

## Physiological changes during pregnancy

Cardiovascular system	Respiratory system	Renal system
<ul style="list-style-type: none"> <li>Peripheral vasodilation lead to decrease SVR.</li> <li>Increase 40% in CO (20% by week 8). <ul style="list-style-type: none"> <li>Max CO at 20-28 week</li> <li>CO increase more in labor (15% 1st stage, 50% in 2nd stage).</li> <li>CO returns normal in 2 week postpartum.</li> </ul> </li> <li>Increase stroke volume.</li> <li>Increase HR.</li> <li>Increase contractility.</li> <li>The heart is dilated.</li> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>40-50% increase in minute ventilation due to: <ul style="list-style-type: none"> <li>Increase tidal volume.</li> <li>Hyperventilation (leads to decrease PaCO<sub>2</sub> &amp; compensatory fall in bicarbonate).</li> </ul> </li> <li>Decreased PVR.</li> <li>Decreased functional residual capacity &amp; residual volume.</li> <li>Increased O<sub>2</sub> consumption 20%.</li> <li>Increased metabolic rate 15%.</li> <li>No change in: vital capacity, RR, PaO<sub>2</sub>, FEV<sub>1</sub>, PEFR.</li> </ul>	<ul style="list-style-type: none"> <li>Dilation in renal collection system. <ul style="list-style-type: none"> <li>More in right.</li> <li>Progesterone.</li> <li>Uterine compression.</li> </ul> </li> <li>Renal plasma flow increase 60-80% in 2nd TM, then decrease in 3rd TM (still 50% higher than pre-pregnancy).</li> <li>Decrease serum urea &amp; creatinine due to: <ul style="list-style-type: none"> <li>Increase GFR.</li> <li>50% increase in creatinine clearance.</li> </ul> </li> <li>Increased protein excretion (300 mg instead of 150 mg).</li> <li>Physiological Na &amp; water retention &gt; edema (80%).</li> </ul>

Hepatobiliary system	Gastrointestinal system	Skin
<ul style="list-style-type: none"> <li>Increased liver metabolism.</li> <li>Decreased total serum protein. concentration due to: <ul style="list-style-type: none"> <li>20-40% decrease in albumin.</li> <li>Dilution.</li> </ul> </li> <li>Increase in almost all binding proteins (TBP, SHBP, CBG, transferrin, ciruloplasmin).</li> <li>3-4x increase in ALP.</li> <li>ALT &amp; AST slightly fall.</li> </ul>	<ul style="list-style-type: none"> <li>Decreased lower esophageal pressure.</li> <li>Decreased peristalsis.</li> <li>Delayed in gastric emptying. <ul style="list-style-type: none"> <li>Constipation.</li> <li>Nausea.</li> <li>Vomiting.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Pigmentations start in 1st TM, fade after dilevary.</li> <li>Melasma: patches of pigmentations on the face.</li> <li>Spider nevi.</li> <li>Palmar erythema.</li> <li>Pruritus.</li> <li>Stria gravidarum (new is pink, old is white)</li> <li>Hair fall from 2-20 weeks, recover in 6 months.</li> </ul>

Thyroid gland	Adrenal glands & Pituitary
<ul style="list-style-type: none"> <li>Increased TBG. <ul style="list-style-type: none"> <li>Serum concentration of TSH decrease in the 1st trimester.</li> </ul> </li> <li>Total T<sub>3</sub>, T<sub>4</sub> increase, but free fraction remain constant or slightly fall in the 2nd &amp; 3rd TM.</li> <li>HCG has thyrotropic activity &gt; decrease TSH in 1st TM.</li> <li>Hyperemesis gravidarum is often associated with biochemical thyrotoxicosis (high T<sub>4</sub>, low TSH).</li> <li>Iodine deficiency due to: <ul style="list-style-type: none"> <li>Active transport to the fetus.</li> <li>Increased renal excretion (increase GFR, reduced tubular reabsorption).</li> </ul> </li> <li>Thyroid uptake from the blood triples, if there is a dietary deficiency &gt;&gt; goiter.</li> </ul>	<ul style="list-style-type: none"> <li>35% increase in anterior pituitary volume.</li> <li>10x increase in prolactin, return to normal 2 weeks postpartum.</li> <li>LH &amp; FSH are suppressed.</li> <li>Cortisol level increase (free &amp; bound).</li> <li>ACTH remain unchanged.</li> <li>2-4x increase in renin &amp; angiotensin II</li> <li>3x increase in aldosterone in 1st trimester (10x in 3rd trimester).</li> <li>Placenta produces: <ul style="list-style-type: none"> <li>hPL (resemble GH).</li> <li>Placental GH.</li> <li>ACTH.</li> <li>CTH.</li> </ul> </li> </ul>

Sugar control	Coagulation
<ul style="list-style-type: none"> <li>○ Physiologic insulin resistance and glucose intolerance (progressive with GA).</li> <li>○ Fasting sugar decrease.</li> <li>○ Post-prandial sugar increases.</li> <li>○ 2x increase in insulin (diabetic women need more insulin).</li> <li>○ Renal threshold for glucose fall.</li> <li>○ Anti-insulin hormones secreted by placenta: <ul style="list-style-type: none"> <li>➤ HPL.</li> <li>➤ Glucagon.</li> <li>➤ Cortisol.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>○ Hypercoagulable state</li> <li>○ 59% increase in the following factors: <ol style="list-style-type: none"> <li>1. II (prothrombin)</li> <li>2. VII</li> <li>3. VIII</li> <li>4. IX</li> <li>5. X</li> <li>6. Fibrinogen</li> </ol> </li> <li>○ Fibrinolytic activity is reduced.</li> <li>○ Endogenous anticoagulant decrease: <ul style="list-style-type: none"> <li>➤ Anti-thrombin III</li> <li>➤ Protein S</li> </ul> </li> <li>○ Clotting test remains normal</li> <li>○ Venous stasis in the lower limb (marked in the left side)</li> <li>○ The hypercoagulable state extends to 6 weeks postpartum.</li> </ul>

#### 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, 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, protein S decreases.

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