Anatomical and physiological changes in pregnancy – a critical care point of view

Dr. Jyothi G S

Professor of OBG

Secretary of BSOG

Department of Obstetrics and Gynecology

Ramaiah Medical College and Hospitals

Bengaluru – 54

INTRODUCTION:

•Physiological changes occur in pregnancy to nurture the developing fetus and prepare the mother for pregnancy and delivery.

• Clinicians need to recognize pathological deviations in these normal anatomical and physiological changes to institute appropriate action to improve maternal and fetal outcome.

Clinical pearl

- When treating a critically ill obstetric patient, remember that what benefits the mother is (in general) good for the fetus.

- In the obstetric patient, uterine displacement should be considered part of the initial ABC evaluation in the hemodynamically unstable obstetric patient.

HAEMATOLOGICAL PARAMETERS.

- Hypercoaguable state and hemodilution of pregnancy:

- Predispose to venous thromboembolism (MC in left leg or left iliac system due to the kinking of left iliac vein by the right iliac artery).

- The increase in blood volume and coagulation factors will provide physiological protection against hemorrhage.

- May underestimate the blood loss and so delay in taking active steps to prevent further bleeding.

Clinical pearl

- Vasopressor agents may have deleterious effects on utero-placental perfusion.
- Assessment of the utero-placental-fetal unit (fetal well being) is an important guide to adequacy of tissue perfusion and resuscitation.

CARDIOVASCULAR SYSTEM.

•Gravid uterus pressing over IVC: Supine hypotension. During cardiac arrest, In order to minimize the effects of gravid uterus on venous return and cardiac output, a pelvic tilt to the left of greater than 15^{o} but < 30^{o} is recommended.

•Increased HR and stroke volume and cardiac output: women with heart disease and fixed CO may not cope with the demands and may develop pulmonary edema.

•Reduced peripheral resistance would lead to fall in the diastolic BP ---Placenta acts like AV shunt, together with peripheral vasodilating factors like oestrogen, progesterone and increased endothelial synthesis of PG E2 and Prostacyclins.

•Both BP and CO fall during epidural analgesia.

Clinical pearl

- The parturient in her last month of pregnancy may display some of the clinical features of heart failure as a result of the physiologic adaptations of pregnancy.

- Although there is a small risk of inducing fetal arrhythmias, cardioversion and defibrillation are considered safe at all stages of pregnancy.

RESPIRATORY SYSTEM:

• Diaphragm is pushed upwards by the gravid uterus. Increase in minute ventilation due to increase in tidal volume as there is 20% decrease in FRC due to pressure from the gravid uterus on diaphragm and lungs and increase in resting O2 demand – results in faster onset of hypoxemia during periods of apnoea.

•Dyspnoea is a presenting complaint in upto 50% - 75% of pregnant women. Relative hyperventilation causes a fall in PaCO2 which results in chronic respiratory alkalosis.

•Rhinitis, laryngeal edema, hypertrophy of breast – estrogen induced -difficult intubation.

•Protect the airway. Pregnant women are more prone to develop regurgitation and aspiration. Intubate if necessary (difficult intubation due to physiological changes).

•Difficult laryngoscopy may necessitate insertion of supraglottic airway device for short term ventilation.

•If not intubated, administer O2 as they are more prone to rapid acute O2 desaturation.

CENTRAL AND PERIPHERAL NERVOUS SYSTEM:

• Altered anatomy and responses to pain and pharmacotherapy occurs as pregnancy progresses. Increase in venous pressure below the gravid uterus causes blood to be diverted towards spinal vessels and epidural plexus gets engorged . This leads to diminished epidural space and a decrease in CSF volume occurs → increased cerbral blood flow.

- Space reduction with enhanced neural susceptibility to local anaesthetics leads to 25% reduction in dose required for spinal and epidural anaesthesia.

- All sedative/anxiolytics and analgesics used in critical care are safe for both mother and fetus.

Clinical pearl

- Upto 50% of obstetric critical care patients have some form of neurological compromise, mostly due to the consequence of their admission diagnosis, rather than as a precipitant of their ICU admission.

- Criteria for diagnosis of brain death in obstetric patient is same as for non-obstetric population.

RENAL SYSTEM:

• Retroverted gravid uterus pressing on the urethra-vesical junction – acute retention of urine in early pregnancy.

•Dextrorotation of uterus, pressure from gravid uterus – dilatation of ureter.

•Increased risk of pyelonephritis and difficulty of interpretation of radiological studies of the urinary collecting system.

•Treatment of asymptomatic bacteriuria reduces the incidence of pyelonephritis.

Clinical pearls

- The serum creatinine level tends to remain below normal non-pregnant levels unless there is severe pre-ecclampsia with associated renal failure.

- Hypertension in obstetric patients must be considered a sign of pre-ecclampsia unless proved otherwise.

GASTROINTESTINAL SYSTEM:

• Reduced LOS pressure, high intragastric pressure and delayed gastric emptying time – reflux esophagitis, heart burn, constipation, high risk of aspiration during general anaesthesia. 49% of women undergoing LSCS are at risk of acid aspiration.

•Decrease colonic motility – constipation, prolonged drug absorption. If drug is metabolised in the gut wall, then reduced bioavailability. Narcotic analgesics will further prolong gastric emptying– repeated dosing and accumulation of medication –higher than desired effects.

•Course of IBD is usually not affected in pregnancy. Crohns disease -- postpartum flare.

ENDOCRINE SYSTEM:

• Increased secretion of anti-insulin hormones – HPL, glucagon and cortisol by placenta.

•Glucose tolerance decreases progressively with increasing gestation → increased insulin requirements in established diabetics and development of abnormal glucose tolerance in gestational diabetics, in whom there is insufficient insulin secretion to compensate for the insulin resistance.

•Exacerbation of complications of diabetes such as nephropathy and retinopathy.

•Transient hyperthyroidism due to the action of HCG on TSH receptors due to identical subunits.

SKIN :

• There is hyperpigmentation.

•Spider naevi, palmar erythema are normally seen in pregnancy.

ANTIBIOTICS :

•Choice of antibiotic depends on the safety for the growing foetus and penetration of placenta.

•Volume of distribution of the drug increases due to increase in the TBW, decrease in s. albumin.

• Delayed gut motility and gastric emptying also increases drug absorption.

•Increase in RBF and GFR also increases excretion of water soluble drugs, hence even the maintenance doses must be on a higher side.