HUMAN ANATOMY & PHYSIOLOGY-II- BP201T

UNIT: 5 (REPRODUCTIVE SYSTEM)

CLASS: 3

TOPIC: **Functions of Male Reproductive system**

Testes performs two functions:

1. **Gametogenic function: Spermatogenesis**

   Spermatogenesis is the process by which the male gametes called spermatozoa (sperms) are formed from the primitive spermatogenic cells (spermatogonia) in the testis. It takes 74 days for the formation of sperm from a primitive germ cell. Throughout the process of spermatogenesis, the spermatogenic cells have cytoplasmic attachment with Sertoli cells.

   Stages of spermatogenesis

   Spermatogenesis occurs in four stages:

1. Stage of proliferation

   Each spermatogonium contains diploid number (23 pairs) of chromosomes. One member of each pair is from maternal origin and the other one from paternal origin. The 23 pairs include 22 pairs of autosomal chromosomes and one pair of sex chromosomes. Sex chromosomes are one X chromosome and one Y chromosome. During the proliferative stage, spermatogonia divide by mitosis, without any change in chromosomal number. In man, there are usually seven generations of spermatogonia. The last generation enters the stage of growth as primary spermatocyte. During this stage, the spermatogonia migrate along with Sertoli cells towards the lumen of seminiferous tubule.

2. Stage of growth

   In this stage, the primary spermatocyte grows into a large cell. Apart from growth, there is no other change in spermatocyte during this stage.

3. Stage of maturation

   After reaching the full size, each primary spermatocyte quickly undergoes meiotic or maturation division, which occurs in two phases:

   First phase: In the first phase, each primary spermatocyte divides into two secondary spermatocytes. The significance of the first meiotic division is that each secondary spermatocyte receives only the haploid or half the number of chromosomes. 23 chromosomes include 22 autosomes and a X or a Y chromosome.

   Second phase: During this phase, each secondary spermatocyte undergoes second meiotic division, resulting in two smaller cells called spermatids. Each spermatid has haploid number of chromosomes.

4. Stage of transformation

   There is no further division. Spermatids are transformed into matured spermatozoa (sperms), by means of spermeogenesis and released by spermination.

   Spermeogenesis is the process by which spermatids become matured spermatozoa. Changes taking place during spermeogenesis: i. Condensation of nuclear material ii. Formation of acrosome, mitochondrial spiral filament and tail structures iii. Removal of extraneous (extra volume of nonessential) cytoplasm.

   Spermination is the process by which the matured sperms are released from Sertoli cells into the lumen of seminiferous tubules.

2. Endocrine function: Secretion of hormones.

   Testes secrete male sex hormones, which are collectively called the androgens. Androgens secreted by testes are:

   1. Testosterone 2. Dihydrotestosterone 3. Androstenedione.

   Among these three androgens, testosterone is secreted in large quantities. However, dihydro-testosterone is more active. Female sex hormones, namely estrogen and progesterone are also found in testes. Two more hormones activin and inhibin are also secreted in testes. In testes, androgens are secreted by the interstitial cells of Leydig, which form 20% of mass of adult testis. Androgens are steroid hormones synthesized from cholesterol. Androgens are also synthesized directly from acetate. Two thirds of testosterone is transported in plasma by gonadal steroid-binding globulin. It is β-globulin in nature and it is also called sex steroid-binding globulin. The remaining one third of testosterone is transported by albumin.

FUNCTIONS OF TESTOSTERONE

In general, testosterone is responsible for the distinguishing characters of masculine body. It also plays an important role in fetal life.

Functions of Testosterone in Fetal Life

Testosterone performs three functions in fetus:

1. Sex differentiation in fetus
2. Development of accessory sex organs
3. Descent of the testes.

1. Sex differentiation in fetus Sex chromosomes are responsible for the determination of sex of the fetus, whereas testosterone is responsible for the sex differentiation of fetus. Fetus has two genital ducts: i. Müllerian duct, which gives rise to female accessory sex organs such as vagina, uterus and fallopian tube ii. Wolffian duct, which gives rise to male accessory sex organs such as epididymis, vas deferens and seminal vesicles. If testosterone is secreted from the genital ridge of the fetus at about 7th week of intrauterine life, the müllerian duct system disappears and male sex organs develop from Wolffian duct. In addition to testosterone, müllerian regression factor (MRF) secreted by Sertoli cells is also responsible for regression of müllerian duct. In the absence of testosterone, Wolffian duct regresses and female sex organs develop from müllerian duct.

2. Development of accessory sex organs and external genitalia

Testosterone is also essential for the growth of the external genitalia, viz. penis and scrotum and other accessory sex organs, namely genital ducts, seminal vesicles and prostate.

3. Descent of testes Descent of testes is the process by which testes enter scrotum from abdominal cavity. Initially, testes are developed in the abdominal cavity and are later pushed down into the scrotum through inguinal canal, just before birth. The process by which testes enter the scrotum is called the descent of testes. Testosterone is necessary for descent of testes.

Cryptorchidism is a congenital disorder characterized by the failure of one or both the testes to descent from abdomen into scrotum.

Functions of Testosterone in Adult Life

Testosterone has two important functions in adult:

1. Effect on sex organs

Testosterone increases the size of penis, scrotum and the testes after puberty. All these organs are enlarged at least 8 folds between the onset of puberty and the age of 20 years, under the influence of testosterone. Testosterone is also necessary for spermatogenesis

2. Effect on secondary sexual characters.

Secondary sexual characters are the physical and behavioral characteristics that distinguish the male from female.

Secondary sexual characters in males:

i. Effect on muscular growth: One of the most important male sexual characters is the development of musculature after puberty. Muscle mass increases by about 50%, due to the anabolic effect of testosterone on proteins.

ii. Effect on bone growth: After puberty, testosterone increases the thickness of bones by increasing the bone matrix and deposition of calcium. It is because of the protein anabolic activity of testosterone.

iii. Effect on shoulder and pelvic bones: Testosterone causes broadening of shoulders and it has a specific effect on pelvis, which results in: a. Lengthening of pelvis b. Funnel-like shape of pelvis. c. Narrowing of pelvic outlet.

iv. Effect on skin: Testosterone increases the thickness of skin and ruggedness of subcutaneous tissue.

v. Effect on hair distribution: Testosterone causes male type of hair distribution on the body, i.e. hair growth over the pubis, on face, chest and other parts of the body such as back and limbs.

vi. Effect on voice: At the time of adolescence, the boys have a cracking voice.

vii. Effect on basal metabolic rate: At the time of puberty and earlier part of adult life, the testosterone increases the basal metabolic rate to about 5% to 10% by its anabolic effects on protein metabolism.

viii. Effect on electrolyte and water balance: Testosterone increases the sodium reabsorption from renal tubules, along with water reabsorption. It leads to increase in ECF volume.

x. Effect on blood: Testosterone has got erythropoietic action. So, after puberty, testosterone causes mild increase in RBC count.

APPLIED PHYSIOLOGY

Extirpation (removal) of testes is called castration. Effects of castration depend upon the age when testes are removed.

If the testes removed before puberty, he continues to have infantile sexual characters throughout his life and this condition is called eunuchism. If testes are removed after puberty, some of the male secondary sexual characters revert to those of a child and other masculine characters are retained. Removal of testes in adults does not cause loss of secondary sexual characters. But accessory sex organs start degenerating.

Hypogonadism

Hypergonadism

Azoospermia is the condition characterized by lack of sperm in semen. It is a congenital disease. It is also caused by excess use of corticosteroids and androgens.

Oligozoospermia is the low sperm count with less than 20 million of sperms/mL of semen. Oligozoospermia causes infertility.

Teratozoospermia is the condition characterized by presence of sperms with abnormal morphology. It is also called teratospermia. It occurs in Crohn's disease, Hodgkin disease and celiac disease. The abnormal morphology of sperm results in infertility.

Aspermia is the lack of semen. It occurs due to retrograde ejaculation. Retrograde ejaculation is the entrance of semen into urinary bladder instead of entering urethra. It is due to dysfunction of sphincter of the bladder, which is caused by prostatic surgery or excess use of drugs. Aspermia leads to infertility.

Oligospermia is a genetic disorder characterized by low volume of semen.

Hematospermia is the appearance of blood in sperm. It occurs due to infection of urethra or prostate. It is also common in congenital bleeding disorder.