Msc. Alaa hajwal

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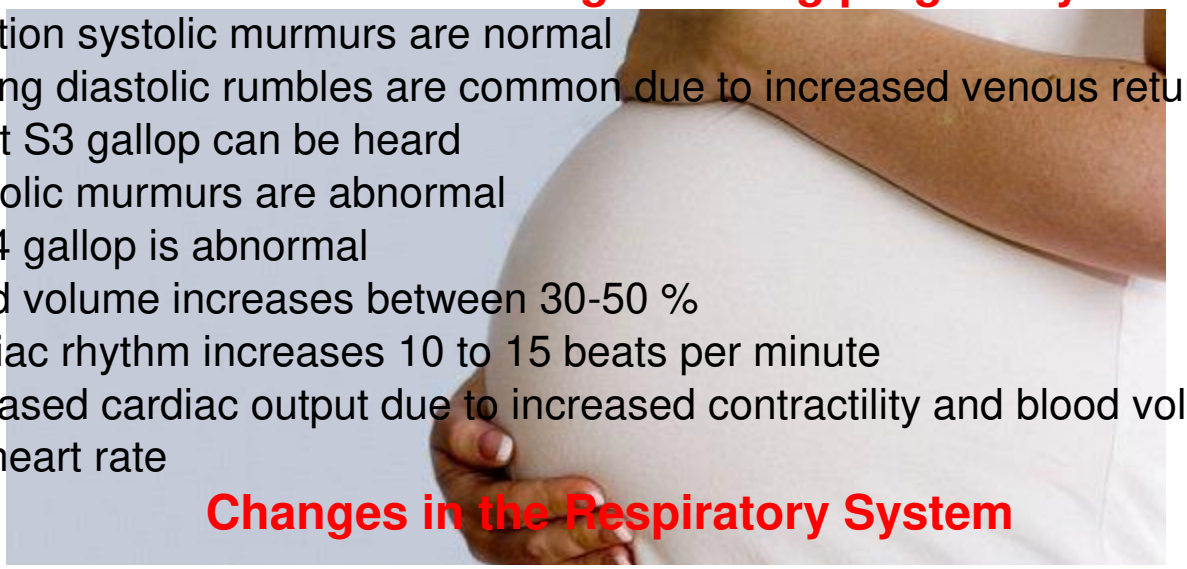
Maternal anatomical and physiological changes

What are the changes in maternal physiology during pregnancy?

During pregnancy, some changes in maternal physiology can occur including increased maternal fat, blood volume, cardiac output, and blood flow to the kidneys and uteroplacental unit, decreased blood pressure, delayed gastrointestinal motility, and gastric emptying. These alterations are essential to optimize fetus and mother health

Cardiovascular changes during pregnancy



1. Function systolic murmurs are normal
2. hearing diastolic rumbles are common due to increased venous return
3. A soft S3 gallop can be heard
4. Diastolic murmurs are abnormal
5. An s4 gallop is abnormal
6. Blood volume increases between 30-50 %
7. Cardiac rhythm increases 10 to 15 beats per minute
8. Increased cardiac output due to increased contractility and blood volume and heart rate

Changes in the Respiratory System

Changes in the respiratory parameters start as early as the fourth week of gestation. Minute ventilation is increased at term by about 50% above nonpregnant values. The increase in
minute ventilation is mainly due to an increase in tidal volume (40%) and, to a lesser extent, an increase in the respiratory rate (15%). Alveolar ventilation is greatly increased as the
tidal volume increases without any change in the ratio of dead space to tidal volume (VD/VT). At term PCO2 is decreased to 32–35 mmHg, although renal excretion of bicarbonate keeps arterial pH normal. Increased progesterone concentrations during pregnancy likely stimulate increased respiration, even before an increase in metabolic rate. Oxygen consumption and carbon

dioxide production increase by approximately 60% over prepregnant values. PaO_2 is increased in early pregnancy due to the fall in PCO_2. Functional residual capacity, expiratory reserve volume, and residual volume are decreased at term. These changes are related to the cephalad displacement of the diaphragm by the large gravid uterus.
Pulmonary volume and capacity changes in pregnancy. increases somewhat because of increase in tidal volume and inspiratory reserve volume. Vital capacity is unchanged. Total lung capacity is only slightly reduced because chest circumference increases. Closing capacity (CC) does not change, but the reduction in FRC contributes to a tendency toward earlier desaturation, as lung volume more easily falls below CC.
Anatomic changes also accompany pregnancy. The respiratory mucous membranes become vascular, edematous, and friable. The voice may deepen and there is a progressive increase in the Mallampati score during gestation. In labor, minute volume further increases in the absence of pain relief, and PCO_2 may decrease to 17 mmHg. Opioids somewhat attenuate this change, but epidural analgesia does so more completely. In the second stage, maternal expulsive efforts increase ventilation, even in the presence of effective regional analgesia.
FRC changes return to normal 1–2 weeks postpartum, accompanying the reduction in uterine size. All other respiratory parameters return to nonpregnant values within 6–12 weeks postpartum.

Decreased FRC as well as increased oxygen consumption can cause a rapid development of maternal hypoxemia during apnea. Decreased FRC decreases the time for denitrogenation
and speeds the uptake of inhaled anesthetics.
Because of the increased edema, vascularity, and friability of the mucous membrane, one should try to avoid nasal intubation in pregnant women, and smaller endotracheal tubes should be used for oral intubation.
Maternal alkalosis associated with decreased $PaCO_2$ values due to hyperventilation as a result of labor pain can cause fetal acidosis because of
(1) decreased uteroplacental perfusion due to uterine vasoconstriction
(2) shifting of the maternal oxygen dissociation curve to the left.