



NEET SS



OBSTETRICS+ PART 1



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MATERNAL PHYSIOLOGICAL ADAPTATION IN PREGNANCY

Reproductive tract

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uterus :

myocyte arrangement :

- There are three muscle layers : The inner circular layer, the middle interlacing layer, and the outer longitudinal layer.
- The middle interlacing layer is responsible for contractions.
- The vessels lie between this layer.
- This interlacing nature of the muscles helps prevent blood loss during delivery.
- There is myocyte hypertrophy.

Division :

- The upper uterus has more longitudinal fibres because that is where contraction happens.
- The lower uterus has circular fibres for constriction, because once the baby is delivered the canal constricts.

Size change :

- A non pregnant uterus weighs around 70 g.
- A pregnant uterus weighs around 1 Kg.

Shape change :

- It is initially spherical, then becomes oval, then becomes cylindrical.

Fundal height :

- At 12 weeks the uterus becomes a pelvic organ.
- At 20 weeks it is at the level of the umbilicus.
- At 36 weeks it is at the level of the xiphoid process.

Positional change :

- The uterus comes into the pelvis and undergoes some dextrorotation.
- It dextrorotates to the right because the sigmoid colon lies on the left side.
- This is why the left lateral position is better to increase blood flow to the uterus.
- It forms a 90° angle with the vagina, but this is only maintained in early

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pregnancy, after which it becomes an abdominal organ.

- Once it becomes an abdominal organ, there is dextrorotation.

Displacement :

- As the uterus rises it displaces everything upward.
- The stomach and intestines move up, which increases the chance of gastrooesophageal reflux.
- The heart also moves up and laterally.

Contractility changes :

- There is hypertrophy of the smooth muscle, with almost a 10 time increase in size.
- Gap junctions increase, more towards term in preparation for parturition.
- Contractile proteins such as actin and myosin increase.
- There is an effect of progesterone and oxytocin.
- Oxytocin receptors are fewer earlier in pregnancy and then increase exponentially.
- The action of oxytocin is therefore seen better later in pregnancy.
- Progesterone maintains the quiescent stage until term, after which there is a dip.
- This is the logic of giving progesterone to a female with preterm labour or twin pregnancy.
- In twin pregnancy many guidelines allow vaginal progesterone, because there is excessive distension of the uterus and progesterone helps with that.

uteroplacental blood flow :

- Cardiac output increases, so more blood goes to the uterus and placenta.
- Prepregnancy uterine blood flow is 50 to 90 ml per minute.
- At term it increases to 500 to 700 ml per minute.

Reasons for increased uterine blood flow :

- Systemic vascular resistance goes down.
- Endothelial nitric oxide helps.
- Progesterone helps.
- Angiogenesis occurs.
- There is vascular remodelling, causing refractoriness, so the vessel becomes refractory to anything causing constriction.
- Three main reasons : vascular refractoriness, more blood vessels through angiogenesis, and endothelial nitric oxide.

Distribution :

- At term, 80% of uterine blood flow goes to the placenta and only 20% goes to the uterus.

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Auto transfusion :

- As delivery happens the placenta comes out and pressure on the IVC is relieved.
- There is auto transfusion, so much of that blood enters the systemic circulation.
- Patients with heart disease or preeclampsia cannot tolerate this massive shift, and it can lead to pulmonary oedema.

Cardiac output to the uterus :

- In the prepregnancy state, only 3.5% of cardiac output goes to the uterus.
- In a pregnant female, 12% of cardiac output goes to the uterus.

Vascular adaptations :

- There is spiral artery remodelling.
- As the embryo implants, the trophoblast invades the spiral artery and remodels it.
- The muscular nature is lost, so it becomes a low resistance, high flow vessel.
- There is vessel dilatation, with a 4 to 6 fold increase in diameter.
- There is increased permeability of the endothelium.
- There is angiogenesis with new blood vessel formation.
- Vasodilatation occurs because of prostacyclins and nitric oxide.

Consequences if vascular adaptation is deficient :

- Foetal growth restriction, due to deficient uteroplacental blood flow.
- Preeclampsia, due to lack of proper spiral artery remodelling, an obstetric vasculopathy.
- Placental abruption, because acute flow disruption can lead to abruption.
- Preterm labour, due to increased contractility from disruption in blood flow.
- The interlacing fibres and vessels help prevent bleeding, which is their role in PPH.

Cervix :

- The cervix becomes softened.
- On per vaginal examination, senior gynaecologists used to diagnose pregnancy by feeling the softening of the cervix when ultrasounds were not easily available.

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- On per speculum examination, **bluish discolouration** of the cervix can be seen.
- Position changes from posterior to anterior (Part of the Bishop scoring).
- Consistency changes from firm to softened.

Goodell sign :

- This softening is the Goodell sign, seen around 6 weeks.

Chadwick sign :

- The bluish discolouration is the Chadwick sign, seen around 8 weeks.

mucus plug :

- The cervical canal has a mucus plug.
- It has an immunological and protective role.
- It prevents organisms from entering to an extent.
- It prevents ascending infection.
- The cervix then dilates for labour.

Cervical length :

- The normal cervical length is around 3 to 4 cm.
- Concern arises when it is **<2.5 cm**.

Ovary :

- The ruptured follicle forms the corpus luteum, which secretes hormones.
- The corpus luteum secretes oestrogen and progesterone for 7 to 9 weeks.
- At 7 to 9 weeks the shift happens and the placenta takes over.
- If the corpus luteum is removed before 9 weeks, before the placenta has taken over, the pregnancy will not survive.

Pregnancy related ovarian masses :

- There are two kinds : **Hyperreactio luteinalis** and **pregnancy luteoma**.

Pregnancy luteoma :

- It is a benign neoplasm.
- It can be unilateral or bilateral.
- It is usually solid.
- Luteinised stromal cells in the ovary lead to its formation.
- It usually occurs in the 2nd half of pregnancy, in the 2nd or 3rd trimester.
- It is associated with an increase in androgen, so testosterone levels increase.
- Up to 25 to 30% of pregnant females develop features of virilisation.
- 80% of female foetuses are affected if the mother is affected.
- If the mother is not affected, the baby will not be affected.

- The chance of female foetal virilisation is extremely high.
- There is no treatment; it follows spontaneous regression.

Hyperreactio luteinalis :

- On ultrasound it looks like a stimulated ovary, mimicking ovarian hyperstimulation syndrome with multiple cysts.
- It occurs because of an increase in HCG, which increases androgen, so it is also associated with virilisation.
- Around 30% of these females can have virilisation, but the chance of the foetus being affected is negligible.

Associations of hyperreactio luteinalis :

1. Gestational trophoblastic disease.
2. Multifoetal gestation.
3. Alloimmunisation and placentomegaly due to diabetes mellitus.
4. Preeclampsia, with an association with growth restricted foetuses.
5. Hyperthyroidism, because HCG and TSH share the alpha subunit, as these are glycoprotein hormones.

Protective mechanisms against virilisation :

- Sex hormone binding globulin increases; in pregnancy all globulins increase, and once SHBG increases the androgen is suppressed because it binds to SHBG.
- The placental enzyme aromatase increases, which converts androgen into oestrogen.

Fallopian tube :

- The fallopian tube slightly lengthens and distends.
- There is increased peristaltic activity, to allow fertilisation.
- There is increased ciliary movement, which enhances transport of the egg, sperm, and finally the embryo into the uterus.
- There is increased blood supply to the fallopian tube.

Vagina :

- There is increased blood flow to the vagina, which can cause bluish discolouration.
- The vagina has a normal microflora and an acidic pH; if disturbed, there is increased chance of ascending infection.

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- Earlier studies, around 20 years ago, researched the association of bacterial vaginosis with preterm labour.
- It is now known that only GBS is important and can lead to preterm labour, and it is necessary to treat.
- The acidic pH decreases further as a protective mechanism.
- There are increased secretions; pregnant females often report white discharge, called leucorrhoea.
 - Leucorrhoea is normal when it is white, has no odour, and is not associated with itching.
- The vaginal epithelium becomes thickened and stratified squamous.
- Lactobacilli increase to maintain the acidic environment.

Perineum :

- The perineal muscle has to stretch and prepare for delivery.
- There is increased blood supply.
- There is increased stretching because of relaxin and oestrogen.
- There is reduced perineal tone.

Consequences if the vaginal flora changes :

- Increased chance of vaginitis, fungal infection, and bacterial infection, which can lead to preterm labour.
- This is why ACOG guidelines in developed nations screen for GBS at 35 to 37 weeks.

GBS screening indications :

- History of GBS in a prior pregnancy.
- Prolonged rupture of membranes.
- Unknown GBS status.

Breast

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Overview :

- Breast size increases because of changes in the ducts and stromal tissue.
- There is breast enlargement by almost 25 to 50% by the third trimester.
- The nipples become darker with increased pigmentation.
- The Montgomery glands become very prominent.

Areola :

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- The areola increases in size and pigments more.
- The nipple does not increase in size; the areola increases and both darken.

vascularity :

- There is increased vascularity, with visible venous engorgement that can appear as bluish discolouration from veins.
- Striae gravidarum can form because of the increase in size, and the breast is one of the more common sites.

Glandular changes :

- The alveoli proliferate more than the glands.
- There is increased formation of lobules, with 15 to 25 lobules per lobe, compared with the normal 10 to 15.
- There is ductal branching.
- There are stromal changes because of increased connective tissue.

Colostrum :

- Colostrum, the yellowish first milk, starts at 16 to 20 weeks.

Nipple discharge :

- Some patients report breast or nipple discharge in pregnancy.
- One cause can be withdrawal of progesterone, and such a patient may have imminent labour.
- Nipple stimulation can help in labour as a natural technique; the female starts from the 34th week, three times a day for about an hour.
- Lactogenesis increases.

Hormonal regulation :

- Oestrogen controls ductal growth.
- Progesterone controls the alveoli, with a 15 to 20% growth in the alveoli.
- Prolactin maintains the breast milk.
- Human placental lactogen is responsible for breast development.
- Growth hormone helps in tissue development.

Breast cancer screening :

- Pregnancy is a good time for ruling out breast lumps.
- In a country like India with a large population and limited doctors, breast cancer screening should happen in pregnancy.
- The female can be taught how to palpate a lump, usually in the first or early second trimester.

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- Nipple care should be explained, as mastitis can occur later during feeding.

Skin and hair changes

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Linea nigra :

- The linea alba darkens to become the linea nigra.
- It is a dark coloured line from the umbilicus to the pubis.
- It is usually present in 70 to 90% of females.

melasma :

- The mask of pregnancy is melasma, which is hyperpigmentation of the face.

Pigmentation :

- The areola and nipple darken.
- The genitalia darken.
- The axilla can darken.

Freckles :

- Freckles become more visible, especially in females from equatorial regions, because of skin changes in pregnancy.

Striae gravidarum :

- They appear silvery, reddish, or purplish.
- They occur in 50 to 90% of females.

Predisposing factors :

- Protein deficiency.
- Genetic predisposition to striae.

Prevention :

- There is no definite way to prevent them.
- Only almond oil, vitamin E, and aloe vera have been shown to help to some extent.
- Commercial products such as bio oil do not work.
- The female should never scratch the striae, as this increases them.

Sites :

- They are most commonly present on the abdomen, breast, thigh, and buttocks.
- They are initially red and purplish and then become silvery.

Risk :

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- Females with rapid weight gain are at risk.
- Genetic predisposition is a risk.
- Moisturisation is key.

Vascular changes :

- There is increased blood flow and therefore stasis.
- Spider angiomas can be seen, which are also common in liver disease, so it is important to know what is normal.
- Spider angiomas are usually seen on the face, chest, and near the breast.
- There is palmar erythema, so the palms become red.
- Varicose veins are common because of venous stasis in the lower limbs.
- Haemangiomas may increase in size if any are present.

Hair changes :

- There can be hirsutism, which can be due to ovarian disease such as an ovarian mass, but in general because androgens are increasing.
- It is not permanent and usually occurs over the face and abdomen; many females develop facial hair on the chin which they never had.
- There can be telogen effluvium.
- Pregnancy has a prolonged anagen phase, so many females report shinier, better hair in pregnancy.
- Postpartum, the anagen phase converts to telogen, causing telogen effluvium for a long time.
- Up to 90% of females regain their hair, so it is not lost permanently in most; only 10% or less do not regain it.
- Regrowth can take time, around 3 months, 6 months, up to 18 months.
- Hair texture can change and become dry.
- Nails become brittle and their growth rate increases, so these females may need to cut their nails twice a week.

Skin lesions :

- There is prurigo of pregnancy.
- There is increased itching; patients are advised to apply aloe vera gel, moisturise well, and drink plenty of water.
- There can be pruritic urticarial papules.
- Intrahepatic cholestasis (Spider angiomas).