Maternal Adaptation during pregnancy

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Maternal changes in pregnancy

- 1-Genital system 2-Breast 3-Skin
- 4-Hematological 5-Cardiovascular
- 6-Respiratory 7-Gastroentrology
- 8-Urinary 9-Endocrine system
- 10-Musculoskeletal system
- 11-Metabolic changes

Genital Organs Changes

- **Ovaries**
- **Tubes**
- **Uterus**
- **Cervix**
- **Vagina**
- **vulva**

Ovarian &Tubal changes

- Enlarged due to high vasculrity
- CL causes enlargement of one ovary and secrets progesterone till 9^{th}.
- Cessation of ovulation due to inhibition of pituitary hormones by excess estrogen and progesterone

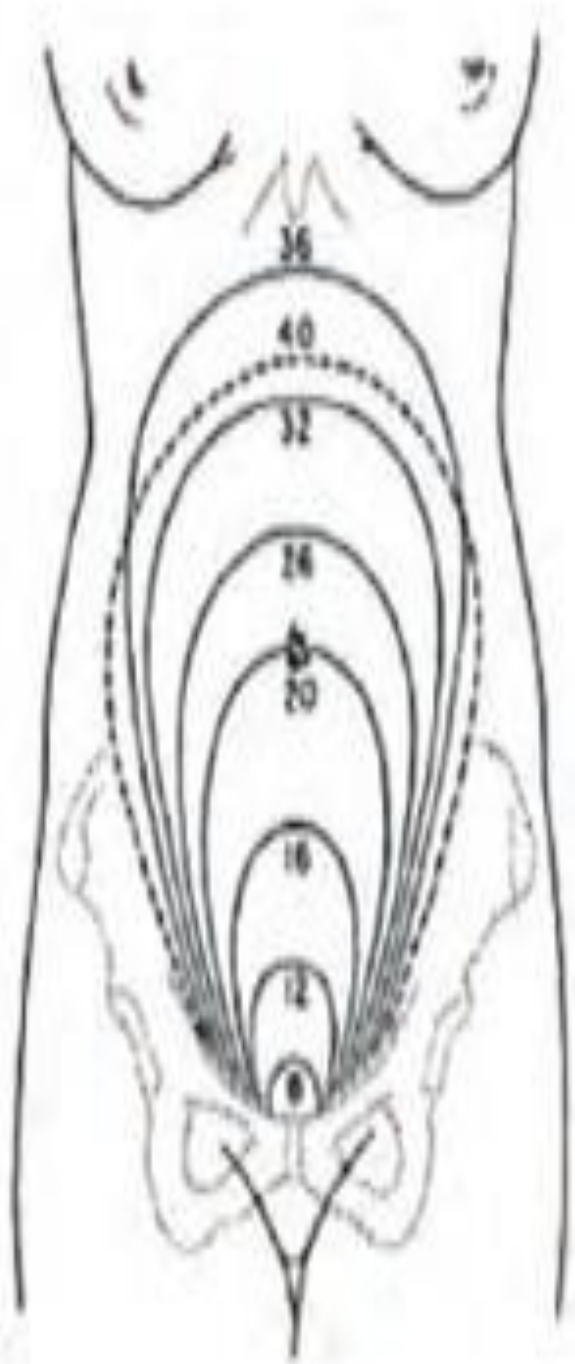
- *Fallopian tube show hypertrophy of muscle layer and flattened epithelium

Uterine changes

- Size & position
- shape
- Weight
- Capacity
- Consistency
- Contractility
- Blood flow
- Formation of lower segment

Uterine changes

- 1-Position increase in size with right tilt due to presence of sigmoid colon on left side (dextro-rotated)
- 2-Size increase from 7.5X5X2.5 cm non-pregnant to 35 X25 X20cm at term
- 12wk...just above symphysis pubis
- 16wk...midway between symphysis and umbilicus
- 20we..at level of umbilicus
- 28wk..at lower 1/3 of line between umbilicus and xiphisternum
- 32wk..at 2/3 of the same line
- 36wk..at level of xiphisternum
- 40wk..desecnd to the level of 32wek



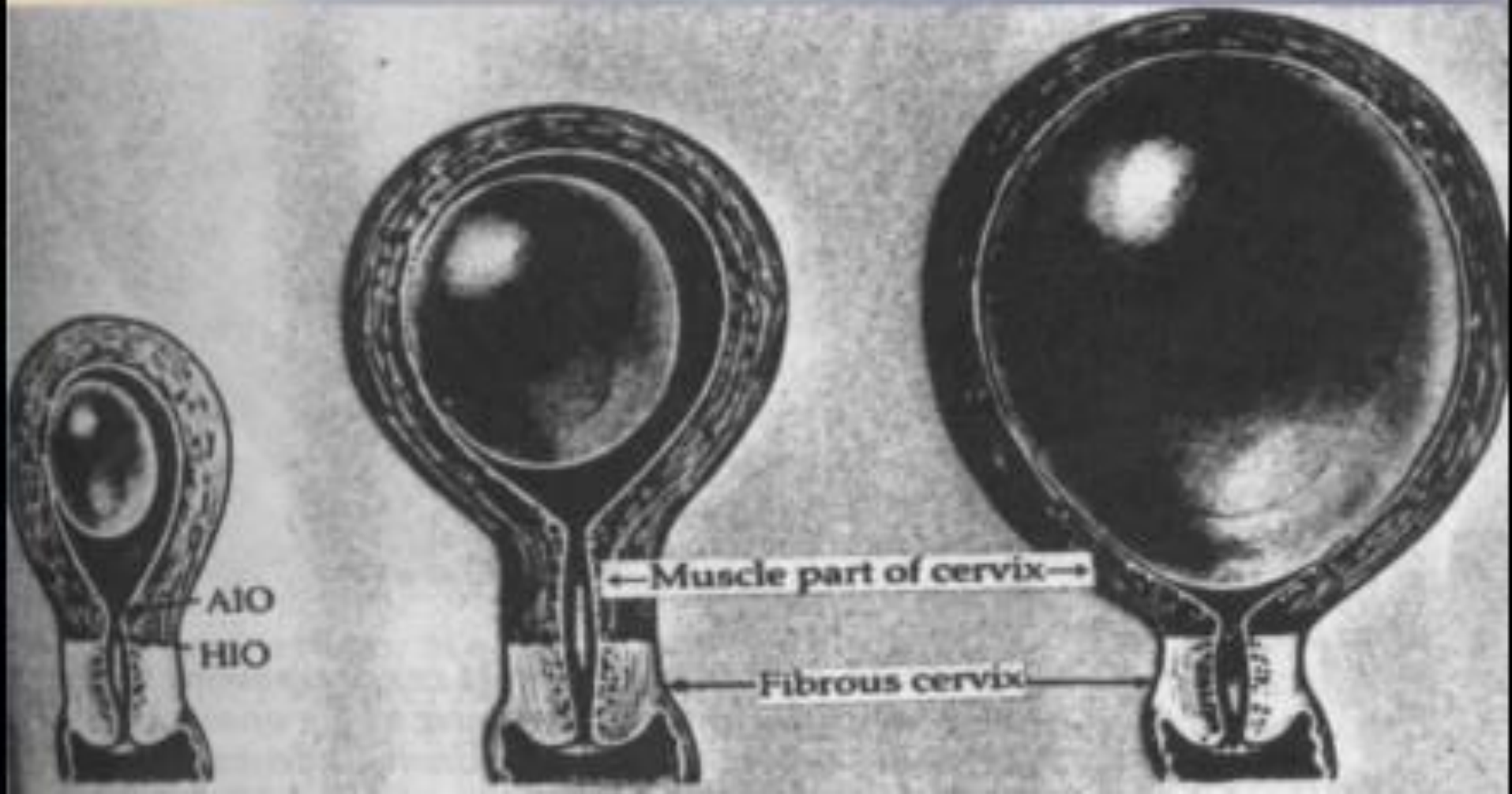
Uterine changes

- **3-Shape**: at 8 wk it is globular and at 16th. Week it becomes pyriform till term
- **4-Capacity** from 4ml to 4L
- **5-Weight** from 70mg to 1kg due to *hypertrophy *hyperplasia *Increase elastin content
- **6-Consistency**:progressive softening due to *increase vascularity *AF

Uterine changes (cont.)

- **Contractility**: starts early and felt by the patient late (Braxton Hicks) and might be confused with labor ,however, these are irregular, not painful, ineffective, relieved by analgesia
- **Uterine blood flow**… increase diameter and tortuosity of blood vessels with increase in blood flow reaching 500cc/min at late pregnancy

Formation of lower uterine segment



Formation of lower segment

	Upper segment	Lower segment
Peritoneum	adherent	Loose
Muscle	3 layers, outer long.intermedia figure 8,inner circular	2layers,outer,long .& inner circular
Decidua Membranes	Well developed Adherent	Poorly developed Loosely attached
activity	Active,contraction and retraction.	Passive,streetsh, become thin

Changes in cervix

- Hypertrophy
- Progressively softening (Hegar's sign)
- Secretion become viscid and form mucus plug (help prevent ascending infection)
- Bluish in color due to excessive congestion of blood vessels (Chadwick's sign)
- Development of columnar epithelium on the ectocervix (Ectopy)

Cervical Ectopy

Vulval & vaginal changes

- Vagina become warm, moist and bluish in color (Chadwick's sign)
- Vulva become warm and moist and varicosities may appear

Breast changes

- Early become heavy with tingling and over sensitivity of nipples, then enlarge and shows nodularities due to hypertrophy of milk ducts
- Visible veins may appear in the skin
- **Primary areola**: dark pigmentation of nipples start to appear at 6-8 wk
- **Montgomery's follicles** appear at same time due to hypertrophy of sebaceous glands
- **Colostrum**: yellowish discharge appear at 13-14 wk
- **Secondary areola**: dark pigmentation in the area around the nipples appear around 20th.wk
- Striae gravidarum may present

Skin Changes

- **Pigmentation**: due to increase secretion of melanocyte stimulating hormones
- ***Clams gravidarum** butterfly pigmentation on the checks called mask of pregnancy. disappear after pregnancy
- ***Breast pigmentations**
- ***Linea nigra**: dark pigmentation of the line extending from umbilicus to symphysis pubis

Skin changes

- **Striae gravidarum**: reddish depressed streaks usually seen in the abdomen, breasts and thigh
- Due to rupture of elastic fibers of the dermis leading to exposure of SC vessels
- Become fibrotic after delivery and called striae albicans
- ***increase vascularity** with blood flow, leading to feeling of hotness
- Increase secretion of sweat and sebaceous glands

Hematological Changes

- **Blood volume**: increases steadily reaching 40% above non-pregnant by 32-34wk
- Increase plasma volume 40%
- Increase blood cell mass 18%
- This leads to haemodilution and physiologic anemia
- N.B with iron supplementation RBCs mass increase 30%

Benefits of increased blood volume

- 1-compensate the blood loss during delivery
- 2-protect the mother from hypotension which occurs in late pregnancy during standing or sitting (due to pooling of blood in LL)
- Plasma increase more than Red blood cell mass…increase flow to skin and kidneys.. more excretion power.
- Increase peripheral flow leading to loss of excess heat (resulting from increased BMR30%)

Blood indices

- RBCs decreases from 4.5 million to 3.7 million relative to increase in plasma volume
- Leucocytes increased from 7000 to 11000 and in labor reach 16000/mm3
- Fibrinogen increases from 200-400 to 400-600gm/l
- Hb decreases from 14 to 12gm/l due to increase in plasma volume
- ESR increase from 12 to 50mm/h

Iron requirements

- Increase through pregnancy which requires 1gm . Daily requirements is 6-7mg.
- Mother needs 500mg
- Fetus needs 300mg and
- 200mg for excretion
- Supplemental iron is indicated in pregnancy because iron absorbed and recruited from food (300-500mg) does not compensate for the requirements

Cardiovascular system

- Heart
- Position: sifted 2-3cm to left and rotates 15° along its axis and lies outside its normal position
- X-ray show enlarged heart with straight left border
- HS. *Loud 1st. HS *splitting of 1st.HS
- *hearing 3rd HS *soft ejection systolic murmur
- ECG:-flat or inverted T -depressed s-t segment
- -frequent o waves –occasional u waves
- These due to left axis deviation

Blood pressure

- Blood pressure is highest on sitting, intermediate on lying supine and lowest on lateral side (i.e there is positional changes of BP)
- Systolic blood pressure remain all through pregnancy, diastolic pressure decrease during second half leading to wide pulse pressure
- Supine Hypotension syndrome: pressure of gravid uterus on IVC leads to decrease VR and COP leading to hypotension
- Pressure of gravid uterus on aorta may lead to decreased placental blood flow
- Roll-over test

Veins

- Venous pressure does not change in the antecubital vein but increase from 8 to 24cmH20 in femoral veins due to pressure of gravid uterus on iliac vessels
- increased incidence of varicosities in LL due to pressure of gravid uterus on iliac veins and relaxation of smooth muscles of the veins (progesterone effect)

Respiratory system

- Dyspnea increased due to:
- 1-increased sensitivity of RC to CO2 (progesterone effect)
- 2-Elevation of diaphragm in late pregnancy
- *Increase tidal, minute volume, plasma pH, o2 consumption
- *Decreased IRV,ERV,RV,PCO2
- *Vital capacity and PO2 do not change

Metabolic changes

Weight Gain

*Marked variation occurs during pregnancy

*Average weight gain 12.5kg mainly in the second half

*Weight gain ranges between 250g to 750gm per week in the second half

*Products of conception contributes to 4-4.5kg

Distribution of weight gain

organ	Wt. gain	organ	Wt. gain
Fetus	3400gm	Blood	1450gm
Placenta	650gm	Extra cellular	1480
AF	800gm		
uterus	970gm		
breasts	400gm	total	12500gm

Carbohydrate changes

- Pregnancy is potentially diabetogenic due to:
- 1-decreased insulin secretion
- 2-increased insulin elimination
- 3-decrese in receptor binding
- 4-presence of anti-insulin:
- A-glucocorticoids b-sex steroid hormones c-insulinase d-hPL
- Renal Glucosuria may occur due to decreased renal threshold for glucose
- Alimentary Glucosuria may also occur

Other metabolic changes

- Water retention increases secondary to sodium retention (aldosterone effect)
- Tendency to nitrogen retention for fetal and maternal tissues
- Increase plasma lipids with tendency to acidosis
- Increase demand for iron, calcium, phosphate and magnesium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