PREGNANCY: RESPIRATORY CHANGES

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Oxygen consumption:

Several authors have reported that oxygen consumption increases by 30% to 40% during pregnancy, the progressive rise is due primarily to the metabolic needs of the fetus, uterus, and placenta and secondarily to increased cardiac and respiratory work. Carbon dioxide production shows changes similar to those of oxygen consumption.

Anatomy:

The thoracic cage increases in circumference by 5 to 7 cm during pregnancy because of increase in both the anteroposterior and transverse diameters. Flaring of the ribs, which begins at the end of the first trimester, results in an increase in the subcostal angle from 68.5 degree to 103.5 degree at term.

Capillary engorgement of the nasal and oropharyngeal mucosae and larynx begins early in the first trimester and increases progressively throughout pregnancy. Nasal breathing commonly becomes difficult, and epistaxis may occur because of nasal mucosal engorgement. Airway conductance increases, indicating dilatation of the large airways below the larynx, mainly due to direct effects of progesterone, cortisone, and relaxin and possibly enhanced beta-adrenergic activity induced by progesterone.

Lung volumes and capacities:

Tidal volume increases by 45% during pregnancy, with approximately half of the change occurring during the first trimester. Functional residual capacity begins to decrease by the fifth month of the pregnancy. This is due to elivation of the relaxed diaphragm, which occurs as the enlarging uterus enters the abdominal cavity. Functional residual capacity is reduced to 80% of the nonpregnant volume by term gestation. A 25% reduction of expiratory reserve volume and a 15% reduction of residual volume account for the change. Inspiratory capacity increases by 15% during the third trimester because of increases of tidal volume and inspiratory reserve volume.

Ventilation:

Minute ventilation increases by 45% during pregnancy, with increase evident early in the first trimester, as a result of increase in tidal volume. Although respiratory rate declines slightly during mid gestation, it is essentially unaltered during pregnancy.

The increased ventilation during pregnancy results from hormonal changes and increased carbon dioxide production. The arterial carbon dioxide tension is closely related to the blood level of progesterone. This hormone increases the sensitivity of the central respiratory center to carbon dioxide and acts as a direct respiratory stimulant.