Puberty, Menopause, abnormalities of testicular functions & Contraception

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البلوغ PUBERTY

Definition:

- Period during which **both** endocrine & gametogenic functions of **primary** sex organ have **first** developed to a degree sufficient for reproduction. قادر

- complete capability to reproduction.

Age of puberty:

- ***In female:*** **8 – 13** years. (Delayed if after 17)

- ***In male:*** **9 – 14** years. (Delayed if after 20)

Theories of onset of puberty

1. Change in the sensitivity of the negative feedback of hypothalamus

- Puberty is initiated by maturation of **CNS** & **hypothalamus**.

- CNS maturation ⇨ ⇩ sensitivity of hypothalamus to the –ve feedback of sex Hormones .

In children: Very high sensitivity of -ve feedback .

So, very low level of sex Hormones ⇨ inhibition of **Gn-RH** so, inhibition of pituitary gonadotropins

After that: ⇩ sensitivity of -ve feedback ⇨ ⇧ FSH ⇨ follicular development.

So, there is ⇧ estrogen with secondary sexual development.

At puberty: normal sensitivity of -ve feed back. So, estrogen is increased to level able to cause LH surge.

2. Role of pineal gland

- Pineal gland secretes **melatonin** ⇨ inhibition of gonadotropins.

- Atrophy & calcification of pineal gland ⇨ removal of the inhibitory effect of the pineal hormones on the anterior pituitary and gonads.

3. Release of neurotransmitters at the hypothalamus

- Dopamine & noradrenalin ⇨ ⇧ release of gonadotropin releasing factors(Gn-RH).

- Enzymes needed for formation of these transmitters increase at puberty.

4. Role of opioid peptides:

- Beta endorphin & encephalin ⇨ ⇧ levels of circulating gonadotropins.

- These peptides reach highest level at puberty.

5. Increase secretion of adrenal androgen .

- At the age of **8 - 10** years adrenal androgen is increased due to:

1. A) change in enzymes. So, more **pregnenolone** ⇨ androgen pathway.
2. B) ⇧ secretion of adrenal androgen stimulating hormone from pituitary **(ACTH)** in 2 zones

6. Role of leptin

adipocytokines from lipid cells.
↳ Not for energy storage only (have endocrine

- [May correlate puberty to body weight.]

- ↑ sensitivity of insulin
- Block of apeptite. (satiety protein)
- ↑ basal metabolic rate.

⟶ لانه في وزن معين لازم يوصل الولد/الشخص عشان الـ puberity.

+ الشخص النحيف غالبًا delayed puberity (sterile)

Changes at puberty

1. Growth promotion

- Due to **sex hormones** from gonads with **growth hormone** from anterior Pituitary and other growth promoting hormones e.g. Insulin & thyroxin.

- The end of the growth occur with **union of epiphysis**.

2. Maturation of the secondary sex characters

- Voice & shoulder & hip & hair & fat distribution.

3. Maturation of the secondary sex organs

- ترتيب الاحداث

In female: in the following sequence:

1) **thelarche:** development of **breast** under the effect of sex hormones. (enlargement of breast)

2) **pubarche:** development of **axillary & pubic hair** under the effect of **adrenal & gonadal androgens**. (androgenic action) (ذكري)

3) **menarche:** the first menstrual period (non -ovulatory for 1 - 2 years).

4) **size of hip:** is more in female than in male. (اول سنتين واخر سنة قبل الـ menopause)

5) **lastly:** true reproductive capability.

In male: the most obvious manifestations are:

1) growth and development of **external genitalia**. (genitalia)

2) hair distribution in face and body. (hair)

3) deepening of voice. (voice)

4) **lastly: spermatogenesis.** (Sperms)

Abnormal puberty

Early puberty (precocious puberty)

a) precocious pseudo-puberty

Early development of **secondary sex organs** and **characters without gametogenesis** due to exposure of immature male to androgen or exposure of immature of female to estrogen the cause may be adrenal(androgen-secreting tumor) or gonadal in origin (interstitial cell or granulosa cells tumors).

b) precocious true puberty

Early normal puberty due to early secretion of Gn-RH due to abnormality of hypothalamus or pineal gland .

Delayed puberty

In female if delayed to 17 years.

In male if delayed to 20 years.

Absent puberty

Failure of sexual maturation.

- In male **eunuchoidism**. No testicle → No Primary sex organs.

ما جتها أصلا

In female **primary amenorrhea**. sensation of manusturation

2ry → period في ظروف معينة الـ → . مثل الحمل

The cause may abnormalities in **pituitary**, **thyroid** e.g. pan-hypopituitarism.

or Removal of testicles

قتل

Menopause

Definition

- Stoppage of female sexual cycles manifested by **amenorrhea.**
- Average age = 45 – 50 years.
- It is due to vanishing of ovarian follicles (either ovulate or degenerate).

The cause of menopause

- The ovaries become **unresponsive to pituitary gonadotropins**.
- Because all ovarian follicles either degenerate or ovulate ⇨ at menopause the number of **primordial follicles** approaches **zero**.
- So, estrogen & progesterone production falls and can no longer inhibits the Production of **Gn-RH** ⇨ increase in pituitary gonadotropins.

Symptoms of menopause

1) hormonal changes

- ⇩ estrogen & progesterone production ⇨ ⇧ gonadotropins.

- Atrophy of **secondary sex organs** (uterus & vagina ….)occur after menopause.

- Regression of the **secondary sex characters**

2) mental symptoms

- Tiredness & depression & irritability.

3) Osteoporosis

4) hot flushes

- Unpleasant sensation followed warm feeling in the skin of face & chest.

- There is visible flushing and sweating.

- **Cause**: vasomotor instability due to sudden decrease in estrogen level.

- **These symptoms can be relieved by daily administration of small doses of estrogen.**

Hypogonadism

Causes of hypogonadism

1) **primary:** due to **failure of testicular functions** May be:

- **Complete:** as in **eunuchoidism** (castration)

Failure of **both** spermatogenesis & endocrinal functions.

- **partial:** as in **cryptorchidism**

Failure of spermatogenesis **but** testosterone secretion in normal.

2) **secondary:** due to failure of secretion of pituitary gonadotropins.

N.B The clinical picture in cases of complete hypogonadism depends on whether the condition develops before or after puberty

Pre-pubertal hypogonadism

- This condition is called **eunuchoidism**
- It is characterized by :
  - Infantile sex organs and loss of libido (sexual desire).
  - A taller stature than normal (due to delayed fusion of the epiphyses to long bones and may be a greater span (= distance between the full extended arms) than the body height (normally both are nearly equal).
  - Absence of male secondary sex characteristics :

The body configuration resembles that of females (narrow shoulders, small muscles and feminine fat distribution in the hips and lower abdomen).

The voice is high pitched and the frontal scalp hairline does not recede.

Pubic and axillary hair appear (**by the adrenocortical androgens**) but the hair is sparse, and in the pubic region, it is triangular with the base up (as in females).

Post-pubertal hypogonadism

This condition occurs as a result of testicular, pituitary or hypothalamic disease. It also **normally occurs in old age** (and is **called male climacteric**) at about the age of **60 years** but there is **no andropause** similar to the **menopause** that occurs in women). It is characterized by the following :

- Depressed sexual functions and libido, in addition to sterility.
- Wasting and osteoporosis due to **loss of the androgen anabolic effect**.
- The secondary sex characteristics and accessory sex organs **are almost not affected** (since they need very little androgen for maintenance), so the voice remains deep and the body hair and penis are not affected.
- The patients occasionally have symptoms like those occurring in menopausal women (e.g. hot flushes, sweating and palpitation).
- Psychological disturbances : The patients commonly become more irritable, passive and depressed.

Reproductive changes in old age:

- These changes are due to: CNS & pituitary & testicular changes.

1) ⇩ daily sperm production. (count)

2) ⇩ libido & sexual potency (starting from the seventh decade).

3) ⇩ fertility rates (but men may be fertile even after the age of 90).

Male sex act

(1) Erection

- **mechanism:**

- Erection is initiated by VD of the arterioles of the penis.

- Then, the veins are compressed ⇨ blocking outflow of blood.

- **Erection center:** sacral segments of the spinal cord (s 2,3,4).

- **Stimulus**

A) unconditioned: afferents from the genital organs.

B) conditioned: descending fibers from cortex that mediate erection in response to erotic psychic stimuli.

- **Efferent:** parasympathetic pelvic sacral nerve (**nervi erigentes**).

- Secrete **Ach & vasoactive intestinal peptide** (VIP) as co-transmitter.

- Also, **nitric oxide** (NO) ⇨ Activate **Guanyl cyclase** ⇨ ⇧ **cGMP** ⇨ **VD**

- Erection is inhibited by **sympathetic VC** impulses to the arterioles.

خروج كل السوائل هاي

(2) Emission

sympathetic

- Contraction of the vas deferens causes expulsion of sperms into the internal urethra.

storage of mature sperms

- Then, contractions of the prostatic capsule & seminal vesicles expel prostatic fluid and seminal fluid.

- All this fluids are mixed in the internal urethra with mucous secreted by the bulbourethral glands forming **semen**.

Cooper glands.

(3) Ejaculation

- It is the propulsion of **semen out of the urethra** at the time of orgasm.

the center in hypothalamus

- ***Orgasm*** is a pleasurable feeling (organic sensation) that usually occurs Simultaneously with emission and /or ejaculation.

- The afferent pathway is fibers from touch receptors in the glans penis that reach the spinal cord through the internal pudendal nerves.

Semen analysis

1. Volume	- 2 – 4 ml for each ejaculation.
2. Color	- White and **opalescent**. bright
3. Specific gravity	- 1028.
4. pH	- 7.5.
5. Fructose concentration	- **200 – 800** mg%. - by prostate (fructose) // main fuel of sperm - If below 135 mg% it indicates decrease testosterone secretion.
6. Sperm count	- **80 – 120 millions/ml**. - If below **20** millions/ml the man is sterile. - No sperms is called azospermia.
7. Abnormal forms	- Less than **20%** of the total count. لو ↑ عن ٢٠٪ ممكن يدخل في
8. Lifespan & Motility	- Maximal life span is **2 days** at **body temperature** after ejaculation. in female tract (Although sperm can live for many weeks in the male genital ducts)

Coagulation & liquefaction of semen

- Clotting enzyme of prostate + fibrinogen of seminal vesicles ⇨ form a weak **coagulum**

(So, sperms are immotile).

- Then, the coagulum dissolved after **15 - 20 min** by **fibrinolysin** of prostate (So, sperms become motile).

- **Impaired liquefaction** may occur **in 4 - 9%** of **infertile** men, and artificial liquefaction with amylase may enhance fertility.

Capacitation of sperms

- It is the ability of sperm to **penetrate** the layer of granulosa cells that cover the ovum.

- This is due to the **acrosomal hyaluronidase & proteolytic** enzymes. (in acrosome (cap).)

- It is **prevented** inside male genital system by **cholesterol** covering the acrosome and Prevents the release of these enzymes.

- **After ejaculation**, the sperms loss their excess cholesterol .

So, acrosomal enzymes are released ⇨ allow penetration of ovum.

Chromatic material + enzymes in ovum prevent another penetration by (-) Chemotaxis

* full capacitation in female genital tract.

Contraception (prevention of pregnancy)

(A) Methods of contraception in females

1- Contraceptive pills: Most contraceptive pills contain relatively **large doses of both estrogen and Progesterone** which **inhibit the release of GTHS** by a negative feedback mechanism, thus preventing **follicular growth** and **ovulation**

Progesterone also makes the **cervical mucus thick** which prevents sperm migration.

2- Intra-uterine devices: e.g. Copper loops

These devices interfere with **ovum implantation** by disturbing the normal endometrial cyclic changes. **In addition**, the devices that contain copper appear also to exert a spermato-cidal effect.

3- Placing spermato-cidal foams in the vagina

These foams either kill the sperms or prevent their motility.

4-Placing diaphragms in the vagina

These are intended to cover ***the uterine cervix***, thus preventing the sperms from getting into the uterus.

5- Tubal ligation

This is ligation of the 2 fallopian tubes, so fertilization cannot occur. However, this method produces **permanent sterility**.

The rhythm method of contraception (safe period)

- Since the ova are viable for fertilization for **only about 24 : 48 hours** after ovulation and the sperms survive in the female genital tract for **about 48 hours** **the effective fertile period** is about **48 hours** and the rhythm method of contraception depends on avoidance of intercourse at that period.

- During the periods **before the 9th day and after the 20th day** of the cycle, there **little chance for pregnancy** to occur, and are thus called the **safe period**. However, this method is **not absolutely safe** because the **time of ovulation is variable** and **some ova and sperms may survive for longer times** than usual

(B) methods of contraception in males

1- Coitus interruption.

This is rapid withdrawal of the penis just before ejaculation so that semen is ejected outside the female genital tract.

2- Taking a hot bath 30 minutes before coitus .

This may be useful since heat **depresses spermatogenesis** and **kills the stored sperms** .

3. Use of condoms

- Condoms are thin rubber sacs that are applied to the penis so that they tightly cover its glans. At the end of a sexual intercourse, the ejaculated semen will be in these sacs and thus prevented to enter the female genital tract.
- It also prevents sexually transmitted diseases.

4-Giving exogenous testosterone

Giving **moderate daily doses of testosterone** depresses spermatogenesis

5- Giving Gn-RH receptor blockers

- These drugs inhibit the secretion of **GTHS** which suppresses spermatogenesis.
- **Inhibin** also decreases the secretion of **FSH** and is **tried to be used as a contraceptive drug** .

6- Vasectomy : This is bilateral **ligation of the vas deferens**. It is an efficient method of contraception , but it leaves the individual **permanently sterile.**


THank you