MATERNAL PHYSIOLOGICAL CHANGES DURING PREGNANCY

ALI MUMBO
REPRODUCTIVE HEALTH

Outline

- Introduction
- Endocrine system
- Genital system
- Breast changes
- Abdominal wall and Pelvic changes
- Gastrointestinal system
- Kidneys and Urinary Tract
- Haematologic system
- Cardiovascular system
- Respiratory system
- Changes in Metabolism

Introduction

- Pregnancy brings about physiologic, biochemical and anatomical changes
- Aimed at maintaining a healthy environment for the fetus without compromising that of the mother
- Also prepares mother for childbirth and lactation
- All systems affected but most conspicuous changes in the genital system

Introduction contd.

- Changes revert to pre-pregnancy status from time of delivery up to 6 weeks postpartum
- Most changes due to pregnancy hormones, others due to uterine enlargement
- Some changes predispose to disease processes, others make diagnosis of the disease processes more difficult

Changes in Endocrine system

- Fetal trophoblast produces large quantities of HCG – prolongs lifespan of corpus luteum
- Hormone production by Corpus luteum is taken over by placenta after 12th week
- Placenta produces large quantities of hPL, Progesterone, estrogen
- Maternal adrenal glands also produce increased amounts of Cortisol, aldosterone

Effects of endocrine changes

- Progesterone
  - Reduces smooth muscle tone
    - GIT motility – nausea, bloating, constipation
    - Uterine tone – maintenance of pregnancy
    - Bladder/ureteric tone – stasis of urine
  - Reduced vascular tone – diastolic BP↓, varicosities
  - Thermogenic – elevated temperature
  - Increased fat storage
  - Over-breathing - low pCO_2, high pO_2
  - Development of breasts - alveoli

Effects of endocrine changes 2

- Estrogen
  - Induces growth of uterus, controls its function – receptors for oxytocin
  - Induces breast development – duct system
  - Causes water and Sodium retention
  - Softens connective tissue – cervix, joint capsules, relaxes pelvic joints – pain, waddling gait
  - Oestriol levels – been used to assess well being and function of feto-placental unit

Effects of endocrine changes 3

- HPL – alters maternal carbohydrate, lipid metabolism – raises blood glucose levels – more available to fetus
- ACTH – increases Cortisol, Aldosterone - ↑blood glucose, water/Sodium retention
- TSH – causes thyroid enlargement ith icreased production but free thyroid hormones normal due to ↑binding proteins (estrogen effect)

Changes in Genital system

- Uterus
  - Grows under influence of E2, P4, and distension – initially – increase in number of cells, later hypertrophy of cells
  - At term measures 35x23 with walls 1 cm thick
  - Wall consists of – outer layer of longitudinal fibres, intermediate layer of an interlacing meshwork , inner layer of circular fibres – most prominent at internal os, tubal openings
  - Blood supply greatly increased – dilated vessels
  - Undergoes irregular painless contractions – Braxton Hicks

Genital system changes 2

- Cervix
  - Hypertrophies
  - Becomes softer – increased vascularity, gland spaces
  - External os appears open in multiparae, closed in primis
  - Integrity of internal os ensures retention of pregnancy
  - External os appears red-pink due to extension of collumnar epithelium – a form of cervical erosion
  - Glandular activity increases

Genital system changes 3

- Vagina and Vulva
  - Vascularity increases
  - Color of vaginal wall purplish
  - Perineal body becomes softened and relaxed
  - Vaginal secretions increase – from cervical glands and transudation across vaginal walls
  - Increase in Vulva vascularity – varicose veins may appear

Breast changes

- Occur under influence of Estrogen, Progesterone , Prolactin, Cortisol
  - Breasts enlarge – especially at periphery
  - Lobules become prominent , a bit tender
  - Nipple larger, more readily erectile
  - Areola more deeply pigmented – variable extend
  - Sebaceous glands in areola enlarge – seen as a ring of 12-20 small tubercles around the nipple (Montgomery's tubercles)
  - Stretch marks in the skin – striae
  - Clear fluid can be expressed from 12th week – increases, yellowish color towards end of pregnancy - colostrum

Abdominal wall and Pelvic changes

- Striae gravidarum – due to distension - rupture of elastic fibres in skin
- May also appear on thighs, groin
- Due to high glucocortcoid levels
- Linear nigra appears in dark skinned individuals
- Increased vascularity – softening of joint capsules, ligaments – increased mobility at joints - pelvic discomforts, waddling gait

GIT changes

- Oral cavity
  - Salivation may seem to increase – reduced swallowing due to tastelessness, nausea
  - Tooth decay due to reduced pH
  - Gum hypertrophy with hyperemia- bleed easily – estrogen effect
- Stomach and Eosophagus
  - Relaxation of cardiac sphincter – regurgitation of gastric contents – heartburn

GIT changes contd.

- Slow gastric motility – prolonged emptying time – bloating, nausea, hyperacidity
- Reduced small intestine motility – more complete digestion and absorption
- Reduced large bowel motility – more time for water re-absorption – constipation
- Increased nutritional needs – raised appetite
- Bloating/nausea - low appetite
- Pressure from enlarging uterus – reduced capacity for large meals – small frequent feeds

Changes in kidneys & urinary tract

- Anatomic changes
  - Enlargement of kidneys - by 1-1.5 cm in length
  - Elongation and dilatation of the ureters – more so above the brim
  - Ureteric changes due to progesterone effect, compression by uterus & distended ovarian vessels in infundibulo-pelvic ligament
- Effects of anatomic changes
  - Stagnation of urine in dilated ureters, incomplete emptying of bladder
- Other effects
  - Frequency of micturition in early pregnancy and near term

Changes in renal function

- Blood flow to kidneys increased – increased GFR but urine output about the same
- Due to ↑GFR – wastes more easily excreted, blood creatinine, urea levels lower than non-pregnant state
- Filtered glucose may exceed re-absorptive capacity – glucosuria not uncommon
- Glucosuria increases likelihood of UTI's, candidiasis.

Hematological changes

- Blood volume increases – proportional to body size
- Starts in 1st trimester, rapid in 2nd, plateaus in 3rd
- Average increase by term = 45-50%
- Due to high levels of Aldosterone, Estrogen, increased vascular space, extra metabolic needs of fetus
- Increase in plasma volume exceeds increase in red cell mass – hemodilution – Hb =/> 11(10) g/dl

Hematological changes contd.

- WBC count also increases – to 5-12 x 10^6/ L.
- Too high if > 15x10^6/L, may go as high as 25-30^9 /L during labor
- Clotting factors in plasma also increase – esp. 1, 7, 8, 9, 10, and 12

Cardiovascular system

- Related to cardiac output, BP, blood flow, position of the heart and heart sounds
- Cardiac output increases by about 40% - reaches maximum at 20-24 weeks
- Due to an increase in both stroke volume and heart rate
- Cardiac output is sensitive to position – due to pressure from the enlarging uterus
- BP decreases slightly – by a factor of about 10mmHg

Cardiovascular system changes 2

- BP reduces in 2nd trimester and gradually rises to pre-pregnancy level by about 36 weeks
- Blood flow increases to uterus, kidneys, breasts & skin – hands and feet noticeably warm
- Stasis occurs in venous system – predisposes to ankle edema, varicose veins, hemorrhoids
- Pressure from enlarging uterus displaces heart upwards and outwards – apex beat shifts to 4th intercostal space lateral to mid-clavicular line
- Ejection systolic murmur often heard due to increased stroke volume

Changes in respiratory system

- Pulmonary ventilation increases by about 40%
- Due to increase in tidal volume and decrease in residual volume
- Results in lowering of pCO2 (and increase in pO2).
- Gives rise to sensation of breathlessness – diminishes in late pregnancy when head engages = lightening

Changes in metabolism

- Weight gain occurs – total varying between 7-17 kg, average 12 kg
- Average gain in late 2nd and 3rd trimester = 0.5kg per week
- Results from – uterine contents(4.5kg), uterus (1kg), breasts (1kg) – rest = other maternal tissues (protein, fat, water retention)
- Basal metabolic rate increases by 10-25%
- May result in increased appetite
- Changes in carbohydrate and fat metabolism may unmask latent diabetes