Physiological changes during pregnancy

Cardiovascular system	Respiratory system	Renal system
○ Peripheral vasodilation lead to decrease SVR. ○ Increase 40% in CO (20% by week 8). ➢ Max CO at 20-28 week ➢ CO increase more in labor (15% 1st stage, 50% in 2nd stage). ➢ CO returns normal in 2 week postpartum. ○ Increase stroke volume. ○ Increase HR. ○ Increase contractility. ○ The heart is dilated. ○ BP drops during pregnancy (lowest at 22-24 week), then return to the pre-pregnancy state at term, drop after delivery, then return back within 3-6 days.	○ 40-50% increase in minute ventilation due to: ➢ Increase tidal volume. ➢ Hyperventilation (leads to decrease PaCO & compensatory fall in bicarbonate). ○ Decreased PVR. ○ Decreased functional residual capacity & residual volume. ○ Increased O2 consumption 20%. ○ Increased metabolic rate 15%. ○ No change in: vital capacity, RR, PaO2, FEV1, PEFR.	○ Dilation in renal collection system. ➢ More in right. ➢ Progesterone. ➢ Uterine compression. ○ Renal plasma flow increase 60-80% in 2nd TM, then decrease in 3rd TM (still 50% higher than pre-pregnancy). ○ Decrease serum urea & creatinine due to: ➢ Increase GFR. ➢ 50% increase in creatinine clearance. ○ Increased protein execration (300 mg instead of 150 mg). ○ Physiological Na & water retention > edema (80%).

Hepatobiliary system	Gastrointestinal system	Skin
○ Increased liver metabolism. ○ Decreased total serum protein. concentration due to: ➢ 20-40% decrease in albumin. ➢ Dilution. ○ Increase in almost all binding proteins (TBP, SHBP, CBG, transferrin, ciruloplasmin. ○ 3-4x increase in ALP. ○ ALT & AST slightly fall.	○ Decreased lower esophageal pressure. ○ Decreased peristalsis. ○ Delayed in gastric emptying. ➢ Constipation. ➢ Nausea. ➢ Vomiting.	○ Pigmentations start in 1st TM, fade after dilevary. ○ Melasma: patches of pigmentations on the face. ○ Spider nevi. ○ Palmar erythema. ○ Pruritus. ○ Stria gravidarum (new is pink, old is white) ○ Hair fall from 2-20 weeks, recover in 6 months.

Thyroid gland	Adrenal glands & Pituitary
○ Increased TBG. ➢ Serum concentration of TSH decrease in the 1st trimester. ○ Total T3, T4 increase, but free fraction remain constant or slightly fall in the 2nd & 3rd TM. ○ HCG has thyrotropic activity > decrease TSH in 1st TM. ○ Hyperemesis gravidarum is often associated with biochemical thyrotoxicosis (high T4, low TSH). ○ Iodine deficiency due to: ➢ Active transport to the fetus. ➢ Increased renal excretion (increase GFR, reduced tubular reabsorption). ○ Thyroid uptake from the blood triples, if there is a dietary deficiency >> goiter.	○ 35% increase in anterior pituitary volume. ○ 10x increase in prolactin, return to normal 2 weeks postpartum. ○ LH & FSH are suppressed. ○ Cortisol level increase (free & bound). ○ ACTH remain unchanged. ○ 2-4x increase in renin & angiotensin II ○ 3x increase in aldosterone in 1st trimester (10x in 3rd trimester). ○ Placenta produces: ➢ hPL (resemble GH). ➢ Placental GH. ➢ ACTH. ➢ CTH.

Sugar control	Coagulation
○ Physiologic insulin resistance and glucose intolerance (progressive with GA). ○ Fasting sugar decrease. ○ Post-prandial sugar increases. ○ 2x increase in insulin (diabetic women need more insulin). ○ Renal threshold for glucose fall. ○ Anti-insulin hormones secreted by placenta: ➢ HPL. ➢ Glucagon. ➢ Cortisol.	○ Hypercoagulable state ○ 59% increase in the following factors: 1. II (prothrombin) 2. VII 3. VIII 4. IX 5. X 6. Fibrinogen ○ Fibrinolytic activity is reduced. ○ Endogenous anticoagulant decrease: ➢ Anti-thrombin III ➢ Protein S ○ Clotting test remains normal ○ Venous stasis in the lower limb(marked in the left side) ○ The hypercoagulable state extends to 6 weeks postpartum.

Others from the past papers:

- Mild to moderate increase in polymorphonuclear leukocytes (neutrophils), which is a physiological leukocytosis.
- Plasma volume increases and red blood cell mass increases.
- 17-alpha hydroxyprogesterone increase.
- Normal cardiac auscultation: Increased splitting of S1, increased splitting of S2, systolic murmur, ~~diastolic murmur~~, third heart sound.
- Increased ketone production and clearance.
- Melanocyte-stimulating hormone (MSH) levels increase during pregnancy, contributing to the hyperpigmentation.
- High-density lipoprotein (HDL) cholesterol is elevated in pregnancy.
- The average weight gain is approximately 12.5 kg.
- Pregnancy leads to increased intestinal calcium absorption to meet the demands of fetal bone development.
- Factor V & XII increase

** Total body water increases by about 6-8 L.

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