



Physiology of Pregnancy

Prepared by

ا.م.د. سها طلال عبد

Introduction

Maternal physiology undergoes continual adaptation during pregnancy. The changes are present in all body systems and are driven by the hormonal influences of the placenta and the mechanical adaptations required to accommodate a growing fetus. Knowledge of these changes is essential for safe anaesthetic practice.

Cardiovascular system

Most cardiovascular changes occur early in pregnancy. Vascular smooth muscle relaxation occurs in response to increased circulating levels of progesterone, oestrogen and prostaglandins, leading to a reduction in systemic and pulmonary vascular resistance. Cardiac output gradually increases, eventually by up to 30–50% during the third trimester. The increase in cardiac output is as a result of an increase in heart rate and stroke volume, secondary to ventricular hypertrophy.

Respiratory System

The alterations in maternal respiratory physiology occur as a result of hormonal and biochemical effects on the central respiratory centre, via local effects on the respiratory smooth muscle or by mechanical effects of the growing fetus.

Circulating progesterone stimulates the respiratory centre, leading to an increase in minute ventilation, primarily by an increase in tidal volume (by ~ 40%) and by an increase in respiratory rate (by ~ 15%).

Hematological Changes

The peripartum period sees wide spread adaptations in the haematological system with a marked increase in risks including anaemia, thromboembolism and consumptive coagulopathies. Increased secretion of aldosterone (by activation of the renin–angiotensin axis) results in an increase in total body water and, consequently, plasma volume. Erythropoiesis also increases by around 30%.

Renal Changes

Renal blood flow and, therefore, the glomerular filtration rate are increased by 50% owing to the proportional increase in cardiac output. Serum urea and creatinine can be 40% lower than pre-pregnant values.

Urinary protein and glucose levels are increased as renal absorption of these molecules (and others such as bicarbonate and some electrolytes) is outpaced by the increase in glomerular filtration. The increased bicarbonate loss contributes to compensation of the respiratory alkalosis.

Neurological Changes

The nervous system exhibits increased sensitivity to both general and local anaesthetic agents. The minimum alveolar concentration (MAC) value of several volatile anaesthetic agents has been demonstrated to decrease during pregnancy. The MAC value of sevoflurane is reported to decrease by approximately 30%. Although uterine relaxation is an undesired effect when using volatile anaesthetic agents.

Gastrointestinal Changes

Lower oesophageal sphincter smooth muscle relaxation and upward displacement of the stomach by the gravid uterus contribute to the increased incidence of reflux during pregnancy. Although gastric transit is unaffected, there remains an increased risk of aspiration. Fear, pain and analgesics in labour can compound gastric stasis further increasing this risk. The risk of aspiration is thought to revert to that of pre-pregnancy within 24–48 hours post delivery.

Endocrine Changes

Many of the physiological adaptations of pregnancy are due to increased circulating reproductive hormones including oestrogen and progesterone. Additionally, the placenta secretes hormones such as relaxin, human placental lactogen (HPL) and human chorionic gonadotrophin which contribute to changes within several body systems.

The thyroid gland undergoes follicular hyperplasia and increases in size. Thyroid stimulating hormone (TSH) receptors can be stimulated by B-HCG

Musculoskeletal Changes

Gestational weight gain, with a change in posture required to accommodate the growing fetus, alters the loading pattern on joints and other musculoskeletal structures. For example, lumbar lordosis becomes increasingly exaggerated as pregnancy progresses. In some parturients, these changes can cause significant pain.

The hormones relaxin and oestrogen contribute to increased ligamentous laxity, particularly in the pelvis. This enables the fetus to be accommodated.

Conclusion

The adaptive changes that occur in pregnancy affect all of the body's systems. Knowledge of the expected physiological changes is essential to enable recognition of pathology, anticipation of possible complications and modification of anaesthesia to ensure safe obstetric practice



Thank You