Trauma in pregnancy

Clinical Guideline Presentation

45 minutes
towards CPD

References:

Queensland Clinical Guideline: Trauma in pregnancy is the primary reference for this package.

Recommended citation:

Queensland Clinical Guidelines. Trauma in pregnancy clinical guideline education presentation E19.31-1-V2-R24. Queensland Health. 2019.

Disclaimer:

This presentation is an implementation tool and should be used in conjunction with the published guideline. This information does not supersede or replace the guideline. Consult the guideline for further information and references.

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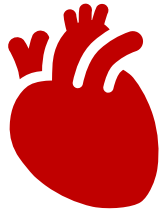
General principles

The first priority is the identification and management of life threatening injuries to the woman

- Fetal survival is directly related to maternal wellbeing

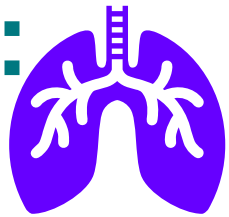
- Consider every woman of reproductive age pregnant until proven otherwise
  - Perform a pregnancy test on all women of child bearing age who experience trauma
- Generally, do not withhold medications, tests, treatments and procedures required for the woman's stabilisation because of pregnancy
- Collaboration between trauma, maternity and neonatal teams is essential

Physiological changes: Cardiovascular system



- Cardiac output increased by 30 to 50% and heart rate increased by 15 to 20 bpm → Increased CPR demands
- Plasma volume increased by up to 50% → Dilutional anaemia and reduced O_2 carrying capacity
- Uterine blood flow increased → Potential for rapid massive haemorrhage
- Systemic vascular resistance decreased → Sequesters blood during CPR
- Arterial blood pressure decreased by 10 to 15 mmHg → Decreased reserve
- Aortocaval compression → Increased CPR demands and increased reserve
- Increased concentrations of clotting factors → Activated state of coagulation cascade and increased tendency for thrombosis

Physiological changes: Respiratory system



- Respiratory rate increased → Decreased buffering capacity, acidosis more likely
- Oxygen consumption increased → Hypoxia develops more rapidly
- Functional residual capacity decreased → Decreased buffering capacity, acidosis more likely
- Arterial pCO_2 decreased → Decreased buffering capacity, acidosis more likely
- Laryngeal oedema increased → Difficult intubation
- Mucosal congestion increased → Predisposition to airway bleeding
- Airway size decreased → Difficult intubation
- Upper airway blood supply increased → Friable mucosa may lead to impaired airway visualisation and increased bleeding

Physiological changes: Other changes

- Gastric motility decreased → increased risk of aspiration
- Gastro-oesophageal sphincters relaxed → increased risk of aspiration
- Increased neck and mammary fat → difficult airway management
- Hypertrophied pelvic vasculature → potential for massive retroperitoneal haemorrhage with pelvic fracture and uterine trauma
- Superior displacement of bowel → potential for complex and multiple intestinal injuries with penetrating trauma of upper abdomen
- Anterior and superior displacement of bladder → susceptible to injury as effectively an intra-abdominal organ
- Renal blood flow increased → “normal” serum urea nitrogen and creatinine may reflect seriously compromised function

The uterus throughout pregnancy

1st trimester (0 to 12+6 weeks)

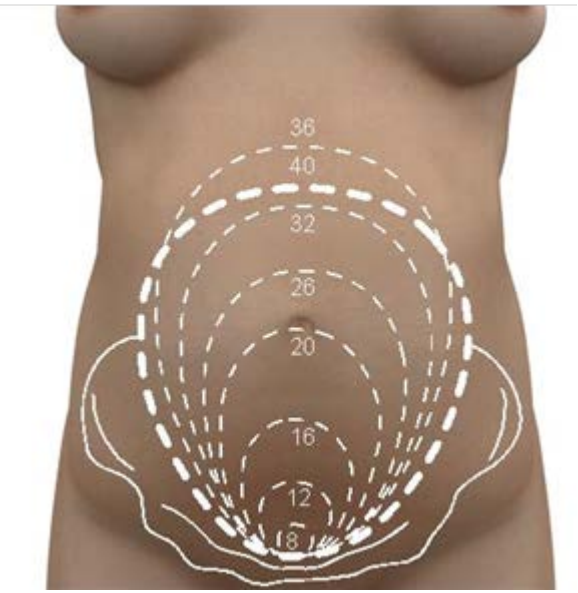
- Uterus: thick walled | small | confined to pelvis

2nd trimester (13+0 weeks to 27+6 weeks)

- Uterus: enlarges beyond pelvis
- Fetus: small | mobile | protected by generous amniotic fluid

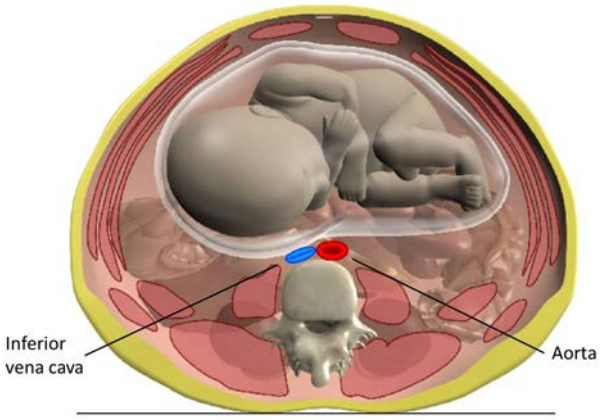
3rd trimester

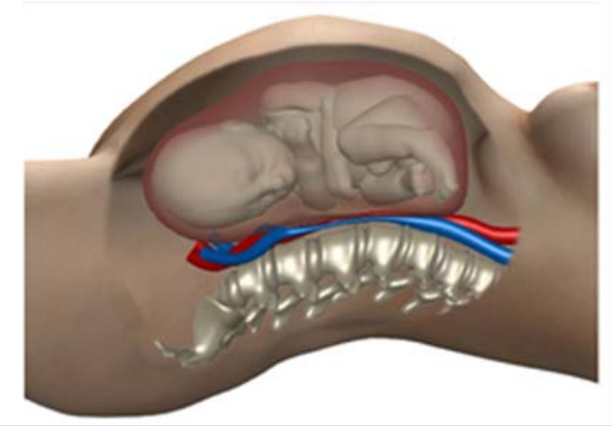
- Uterus: thin walled | large
- In vertex position, fetal head is usually within pelvis with remainder of fetus exposed above pelvic brim
- Pelvic fracture may cause skull fracture or intracranial injury to fetus



Aortocaval compression

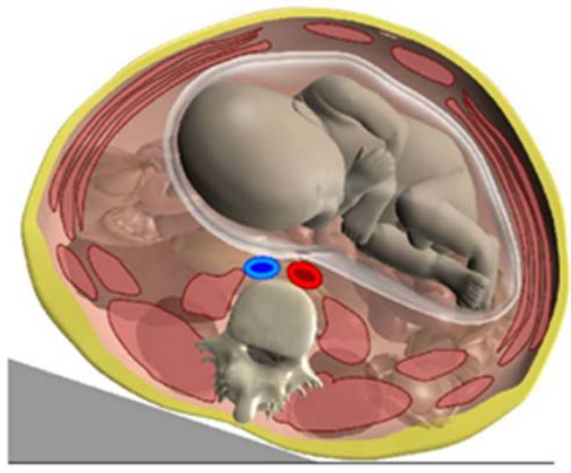
- When lying supine, pregnant women who are 20 weeks gestation or more experience **aortocaval compression**
- Aortocaval compression = compression of the abdominal aorta and inferior vena cava by the gravid uterus





Positioning for general management

Position the woman to minimise aortocaval compression by positioning her in left lateral tilt: 15–30 degrees (right side up)



Assessment: Primary survey

Considerations for pregnancy

AIRWAY

- Increased risk of airway management difficulties → have most experienced health care provider secure and maintain airway
- Increase risk of failed or difficult intubation. Consider:
  - Early intubation
  - Using short handled laryngoscope
  - Smaller ETT
  - LMA if unable to intubate
- Increased risk of aspiration → ensure early gastric decompression with naso/orogastric tube

Assessment: Primary survey

Considerations for pregnancy

BREATHING

- Increased risk of rapid desaturation → provide O_2 to maintain saturations greater than 95%
- If safe, raise head of bed to reduce weight of uterus on diaphragm and facilitate breathing
- If chest tube indicated → insert 1–2 intercostal spaces higher than usual

Assessment: Primary survey

Considerations for pregnancy

CIRCULATION

- Control obvious haemorrhage
- If seriously injured, insert 2 large bore IV lines
    - Avoid femoral lines due to compression by gravid uterus
- Deliver minimal crystalloids (greater than 1 L) which may lead to pulmonary oedema due to low oncotic pressure in pregnancy
- Maintain awareness of pregnancy related physiological parameters
- Perform thorough search for occult bleeding
- If haemodynamically unstable, Focused Abdominal Sonography for Trauma (FAST) is useful to identify presence of free fluid in intra-abdominal and intrathoracic cavities

Assessment: Fetus

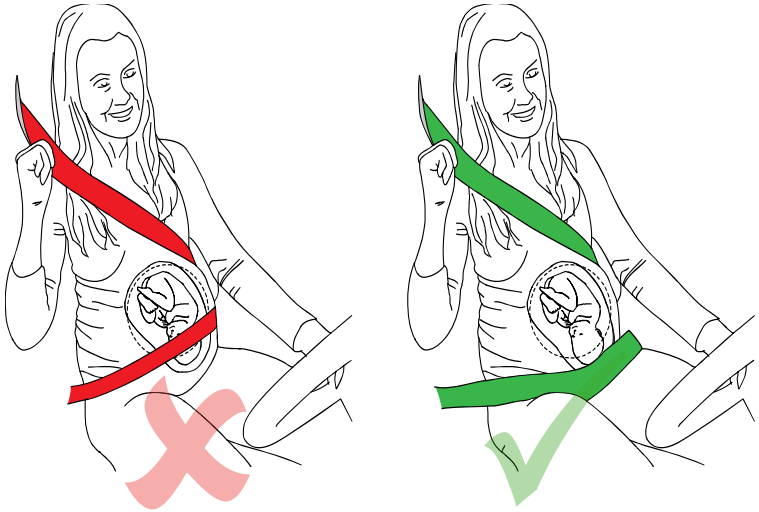
Assessment fetus after primary survey assessment and resuscitation of the woman.

- Thorough obstetric history including estimation of gestation → if available, consult Pregnancy Health Record (PHR)
- Fetal heart rate (FHR) monitoring:
  - If greater than 23 weeks, initiate continuous cardiotocograph (CTG) as soon as possible
  - Abnormalities may be only indication of injury or compromise to fetus
  - CTG highly sensitive in detecting both fetal distress AND maternal perfusion

Secondary Survey

To occur following exclusion or management of life threats.

- Inspect abdomen for ecchymosis or asymmetry
- If MVC, assess seat belt positioning. Incorrect positioning may:
  - Cause marked bruising of abdomen and increase risk of placental abruption and uterine rupture



- If indicated, perform sterile speculum vaginal examination and evaluate for:
  - Ruptured membranes, vaginal bleeding, cord prolapse, cervical effacement/dilatation, fetal presentation
- Do not perform digital vaginal examination until placenta praevia excluded

Diagnostic imaging

The risks of radiation to the fetus are small compared with the risk of missed or delayed diagnosis of trauma

- Do not defer radiographic studies indicated for maternal evaluation due to concerns regarding fetal exposure
- Risk to fetus is highest during first 15 weeks of pregnancy
- Gadolinium has known teratogenic effects on animals and is not recommended unless benefit clearly outweighs risk
- **If risk of non-diagnosis outweighs risk of exposure, perform examination**

Ultrasound scan

- Ultrasound scan (USS) is useful to assess:
  - Solid organ injury
  - Intra-peritoneal fluid
  - Gestational age
  - Fetal heart rate
  - Fetal activity
  - Fetal presentation and position
  - Placental location
  - Amniotic fluid volume

! **USS is not a reliable indicator of placental abruption**

Haemorrhage

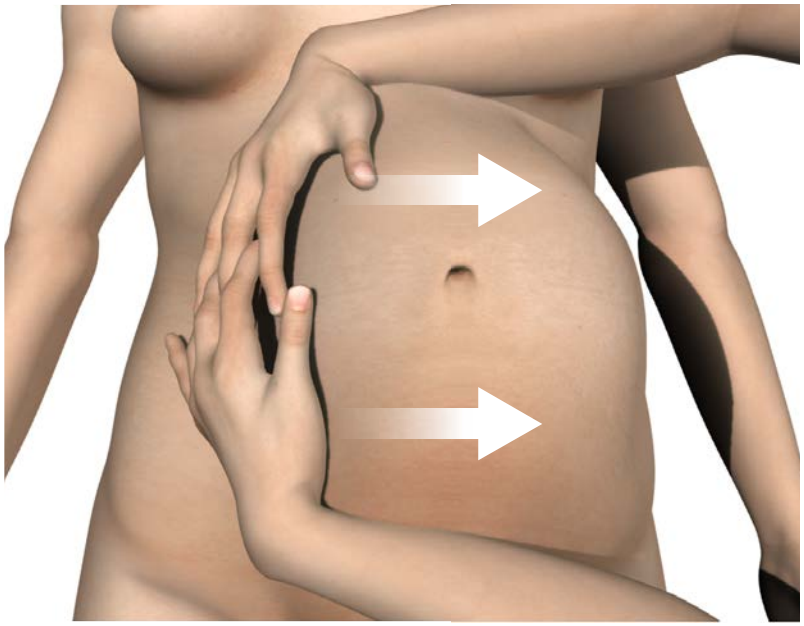
- Principles of treatment are the same as for non-pregnant patients
- Obstetric haemorrhage is often underestimated and may be concealed
- Clinical signs may not be apparent until blood loss is severe
- In pregnancy, fibrinogen levels increase to an average of 5–6 g/L compared to 2–4.5 g/L in non-pregnant women
- Use fibrinogen concentrate or cryoprecipitate early and aim to maintain fibrinogen levels above 2.5 g/L
- Be attentive to possibility of acute traumatic coagulopathy (ATC)
- Activate MHP early in pregnant patients
- If ROTEM® or TEG® available, follow local protocol and ensure algorithm has appropriate parameters and targets for pregnancy

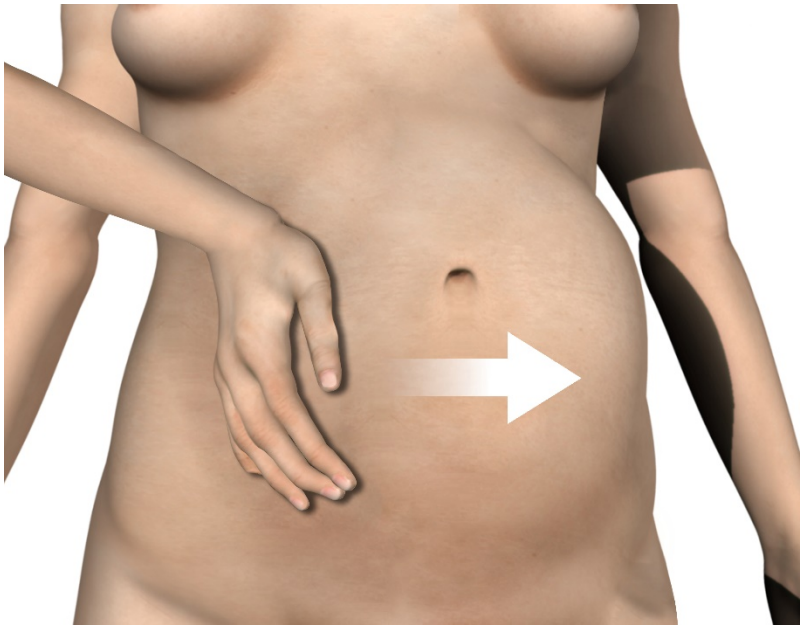
Cardiac arrest

- If gestation greater than or equal to 20 weeks → commence resuscitative hysterotomy (RH) as soon as possible
  - Whilst preparing for RH, manually displace the uterus to reduce aortocaval compression whilst still allowing for effective compressions [refer to next slide]
- Follow standard guidelines for cardiac arrest
  - Defibrillate as for non-pregnant patient → no significant shock to fetus
  - Drugs as per non-pregnant patient
  - Hand placement for chest compressions same as for non-pregnant patients
- If primary cause of arrest is trauma, focus on reversible causes: securing patent airway | restoration of circulating volume | chest decompression | early consideration of resuscitative thoracotomy

Positioning for CPR

- Position the woman to minimise aortocaval compression by manually displacing her uterus to the left
  - Simultaneously allows for aortocaval decompression and high-quality chest decompressions
  - Allows woman to remain supine, improving airway access, ease of defibrillation and IV access





Resuscitative hysterotomy

- A caesarean section initiated after CPR has commenced
- Also known as a perimortem caesarean section

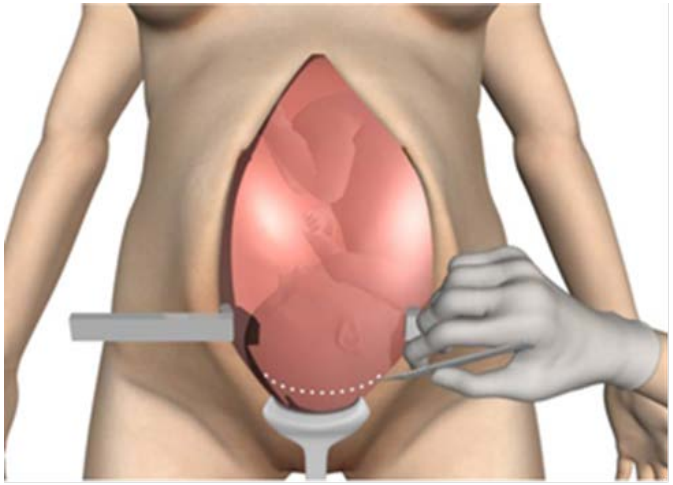
If CPR has commenced and woman is 20 weeks gestation or more, perform a RH as quickly as possible

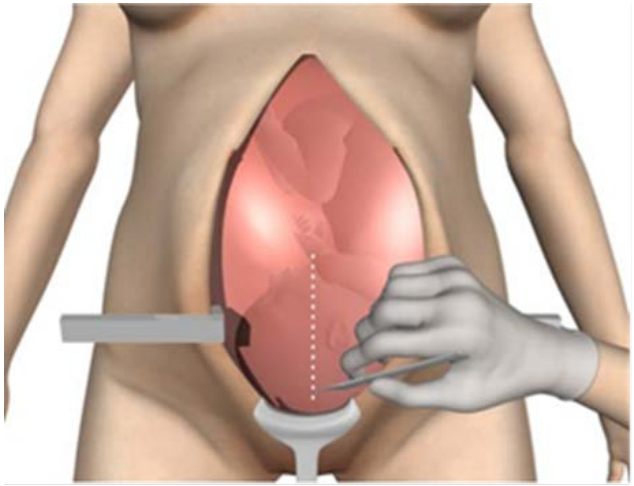
- Primarily performed as a resuscitative procedure for the woman
- Benefits for woman:
  - Complete aortal decompression once uterus evacuated
  - Allows for redistribution of uterine blood to other organs
  - Increases functional residual capacity allowing for better oxygenation
  - Increases effectiveness of CPR

- Roughly linear decrease in injury free survival rates for both woman and the fetus as time interval from cardiac arrest to birth increases

Resuscitative hysterotomy

- Perform at point of resuscitation
- Continue CPR during and after the procedure
- Ideally, make vertical midline incision to skin
  - Incision to uterus can be horizontal depending on:
    - Experience and skill of surgeon
    - Clinical circumstances
    - Priority is to do procedure as quickly as possible
- Ensure neonatal team and neonatal resuscitation equipment are ready





Blunt trauma

- Most common type of trauma presentation
- Common causes of blunt trauma in pregnancy include motor vehicle collisions (MVC), falls and direct assault
- MVC is the most common cause of blunt trauma, and the leading cause of maternal death in the pregnant population
- Potential injuries include:
  - Placental abruption from shearing forces and abrupt changes in pressure
  - Uterine contractions leading to preterm labour
  - Feto-maternal haemorrhage
  - Rarely, direct fetal intracranial injury

Penetrating trauma

- Less common presentation type
- Gunshot and stab wounds are primary causes
- Fetal loss is frequent if uterus is penetrated in injury

- Visceral organs are displaced upwards in pregnancy, changing pattern of injury
- Uterus and fetus are susceptible to significant injury after penetrating abdominal trauma

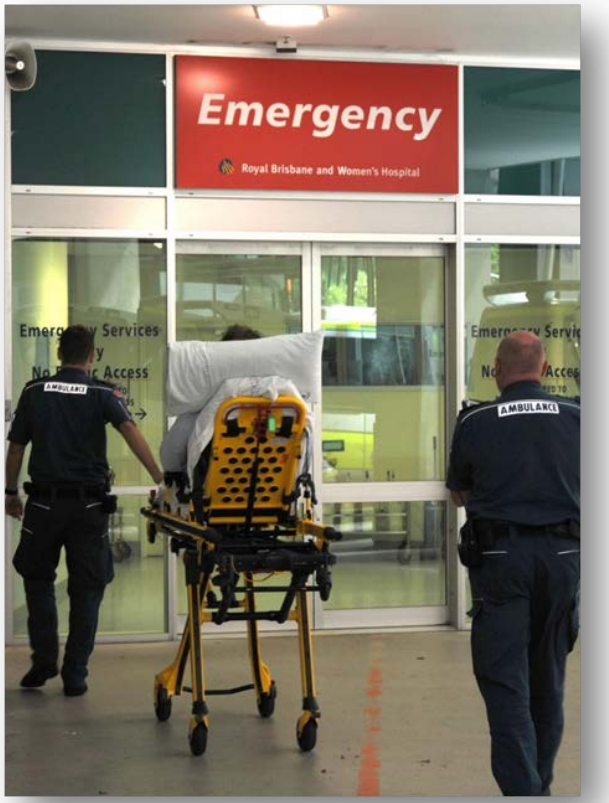
- Management does not differ in the pregnant patient
- Recommend a low threshold for exploratory laparotomy

Burns

- Little evidence to guide practice
- Basic principles of management are unchanged by pregnancy
- Emergent assessment includes:
  - Extent of total body surface area burned (TBSAB)
  - Presence of inhalation injury
  - Gestational age and electronic fetal monitoring for viable pregnancies
- Management principles:
  - Early supplemental O_2 if inhalation injury suspected
  - Thromboprophylaxis
  - High suspicion for sepsis with early and aggressive treatment
  - Low threshold for mechanical ventilatory support
  - Fluid resuscitation according to Parkland's formula
  - If extensive burns and woman is in third trimester → birth
  - If TBSAB 55% or more and viable fetus → recommend urgent CS without delay for corticosteroids
  - If TSSAB less than 55% → administer corticosteroids and manage expectantly

Domestic and family violence

- Incidence is increased in pregnancy
- Most commonly struck area is abdomen
- Mechanism may be blunt or penetrating
- Consider domestic and family violence (DFV) as a cause of trauma
- Be vigilant and question every woman who sustains trauma about DFV without partner present
- Remember child safety reporting
  - Not mandatory for unborn child, but staff may still report concerns
  - If other children are in family where DFV has occurred, consider mandatory reporting
- Offer relevant referrals
- Consider psychosocial assessment prior to discharge where DFV is identified



Potential obstetric complications: Uterine rupture

- More likely with advanced gestational age and severe abdominal trauma
- Diagnosis usually made on ultrasounds scan

Presentation

- CTG abnormalities
- Pain
- Fetal demise
- Positive FAST
- Uterine tenderness
- Vaginal bleeding
- Palpable fetal parts abdominally
- Maternal shock

Potential obstetric complications: Placental abruption

Separation of implanted placenta before birth

- Common complication of trauma, especially following MVC
- Leading cause of fetal death following trauma
- Presentation can vary widely but may include:
  - Abdominal pain
  - Vaginal bleeding
  - Uterine contractions
  - Uterine tenderness
  - Evidence of fetal compromise – CTG changes
  - Maternal haemodynamic instability

- Significant placental abruption → urgent CS
- Hospital admission for surveillance as indicated
- Consider corticosteroids
- Monitor for DIC

Potential obstetric complications: Preterm labour

Onset of labour before 37+0 weeks

- Presentation
  - Uterine contractions
  - Cramping abdominal/back pain
  - Pelvic pressure
  - Vaginal bleeding
  - Change or increase in vaginal discharge
- Consult with an obstetrician
- Consider tocolytic therapy and corticosteroids

Potential obstetric complications: Feto-maternal haemorrhage

- Occurs in around 10–30% of pregnant trauma patients
- Severity related to size of bleed
- Clinical presentation is variable and can be non-specific
  - Fetal distress
  - Sinusoidal trace on CTG indicating fetal anaemia
  - Women may experience a transfusion reaction
  - More common with anterior placentas and in women who experience uterine tenderness after trauma
- Kleihauer test is used to detect and quantity FMH
  - Limited usefulness in predicting outcomes and guiding management
  - Recommend for Rh D negative women 13+0 weeks or more to aid in determining dose of Rh D Immunoglobulin (“Anti-D”)
- Management
  - Continuous electronic fetal monitoring
  - Abdominal USS
  - Emergency CS may be indicated

Potential obstetric complications: Amniotic fluid embolism

- Unpredictable, rare and often fatal
- Typically occurs during labour or birth, but may rarely occur in trauma
- Classic symptoms include respiratory distress, hypoxia, hypotension and coagulopathy

- Management is primarily supportive
- Major goals of management
  - Oxygenation
  - Aggressive restoration of cardiac output
  - Reversal of coagulopathy
- Rapid, all-out resuscitative efforts
- Prompt birth if cardiac arrest
- Blood product replacement

Potential obstetric complications:
Disseminated intravascular coagulation (DIC)

- Life threatening
- Always occurs secondary to another occurrence such as
  - Placental abruption, obstetric haemorrhage, fetal demise or amniotic fluid embolism
- Key trends indicative of DIC
  - Decreasing platelets and fibrinogen
  - Prolongation of prothrombin time
  - Increasing fibrin-related marker
- Management
  - Treat underlying cause
  - Early aggressive management
  - Replace missing haemostatic components with blood products and utilise ROTEM®/TEG® where available
  - Consult with a haematologist

Minor trauma

Even minor injuries can be associated with placental abruption, preterm labour, massive FMH, uterine rupture and fetal loss
    - Severity is not predictive of fetal outcome
- CTG monitoring provides good screening and high sensitivity for immediate adverse outcome
- Monitor FHR via CTG for 4 hours at a minimum

Discharge criteria

- Normal CTG
- No contractions, vaginal bleeding or loss
- Reassuring maternal status
- Laboratory evaluation within normal limits
- Kleihauer test reviewed and sufficient Rh D immunoglobulin administered if required
- Advise woman about when to seek medical advice
- Ensure appropriate follow up and communication with regular care provider

Case scenario: Nicole

- Handover from Queensland Ambulance Service (QAS)
  - 30 year old female
  - Passenger in high speed MVC
  - GCS 15
  - Well perfused
  - Breathing normally
  - Heart rate: 96 bpm
  - Blood pressure: 90/55 mmHg
  - 28 weeks pregnant

Case scenario: Nicole

Assessment and management principles

1. Primary survey
    - Position with left lateral tilt 15–30 degrees
2. Fetal assessment following primary survey assessment and resuscitation if necessary
    - Obtain obstetric history
    - Apply CTG
3. Secondary survey
    - Inspect abdomen for ecchymosis or asymmetry
    - Determine seat belt position during MVC
    - Perform appropriate diagnostic imaging according to circumstances
    - Perform head to toe examination
    - Maintain awareness of common obstetric complications from trauma
        - Assess uterine tone, contractions, rigidity, tenderness and palpable fetal parts

Case scenario: Nicole

Important things to remember

- ! If CPR is required, lie woman supine and manually displace uterus while preparing for resuscitative hysterotomy
- ! Maintain vigilance for haemorrhage, and awareness that it may occur in the presence of normal vital signs
- ! Do not defer indicated radiographic studies (including abdominal CT) due to concerns of fetal exposure to radiation
- ! Test for Rh D status and administer Rh D immunoglobulin if Rh D negative