Critical illness During pregnancy

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Critical illness during pregnancy

Critical illnesses in pregnancy may result from a worsening of underlying cardiac or pulmonary disease or the onset of a unique pregnancy-related illness.

Adaptive changes occur in the circulation, respiratory system, gut, and kidneys to meet the increased metabolic demands of the mother, fetus, and placenta

Knowledge of normal changes in maternal respiratory, cardiac and acid base physiology in pregnancy is essential to distinguish between adaptive and pathologic changes

Assessment, monitoring, and treatment of the gravid patient in the ICU must take into account both maternal and fetal well-being and requires a multidisciplinary approach to care

Circulatory Changes in Pregnancy

- Maternal blood volume increases early, reaching a level 40% above baseline by the 30th week
- increased number of erythrocytes > increase in plasma volume →dilutional anemia (decreased hematocrit by12%)
- Sinus tachycardia (20 beats/min above basline) Peak at 32 wk
- BP Decreases at 28 wk (then increases to baseline towards delivery. Diastolic pressures of 75 mm Hg in the second trimester and 85 mm Hg in the third trimester should be considered the upper limits of Normal)

Circulatory Changes in Pregnancy

- Stroke volume Increases since First trimester
- SVR Decreases (arterio-venous shunting through the low-resistance utero-placental bed and hormonally induced vasodilation)
- Pulmonary vascular resistance Decreases
- Cardiac output Increases Peak at 25–32 wk
  - body position sec to pressure on IVC
  -change with uterine contraction sec to venous return
  -blood loss during deleivary
- physiologic third heart sound in the majority of pregnant patients

Adaptation of the Respiratory System

- Oxygen consumption increases 35%
- progesterone-> respiratory stimulation→ 30% increase in Vt.
- Minute ventilation is increased above the level needed to eliminate CO2 and Pco2 falls to 27 to 32 mm Hg
- Renal compensation results in a maternal pH7.40 to 7.45, with serum bicarbonate decreasing to 18 to 21 mEq/L

Parameters	Direction
Oxygen consumption	Increases
Respiratory rate	Unchanged
V_T	Increases
Total lung capacity	Unchanged
FRC	Decreases
FVC	Unchanged
FEV^1	Unchanged

decreased FRC and increased oxygen consumption makes pregnant woman and fetus more vulnerable to hypoxia in the event of hypoventilation or apnea.

Variables	Pao_2, mm Hg	$Paco_2$, mm Hg	pH	Alveolar- Arterial Pressure Gradient, mm Hg
Nonpregnant	98	40	7.40	2
Term pregnancy, seated	101	28	7.45	14
Term pregnancy, supine	95	28	7.45	20

Renal and GI Adaptation

Renal

- Serum Creatinine during pregnancy is lower than baseline. Therefore, creatinine levels that would be normal in a non-pregnant patient can indicate renal dysfunction in pregnant patients.

GI

- Lower esophageal sphincter tone
- prolonged gastric emptying time
- abdominal organs pushed upward towards term

Circulatory Disorders of Pregnancy

- Shock;distinguish between low-flow states (hypovolumia , cardiac dysfunction), and high-flow states such as septic shock, while taking into account the physiologic alterations associated with pregnancy

- In case of cardiac arrest

  -patient should be placed 15 to 30° from the left lateral position by use of a wedge under the right hip

  - Chest compressions should be performed higher on the sternum to adjust for the elevation of the diaphragm

  -Fetal or uterine monitors should be removed prior to delivering shocks

  -An emergency hysterectomy may save the life of both the mother and the fetus if gestational age is > 24 weeks

  -if resuscitation unsuccessful, the best survival rate for infants occurs when delivery is no more than 5 min after the mother's heart stops beating

Hemorrhagic Shock

Early	Late (Third Trimester)	Postpartum
Trauma	Trauma	Uterine atony
Ectopic or abdominal pregnancy	Placenta previa or abruption	Surgical trauma
Abortion	Uterine rupture	Uterine inversion
DIC	DIC	DIC
Hydatidiform mole	Marginal sinus rupture	Retained placenta

Placental abruption

occurs more commonly in patients with hypertension, high parity, cigarette or cocaine use, and previous abruption.

Patients may initially present with painful vaginal bleeding and be misdiagnosed as having premature labor

Blood loss averages 2 to 3 L, and much of this blood may remain concealed within the uterus.

Maternal complications include acute renal failure and DIC

Hemorrhagic Shock

Uterine rupture

- risk factors
  - multipara with protracted labor.
  - prior cesarean section,
  - operative (assisted) vaginal delivery
  - use of uterotonic agents
- In overt rupture, peritoneal signs may be observed. Nonetheless, substantial blood loss can occur in the absence of significant physical findings.

Uterine atony

- occurs after prolonged labor, abruptio placentae, oxytocin administration, cesarean section, or as a result of retained intrauterine contents.

Hemorrhagic Shock

Truma

- The gravid woman is at greater risk of hemorrhage after trauma, as blood flow to the entire pelvis is increased.
- Rapid deceleration injury can cause placental abruption
- Abruption may be complicated by DIC
- The cephalad displacement of abdominal contents in pregnancy increases the risk of visceral injury from penetrating trauma of the upper abdomen
- The urinary bladder is a target for injury because it is displaced into the abdominal cavity beyond 12 weeks of gestation.

Management

- ***vital signs may not indicate significant blood loss***
- Unmatched type-specific blood
- When shock is clinically evident in gravid patients, it signifies enormous blood loss.
- left lateral decubitus position
- Fetal monitoring
- Elective intubation and mechanical ventilation
- Consider DIC, dilutional coagulopathy, Ultrasonography to diagnose retained intrauterine products
- Recombinant factor VIIa
- Surgical exploration

Cardiogenic Shock

- Most often caused by congestive heart failure due to either preexisting myocardial or valvular heart disease or *de novo* cardiomyopathy
- Prior subclinical heart disease may manifest itself for the first time during pregnancy
- Eisenmenger syndrome, cyanotic congenital heart disease, or pulmonary hypertension mortality rate up to 40% during pregnancy
- Myocardial infarction is extremely uncommon
- Increased incidence of aortic dissection

Management

- Echocardiography
- Once the cause of cardiac dysfunction is determined, the initial management of the hypoperfused cardiac patient should focus on volume status, and hypovolemia should be excluded
- Vasoactive drugs are reserved for situations in which hypovolemia has been corrected and perfusion remains inadequate
- Dobutamine is the drug of choice (optimises placental blood flow)
- Angiotensin- converting enzyme inhibitors are absolutely contraindicated during pregnancy because they cause fetal growth retardation, oligohydramnios, and anuric renal failure *as well as* neonatal death.

considerations

- decreased SVR may lead to further decompensation in patients with aortic stenosis, hypertrophic cardiomyopathy, or pulmonary hypertension
- general anesthesia is preferred
- Invasive monitoring or echocardiography is required to follow shifts in volume status produced by each uterine contraction "autotransfusions"

Septic Shock

Table 5. *Bacterial Infections Associated With Sepsis in Pregnancy and Postpartum**

Obstetric
Postpartum endometritis
Chorioamnionitis (intra-amniotic infection)
Septic abortion
Septic pelvic thrombophlebitis
Antepartum pyelonephritis
Nonobstetric
Appendicitis
Cholecystitis
Pyelonephritis
Pneumonia
Invasive procedures
Abdominal wall or perineal incisions (necrotizing fasciitis)
Amniocentesis/chorionic villus sampling (septic abortion)
Infected cerclage (chorioamnionitis)

Septic Shock

- can be obscured by the normal hemodynamic changes of pregnancy (*ie, increased cardiac output,* decreased SVR).
- Animal data suggest increased vulnerability to the systemic effects of bacteremia and endotoxemia
- decreased cell-mediated immune response during pregnancy→ increased susceptibility to infection with *Listeria monocytogenes*, herpesvirus, varicella, and coccidioidomycosis

Management

- Evaluation of pelvic sites, Empiric antibiotic covering Gram-positive, Gram-negative, and anaerobic organisms
  (consider clindamycin and a third-generation cephalosporin)
- Avoid aminoglycosides in anti-partum sepsis (ototoxic and nephrotoxic to the fetus)
- Postpartum deterioration despite adequate antibiotic coverage suggests a localized abscess, a resistant organism, or septic pelvic thrombophlebitis.
- Corticosteroids;
  - baseline Cortisol maybe elevated in pregnancy
  - stimulation tests have not been studied in pregnant population.
- Recombinant protein C has not been systematically evaluated in pregnant patients

Pre-eclampsia

- complicates 5 to 10% of all pregnancies
- 10 to 15% of maternal deaths
- occurs most often in nulliparous women after the 20th week of gestation, typically near term
- may occur postpartum
- hypertension, proteinuria, and generalized edema, and hyperuricemia
- may progress without warning to a convulsive and potentially lethal phase, *eclampsia.*

Maternal complications

- seizures (eclampsia)
- cerebral hemorrhage or edema
- renal dysfunction
- pulmonary edema
- placental abruption with DIC
- HELLP syndrome
- and hepatic infarction, failure, sub capsular hemorrhage, or rupture

HELLP

Hemolysis , Elevated Liver enzymes, Low Platelets

- Multiorgan dysfunction arising from an endothelial abnormality with secondary fibrin deposition and organ hypoperfusion.
- Microangiopathic hemolytic anemia and consumptive coagulopathy develop
- Treatment ; supportive care, corticosteroids, plasmapheresis in sever cases

Management of preeclampsia

- Immediate delivery if >34 wks
- Magnesium sulfate
- BP control is best controlled with IV labetalol
- CCB has augmented effect with Mg infusion
- angiotensin-converting enzyme inhibitors are absolutely contraindicated

Magnesium Dosing in Severe Preeclampsia/Eclampsia

Variables	Normal Renal Function	Renal Insufficiency, Creatinine >1.0 mL/dL
Initial	6 g IV over 15–20 min	4–6 g IV over 15–20 min
Maintenance	2 g/h infusion	1 g/h infusion
Serum levels	4.8 to 8.4 mg/dL	Monitor every 6 h
Monitor	Patellar reflex present	Patellar reflex present
	Respiratory rate >12 breaths/min	Respiratory rate >12 breaths/min
	Urine output >100 mL/4 h	Urine output >100 mL/4 h
Adverse effects	Hypotension/asystole	Hypotension/asystole
	Respiratory depression	Respiratory depression
Drug interactions	Calcium-channel blockers may enhance adverse/toxic effects	Calcium-channel blockers may enhance adverse/toxic effects

Respiratory Disorders

Asthma

- One third of pregnant no change; one third it improves; and in one third it worsens
- Adverse fetal outcomes include preterm birth and infants small for gestational age
- The management of status asthmaticus is similar to nonpregnant, except;

  - Mild hypoxemia should be treated aggressively because it is detrimental to the fetus.

  - An arterial blood gas Paco2 of > 35 mm Hg during status asthmaticus =impending ventilatory failure.

Venous Thromboembolism

- The risk is increased five fold during pregnancy
- (DVT) and (PE) may occur in all three trimesters and the postpartum period
- The majority of DVTs in pregnancy are ileofemoral and are thus more likely to embolize
- dyspnea and mild lower extremity edema are often noted in normal pregnancy. Pregnant women occasionally present with lower abdominal pain, fever, and an elevated WBC count mimicking acute appendicitis

Venous Thromboembolism

Pulmonary Embolism

- most literature recommends a perfusion lung scan as the initial diagnostic study
- A normal perfusion lung scan rules out PE and avoids the extra radiation exposure from the ventilation scan
- a helical CT scan can be obtained , radiation exposure to the fetus within the amount considered safe
- Either IV unfractionated heparin or adjusted-dose subcutaneous low- molecular weight heparin (LMWH) are the treatment of choice because heparin does not cross the placenta

considerations

- As the pregnancy progresses, the potential volume of distribution for LMWH changes, regular anti-factor Xa levels should be monitored
- Life-threatening VTE, thrombolysis
- Recombinant tissue plasminogen activator does not cross the placenta and is the preferred thrombolytic agent

Amniotic Fluid Embolism

- The mortality rate is 90%
- abrupt onset of severe dyspnea, tachypnea, and cyanosis during labor or soon after delivery, associated with cardiovascular collapse from left ventricular dysfunction, hypoxemia, and seizures
- Bleeding secondary to DIC occurs in up to 50% of patients
- Pulmonary arterial blood can be examined cytologically for evidence of abnormal amniotic fluid components such as fetal squamous cells.
- Treatment is supportive care, IV corticosteroid ?

Tocolytic induced pulmonary edema

- Mostly secodary to terbutaline
- edema typically develops during tocolytic therapy or within 24 h after it's discontinuation
- Treatment ;

- discontinuation of tocolytic therapy.
- oxygen administration, and diuresis.

- Response is usually rapid, often within hours

Mechanical Ventilation

- Pharyngeal, laryngeal, and vocal cord edema are common
- highly vascular upper airway may bleed from even minor intubation-related trauma
- Increased risk of aspiration during pregnancy (delayed gastric emptying, increased intraabdominal pressure diminished competence of the gastroesophageal sphincter)

Mechanical Ventilation

- The initial ventilator settings should be aimed at achieving Pco2 of 28 to 35 mm Hg.
- Further Respiratory alkalosis reduces fetal oxygenation and decrease uteroplacental flow
- ARDS net; The safety of this permissive hypercapnia in pregnancy remains to be determined
- continuous fetal monitoring should be conducted after each ventilator setting change

Mechanical Ventilation

- The third trimester of pregnancy, high airway pressures may not signal lung stiffness or overdistension
- In case of fetal distress, increase TV, and allowing plateau airway pressures > 30 cm H_2O If needed
- If paralytics are indicated cisatracurium is preferred
- Narcotic analgesics cross the placenta;, if administered near the time of delivery, immediate intubation of the neonate may be required

Remember

- Pregnant women are human beings like us they are just pregnant.....

THANK YOU