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2nd Edition

Textbook of Physiotherapy for Obstetrics & Gynecological Conditions

GB Madhuri

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CHAPTER

Physiology

FEMALE REPRODUCTIVE SYSTEM

The female organs of reproduction include the ovaries, which produce secondary oocytes (cells that develop into mature ova only after fertilization), progesterone and estrogen (female reproductive sex hormones), inhibin and relaxin, uterine tubes (fallopian tubes) which transport ova to the uterus, the uterus in which embryonic and fetal development occurs.

Female Reproductive Cycle

Uterus

The uterus consists of three layers. They are:

1. **Outer layer or perimetrium:** This layer has epithelial cells and the function of this layer is protection.
2. **Middle layer or myometrium:** This layer consist of smooth muscle cells and the function of this layer is holds baby during pregnancy, expands with pregnancy and helps during labor by pushing the baby.
3. **Inner layer or endometrium:** This layer is the inner layer of the uterus and this layer sheds during menstrual cycle.

During the reproductive years, non-pregnant females normally experience menstrual cycle. Menstrual cycle is a cyclic sequence of changes in the ovaries and uterus. Each cycle takes about a month and involves both oogenesis and preparation of the uterus to receive fertilized ovum. The principal events of female reproductive system are hormonally regulated. The ovarian cycle is a series of events associated with the maturation of the ovum. The uterine or the menstrual cycle is the series of changes in the endometrium of the uterus. Each month endometrium is prepared for the arrival of the fertilized ovum that will develop in the uterus until birth. When the fertilization does not occur the stratum functionalis portion of the endometrium is shedded. Female reproductive cycle has two cycles called ovarian and uterine cycles. These two cycles occur due to hormonal changes and these also regulate the cyclical changes in the breast and cervix.

HORMONAL REGULATION

The uterine cycle and ovarian cycle are controlled by gonadotropin-releasing hormone (GnRH) from the hypothalamus. GnRH stimulates the release of the follicle-stimulating hormone (FSH) and luteinizing hormone (LH) from the anterior pituitary gland. FSH stimulates the initial development of the ovarian

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follicles and secretion of estrogen by the follicles. LH stimulates the further development of ovarian follicles, brings ovulation and stimulates the production of estrogen, progesterone, inhibin and relaxin by the corpus luteum.

Estrogen

It promotes development and maintenance of female reproductive structures; secondary sex characteristics and fat distribution to the breasts, abdomen, mons pubis, hips, voice pitch, broad pelvis and hair pattern. They help to control the fluid and electrolyte balance, they increase protein anabolism. Estrogen inhibition causes inhibition of GnRH, LH, FSH use for contraceptive.

Progesterone

It works with estrogen to prepare the endometrium or implantation of a fertilized ovum and mammary glands for milk secretion.

Inhibin

It is secreted by the corpus luteum of the ovary. It inhibits the secretion of FSH, GnRH, LH. It helps in decreasing secretion of FSH and LH towards the end of the uterine cycle.

Relaxin

It is produced in its highest concentration by the corpus luteum and placenta during the last trimester of pregnancy. It relaxes the pubic symphysis and helps to dilate the uterine cervix to ease delivery.

PHASES OF FEMALE REPRODUCTIVE SYSTEM

The female reproductive cycle normally ranges from 24 to 35 days, events occur during the cycle are divided into three phases:

1. Menstrual phase.
2. Preovulatory.
3. Postovulatory.

Menstrual Phase (Menstruation)

The menstrual phase lasts for 5 days. It has 50 to 150 mL of blood, tissue fluid, mucus, epithelial cells derived from the endometrium. This discharge occurs because the declining level of estrogens and progesterone causes the uterine spiral arteries to constrict. As a result the cells, they supply become ischemic and start to die. Entire stratum functionalis tears off. At this time, the endometrium is very thin because only the stratum basalis remains. The menstrual flow passes from the uterine cavity to the cervix and through the vagina to the exterior. During this stage FSH begins to increase by 25th day of the previous cycle, primordial follicles begins to develop into primary follicles. Towards 4 to 5 day of menstrual cycle, primary becomes secondary (growing) follicle. It has secondary oocytes.

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Preovulatory Phase

It is the second phase of the female reproductive system. It is the time between menstruation and ovulation. It lasts from 6 to 13 days in 28 days cycle. Out of 20 follicles, one gets mature into vesicular ovarian (graafian) follicle or mature follicle, a follicle ready for ovulation. This follicle is visible as a blister-like bulge on the surface of the ovary. Fraternal or nonidentical twins may results, if two vesicular ovarian follicle forms. All hormonal production increases like estrogen, FSH, GnRH, progesterone. Estrogen is liberated into the blood by ovarian follicle stimulate the repair of the endometrium. Cells of the stratum basalis undergoes mitosis and produce stratum functionalis. The endometrium thickness is 4 to 6 mm. Preovulatory phase is also called proliferative phase because endometrium is proliferating. The menstrual phase and preovulatory phase together called follicular phase because ovarian follicle are growing and developing.

Ovulation

It is the rupture of the vesicular ovarian (graafian follicles) with release of secondary oocytes into the pelvic cavity usually occurs on the 14 day in a 28 days cycle. During ovulation, the secondary oocytes remains surrounded by cells called corona radiata. It generally takes 20 days for a primordial follicle to develop into mature vesicular ovarian. During this time, the developing ovum completes reduction division (meiosis I) and reaches metaphase of equatorial division (meiosis II).

At the time of ovulation the secondary oocytes are in metaphase of equatorial division. The fimbriae of the uterine tubes drape over the ovaries and become active near the time of ovulation. Movements of the fimbriae and uterine tube mucosa and ciliary's action creates currents in the peritoneal serous fluid that carry the secondary oocytes into the uterine tube.

All the hormonal levels increase. This sudden surge of LH triggers ovulation. The sign of ovulation is an increase in basal temperature (body temperature at rest). It is 0.4 to 0.6 degree Fahrenheit. Ovulation occurs about 14 days after the start of the last menstrual cycle and due to increasing levels of progesterone. The 24 hours following this rise in temperature is the period immediately after ovulation and is the best time to become pregnant.

Another sign of ovulation is the amount and consistency of cervical mucus. Its secretion is regulated by estrogen and progesterone. At midcycle increasing levels of estrogen causes secretory cells of the cervix to produce large amounts of cervical mucus. As ovulation approaches, the mucus becomes clear and very stretching, if grasped with forceps; the mucus may stretch as far as 12 to 15 cm. This type of mucus indicates the time of greatest fertility.

The cervix also exhibits signs of ovulation. The external os opens, the cervix rises and becomes softer. Some women also experiences a pain in the area of one or both ovaries around the time of ovulation. Such pain is called mittelschmerz meaning pain in the middle and may last from several hours to a day or two.

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Postovulatory Phase

It is the most constant in duration and last for 14 days from 15 to 28 in a 28 days cycle. It represents the time between ovulation and onset of next menses. After the ovulation LH secretion stimulates remains of vesicular ovarian follicle to develop into corpus luteum. Corpus luteum secretes more quantity of estrogen and progesterone. This phase called luteal phase. Progesterone is responsible for preparing the endometrium to receive a fertilized ovum. Preparatory activities include growth and coiling of endometrium glands, which begin to secrete glycogen, vascularization of the superficial endometrium, thickening of the endometrium and increase in the amount of the tissue fluid. These changes are maximum about one week after ovulation. This phase is also called secretory phase because secretory activity of the endometrial glands.

If fertilization and implantation do not occur the rising levels of both progesterone and estrogen secreted by the corpus luteum inhibit GnRH and LH secretion. As LH decreases, the corpus luteum degenerates and become corpus albicans or white body. This decreased secretion initiates another menstrual phase.

Once fertilization and implantation occur hormonal regulation maintained by placenta. Corpus luteum maintained by human chorionic gonodotropin (hCG), a hormone produced by the chorion, which develops into the placenta. Corpus luteum secretes estrogen and progesterone. The presence of hCG is an indication of pregnancy. The placenta secretes estrogen to support pregnancy and progesterone to support pregnancy and breast development, corpus luteum becomes minor.

PHYSIOLOGY OF MALE REPRODUCTIVE SYSTEM

The male reproductive system has external organs and internal organs like penis, scrotum, testicles, prostate gland, urethra, vas deferens, ejaculatory ducts, seminal vesicles and bulbourethral glands. The functions of male reproductive system are sexual function and urination. The male reproductive cells produce sperm and the protective fluid around the sperm is called semen. The male reproductive system also produces hormones. The primary hormones are follicle-stimulating hormones that helps for spermatogenesis. It is a process where sperms are produced. Luteinizing hormone which produces testosterone which helps in process of spermatogenesis and male sexual characteristics development like sex drive, muscle mass, bone mass, fat distribution and bone strength.

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Textbook of Physiotherapy for Obstetrics & Gynecological Conditions

Salient Features

- *Textbook of Physiotherapy for Obstetrics and Gynecological Conditions* has been prepared as per the curriculum and devised as per MCI regulations and universities syllabus.
- This book has been designed for essential and basics of physical therapy for the undergraduate and as well as for the postgraduate courses.
- It includes up-to-date information from the introduction to the recent advances.
- It will be useful for physical therapists, teachers, doctors, rehabilitation professionals, other paramedics and every woman in a child-bearing years.

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Her passion is to write many more books with Advanced Knowledge especially on Orthopedics and Neurology that helps the current and future physical therapy students to update their knowledge and stay with the current trends.

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