attaches the lateral pelvic wall to the uterus.
- c. Cardinal ligament - Runs laterally from the cervix and vagina to the walls of the pelvis.
- d. Round ligament - is actually a continuation of the ovarian ligaments. It extends from the lateral border of the uterus below the uterine tube to the lateral pelvic wall.

Uterine wall - has three layers

- a. Perimetrium - is a thin covering on the outside of the uterus. It is actually part of the peritoneum.
- b. Myometrium - consists of three layers of smooth muscle. longitudinal, circular, and spiral.
- c. Endometrium - is the inner mucosal lining. it consists of two layers:
  1. Stratum functionale - contains secretory glands. This is the portion that is shed during menses.
  2. Stratum basale - is a highly vascularized layer which serves to regenerate the stratum functionale.

Here we should mention ectopic pregnancy. This is the implantation of the blastocyst in a site other than the uterus.

3. Vagina - serves a dual function in being used both for copulation and as a birth canal. It is a potential space that is about 3.5" long (from vestibule to cervix). The area beyond the cervix is called the posterior fornix. There are also smaller anterior and lateral fornices.

The vaginal wall has three layers:

- a. inner mucosal layer- this layer has few glands. It is comprised of nonkeratinized stratified squamous epithelium. There are many folds (vaginal rugae) which allow for distention to allow for the insertion of the penis and passage of the fetus. They also act as friction ridges for stimulation of the penis.
- b. muscularis layer - is made of longitudinal and circular bands of smooth muscle.
- c. fibrous layer - covers the vagina and attaches it to the surrounding pelvic organs.

The vagina has both sympathetic and parasympathetic innervation.

4. Vulva - the external female genitalia. Consists of 5 areas.

- a. mons pubis - is a subcutaneous fat pad overlying the symphysis pubis.
- b. labia majora - two folds of skin. These have hair and sweat glands. They are homologous to the scrotum. They enclose and protect the other organs of the vulva.
- c. labia minora - two folds of skin. These are hairless but they do have sweat glands. They merge anteriorly to form the prepuce (covering of the clitoris). They also serve to protect the vaginal and urethral openings.
- d. clitoris - is highly innervated erectile tissue that is homologous to the glans penis. It is exposed at the upper portion of the pudendal cleft. Like the penis it has two columns of corpora cavernosa which form a crura to attach to the pubic arch.
- e. vestibule - the longitudinal cleft enclosed by the labia minora. It contains the openings for the urethra and the vagina. It also contains greater vestibular (Bartholin's) glands. There is also erectile tissue (vestibular bulbs) under the skin forming the lateral walls of the vestibule.

The vulva has both sympathetic and parasympathetic innervation. Here the parasympathetic system causes a response similar to the male, that is, dilation of the arterioles and constriction of the venous return. This results in female erection.

Orgasm - results in a rhythmic contraction of the muscles of the perineum and the muscular walls of the uterus and uterine tubes. This aids the movement of sperm into the uterine tubes.

5. Mammary glands - are really modified sweat glands. They are divided into 15 to 20 lobes, each with its own duct. Each lobe is divided into lobules which contain alveoli which secrete milk. Suspensory (Cooper's) ligaments support the breasts and divide the lobules.

Clustered alveoli secrete milk into secondary tubules which empty into mammary ducts which enter lactiferous ducts which enter into the ampulla just deep to the nipple. Milk is ejected through the nipple which has an areola with areolar glands.

Ovulation and menstruation - are cyclic events that are regulated by follicle stimulating hormone (FSH) and Luteinizing hormone (LH) from the anterior pituitary and estrogen and progesterone from the ovaries.

The hypothalamus produces Gonadotropin releasing factor (GRF) and sends it to the anterior pituitary causing it to release FSH. The FSH in turn stimulates the follicle which will now produce and secrete estrogen. The estrogen in turn causes the uterine lining to thicken.

Later the anterior pituitary will secrete LH and FSH which will cause ovulation. Immediately after ovulation the follicular cells convert into a corpus luteum which produces progesterone and estrogen.

Estrogen - continues uterine wall development

Progesterone - stimulates and maintains the uterine wall. (vascular and glandular portions)

Both estrogen and progesterone inhibit FSH and LH.

If implantation occurs, the placenta will take over the function of the corpus luteum.

If fertilization and implantation do not occur the corpus luteum will degenerate and the estrogen and progesterone levels will drop. This allows for sloughing of the uterine lining (menses). Also FSH is no longer inhibited so the cycle can start over again. Ovulation is normally 14 days after the start of menses and a normal cycle is 28 days.

Amenorrhea - is the absence of menstruation. There are three classifications of amenorrhea.

1. normal amenorrhea - following menopause or during pregnancy. Sometimes during lactation
2. primary amenorrhea - This is when a woman has never menstruated although she is of appropriate age. These women usually lack secondary sex characteristics. This is usually due to an endocrine disorder.
3. secondary amenorrhea - This is when menstruation stops in otherwise normal women. It may be due to sickness, fatigue, stress, nutrition, etc.

Dysmenorrhea - This is painful or difficult menstruation with severe cramps. This may be caused by endocrine disturbances (decreased progesterone) faulty position of the uterus, stress, or obstruction.