

THE PREGNANT PATIENT

Intensive Care Training Day
November 2014

Critically Ill Pregnant Patient

- Physiology
- CPR
- PPH
- Pre-eclampsia
- Liver disease
- AFES
- Supportive Care
- Acute respiratory failure
- Pharmacology
- VTE
- Trauma
- Cardiac disease
- Asthma/DKA/epilepsy
- Infections
 - Chorioamnionitis
 - Endometritis
 - UTIs
 - Respiratory
- Investigations

The Critically Ill Pregnant Patient

- Altered physiology
- 2 patients
 - Consider viability
 - NICU services
- Multiple teams
- Emotive
- Pathology
 - Diseases specific to pregnancy
 - Diseases which happen & the woman is pregnant

Maternal mortality per 100,000 live births

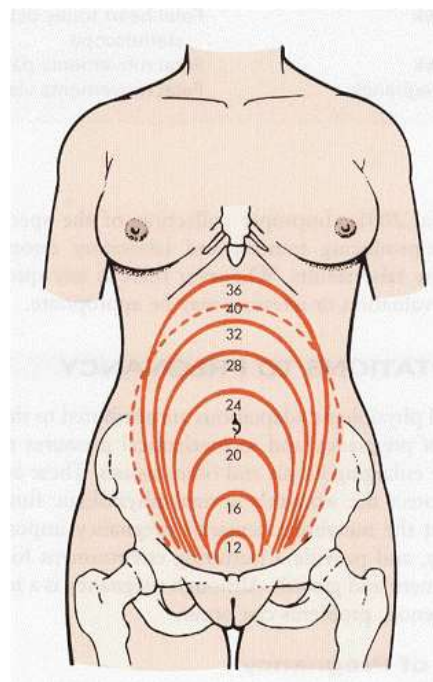
COUNTRY	2004-2008	2009-2013
NEW ZEALAND	12	8
NICARAGUA	110	100
NIGER	690	630
NORWAY	5	4
AUSTRALIA	5	6

Normal physiological changes in pregnancy & their clinical implications

- Airway
 - Oedema and vascular engorgement
 - Breasts
 - Reflux
- ***Expect difficult airway and have ETT 0.5-1 size smaller***

Respiratory

- Diaphragm elevates
 - Reduced FRC, RV, TLC
- Increased TV (40%)
- Increase minute volume
- Increased RR
 - ↓dead space ventilation
- Increased VO₂
 - By 20% much higher during labour
- Increased RR
 - Chronic Resp alkalosis
- No change in VC, FEV₁, DLCO
- Bronchodilation and reduced airway resistance



ABG

- pH No change
- PCO₂ Decrease
- PO₂ Increase early/normal at term
- HCO₃ Decrease

Important clinical features

- ***Normal CO₂ = resp failure***
- ***Desaturate VERY quickly***
- ***Become hypercapnic quickly***
- ***Less buffer reserve***

CVS

- Increased CO
- Increased blood volume
- Increased HR
- Increased stroke volume
- Reduced SVR
 - Reduced sys & Dia BP
- Aorto-caval compression
- Systolic flow murmur
- ECG LAD
- Cardiac hypertrophy

Clinical importance

- ***Shock may be overlooked***
- ***Interpretation of ECG***
- ***Supine hypotension due to aorto-caval compression***
 - ***positioning***



Investigations

- Plasma volume ↑ 50%
- RCV volume ↑ 15%
- Blood volume ↑ 30-40% to 100 ml/kg Low platelets
- LFTs
- Inc GFR lower Cr, urate, urea

- ***Fall in Hb and Hct***
- ***Blood loss initially tolerated better***

With respect to pregnancy 2007

1. Indicate how the following variables change in pregnancy

VARIABLE	DIRECTION OF CHANGE
Systolic BP	
Diastolic BP	
HR	
Blood volume	
Haematocrit	
Tidal volume	
pH	
PCO ₂	
PO ₂	
HCO ₃	

VARIABLE	DIRECTION OF CHANGE
Systolic BP	decreases
Diastolic BP	decreases
HR	increases
Blood volume	increases
Haematocrit	decreases
Tidal volume	increases
pH	same
PCO ₂	decreases
PO ₂	increase
HCO ₃	decreases

Exam question

- 36/40 pregnant women involved MVA suffers fractures to left femur, tibia and ribs L4-8.

What are the cardio-respiratory changes in normal pregnancy?

How do they affect her response to these injuries?

Outline the differences for CPR in the pregnant patient

- CPR in pregnancy
 - A
 - B
 - C
 - Defib
 - Peri-mortem section

A 40-year-old woman who is 34 weeks pregnant, presents to hospital following a generalised tonic-clonic seizure lasting 5 minutes

- a) List 6 differential diagnoses
- b) Briefly discuss the indications for an urgent CT scan in this patient
- c) List the reasons why pregnant patients may experience worsening of seizure control
- d) List the consequences of seizures on perinatal morbidity and mortality

Diff Dx seizure in pregnancy

- Eclampsia
- Intracranial vascular event- venous thrombosis, infarct, bleed, dissection
- Hepatic encephalopathy- fatty liver of pregnancy
- TTP-HUS
- Epilepsy
- Metabolic
- Infections- encephalitis, meningitis
- TBI
- Encephalopathies- HT
- Intra-cranial mass lesions
- Drugs- withdrawal, ingestion

Pre-eclampsia

- Pre-eclampsia is a complex multi-system disorder that may progress to eclampsia
- **Definition** - new onset of hypertension and proteinuria **or** new onset end-organ dysfunction after 20/40
 - Systolic BP >140 or diastolic >90 mmHg
 - or a rise of >30 systolic or >15 diastolic above baseline
 - with or without proteinuria

Pre-eclampsia

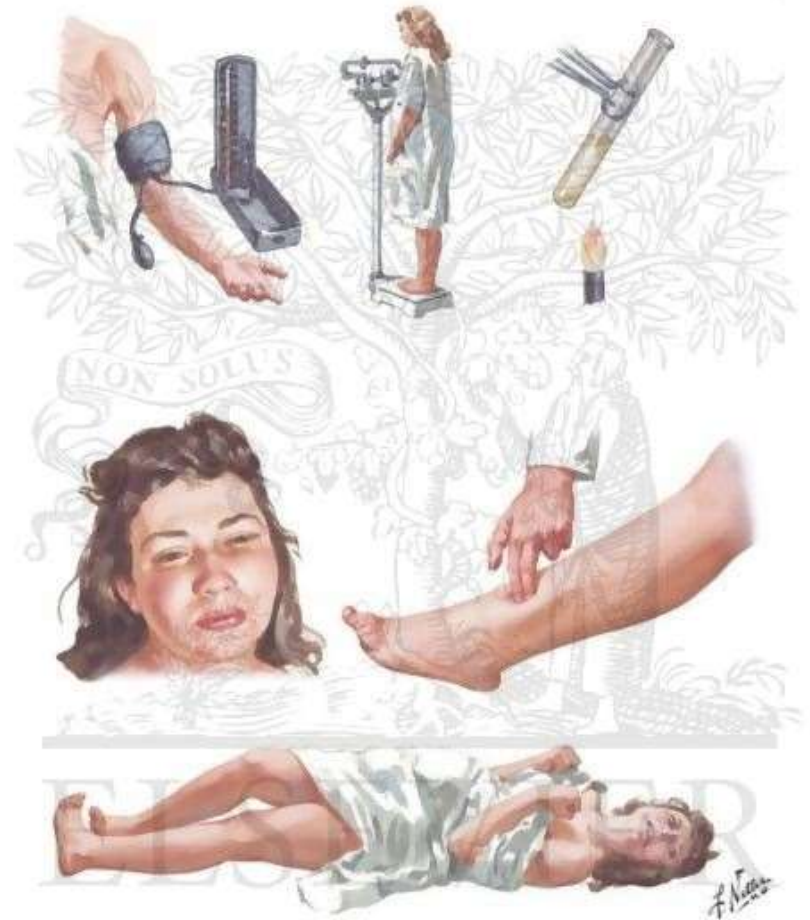
- Placental ischaemia causes diffuse systemic vascular endothelial activation/damage which results in
- Vasoconstriction, proteinuria, reduced intravascular volume, haemoconc & reduced organ perfusion
- Delivery of the foetus and placenta is the only curative therapy
- Increased risk foetal and maternal M&M

Severe pre-eclampsia

- Definition = Proteinuric HT with at least one other organ dysfunction
 - **CV** sys >160 dia >110, pulmonary oedema
 - **CNS** –severe HA, scotoma, CVA, confusion
 - **GI**- n&v, RUQ pain, transaminases X2 ULN, ↑bili
 - **Haem**- platelets < 100, DIC, coagulopathy
 - **GU**- oliguria, ↑ creatinine
- ***Seizures may occur in patients who not yet Dx with pre-eclampsia or not labelled severe***

Complications

- Abruptio
- Foetal demise
- Cerebral haemorrhage
- Liver rupture
- Renal failure
- Pulmonary oedema



Management goals in the ICU

- Maintenance of placental perfusion
- Prevention of seizures
- Control of hypertension
 - this is to prevent maternal end organ damage
- Prevent damage to the foetus
- Prevent and manage complications

Rx of Severe Pre-eclampsia

- Delivery is the definitive Rx
- Severe pre-eclampsia indication for delivery
 - If <34/40 may consider antepartum Mx but must liaise closely with O&G
- Airway oedematous
- Increase RR early sign pulmonary oedema

Rx of severe pre-eclampsia

- Circulation
 - Typically intra-vascularly deplete
 - Maintenance fluids, target UO 0.5ml/kg/hr
 - Close monitoring

Anti-hypertensive agents

- DO NOT normalise BP
 - If systolic >160-170mmHg drop by 20mmHg
 - If diastolic >105-110mmHg drop by 10mmHg
- Magnesium
 - Prevents seizures & drops BP
 - Load then infusion
 - Monitor for side effects
 - If severe pre-eclampsia continue 24-48hr post partum

Anti-hypertensive agents

- Oral agents labetolol & nifedipine
- I.V.
 - Labetolol
 - 20mg iv q10-15min up to 200mg or infusion 1-2mg/min
 - Hydralazine
 - 5mg q20min up to 40mg
 - Don't give through Mg line
 - GTN
 - (Nitroprusside)
 - If HT emergency can use <4hr fetal toxicity
 - Give fluids as well
 - Epidural

General supportive care

- Ranitidine to reduce gastric acidity
- Steroids for foetal lung maturation if < 34 weeks gestation.
 - IM Betamethasone 11.4mg - 2 doses 24 hours apart
- U&Es, FBC, LFTs, coags q 6-8 hourly
- Ensure current G&H
- CTG monitoring if receiving anti-hypertensive drugs

Post-partum

- 40% eclamptic seizures are postpartum
- Risk of pulmonary oedema greater post-partum
- Commence longer acting anti-hypertensives
 - Quinapril (if Cr okay)
 - Metoprolol
 - Felodipine or Nifedipine SR
- Start DVT prophylaxis if platelets are >100
- Complete 24 hour MgSO₄

Seizing pregnant patient

- O2, Left lateral position
- Stop the seizure
 - Mg load 20mmol and repeat 8mmol if still fitting
 - Can give IM
 - Benzo
 - Phenytoin
- Airway support
- Call obstetric emergency/delivery
- Differential Dx

A 40-year-old woman who is 34 weeks pregnant, presents to hospital following a generalised tonic/clonic seizure lasting 5 minutes

- a) List 6 differential diagnoses

- a) Briefly discuss the indications for an urgent CT scan in this patient
 - Diagnosis not clear
 - Failure to wake
 - Focal signs

- b) List the reasons why pregnant patients may experience worsening of seizure control

- c) List the consequences of seizures on perinatal morbidity and mortality

A 40-year-old woman who is 34 weeks pregnant, presents to hospital following a generalised tonic/clonic seizure lasting 5 minutes

- a) List 6 differential diagnoses
- b) Briefly discuss the indications for an urgent CT scan in this patient
- c) List the reasons why pregnant patients may experience worsening of seizure control
 - Non compliance
 - Sleep deprivation
 - Altered Pks- Vd, hepatic CI
 - Psychological stress
- d) List the consequences of seizures on perinatal morbidity and mortality

List the consequences of seizures on perinatal morbidity and mortality

- Fetal demise/still birth
- Fetal hypoxia and acidosis
- Trauma- ICH
- Complications of AEDs
- Placental abruption, uterine rupture, maternal death
 - MOF

HT disorder of pregnancy

- HELLP
 - Severe pre-eclampsia but can be independent disorder
- Chronic HT
 - 140/90 before 20/40 and more than 12/52 post partum
- Gestational HT
 - No proteinuria or other Sx/Sg after 20/40
- Chronic HT + pre-eclampsia
 - New onset proteinuria &/or Sx/Sg

Liver disease in pregnancy

- **Cholestasis of pregnancy**

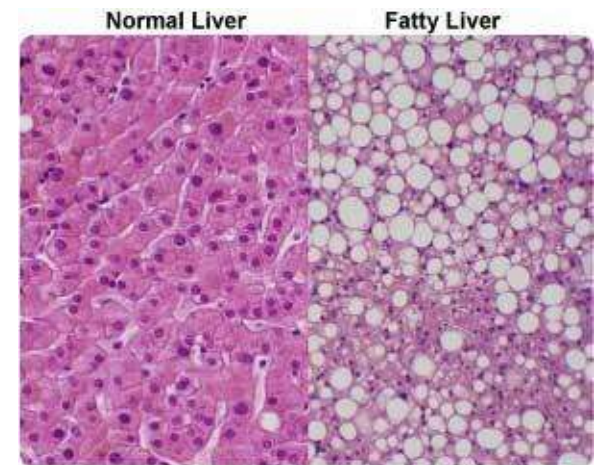
- 2nd/3rd TM
- Itch
- ↑bilirubin, ALP but normal GGT, transaminases <1000
- ↑PR due to Vit K deficiency
- Maternal Px good but fetal complications

- **Viral hepatitis**

- Can lead to fulminant hepatic failure
- Consider HSV

Fatty liver of pregnancy

- Microvesicular fatty infiltration of hepatocytes
- Rare but potentially fatal
- 3rd TM
- Abdo pain, n,v,jaundice
- 50% have pre-eclampsia
- Liver failure, abdominal bleeding



Investigations

- Transaminases up to 500s
- Bilirubin usually elevated
- WCC up
- Platelets reduced +/- DIC
- Severe cases- elevated ammonia, PR, hypoglycaemia due to liver failure
- AKI and hyperuricaemia
- US liver infarct, other causes
- Diff Dx HELLP

Treatment

- Cure is delivery of baby
- Supportive care
 - Hypoglycaemia common
 - Correct coagulopathy
- Can progress to fulminant liver failure warranting transplant
- Mortality 7-18%

A woman in labour at 39/40 collapses what is your differential diagnosis?

Specific to pregnancy

- Eclampsia
 - Or complication of pre-eclampsia
- Blood loss
- Uterine rupture
- Amniotic fluid embolism
- Puerperal cardiomyopathy
 - Arrhythmia
 - Cardiac failure
- Complication of epidural
- Dissection

Not pregnancy specific

- Epilepsy
- Intracranial event
- Sepsis
- Arrhythmia
- Respiratory failure
- Overdose
- Anaphylaxis
- PE
- Tension pntx
- Electrolyte disturbance
- Hypovolaemia other than blood

ICU Management of PPH

- Leading cause of maternal death in Western world
- 5-10% of deliveries
- Differential Dx
 - Uterine atony- RPOC
 - Trauma –lacerations, uterine rupture
 - Coagulopathy- pre-eclampsia, abruption, ITP, AFES

Recognition of blood loss

- Can lose up to 2L before becomes tachycardic
- Pre-eclamptic patients and small women lower circulating volumes so Sx earlier
- Often underestimated
 - At any stage

PPH

- Resuscitation- lines, O2, lie flat, bloods
- Drugs
- Manual compression
- Theatre
- Appropriate blood products
- Avoid secondary complications

PPH Drugs

- **FIRST LINE**

- Syntocinon
 - Iv (5units) or 10U IM
- Syntometrine IM (C.I HT, cardiac disease, sepsis)

- **SECOND LINE**

- Syntocinon infusion (30U in1000ml 250ml/hr)
- Misoprostol PR or s/l (okay in HT and asthma)
- Carboprost 250mcg im q15min max 2mg
 - Bronchospasm

PPH- theatre

- If being referred to ICU
 - Either in or going to OR
- OR with anaesthesia
 - RPOC
 - Repair lacerations
 - Balloons
 - Uterine packs
- Catch up on resus, reverse any coagul

Belfort-Diddy Obstetrical Tamponade System



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UpToDate®

Haemorrhage control

- Arterial embolisation
- Laparotomy
 - Exclude uterine rupture
 - Ligation uterine arteries +/- uterine compression sutures
- Hysterectomy
 - Last resort but life saving
 - Planned if placenta accreta

Massive PPH

- Vascular surgeon
- Massive transfusion protocols
 - RBC:FFP:Plt:cryo
 - Blood warmer
 - Tranexamic acid, Ca, FVIIa

PPH pitfalls

- Not recognising volume of blood loss
 - Or that patient has started to re-bleed
- Use of balloons when atony not the cause
- Coagulopathy
- Need for other surgical assistance

In ICU

- Monitor for blood loss & surgical complications
- Other pregnancy complications- pre-eclampsia
- Correct coagulopathy
- Warm
- Pain relief
- Antibiotics

Acute Respiratory failure

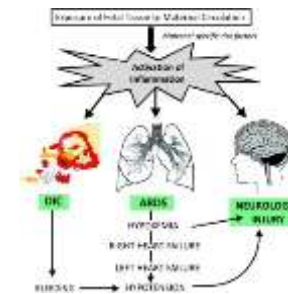
- Amniotic fluid embolism syndrome
- Cardiomyopathy
- PE
- Asthma
- Aspiration
- Venous air embolism
- Pneumonia

Amniotic Fluid Embolism Syndrome

- “Anaphylactoid syndrome of pregnancy”
 - fetal antigens enter the maternal circulation via the amniotic fluid
- Risk factors
- May be a lag between event and Sx
- Sudden, profound, unexpected collapse
- ***The syndrome is best considered unpredictable and unpreventable***

Pathophysiology of AFES

- Amniotic fluid enters maternal circulation
 - Biphasic response
 - Pulmonary v/s with RVF, systemic hypotension
 - Then LVF with \uparrow PAP,PCWP
 - Coagulopathy
- Severe hypoxia
- Inflammation



Clinical presentation of AFES

- During labour or immediately after
 - 2nd Tm to 48hr Post partum
- Nonspecific Sx
- Hypoxaemia and resp failure
- Hypotension/arrest due to cardiogenic shock
- Coagulopathy- 80% DIC
- Coma or seizures
- Clinical diagnosis

Treatment

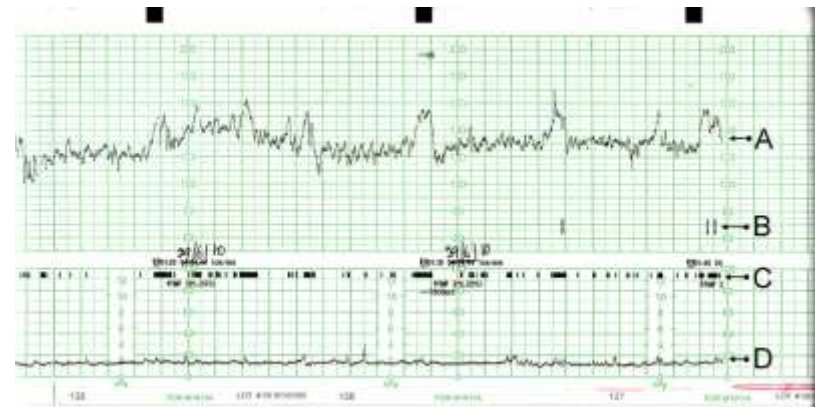
- Supportive
- Monitoring to direct use of vasoactive agents and fluids
- IABP, ECMO, NO
- Prognosis
 - Poor 20% maternal mortality (10-90%)
 - Neurological injury in survivors
 - Neonates 20-60% mortality and only 50% survivors neurologically intact

Supportive ICU care

- Mechanical ventilation
 - PaCO₂ 30-32mmHg pH 7.40-7.47
 - If high plateau pressures weigh up delivery vs ALI
- Drugs
 - Analgesia- avoid NSAIDs
 - Sedation
 - Vasopressors
 - NAd & 2nd line phenylephrine
 - Fluids & Left lateral decubitus
- DVT prophylaxis

Supportive ICU care

- Monitoring
 - Usual
 - CTG- must have someone to interpret!!
- $<34/40$
 - IM Betamethasone 11.4 mg - 2 doses 24 hours apart
 - Consider tocolytics
 - Allow steroids and transfer
 - Mg if $24-27^{+6}/40$



The Critically Ill Pregnant Patient

- Two patients
 - What's best for mother usually best for baby
 - <34/40 steroids
 - Viability 24/40 liaise with neonates, mother the priority
 - Transport
- Team
 - Close liaison with other specialties

The Critically Ill Pregnant Patient

- Consider specific obstetric diseases vs diseases that occur in non-pregnant women
 - often don't follow textbook definitions*
- Frequent re-assessment