Hormonal cytology of female genital tract

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- Hormones influence more or less the morphology and staining characters of endocervical, endometrial, and vaginal cells.
- It based on the degree of squamus cell maturation from the intact healthy vaginal surface.
- The best site for taking sample is the lateral mid-third vaginal surface epithelium.
• For useful interpretation; the following information must be taken in account:-

– Age of the patient

– Menstrual history (regular or irregular cycles)

– Previous past history:
  – Hormonal therapy
  – Surgical operations in the genital tract
  – Irradiation

• The ideal type for sample collection is by:

– Aspiration of vagino-cervical secretion from the posterior vaginal fornix or

– Gentle scraping from the lateral mid-third of healthy vaginal epithelium.
Indication of cytological hormonal evaluation

• Assessment of ovarian function
  • After hystrectomy
  • During menstrual cycle
  • In premature menses
• Assessment of abnormal hormonal production
  • Pregnancy  Abortion  Retained placenta
  • Various endocrine disorders
  • Existence of hormone producing ovarian tumors
• Assessment and guidance of hormonal therapy.

Maturation Index

• It is the percentage study of the parabasal, intermediate, and superficial squamous cells\100 cells counted from exfoliated epithelial cells of healthy vaginal smear.

• It is determined by morphology of the nucleus and thickness of cytoplasm of epithelial cells.
Physiology of hormone cycle on women

• In infancy and childhood:
  • Small amount of estrogen without progesterone –
    inactive ovary.

• At puberty:
  – **FSH**: from the pituitary gland --- proliferation of
    ovarian follicles ---- estrogen secretion
    – Maturation of vaginal epithelium
    – Proliferative phase of endometrium

  – **LH** (luteinizing hormone): cause maturation of
    ovarian follicles until rupture and release of ova
    (ovulation).
    – Maintain corpus luteum and progesterone secretion.
    – Stimulate secretory phase of endometrium

  – **If no pregnancy (no implantation of fertilized ova)**
    --- sudden drop of progesterone and estrogen level ---
    - menstrual bleeding (shedding of endometrium and
      basal blood vessels).
– If pregnancy occur (implantation of fertilized ovum) --- corpus luteum continuous secret progesterone and gonadotrophic hormones ----- until the third month of gestation.

– Also; placenta secrete progesterone and gonadotrophic hormones

Reading of the maturation index

1- Shift to the right: indicate an increase number of superficial cell (maturation) i.e. 0\0\100 under the effect of increase estrogen like effect.
2- Shift to the left: indicate an atrophic effect e.g. post menopause women i.e 100\(\%\)0 with no effect of estrogen.

3- Shift to the mid-zone: means progesterone like effect e.g. secretory phase of endometrium i.e. 0\(\%\)100\(\%\)

Normal cyto-hormonal patterns in women

- Throughout life, women under variations in type and level of hormone, which could be due to some factors such as:-
  - Age
  - Pregnancy
  - Menopause
  - Function of pituitary – ovarian – adrenal axis
Hormonal effect

• Estrogen:
  • Proliferation and maturation of the vaginal squamous epithelial cells, including the superficial cells.
  • Deposition of glycogen within the vaginal epithelium.

• Progesterone and androgen:
  • Rapid desquamation of the upper layer of epithelium.
  • Exposed intermediate and parabasal cells to the surface

Normal Maturation Index

1- New born (up to 8 weeks) : MI= 0\90\10
   - Increased number of intermediate cells with glycogen in the cytoplasm, similar to pregnancy cells: due to the effect of maternal hormones on the infant blood.

2- Infancy (8 weeks – puberty): MI= 80\20\0
   - Vaginal smear shows mainly parabasal cells similar to post-menopausal period (vaginal atrophy).
3- Reproductive period (menstrual age):

a- Onset of menstruation (3–5 days)
   - MI= 0/60/40 : intermediate and superficial cells with few RBCs, degenerated endometrial cells, eosinophils, and dirty background.

b- Proliferative phase; pre-ovulatory phase (5-14 days)
   - MI= 0/40/60 : increase estrogen level lead to gradual increase of superficial calls
   - no endometrial cells

c- Secretory phase (pos-ovulatory) (15-28 day)
   - MI= 0/70/30
   - increased intermediate cells
   - increase progesterone secreted by corpus luteum

d- Late secretory phase
   - increase number of lactobacillus organisms
   - Lysis of intermediate cells with dirty background smears
4- Pregnancy  MI= 0\90\10

- Marked increase of estrogen and progesterone (placental secretion).
- Increase number of intermediate cells

**NB** - >20% of superficial cells during 3-4 month of pregnancy indicates poor hormonal support of pregnancy.

- Appearance of significant number of parabasal cells indicates fetal death.

5- Menopause:

- Early menopause:  MI= 0\80\20
  - Most cells are intermediate cells
  - Superficial cells become gradually smaller

- Postmenopausal period:  MI= 50\50\0
  - Progressive decrease of estrogen lead to
    - Increase number of parabasal cells
    - Decrease glycogen in cytoplasm

- Late postmenopausal period:  MI= 100\0\0
  - Complete atrophy of vaginal epithelium with no glycogen; with no superficial cells.
Effect of extrinsic hormones on vaginal cytology

- **Estrogen: MI=0\10\90**
  - Increase cell maturation
  - Proliferation of all layers of epithelium

- **Progesterone: MI= 0\90\10**
  - Proliferation of intermediate cells
  - Decrease superficial cell maturation

- **Androgen like H. (testosterone) MI= 20\80\0**
  - Increase number of parabasal and intermediate cells
  - No superficial cells.