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Queensland Clinical Guidelines

Translating evidence into best clinical practice

Maternity and Neonatal **Clinical Guideline**

Trauma in pregnancy

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Cultural acknowledgement

We acknowledge the Traditional Custodians of the land on which we work and pay our respect to the Aboriginal and Torres Strait Islander elders past, present and emerging.

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- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

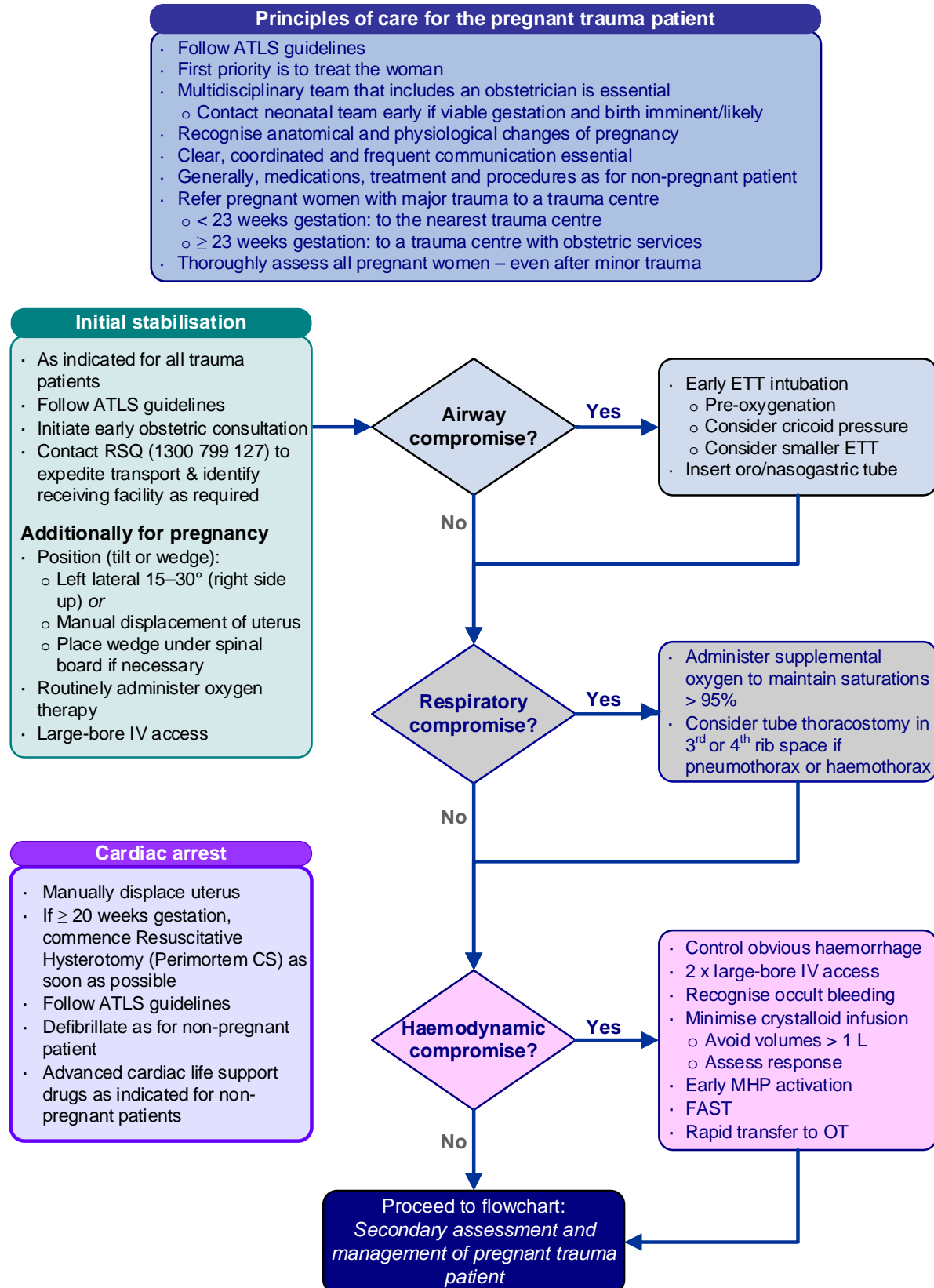
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Flow Chart: Initial assessment and management of the pregnant trauma patient

ATLS: Advanced Trauma Life Support, **CPR:** Cardiopulmonary Resuscitation, **CS:** Caesarean section, **ETT:** Endotracheal tube, **FAST:** Focused Abdominal Sonography for Trauma, **IV:** Intravenous, **MHP:** Massive Haemorrhage Protocol, **OT:** Operating Theatre, **RSQ:** Retrieval Services Queensland, **>:** greater than, **≥:** greater than or equal to

Flow chart: F19.31-1-V2-R24

Flowchart: Secondary assessment and management of pregnant trauma patient**Fetal assessment and secondary survey****As for non-pregnant patient AND**

- Consult obstetric team
- Obtain obstetric history
 - Gestation
 - Pregnancy complications
- Assess and record FHR
- Maintain high index of suspicion for occult shock and abdominal injury
- Maintain position (tilt or wedge) left lateral 15-30° (right side up) or
 - Manual displacement of uterus
 - Wedge spinal board if required
- Physical examination
- Assess uterus
 - Tone, rigidity, tenderness
 - Contractions
- Estimate gestational age
 - Fundal height
 - USS
 - If uncertain (i.e. severe trauma, no prior USS or lack of accurate records) presume viability

Consider - especially for major trauma

- Pelvic exam (obstetric team)
 - Sterile speculum
 - Assess for rupture of membranes, vaginal bleeding, cervical effacement and dilation, cord prolapse, fetal presentation
- Imaging
 - Formal obstetric USS
 - FAST if haemodynamically unstable
 - Other radiographs
- Blood tests
 - Standard trauma bloods
 - Group and Antibody screen
 - Coagulation Profile, ROTEM®/TEG® for major trauma
 - Kleihauer Test:
 - § For all Rh D negative women $\geq 13+0$ weeks gestation
 - § Major trauma
 - If Rh D negative and $\geq 13+0$ weeks gestation, administer Rh D immunoglobulin (but do not delay definitive care to do so)

Gestation
 $\geq 23+0$ weeks?

Yes or uncertain

No

- CTG (minimum 4 hours)
 - Application and interpretation by experienced maternity team member
 - Interpret with caution at < 28 weeks
- Monitor uterine activity

Maternal or
fetal
compromise?

Yes

No

Consider discharge criteria

- Obstetric team consulted/agree for discharge
- Reassuring maternal status
- No vaginal loss/bleeding
- Normal CTG/FHR (minimum 4 hours CTG)
 - Interpret CTG with caution at < 28 weeks
- No contractions
- Blood results reviewed
- Rh immunoglobulin given if required
- Social worker referral offered

Discharge
criteria
met?

Yes

No

Discharge

- Advise to seek medical advice if:
 - Signs of preterm labour
 - Abdominal pain
 - Vaginal bleeding or discharge
 - Change in fetal movements
- Advise to inform usual maternity care provider and GP of trauma event

Admit

- Assess for:
 - Placental abruption
 - FMH
 - Uterine rupture
 - Preterm labour
 - DIC
- Continuous CTG if $\geq 23+0$ weeks gestation
- Intervene as appropriate
- Consider emergency CS

CS: Caesarean section, **CTG:** Cardiotocograph, **DIC:** Disseminated intravascular coagulation, **FAST:** Focused Abdominal Sonography for Trauma, **FHR:** Fetal heart rate, **FMH:** Feto-maternal haemorrhage, **GP:** General Practitioner, **ROTEM®/TEG®:** Point of care blood clotting analysers, **USS:** Ultrasound scan, **<:** less than, **>:** greater than, **\geq :** greater than or equal to

Abbreviations

ATC	Acute traumatic coagulopathy
BP	Blood pressure
bpm	Beats per minute
CPR	Cardiopulmonary resuscitation
CS	Caesarean section
CT	Computerised tomography
CTG	Cardiotocograph
DFV	Domestic and family violence
DIC	Disseminated intravascular coagulation
FAST	Focused abdominal sonography for trauma
FFP	Fresh frozen plasma
FHR	Fetal heart rate
FMH	Feto-maternal haemorrhage
ISS	Injury severity score
IV	Intravenous
IVC	Inferior vena cava
MHP	Massive Haemorrhage Protocol
mSv	millisievert
MVC	Motor vehicle collision
RBWH	Royal Brisbane and Women's Hospital, Brisbane, Queensland
RH	Resuscitative hysterotomy
RSQ	Retrieval services Queensland
PHR	Pregnancy health record
PSPABC	Professor Stuart Pegg Adult Burns Centre
TBSAB	Total body surface area of burns
USS	Ultrasound scan
VE	Vaginal examination

Definition of terms

Cardiotocograph	A recording of the fetal heart beat and uterine activity during pregnancy.
Trauma	An acute physical harm, injury or hurt inflicted on the body by an external force.
Major trauma	Classification of trauma depends on the mechanism and severity of injury. Refer to Appendix A: Prehospital criteria for major trauma and Appendix B: Injury Severity Score.
Obstetrician	Local facilities may, as required, differentiate the roles and responsibilities assigned in this document to an 'Obstetrician' according to their specific practitioner group requirements. For example; Gynaecologists, General Practitioner Obstetricians, Specialist Obstetricians, Consultants, Senior Registrars and Obstetric Fellows.
Sievert	International unit of measurement for the biological effect to human tissue by ionizing radiation.

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1 Introduction

Physical trauma affects up to 8% of all pregnancies and is the leading cause of non-obstetric death during pregnancy.^{1,2} The predominant causes of trauma in pregnancy are motor vehicle collision (MVC) and domestic or family violence (DFV).³

Compared with non-pregnant women of reproductive age, pregnant women are nearly twice as likely to die after trauma, and twice as likely to experience DFV.⁴ Management of pregnant trauma patients requires consideration of several issues specific to pregnancy. These include alterations to physiology and anatomy during pregnancy, exposure to radiation and possible teratogens, the need to assess fetal well-being, and monitoring for potential obstetric complications that may occur secondary to trauma.⁵ Evidence for care provision is limited with the majority of studies being retrospective and reported outcomes varying widely.³

1.1 Clinical standards

Table 1. Clinical standards

Aspect	Consideration
Standard care	<ul style="list-style-type: none"> Refer to Queensland Clinical Guideline: <i>Standard care</i> for clinical standards such as documentation, communication for safety, consent and woman-centred care⁶
Pregnancy testing	<ul style="list-style-type: none"> Consider every woman of reproductive age with significant injuries pregnant until proven otherwise⁵ <ul style="list-style-type: none"> History alone is unreliable in excluding pregnancy Perform a pregnancy test on all women of child bearing age who experience trauma⁷⁻⁹ Where pregnancy is confirmed after a trauma event, provide information and counselling on the implications of the care provided (e.g. diagnostic imaging)
Collaboration	<ul style="list-style-type: none"> Trauma specialist and team to lead and coordinate clinical assessment and stabilisation A multidisciplinary team approach that includes early involvement of obstetric and midwifery staff is essential^{2,10} Involve neonatal team early if birth imminent/likely¹¹ <ul style="list-style-type: none"> Refer to Queensland Clinical Guideline: <i>Neonatal resuscitation</i>¹² Clear, timely, coordinated and frequent communication between care providers is essential¹¹
Transfusion	<ul style="list-style-type: none"> If transfusion required and birth is not imminent, use cytomegalovirus (CMV) negative products Indicate pregnancy on request forms to blood bank Infuse all women of child bearing age with K negative units where available For women who decline blood products (e.g. Jehovah Witness), manage as per local HHS policy
Training and staff support	<ul style="list-style-type: none"> Educate clinicians about adaptations to cardiopulmonary resuscitation (CPR) for the pregnant woman^{13,14} Include information about CPR in the pregnant woman in all generic life support training^{13,14} Offer debriefing to clinicians involved in pregnant trauma care events¹³
Equipment	<ul style="list-style-type: none"> Ensure the following is always available where trauma is managed: <ul style="list-style-type: none"> Equipment to manage a difficult airway Equipment to perform resuscitative hysterotomy (RH)^{13,15} <ul style="list-style-type: none"> § Also known as perimortem caesarean section Equipment for neonatal resuscitation¹¹

1.2 General principles

Table 2. General principles

Aspect	Consideration
Aim/Goal	<ul style="list-style-type: none"> The goal of treatment is maintenance of utero-placental perfusion and fetal oxygenation by avoiding hypoxia and preventing hypotension, acidosis and hypothermia
General	<ul style="list-style-type: none"> Manage pregnant trauma patients in accordance with the Advanced Trauma Life Support (ATLS) guidelines¹⁶ The first priority is identification of life threatening injuries to the woman^{2,5,8,10} Thoroughly assess the woman as fetal survival is directly related to maternal wellbeing^{2,3} Beyond mid-pregnancy, move the gravid uterus off the inferior vena cava (IVC) to increase venous return and cardiac output in acutely injured woman⁵ <ul style="list-style-type: none"> Achieve by positioning woman in left lateral tilt, or by manually displacing the uterus⁵ Offer debriefing to the woman and/or family following pregnant trauma care events¹³ Consider the need for short and long-term psychological support and/or referral following trauma events
Pregnancy considerations	<ul style="list-style-type: none"> Recognise maternal anatomical and physiological changes due to pregnancy^{2,17} Generally, do not withhold medications, tests, treatments and procedures required for the woman's stabilisation because of pregnancy³ Provide pregnant women with minor injuries, medical treatment for their injuries and appropriate fetal assessment¹⁸ Give tetanus vaccination or immunoglobulin when indicated^{5,19} <ul style="list-style-type: none"> Considered safe in pregnancy
Positioning	<ul style="list-style-type: none"> Position the woman to minimise aortocaval compression <ul style="list-style-type: none"> Consider gestation and the ability to provide effective care (e.g. intubation) when determining positioning requirements Left lateral tilt 15–30 degrees^{3,8,20} (right side up) Place a firm wedge under the right buttock/hip to achieve tilt In cases of major trauma, place the wedge under the spinal board¹³ If lateral tilt is not feasible, use manual uterine displacement to minimise IVC compression^{7,13,21,22} <ul style="list-style-type: none"> Can be performed from left or right side of woman: <ul style="list-style-type: none"> § Standing on the woman's left, the uterus (abdomen) is cupped with two hands and pulled towards themselves²³ § Standing on the woman's right, the uterus is pushed towards the woman's left using one hand²³ Refer to Appendix G: Positioning to relieve aortocaval compression
Common pitfalls	<ul style="list-style-type: none"> Common pitfalls include failure to: <ul style="list-style-type: none"> Detect early pregnancy Suspect or recognise shock in the presence of normal vital signs Detect abdominal injury because of a benign examination Suspect and screen for DFV Recognise and treat supine hypotensive syndrome Conduct necessary radiology studies due to fear of injury to the fetus Distinguish between eclampsia and head injury¹⁶ Observe and monitor with cardiotocograph (CTG) all women with minor trauma and a viable fetus (greater or equal to 23 weeks gestation) Test for Rh D status and administer Rh D immunoglobulin in Rh D negative women Initiate RH (perimortem caesarean section) as quickly as possible

1.3 Transfer, retrieval and place of management

Table 3. Transfer, retrieval and place of management

Aspect	Consideration
Place of management	<ul style="list-style-type: none"> Refer all major trauma cases to a trauma centre [refer to Appendix A: Prehospital criteria for major trauma] Generally: <ul style="list-style-type: none"> If less than 23 weeks gestation, transfer to the nearest trauma centre⁵ If greater than or equal to 23 weeks gestation, transfer to a trauma centre with obstetric services⁵ In Queensland, Trauma Centres with obstetric services are located at: <ul style="list-style-type: none"> The Townsville Hospital Royal Brisbane and Women's Hospital (RBWH) Gold Coast University Hospital Where feasible, major trauma surgery should occur in Level 4 or higher operating suite²⁴
Retrieval and Transfer	<ul style="list-style-type: none"> Arrange transfer/retrieval as per usual local protocols for major trauma If outside the Brisbane greater metropolitan area, arrange inter-hospital transfer via Retrieval Services Queensland (RSQ) Early notification of trauma to RSQ <ul style="list-style-type: none"> Telephone RSQ: 1300 799 127 Within the greater metropolitan area of Brisbane, transfer via Queensland Ambulance Service (QAS) to the RBWH Liaise with the RBWH Emergency Consultant – telephone (07) 3646 5900

1.4 Gestational considerations

Table 4. Gestational considerations

Category	Considerations
Estimating gestational age	<ul style="list-style-type: none"> Management decisions may require estimation of gestational age²³ <ul style="list-style-type: none"> Woman may be unconscious or unaware of pregnancy In singleton pregnancies, the symphysis fundal height (measurement from maternal pubic bone to top of uterine fundus) in centimetres approximately corresponds to gestational age in weeks when measured between 16 and 36 weeks gestation²³ <ul style="list-style-type: none"> If tape measure is unavailable, finger breadths may be used as a replacement for centimetres Rule of thumb landmarks may also be used to estimate gestational age²³: <ul style="list-style-type: none"> 12 weeks: uterus palpable at above the symphysis pubis 20 weeks: uterus palpable at the level of the umbilicus 36 weeks: uterus palpable at the level of the xiphisternum Estimation may be skewed by other factors including abdominal distention, fetal growth restriction and increased body mass index²³
Pre-viable gestation (< 23 +0 weeks)	<ul style="list-style-type: none"> Dates and estimations of gestational age may be inaccurate or unreliable Where there is doubt about the gestation, presume viability CTG monitoring not indicated Document presence/absence of fetal heart rate (FHR)
Viable gestation	<ul style="list-style-type: none"> Gestations greater than or equal to 23+0 weeks are potentially viable²⁵ <ul style="list-style-type: none"> Refer to Queensland Clinical Guideline: <i>Perinatal care at the threshold of viability</i>²⁵ Seek specialist advice and use clinical judgement, especially in regional and remote locations Commence CTG monitoring as soon as feasible²⁶ <ul style="list-style-type: none"> CTG will assess both maternal perfusion and fetal well-being

2 Physiological changes in pregnancy

An understanding of the anatomic and physiologic alterations of pregnancy is essential.²⁷ Refer to Appendix C for normal pregnancy values.

Table 5. Physiological and physical changes in pregnancy

	Changes in pregnancy	Implication
Cardiovascular system		
Plasma volume	Increased by up to 50%	Dilutional anaemia Reduced oxygen-carrying capacity Signs of shock due to blood loss appear late
Heart rate	Increased 15–20 beats per minute (bpm)	Increased CPR demands
Cardiac output	Increased by 30 to 50% ²³ Significantly reduced by pressure of gravid uterus on IVC	Increased CPR demands
Uterine blood flow	10% of cardiac output at term	Potential for rapid massive haemorrhage
Systemic vascular resistance	Decreased ²³	Sequesters blood during CPR
Arterial blood pressure (BP)	Decreased by 10–15 mmHg	Decreased reserve
Venous return	Decreased by pressure of gravid uterus on IVC ²³	Increased CPR circulation demands Increased reserve
Coagulation	Increased concentrations of most clotting factors	Activated state of coagulation cascade Increased tendency for thrombosis
Respiratory system		
Respiratory rate	Increased	Decreased buffering capacity, acidosis more likely
Oxygen consumption	Increased by 20 to 33% ²³	Hypoxia develops more quickly
Functional residual capacity	Decreased by 25% ²³	Decreased buffering capacity, acidosis more likely
Arterial pCO ₂	Decreased	Decreased buffering capacity, acidosis more likely
Laryngeal oedema	Increased ¹¹	Difficult intubation
Mucosal congestion	Increased	Predisposition to airway bleeding
Airway size	Decreased ¹¹	Difficult intubation
Upper airway blood supply	Increased ¹¹	Friable mucosa of airway may result in impaired airway visualisation and increased bleeding
Other changes		
Gastric motility	Decreased	Increased risk of aspiration
Gastro-oesophageal sphincters	Relaxed ²³	Increased risk of aspiration
Weight	Increased neck and mammary fat levels	Difficult airway management
Pelvic vasculature	Hypertrophied	Potential for massive retroperitoneal haemorrhage with pelvic fracture, uterine trauma ²
Bowel	Superior displacement	Potential for complex and multiple intestinal injuries with penetrating trauma of the upper abdomen
Bladder	Anterior and superior displacement by uterus	Susceptible to injury as effectively an intra-abdominal organ
Renal blood flow	Increased by 40% ²³ . Serum urea, nitrogen, creatinine reduced	'Normal' serum urea nitrogen and creatinine may reflect seriously compromised function

2.1 Uterine and placental considerations

Table 6. Implications for uterus and placenta in trauma

Aspect	Consideration
Uterine changes throughout pregnancy	<ul style="list-style-type: none"> First trimester (0 to 12+6 weeks) <ul style="list-style-type: none"> Uterus thick walled and small in size Uterus confined within and protected by bony pelvis⁷ Second trimester (13+0 to 27+6 weeks) <ul style="list-style-type: none"> Uterus enlarges beyond pelvis Fetus is small, mobile and protected by generous amniotic fluid Third trimester (28+0 weeks and onwards) <ul style="list-style-type: none"> Uterus thin walled and large in size In vertex position, fetal head is usually within pelvis with remainder of fetus exposed above pelvic brim Pelvic fracture in third trimester may cause skull fracture or intracranial injury to fetus
Implications of enlarged uterus	<ul style="list-style-type: none"> Lacks autoregulation and is very sensitive to changes in maternal BP Maternal hypovolaemia or hypotension cause reduced uterine blood flow and uterine vasoconstriction Uterine contractions also reduce blood flow, shifting 300 to 500 mL of blood into systemic vessels during contractions²⁰ Diaphragmatic splinting reduces residual capacity and makes ventilation more difficult Aortal compression causes supine hypotension, reduced venous return and significantly impairs efficacy of resuscitation Heart rotation to the left—left axis deviation on electrocardiogram (ECG) can be normal in third trimester Woman's entire blood volume passes through uterus every 10 minutes⁷ <ul style="list-style-type: none"> Potential for massive blood loss from traumatised uterus^{2,7}
Placenta	<ul style="list-style-type: none"> Little elasticity and is vulnerable to shear force at interface between uterus and placenta which can lead to placental abruption⁷ <ul style="list-style-type: none"> Refer to 7.2 Placental abruption Placenta and fetus extremely sensitive to catecholamine stimulation

3 Assessment

Conduct the primary and secondary survey as for non-pregnant patients.¹⁷ Additional considerations for pregnancy are outlined below.

3.1 Primary survey

As for non-pregnant patients, the priority for pregnant women following trauma remains airway, breathing and circulation.²⁸

Table 7. Primary survey considerations for pregnancy

Aspect	Consideration
Airway and C-Spine	<ul style="list-style-type: none"> Increased risk of airway management difficulties due to⁵: <ul style="list-style-type: none"> Weight gain Respiratory tract mucosal oedema¹¹ Hyperaemia and hypersecretion of upper airway¹¹ Decreased functional residual capacity Reduced respiratory system compliance Increased airway resistance Increased oxygen requirements Consider airway to be difficult and have most experienced provider secure and maintain airway¹¹ Increased risk of failed or difficult intubation⁵—consider: <ul style="list-style-type: none"> Early intubation^{5,13,20,27,28} Use of a short handle laryngoscope Smaller endotracheal tube (ETT)^{5,8,29} Use of laryngeal mask airway if unable to intubate Increased risk of aspiration due to delayed gastric emptying in pregnancy⁵ <ul style="list-style-type: none"> Ensure early gastric decompression with nasogastric or orogastric tube¹⁶ Apply cervical spine collar
Breathing and ventilation	<ul style="list-style-type: none"> Increased risk of rapid desaturation¹¹ <ul style="list-style-type: none"> Provide oxygen supplementation to maintain maternal oxygen saturation greater than 95% to ensure adequate fetal oxygenation⁸ If safe to do so, raise the head of the bed to reduce weight of uterus on the diaphragm and facilitate breathing²⁸ If a chest tube is indicated, insert 1–2 intercostal spaces higher than usual to avoid potential abdominal injury due to raised diaphragm^{3,7,8,20,28} Increased risk of aspiration¹¹
Circulation and haemorrhage control	<ul style="list-style-type: none"> Control obvious external haemorrhage Position with left lateral tilt 15–30 degrees²⁰ (right side up) or perform manual left uterine (abdominal) displacement [refer to Appendix G: Positioning to relieve aortocaval compression] If seriously injured, insert two large bore intravenous (IV) lines⁵ Avoid femoral lines due to compression by gravid uterus If unable to achieve IV access, consider intraosseous lines Assess response—maintain an awareness of pregnancy related physiological parameters Aim to avoid large volumes of crystalloids (greater than 1 L) which may lead to pulmonary oedema due to the relatively low oncotic pressure in pregnancy³⁰ Perform a thorough search for occult bleeding as maternal blood flow is maintained at expense of fetus⁷ If haemodynamically unstable, Focused Abdominal Sonography for Trauma (FAST) is useful to identify presence of free fluid in intra-abdominal and intrathoracic cavities Refer to Section 4 Haemorrhage
Disability	<ul style="list-style-type: none"> Rapid neurological evaluation³¹ utilising the Glasgow Coma Scale and assess for neurological deficits distally
Exposure	<ul style="list-style-type: none"> Head to toe examination as for non-pregnant trauma patients⁵ <ul style="list-style-type: none"> Expose and thoroughly examine all body parts^{5,16} Prevent hypothermia

3.2 Fetal assessment

Following primary survey assessment and resuscitation of the woman, assess the fetus before conducting secondary survey.¹⁶

Table 8. Fetal assessment

Aspect	Consideration
Obstetric history	<ul style="list-style-type: none"> • If available, consult Pregnancy Health Record (PHR) • Gestation in weeks and current pregnancy complications • Singleton or multiple pregnancy • Current fetal lie, presentation and placental location • Antenatal care and rhesus status • Previous pregnancy and birth complications
Estimation of gestational age	<ul style="list-style-type: none"> • Ideally obtained from woman or PHR • Can be estimated by measuring fundal height <ul style="list-style-type: none"> ◦ Refer to Appendix F: Estimating gestational age by fundal height • Ultrasound scan (USS) estimation³² • Biparietal diameter (BPD) of 60 mm corresponds to around 24 weeks
Fetal response to trauma	<ul style="list-style-type: none"> • Fetal wellbeing is dependent on adequate uterine blood flow²⁰ • Fetus may become hypoxic and respond by centralising blood flow to fetal brain²⁰
FHR monitoring	<ul style="list-style-type: none"> • Normal baseline FHR for a term fetus is 110–160 bpm³³ • FHR is sensitive indicator of maternal blood volume and fetal well-being¹⁶ • Differentiate maternal and FHR²² • If greater than 23 weeks, initiate continuous CTG as soon as feasible^{7,22,26} <ul style="list-style-type: none"> ◦ Monitor FHR via CTG for minimum of 4 hours^{5,22,34} ◦ Good sensitivity for immediate adverse outcome ◦ Highly sensitive in detecting fetal distress and maternal perfusion²⁶ • Abnormalities may be only indication of injury or compromise to the fetus²⁰ • CTG application and interpretation requires clinicians trained in their use <ul style="list-style-type: none"> ◦ Physiological control of FHR and resultant CTG trace interpretation differs in the preterm fetus compared to the term fetus, especially at gestations less than 28 weeks³⁵ ◦ CTG trace review should be performed by a clinician experienced and confident with CTG interpretation relevant to the gestation³⁵ • Move staff and equipment to the woman's location rather than transporting a woman to an obstetric unit for monitoring

3.3 Secondary survey

Once primary life threats are excluded or managed, further assessment can be undertaken.³

Table 9. Secondary survey additional considerations for pregnancy

Aspect	Consideration
Physical examination	<ul style="list-style-type: none"> • Inspect abdomen for ecchymosis or asymmetry • In cases of MVC, incorrect positioning of the seat belt across the gravid uterus may: <ul style="list-style-type: none"> ◦ Cause marked bruising of the abdomen ◦ Increase the risk of placental abruption and uterine rupture ◦ Refer to Appendix E: Seat belt positioning in pregnancy • Assess uterine tone, contractions, rigidity, tenderness, palpable fetal parts <ul style="list-style-type: none"> ◦ The gravid abdomen may be relatively insensate to peritoneal irritation
Pelvic/vaginal examination (VE)	<ul style="list-style-type: none"> • If indicated, perform sterile speculum VE^{8,22} <ul style="list-style-type: none"> ◦ Evaluate for ruptured membranes, vaginal bleeding, cord prolapse, cervical effacement and dilation in labour, fetal presentation⁸ ◦ Vaginal bleeding may indicate preterm labour, abruption, pelvic fracture or uterine rupture¹⁷ • Do not perform digital VE until placenta praevia is excluded⁵ <ul style="list-style-type: none"> ◦ Experienced practitioner to perform VE when indicated • Consider urinary catheter insertion²⁸ • If suspected spinal cord injury, perform rectal examination for anal tone and perineal sensation

3.4 Diagnostic imaging

Table 10. Diagnostic imaging in trauma in pregnancy

Aspect	Clinical care
Context	<ul style="list-style-type: none"> The risks of radiation to the fetus are small compared with the risk of missed or delayed diagnosis of trauma³⁴ Risk to fetus is dependent on gestational age and radiation dose³⁶ <ul style="list-style-type: none"> The fetus is most vulnerable to radiation during the first 15 weeks of gestation^{37,38} Confusion about safety of diagnostic imaging for pregnant women can result in unnecessary avoidance³⁶ Magnetic resonance imaging does not have radiation and is appropriate for assessment of spinal cord injury as per non-pregnant patient
Radiation dose	<ul style="list-style-type: none"> Increased risks to the embryo or fetus have not been observed for intellectual disability, birth defects, growth restriction, neurobehavioural effects, impaired school performance, convulsive disorders, or embryonic or fetal death below an effective dose of 100 millisieverts (mSv)³⁹ Optimisation of the examination's exposure parameters has the largest effect on doses It is preferable to perform a single computerised tomography (CT) scan with iodinated contrast rather than perform multiple suboptimal studies without contrast² Personal protective equipment, (e.g. lead gown) is advised for pregnant women only when the position of the uterus is in the direct X-ray beam (and not if it interferes with imaging)⁴⁰ Refer to Appendix H: Approximate fetal effective doses (mSv) from common radiological examinations
Contrast	<ul style="list-style-type: none"> Although iodinated contrast agents cross the placenta and may be taken up by the fetal thyroid, no cases of fetal goitre or abnormal neonatal thyroid function have been reported in connection with in-utero contrast exposure² Gadolinium has known teratogenic effects on animals and is not recommended unless benefits clearly outweigh the risks⁴¹
Ultrasound scan	<ul style="list-style-type: none"> USS can assess gestational age, solid organ injury, intraperitoneal fluid, pericardial fluid, FHR, fetal activity, fetal presentation, placental location, amniotic fluid volume^{2,34,38} USS is not a reliable indicator of recent placental abruption^{2,13,34} FAST scan is as accurate as in non-pregnant patients,⁸ for detecting presence of intra-abdominal or intrathoracic free fluid
Recommendation	<ul style="list-style-type: none"> Do not defer radiographic studies indicated for maternal evaluation including abdominal CT due to concerns regarding fetal exposure to radiation⁵ If risk of non-diagnosis outweighs risk of exposure, perform examination³⁶ X-ray examinations of the extremities, and CT examinations of the head and neck can be undertaken on pregnant or possibly pregnant women without concern^{39,40} Provide information and counselling to women exposed to radiation during diagnosis and care

4 Haemorrhage

Table 11. Management of haemorrhage

Aspect	Consideration
General principles	<ul style="list-style-type: none"> Obstetric haemorrhage is often underestimated and may be concealed⁴² Clinical signs may not be apparent until blood loss is severe <ul style="list-style-type: none"> 1200–1500 mL of blood loss before signs of hypovolaemia apparent³⁰ Danger of failing to identify blood loss and/or underestimating severity³⁰ Maintain a high index of suspicion for bleeding and an awareness of the limitations of clinical signs¹³ Be attentive to possibility of acute traumatic coagulopathy (ATC): <ul style="list-style-type: none"> Unique pathophysiology present in up to a quarter of trauma patients⁴³ Characterised by failure of coagulation system to maintain haemostasis following major injury⁴³
Clinical signs	<ul style="list-style-type: none"> Most common signs of hypovolaemia are³⁰: <ul style="list-style-type: none"> Increase in heart rate (greater than 100 bpm) Tachypnoea and pallor Cold, pale, sweaty, cyanosed skin with delayed capillary refill Alteration of mental state Fall in urine output Narrowed pulse pressure and hypotension (late sign)
Fibrinogen	<ul style="list-style-type: none"> In pregnant women, fibrinogen levels increase to an average of 5–6 g/L compared to non-pregnant levels of 2.0–4.5 g/L⁴² Use fibrinogen concentrate or cryoprecipitate early and aim to maintain fibrinogen levels above 2.5g/L⁴⁴
Point of care (POC) blood clotting analysers	<ul style="list-style-type: none"> Both thromboelastography® (TEG®) and thromboelastometry (ROTEM®) point of care blood clotting analysers are in use in Queensland If available, follow a locally agreed algorithm relevant to device used and facilitate education and training on use Ensure algorithm has appropriate parameters and targets for pregnancy
Massive Haemorrhage Protocol (MHP)	<ul style="list-style-type: none"> Activate MHP early in pregnant patients⁴² Establish and follow a locally agreed MHP for pregnant women <ul style="list-style-type: none"> If no local MHP refer to Queensland Clinical Guideline <i>Primary postpartum haemorrhage</i>⁴⁵ or the National Blood Authority MHP^{42,46} There is no evidence that the dose and timing of fresh frozen plasma (FFP) should differ from standard MHPs in pregnant women, except when disseminated intravascular coagulation (DIC) is present <ul style="list-style-type: none"> Refer to Table 24 Disseminated intravascular coagulation In the setting of trauma with significant bleeding, tranexamic acid is considered safe for the fetus¹ <ul style="list-style-type: none"> Unknown if use in pregnancy trauma reduces mortality¹
Management	<ul style="list-style-type: none"> Principles of treatment are same as for non-pregnant patients Identify source of bleeding as external or internal Control external bleeding with direct manual pressure on wound, limb elevation, packing, or by reduction and immobilisation of fractures Management of internal bleeding may be aided by use of binders or splint application Rapid transfer to operating theatre or interventional radiology as indicated If hypovolaemia suspected, initiate volume limited fluid resuscitation to restore circulating volume and ensure adequate maternal and utero-placental perfusion^{2,13} If required, transfuse O-negative blood until cross-matched available⁵ If ongoing volume resuscitation required, consider activating MHP or ROTEM®/TEG® algorithm Treat ATC as per principles of non-pregnant patient <ul style="list-style-type: none"> Control bleeding through rapid surgical or radiological intervention, and with balanced resuscitation of blood and blood components Early use of Tranexamic Acid (TXA) Utilise MHP and coagulation testing with ROTEM®/TEG® Avoid vasopressors²⁰ as they may compromise uteroplacental perfusion⁵ <ul style="list-style-type: none"> Use only for intractable hypotension that is unresponsive to fluid resuscitation, or to manage neurogenic shock⁵

5 Cardiac arrest

Preparedness for pregnant patients in cardiac arrest is essential for all emergency departments.¹¹ Ensure that team members with responsibility for pregnant women are familiar with physiological changes of pregnancy which can affect resuscitation techniques and potential complications.²³ Ideally, a maternal cardiac arrest team is comprised of an adult resuscitation team, as well as obstetric, anaesthetic, midwifery and neonatal teams.¹¹

Table 12. Implications for CPR

Aspect	Consideration
General principles	<ul style="list-style-type: none"> Follow standard guidelines for cardiac arrest^{3,47} If primary cause is trauma, focus efforts on reversible causes: <ul style="list-style-type: none"> Prevention of hypoxia by securing patent airway Restoration of circulating blood volume Chest decompression Early consideration of resuscitative thoracotomy First priority for medical cardiac arrest is to commence compressions³⁰ <ul style="list-style-type: none"> Hand placement for compressions is the same as for non-pregnant patients²³ Do not monitor fetus⁴⁷ Remove internal and external fetal monitors if present^{23,47} Commence RH as soon as possible <ul style="list-style-type: none"> Refer to 5.1 Resuscitative hysterotomy (perimortem caesarean section) Defibrillate as for the non-pregnant trauma patient¹¹—no significant shock is delivered to the fetus^{23,29,48} <ul style="list-style-type: none"> When indicated, perform without hesitation or delay²³ Ensure CTG leads are removed prior to defibrillation²⁹ Administer advanced cardiac life support drugs as would be indicated for the non-pregnant patient^{13,48} Deflate air-filled mattresses if in use²³
Positioning	<ul style="list-style-type: none"> After 20 weeks gestation, the uterus impedes resuscitation by: <ul style="list-style-type: none"> Decreasing venous return causing supine hypotension Reducing stroke volume and cardiac output^{13,21,30} Decreasing the effectiveness of thoracic compressions^{13,21,29,49} If uterus is palpated at or above the umbilicus, perform manual left uterine (abdominal) displacement to minimise aortocaval compression^{11,23,30} <ul style="list-style-type: none"> Simultaneously allows for aortocaval decompression and high-quality chest compressions^{11,23} Allows woman to remain supine which improves airway access, ease of defibrillation and IV access¹¹ Refer to Appendix G: Positioning to relieve aortocaval compression Tilting women in cardiac arrest can: <ul style="list-style-type: none"> Delay starting compressions Reduce quality and efficacy of compressions^{11,30,47}
ABC considerations	<ul style="list-style-type: none"> Refer to Table 7. Primary survey considerations for pregnancy Hypoxaemia develops more rapidly in pregnant patients, therefore, rapid and high-quality airway and breathing interventions are essential²³ Insert advanced airway early in resuscitation⁴⁷ Initially ventilate with 100% oxygen⁴⁷ Tidal volumes may need to be reduced because of elevated diaphragm^{11,29} There is no significant vertical displacement of the heart during pregnancy⁵⁰ <ul style="list-style-type: none"> No need to alter hand placement for chest compressions

5.1 Resuscitative hysterotomy (perimortem caesarean section)

Table 13. Resuscitative hysterotomy

Aspect	Consideration
Definition	<ul style="list-style-type: none"> A CS that is initiated after CPR has commenced³² Also known as Perimortem caesarean section
Benefits	<ul style="list-style-type: none"> Primarily performed as a resuscitative procedure in the interests of maternal survival¹³ RH within 4—5 minutes of cardiac arrest is widely supported for potential survival of both the woman and the fetus^{3,51} Emptying the uterus through RH provides several important benefits for the woman: <ul style="list-style-type: none"> Allows for complete aortocaval decompression once uterus evacuated¹¹ Alleviates compression of IVC, improving venous return^{32,47,48,51,52} Allows for redistribution of uterine blood to other organs⁵¹ Increases functional residual capacity of woman, allowing for better oxygenation⁵¹ Overall increased effectiveness of CPR⁵¹ Delay in initiating RH has been linked to adverse outcomes¹⁵
Timing	<ul style="list-style-type: none"> If CPR has commenced and woman is more than 20 weeks gestation, perform a RH as quickly as possible⁵³ For both women and the fetus, there is roughly linear decrease in injury free survival rates as the time interval from maternal arrest to birth increases⁵³ Survival and neurologic outcome of the viable fetus is related to time between maternal death and birth^{9,48,49} Reversible causes for maternal cardiac arrest are absolute indications for prompt delivery^{23,53}
Management	<ul style="list-style-type: none"> Perform RH at the point of resuscitation^{13,23,47} as quickly as possible⁵³, no later than 4—5 minutes following maternal cardiac arrest when possible⁵ <ul style="list-style-type: none"> Do not wait until four minutes post cardiac arrest to commence RH⁵³ Do not delay RH by moving the woman to an operating environment or by attempting to assess fetal viability^{13,23,30,52} Ideally, make a vertical midline incision to skin <ul style="list-style-type: none"> This incision is extensible if further surgical interventions are required Incision to uterus may be horizontal or vertical depending on clinical circumstances and skill/experience of surgeon Priority is to do procedure as quickly as possible Refer to Appendix C: Resuscitative hysterotomy procedure Continue CPR during and after the procedure^{30,52} Ensure neonatal team and neonatal resuscitation equipment are ready to receive infant once born¹¹

6 Mechanisms and causes of trauma in pregnancy

Compared to non-pregnant women of childbearing age, there is a higher incidence of MVCs and penetrating trauma in pregnant trauma patients.⁵⁴

6.1 Blunt trauma

Table 14. Blunt trauma in pregnancy

Aspect	Consideration
Context	<ul style="list-style-type: none"> Most common type of trauma presentation in pregnancy (82%)¹⁰ MVC is most common cause of blunt trauma¹⁶ and the most common mechanism of trauma for pregnant patients⁵⁴ <ul style="list-style-type: none"> Other causes include falls and direct assault¹⁶ Direct fetal injuries occur in less than 1% of cases of severe blunt abdominal trauma⁷ <ul style="list-style-type: none"> Abdominal wall, uterine myometrium and amniotic fluid act as buffers protecting fetus from direct injury¹⁶
Motor Vehicle Collision (MVC)	<ul style="list-style-type: none"> Leading cause of maternal death in pregnant population⁵ <ul style="list-style-type: none"> Mechanism of injury often involves uterus⁵ Outcome is related to⁵: <ul style="list-style-type: none"> Mechanism of collision and acceleration-deceleration velocities Use of protective devices such as seat belts and air bags Wearing a seat belt in a motor vehicle during pregnancy is effective in reducing risk of adverse outcomes in a MVC^{5,16} Provide information to pregnant women about the importance of correct positioning of motor vehicle seat belts while pregnant [refer to Appendix D: Seat belt positioning in pregnancy] Potential injuries and consequences include¹⁸: <ul style="list-style-type: none"> Placental abruption as a result of shearing forces and abrupt changes in amniotic fluid pressure Uterine contractions leading to preterm labour Feto-maternal haemorrhage Direct fetal intracranial injury (uncommon)

6.2 Penetrating trauma

Table 15. Penetrating trauma in pregnancy

Aspect	Consideration
Context	<ul style="list-style-type: none"> Less common trauma presentation type (18%)¹⁰ Gunshot and stab wounds are primary causes⁵ <ul style="list-style-type: none"> Stab wounds tend to have better prognosis than gunshot wounds Fetal loss is frequent following penetrating trauma to uterus (71% in gunshot wounds and 42% in stabbings)²
Anatomical considerations	<ul style="list-style-type: none"> Beyond second trimester, maternal bowel less likely to be involved due to protection by uterus Visceral organs displaced upward <ul style="list-style-type: none"> Less likely to be injured overall Upper abdominal stab wounds can result in more complex bowel injury Penetrating injuries below fourth intercostal space anteriorly or below tip of scapula posteriorly may cause visceral injuries Uterus and fetus are susceptible to significant injury after penetrating abdominal trauma <ul style="list-style-type: none"> Fetus more likely to sustain significant injury than mother <ul style="list-style-type: none"> Fetus sustains injury in 60–70% of cases, while visceral maternal injuries are only seen in 20% of penetrating abdominal trauma
Gunshot wounds	<ul style="list-style-type: none"> More damaging and higher mortality for both mother and fetus than low velocity injuries Fetal injury is generally a result of prematurity, maternal shock, uteroplacental injury or direct fetal injury⁵
Recommendation	<ul style="list-style-type: none"> Management does not differ in pregnant patient¹ Low threshold for exploratory laparotomy¹⁷ <ul style="list-style-type: none"> Exploratory laparotomy does not necessitate a CS¹

6.3 Burns

Table 16. Burn trauma in pregnancy

Aspect	Consideration
General context	<ul style="list-style-type: none"> • Paucity of evidence on major burns during pregnancy⁵⁵ <ul style="list-style-type: none"> ◦ Most from developing countries where incidence of burns is higher^{56,57} • Total body surface area of burns (TBSAB) positively associated with maternal death⁵⁵ <ul style="list-style-type: none"> ◦ Maternal survival declines incrementally when TBSAB exceeds 55% ◦ Inhalation injury exacerbates maternal-perinatal risk • Maternal endocrine system changes alter water distribution in pregnancy⁵⁸ <ul style="list-style-type: none"> ◦ Fluid shift towards interstitial space can lead to difficult fluid resuscitation in pregnant burn victims⁵⁸ • Fetal outcome highly dependent on gestation and extent of maternal injury⁵⁷ <ul style="list-style-type: none"> ◦ Fetal injuries are not typically direct injuries, but rather secondary to maternal state¹ ◦ If TBSAB is less than 10%, risk to mother and fetus is minimal, but is significant when TBSAB exceeds 50%
Queensland context	<ul style="list-style-type: none"> • The Professor Stuart Pegg Adult Burns Centre (PSPABC) situated at the RBWH is the only tertiary referral centre for burns in Queensland • Pregnant women with burns are a rare presentation • Between 1997 and 2017, 13 pregnant women were admitted to PSPABC⁵⁹ <ul style="list-style-type: none"> ◦ Represents 0.01% of all women admitted to unit ◦ 100% maternal and fetal survival ◦ Nine patients received operative management ◦ Three women required CS ◦ TBSAB ranged from 0.5–30% (average 8.5%) ◦ Predominant mechanism of injury was scalding of hot liquid (50%) • Time from point of injury to admission to RBWH varies widely <ul style="list-style-type: none"> ◦ If emergent birth is indicated, consider all circumstances and if CS prior to transfer is warranted
Management principles	<ul style="list-style-type: none"> • Basic principles of treatment unchanged by pregnancy⁶⁰, aside from considerations about teratogenic drugs⁵⁶ • Emergent assessment including <ul style="list-style-type: none"> ◦ Extent of TBSAB ◦ Presence of inhalation injury ◦ Gestational age and electronic fetal monitoring for viable pregnancies • Early supplemental oxygen if inhalation injury suspected • Consider risk of thrombosis as per pregnancy state • Burns do not increase risk of venous thromboembolism: <ul style="list-style-type: none"> ◦ Use standard thromboprophylaxis⁶¹ • High suspicion for sepsis with early and aggressive treatment • Low threshold mechanical ventilatory support • If circumferential burns to trunk (abdomen or thorax) and respiratory compromise, escharotomy is indicated
Fluid Resuscitation	<ul style="list-style-type: none"> • Fluid resuscitation according to Parkland's formula (TBSAB and urine output)⁵⁷ • Limited evidence to guide rate and volume for pregnant women with burns
Birth	<ul style="list-style-type: none"> • If burns are extensive and woman is in third trimester, recommend early birth⁵⁷ • If TBSAB 55% or more for viable fetus, recommend urgent CS without delaying for corticosteroids^{1,55} • If TBSAB less than 55%, administer corticosteroids with expectant management^{1,55}

6.4 Domestic and family violence

Table 17. Domestic and family violence in pregnancy

Cause	Consideration
Context	<ul style="list-style-type: none"> Incidence increases during pregnancy⁵⁴, especially in third trimester⁵ Most commonly struck body area is abdomen⁵ Mechanism may be blunt or penetrating
Reporting	<ul style="list-style-type: none"> It is not mandatory to report child protection concerns relating to an unborn child. This does not constrain staff from reporting their concerns about the potential risk of harm to a child following their birth to Child Safety Services⁶² If aware of other children in the family where violence has occurred, consider mandatory reporting⁶² Undertake a search of systems where Unborn Child High Risk Alert may be recorded and respond appropriately where applicable⁶³
Recommendation	<ul style="list-style-type: none"> Consider DFV as a cause of trauma in pregnancy <ul style="list-style-type: none"> Be vigilant and question every woman who sustains trauma about DFV without partner present⁵ Offer referral to social workers as appropriate to the circumstances (e.g. intimate partner violence, following fetal demise, if transfer required, for counselling and support) Consider psychosocial assessment prior to discharge where DFV is a consideration and ensure discharge summary is sent to primary carer

7 Potential obstetric complications

7.1 Uterine rupture

Table 18. Uterine rupture

Aspect	Clinical care
Context	<ul style="list-style-type: none"> Uterine rupture is more likely with advanced gestational age and severe direct abdominal trauma^{7,30} Diagnosis usually made on USS⁶⁴ (extrusion of uterine contents, free fluid in pelvis)
Clinical presentation	<ul style="list-style-type: none"> CTG abnormalities⁶⁴ (most common feature) Severe pain Fetal demise⁶⁴ Positive FAST Uterine tenderness with guarding and rigidity^{30,64} Vaginal bleeding⁶⁴ Palpable fetal parts abdominally^{30,64} Maternal shock including hypotension and tachycardia⁶⁴
Management	<ul style="list-style-type: none"> CS with midline laparotomy Urgent delivery of fetus Repair of uterus (simple repair, subtotal hysterectomy or total hysterectomy) as indicated by individual circumstances³⁰ Prompt haemodynamic resuscitation with blood products decreases risk of DIC⁶⁵ Hysterectomy if uncontrolled haemorrhage⁶⁵

7.2 Placental abruption

Table 19. Placental abruption

Aspect	Consideration
Context	<ul style="list-style-type: none"> Common complication of trauma especially following MVC^{3,26} Separation of implanted placenta before birth⁶⁴ <ul style="list-style-type: none"> Separation can be complete or partial⁶⁴ Leading cause of fetal death following trauma^{2,5,26} accounting for 50–70% of all trauma-related fetal losses² Can occur with rapid deceleration without direct trauma⁶⁶ Can occur following relatively minor trauma³⁰ Most occur within 2–6 hours of injury, and almost all within 24 hours⁵
Clinical presentation	<ul style="list-style-type: none"> Presentation can vary widely and include a lack of symptoms^{64,67} Abdominal pain^{5,68,69} Vaginal bleeding 60–80% of cases^{5,64} <ul style="list-style-type: none"> Amount does not necessarily correlate with severity⁶⁴ Uterine contractions^{2,5} Uterine tenderness⁶⁹/tense or 'woody' feel⁶⁸ <ul style="list-style-type: none"> If placenta is posterior, abdomen may be soft³⁰ Evidence of fetal compromise^{5,68} Maternal haemodynamic instability⁶⁴
Investigations	<ul style="list-style-type: none"> Although USS may detect abruption, it is not sensitive enough to exclude abruption^{68,69} <ul style="list-style-type: none"> False negative reported 50–80%³⁴ Do not delay treatment for USS³⁴ confirmation CTG better than USS in risk stratifying for suspected placental abruption^{2,7} <ul style="list-style-type: none"> Uterine contractions have high-frequency, low-amplitude pattern with an elevated baseline tone⁶⁴ FHR can show recurrent late or variable decelerations, bradycardia, or sinusoidal patterns⁶⁴ Consider feto-maternal haemorrhage (FMH)¹³ [Refer to Section 7.4 Feto-maternal haemorrhage]
Management	<ul style="list-style-type: none"> Significant placental abruption requires urgent delivery by CS^{45,68} <ul style="list-style-type: none"> Midline incision preferable if other abdominal injuries suspected Consider hospital admission for surveillance as clinically indicated Give Rh D immunoglobulin to all non-sensitised Rh D negative women independent of whether routine antenatal prophylactic Rh D immunoglobulin has been administered [refer to Table 22. Rh D immunoglobulin in trauma] Consider antenatal corticosteroids between 23+0 and 34 +6 weeks gestation¹³ Monitor for DIC and request urgent clotting studies as indicated⁶⁸ <ul style="list-style-type: none"> Do not delay treatment by waiting for coagulation results if massive blood loss occurs⁶⁸

7.3 Preterm labour

Table 20. Preterm labour

Aspect	Clinical care
Context	<ul style="list-style-type: none"> Onset of labour before 37+0 weeks gestation⁶⁴
Clinical presentation	<ul style="list-style-type: none"> Uterine contractions of more than four per hour accompanied by cervical change⁸ Cramping abdominal/back pain⁶⁴ Pelvic pressure⁶⁴ An increase or change in vaginal discharge⁶⁴ Vaginal bleeding⁶⁴
Management	<ul style="list-style-type: none"> Consult with an obstetrician regarding management appropriate for the circumstances Refer to the Queensland Clinical Guideline: <i>Preterm Labour</i>⁷⁰: <ul style="list-style-type: none"> Consider tocolytic therapy Consider corticosteroids aimed at promoting fetal lung maturity

7.4 Feto-maternal haemorrhage

Table 21. Feto-maternal haemorrhage

Aspect	Clinical care
Context	<ul style="list-style-type: none"> FMH occurs in approximately 10–30% of pregnant trauma patients^{7,31} The severity of the FMH is related to the size of the bleed in relation to the overall fetal blood volume, the rate at which this blood is lost and whether the event is acute or chronic Clinical presentation of FMH is variable and can be non-specific^{71,72} <ul style="list-style-type: none"> Decreased or absent fetal movements have been reported^{71,72} Fetal distress, especially if the fetal heart tracing is sinusoidal (indicating fetal anaemia) Massive FMH is a rare but severe complication which can result in fetal anaemia, fetal hypoxia, intrauterine death or neonatal neurologic damage⁷² Women may experience a transfusion reaction (nausea, oedema, fever, and chills)⁷¹ May occur more commonly with anteriorly located placentae and in women who experience uterine tenderness after trauma⁷³
Assessment of FMH	<ul style="list-style-type: none"> The Kleihauer test is used to detect and quantify FMH⁷⁴ <ul style="list-style-type: none"> Commonly to determine dose of Rh D immunoglobulin (Rh D-Ig) for Rh D negative women¹⁷ Results are reported quantitatively in mL of fetal blood within maternal circulation A 'negative' result is commonly understood to be less than 1 mL of fetal blood The Kleihauer test is not a test for placental abruption^{64,68} The evidence is limited about the usefulness of a positive Kleihauer test for predicting outcomes and guiding clinical management^{17,75} (beyond determining the dose of RhD-Ig for Rh D negative women) Flow cytometry is the most accurate quantitative test for FMH⁷⁴ and will be initiated by Pathology Queensland as a standard procedure when the quantitative result of the Kleihauer test is greater than 4 mL
Management	<ul style="list-style-type: none"> Continuous electronic fetal monitoring of the viable fetus Abdominal USS to detect fetal heart activity, placental location, amniotic fluid index, suspected intraperitoneal bleeding, gestational age, fetal weight <ul style="list-style-type: none"> Elevated peak systolic velocity of the fetal middle cerebral artery correlates with fetal anaemia^{76,77} Emergency CS may be indicated
Recommendation following trauma	<ul style="list-style-type: none"> Recommend Kleihauer test for Rh D negative women 13+0 weeks gestation or greater^{74,78,79} <ul style="list-style-type: none"> Aids determination of RhD-Immunoglobulin dose Consider a Kleihauer test for women with major or abdominal trauma <ul style="list-style-type: none"> Aids identification of FMH May inform immediate and longer term pregnancy management and outcomes Maintain a high index of suspicion and clinical surveillance for the possibility of significant FMH

7.4.1 Prevention of Rhesus alloimmunisation

Table 22. Rh D immunoglobulin in trauma

Aspect	Clinical care
Context	<ul style="list-style-type: none"> Approximately 21% of women in Queensland are Rh D negative⁸⁰ FMH occurs in 10–30% of pregnant trauma patients Majority of post-traumatic FMH small and subclinical Massive FMH is rare and generally clinically evident with fetal distress or demise
Assessment	<ul style="list-style-type: none"> If woman is Rh D negative and 12+6 weeks or less, quantification of FMH is not required <ul style="list-style-type: none"> Individualise RhD-Immunoglobulin administration according to clinical circumstances Refer to Queensland Clinical Guideline: <i>Early pregnancy loss</i>⁸¹ If woman is Rh D negative and 13+0 weeks or more, collect maternal blood (blood group, antibody screen and Kleihauer test) prior to administration of Rh D immunoglobulin⁷⁸ Do not delay or withhold administration of Rh D immunoglobulin based on or pending the results of quantitative testing
RhD-Ig	<ul style="list-style-type: none"> If gestation is less than or equal to 12+6 days and no contraindications: <ul style="list-style-type: none"> Indicated for miscarriage <ul style="list-style-type: none"> § 250 IU for singleton pregnancy § 625 IU for multiple pregnancy Insufficient evidence to support routine use for bleeding in an ongoing pregnancy⁷⁸ <ul style="list-style-type: none"> § If significant abdominal trauma, individualise RhD-Ig administration according to clinical circumstances^{82,83} If gestation is 13+0 weeks or more and no contraindications: <ul style="list-style-type: none"> Indicated for obstetric haemorrhage, abdominal trauma, or any other suspected intrauterine bleeding or sensitising event in the non-sensitised woman Standard dose 625 IU If not offered within 72 hours, a dose offered within 9–10 days may provide protection⁷⁸ 625 IU of Rh D immunoglobulin protects against 6 mL fetal red cells (12 mL whole blood), which is equivalent to 0.25% fetal cells in the maternal circulation⁷⁴ If FMH is quantified at greater than 6 mL, give additional doses of RhD-Immunoglobulin sufficient to provide immunoprophylaxis within 72 hours⁷⁸ <ul style="list-style-type: none"> 625 IU for each additional 6 mL (or part thereof) of fetal red cells detected Refer to Queensland Clinical Guideline: <i>Early Pregnancy Loss</i>⁸¹
Contraindications	<ul style="list-style-type: none"> Rh D positive woman Rh D negative woman with preformed Anti-D antibodies⁷⁸ Previous sensitivity or allergy to Rh D immunoglobulin

7.5 Amniotic fluid embolism

Table 23. Amniotic fluid embolism

Aspect	Clinical care
Context	<ul style="list-style-type: none"> Unpredictable, rare and often fatal^{29,64} Acute collapse typically occurring during labour, birth or within 30 minutes of birth^{13,30,84} <ul style="list-style-type: none"> May also occur in the context of abdominal trauma^{85,86} Also known as anaphylactoid syndrome of pregnancy^{29,87} Exact pathophysiological mechanism is poorly understood⁶⁴ <ul style="list-style-type: none"> Appears to involve abnormal inflammatory maternal response to fetal tissue exposure⁸⁷ Pathophysiological process comparable to anaphylaxis or severe sepsis¹³ Clinical diagnosis is one of exclusion^{30,88} <ul style="list-style-type: none"> Lack of universally recognised diagnostic criteria⁸⁷ Estimated incidence 1.7–2.5 per 100 000 births^{87,88} Mortality rate estimates range from 20–60%^{87,88}
Clinical presentation	<ul style="list-style-type: none"> Classic symptoms include respiratory distress, hypoxia, hypotension and coagulopathy^{13,88} Other symptoms include <ul style="list-style-type: none"> Maternal hypotension^{13,29,30,64,87} (100% of women²⁹) Acute hypoxia (dyspnoea, cyanosis or respiratory arrest)^{30,87,88} Seizures^{13,87,88} Cardiac arrest^{13,29,30,64,87} (87% of women²⁹) Haemorrhage^{13,88} Coagulopathy/DIC^{13,30,64,88} <ul style="list-style-type: none"> Bleeding from uterus, incisions or IV sites⁸⁷ If AFE occurs before birth, profound fetal distress^{13,87}
Management	<ul style="list-style-type: none"> Management is primarily supportive^{13,29,87} Major goals of management²⁹: <ul style="list-style-type: none"> Adequate oxygenation Aggressive restoration of cardiac output Reversal of coagulopathy Key factors for successful management⁸⁹: <ul style="list-style-type: none"> Sharp vigilance High level of clinical suspicion Rapid, all-out resuscitative efforts Involve obstetrician, neonatologist, anaesthetist, haematologist and intensivist as early as possible¹³ Prompt delivery if cardiopulmonary arrest⁸⁷ Resuscitation and airway management⁶⁴ Blood product replacement including FFP, platelets and cryoprecipitate⁶⁴

7.6 Disseminated intravascular coagulation

Table 24. Disseminated intravascular coagulation

Aspect	Clinical care
Context	<ul style="list-style-type: none"> Life threatening condition⁹⁰ Always occurs secondary to another occurrence such as: <ul style="list-style-type: none"> Placental abruption, obstetric haemorrhage, fetal demise or AFE^{30,90} Placental abruption and AFE are associated with severe early onset DIC⁹⁰ Rate in pregnancy ranges from 0.03–0.35%⁹⁰ May result in clinically detectable microvascular bleeding as well as abnormal blood coagulation tests^{45,78}
Diagnosis	<ul style="list-style-type: none"> Diagnosis is challenging in setting of pregnancy: <ul style="list-style-type: none"> Increased D-Dimers and fibrinogen levels in pregnancy Activated partial thromboplastin time (APTT) shortened in pregnancy Key trends indicative of DIC⁹⁰: <ul style="list-style-type: none"> Decreasing platelet count and fibrinogen Prolongation of prothrombin time Increasing fibrin-related marker
Management	<ul style="list-style-type: none"> Overriding management is to treat underlying cause Early and accurate recognition is vital⁹⁰ Tests need to be repeated to reflect dynamic changes⁹⁰ Requires early aggressive management¹³ If undelivered, deliver fetus and placenta¹³ Collect baseline bloods early and frequently If clinical signs present do not delay treatment by waiting for coagulation results⁶⁸ If there is bleeding, consider early use of tranexamic acid Replace missing haemostatic components with blood products⁹¹ <ul style="list-style-type: none"> Where available utilise POC blood clotting analysers (ROTEM®/TEG®) Avoid hypothermia and acidosis Refer to Queensland Clinical Guideline <i>Primary postpartum haemorrhage</i> for management, blood/product replacement and MHP activation protocols⁴⁵ Consult with a haematologist⁶⁸ If there is active bleeding, consider early use of cryoprecipitate or fibrinogen concentrate to maintain fibrinogen levels above 2.5 g/L⁴⁴ Advise platelet transfusion if marked or moderate thrombocytopenia Give FFP if actively bleeding or significantly elevated International normalised ratio (INR)

8 Musculoskeletal injury

Management principles are generally the same as for the non-pregnant patient.

Table 25. Musculoskeletal injury

Aspect	Clinical care
Spine and spinal cord injuries	<ul style="list-style-type: none"> Adequate immobilisation of neck and spine¹⁷ If possible, position left lateral tilt 15–30 degrees (right side up) Early multidisciplinary approach to care Consider birth at advanced gestations
Major pelvic fracture	<ul style="list-style-type: none"> Immobilise pelvis Vaginal birth is not absolutely contraindicated¹ <ul style="list-style-type: none"> Birth by CS if unstable fracture or pelvic architecture disrupted¹⁷ Consider fetal injury/skull fracture—may be more common with fetal head engagement¹⁷ <ul style="list-style-type: none"> Consult with neonatologist
Limb fracture and longer-term immobility	<ul style="list-style-type: none"> Assess for venous thromboembolism (VTE) risk and consider prophylaxis³⁷ <ul style="list-style-type: none"> Refer to the Queensland Clinical Guideline: <i>Venous thromboembolism (VTE) prophylaxis in pregnancy and the puerperium</i>⁹²

9 Minor trauma

Table 26. Minor trauma

Aspect	Clinical care
Definition	<ul style="list-style-type: none"> Pre-hospital transfer, any trauma injury that does not meet the criteria for defining major trauma <ul style="list-style-type: none"> Refer to Appendix A: Prehospital criteria for major trauma An Injury Severity Score (ISS) of less than 12 <ul style="list-style-type: none"> Refer to Appendix B: Injury Severity Score
Context	<ul style="list-style-type: none"> Even minor injuries in the pregnant woman can be associated with placental abruption, preterm labour, massive FMH, uterine rupture and fetal loss^{2,7} Severity of injury may not be predictive of fetal outcome^{2,18} <ul style="list-style-type: none"> Around 50% of fetal losses occur following minor trauma⁹³ Adverse fetal outcomes are increased after minor trauma not requiring hospitalisation^{2,18,66}
FHR monitoring	<ul style="list-style-type: none"> CTG provides good screening/high sensitivity for immediate adverse outcome Monitor FHR via CTG for 4 hours^{22,34} at a minimum⁵
Discharge following minor trauma	<ul style="list-style-type: none"> Criteria: <ul style="list-style-type: none"> Normal CTG²² <ul style="list-style-type: none"> Interpret with caution at 23–28 weeks gestation Refer to Table 8. Fetal assessment for FHR monitoring considerations No contractions No vaginal bleeding/loss²² Reassuring maternal status Laboratory evaluation within normal limits Kleihauer test reviewed and sufficient Rh D immunoglobulin administered (if required) Consult with the obstetric team prior to discharge Consider review by physiotherapy team prior to discharge to assess and treat musculoskeletal injuries and conditions such as whiplash Offer social work referral before discharge Advise the woman to seek medical advice if experiencing: <ul style="list-style-type: none"> Signs of preterm labour Abdominal pain Vaginal bleeding Change in fetal movements
Follow up	<ul style="list-style-type: none"> Establish local policies and procedures to ensure adequate follow up of all investigations Increased antenatal surveillance is required even after minor trauma as the risk of adverse obstetric outcomes is increased including premature labour, low birth weight, fetal demise¹⁸ and placental abruption² Advise the woman to inform her usual maternity care provider of the trauma event Ensure that discharge summary is provided to both the woman and her primary care provider

References

- Huls CK, Detlefs C. Trauma in pregnancy. *Semin Perinatol* 2018;42(1):13-20.
- Brown S, Mozurkewich E. Trauma during pregnancy. *Obstet Gynecol Clin North Am* 2013;40(1):47-57.
- Mendez-Figueroa H, Dahlke JD, Vrees RA, Rouse DJ. Trauma in pregnancy: an updated systematic review. *Am J Obstet Gynecol* 2013;209(1):1-10.
- Deshpande NA, Kucirka LM, Smith RN, Oxford CM. Pregnant trauma victims experience nearly 2-fold higher mortality compared to their nonpregnant counterparts. *Am J Obstet Gynecol* 2017;217(5):590 e1-e9.
- Jain V, Chari R, Maslovitz S, Farine D, Maternal Fetal Medicine C, Bujold E, et al. Guidelines for the management of a pregnant trauma patient. *J Obstet Gynaecol Can* 2015;37(6):553-74.
- Queensland Clinical Guidelines. Guideline for standard care. Guideline No. MN18.50-V1-R23. [Internet]. Queensland Health. 2018. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
- McAuley DJ. Trauma in pregnancy: anatomical and physiological considerations. *Trauma* 2004;6(4):293-300.
- Einav S, Sela HY, Weiniger CF. Management and outcomes of trauma during pregnancy. *Anesthesiol Clin* 2013;31(1):141-56.
- Barraco RD, Chiu WC, Clancy TV, Como JJ, Ebert JB, Hess LW, et al. Practice management guidelines for the diagnosis and management of injury in the pregnant patient: the EAST Practice Management Guidelines Work Group. *J Trauma* 2010;69(1):211-4.
- Warner MW, Salfinger SG, Rao S, Magann EF, Hall JC. Management of trauma during pregnancy. *ANZ J Surg* 2004;74(3):125-8.
- Jeejeebhoy FM, Morrison LJ. Maternal cardiac arrest: a practical and comprehensive review. *Emerg Med Int* 2013;2013:274814.
- Queensland Clinical Guidelines. Neonatal resuscitation. Guideline No. MN16.5-V5-R21. [Internet]. Queensland Health. 2016. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
- Royal College of Obstetricians and Gynaecologists. Maternal collapse in pregnancy and the puerperium. Green-top Guideline No. 56. [Internet]. 2011 [cited 2018 August 30]. Available from: <http://www.rcog.org.uk>
- Smith A, Edwards S, Siassakos D. Effective team training to improve outcomes in maternal collapse and perimortem caesarean section. *Resuscitation* 2012;83(10):1183-4.
- Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2013-15. 2017.
- American College of Surgeons. Advanced trauma life support: student course manual. 9th edition ed 2013.
- Muench MV, Canterino JC. Trauma in pregnancy. *Obstet Gynecol Clin North Am* 2007;34(3):555-83, xiii.
- Fischer PE, Zarzaur BL, Fabian TC, Magnotti LJ, Croce MA. Minor trauma is an unrecognized contributor to poor fetal outcomes: a population-based study of 78,552 pregnancies. *J Trauma* 2011;71(1):90-3.
- Australian Technical Advisory Group on Immunisation (ATAGI). Australian immunisation handbook. Canberra: Australian Government Department of Health; 2018. Available from: immunisationhandbook.health.gov.au.
- Meroz Y, Elchalal U, Ginosar Y. Initial trauma management in advanced pregnancy. *Anesthesiology Clinics* 2007;25(1):117.
- Kim S, You JS, Lee HS, Lee JH, Park YS, Chung SP, et al. Quality of chest compressions performed by inexperienced rescuers in simulated cardiac arrest associated with pregnancy. *Resuscitation* 2013;84(1):98-102.
- Chames MC, Pearlman MD. Trauma during pregnancy: outcomes and clinical management. *Clin Obstet Gynecol* 2008;51(2):398-408.
- Jeejeebhoy FM, Zelop CM, Lipman S, Carvalho B, Joglar J, Mhyre JM, et al. Cardiac Arrest in Pregnancy: A Scientific Statement From the American Heart Association. *Circulation* 2015;132(18):1747-73.
- Queensland Health. Clinical Services Capability Framework for Public and Licensed Private health Facilities v3.2. [Internet]. 2014 [cited 2018 June 26]. Available from: <https://www.health.qld.gov.au>
- Queensland Clinical Guidelines. Perinatal care at the threshold of viability. Guideline No. MN14.32-V1-R19. [Internet]. Queensland Health. 2014. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
- Wyant AR, Collett D. Trauma in pregnancy: diagnosis and management of two patients in one. *JAAPA* 2013;26(5):24-9.
- Suresh MS, LaToy a Mason C, Munnur U. Cardiopulmonary resuscitation and the parturient. *Best Pract Res Clin Obstet Gynaecol* 2010;24(3):383-400.
- Criddle LM. Trauma in pregnancy: trauma care priorities don't change when the patient is pregnant. *American Journal of Nursing* 2009;109(11):41-8.
- Jones R, Baird SM, Thurman S, Gaskin IM. Maternal cardiac arrest: an overview. *J Perinat Neonatal Nurs* 2012;26(2):117-23; quiz 24-5.
- Paterson-Brown S, Howell C, editors. The MOET course manual: managing obstetric emergencies and trauma. 3rd ed. Cambridge: Cambridge University Press; 2014.
- Oxford CM, Ludmir J. Trauma in pregnancy. *Clin Obstet Gynecol* 2009;52(4):611-29.
- Brun PM, Chenaitia H, Dejesus I, Bessereau J, Bonello L, Pierre B. Ultrasound to perimortem caesarean delivery in prehospital settings. *Injury* 2013;44(1):151-2.
- Queensland Clinical Guidelines. Intrapartum fetal surveillance. Guideline No. MN15.15-V4-R20. [Internet]. Queensland Health. 2015. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
- Sadro C, Bernstein MP, Kanal KM. Imaging of trauma: Part 2, Abdominal trauma and pregnancy--a radiologist's guide to doing what is best for the mother and baby. *AJR Am J Roentgenol* 2012;199(6):1207-19.
- Afors K, Chandrahara E. Use of continuous electronic fetal monitoring in a preterm fetus: clinical dilemmas and recommendations for practice. *Journal of Pregnancy* 2011:848794.
- The American College of Obstetricians and Gynecologists. Guidelines for diagnostic imaging during pregnancy and lactation. *Obstetrics and Gynecology* 2017;130(4):e210-e6.
- McGoldrick NP, Green C, Burke N, Quinlan C, McCormack D. Pregnancy and the orthopaedic patient. *Orthopaedics and Trauma* 2012;26(3):212-9.
- Raptis CA, Mellnick VM, Raptis DA, Kitchin D, Fowler KJ, Lubner M, et al. Imaging of trauma in the pregnant patient. *Radiographics* 2014;34(3):748-63.
- National Council on Radiation Protection and Measurements. Preconception and prenatal radiation exposure: health effects and protective guidance, Report No. 174. 2013.
- Australian Radiation Protection and Nuclear Safety Agency. Radiation protection in diagnostic and interventional radiology; Radiation protection series RPS 14.1. 2008.
- Tremblay E, Therasse E, Thomassin-Naggara I, Trop I. Quality initiatives: guidelines for use of medical imaging during pregnancy and lactation. *Radiographics* 2012;32(3):897-911.
- National Blood Authority (NBA). Patient blood management guidelines: module 5 obstetrics and maternity. [Internet]. 2015 [cited 2019 Feb 28]. Available from: www.blood.gov.au
- Curry NS, Daventport R. Transfusion strategies for major haemorrhage in trauma. *Br J Haematol* 2019;184(4):508-23.
- Collins P, Abdul-Kadir R, Thachil J, Subcommittees on Women's Health Issues in thrombosis haemostasis on disseminated intravascular coagulation. Management of coagulopathy associated with postpartum hemorrhage: guidance from the SSC of the ISTH. *J Thromb Haemost* 2016;14(1):205-10.
- Queensland Clinical Guidelines. Primary postpartum haemorrhage. Guideline No. MN18.1-V7-R23. [Internet]. Queensland Health. 2018. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
- National Blood Authority (NBA). Patient blood management guidelines: module 1 critical bleeding massive transfusion. [Internet]. 2011 [cited 2019 Feb 28]. Available from: www.blood.gov.au
- Rose CH, Faksh A, Traynor KD, Cabrera D, Arendt KW, Brost BC. Challenging the 4- to 5-minute rule: from perimortem cesarean to resuscitative hysterotomy. *Am J Obstet Gynecol* 2015;213(5):653-6, e1.
- Jeejeebhoy FM, Zelop CM, Windrim R, Carvalho JC, Dorian P, Morrison LJ. Management of cardiac arrest in pregnancy: a systematic review. *Resuscitation* 2011;82(7):801-9.
- Guv en S, Yazar A, Yakut K, Aydogan H, Erguv en M, Avci E. Postmortem cesarean: report of our successful neonatal outcomes after severe trauma during pregnancy and review of the literature. *J Matern Fetal Neonatal Med* 2012;25(7):1102-4.
- Holmes S, Kirkpatrick ID, Zelop CM, Jassal DS. MRI evaluation of maternal cardiac displacement in pregnancy: implications for cardiopulmonary resuscitation. *Am J Obstet Gynecol* 2015;213(3):401 e1-5.
- Martin-Gill C. Perimortem cesarean section. *Emergency Medical Services: Clinical Practice and Systems Oversight, 2 Volume Set* 2014:325.
- Katz VL. Perimortem cesarean delivery: its role in maternal mortality. *Semin Perinatol* 2012;36(1):68-72.

53. Benson MD, Padovano A, Bourjeily G, Zhou Y. Maternal collapse: challenging the four-minute rule. *EBioMedicine* 2016;6:253-7.
54. Battaloglu E, McDonnell D, Chu J, Lecky F, Porter K. Epidemiology and outcomes of pregnancy and obstetric complications in trauma in the United Kingdom. *Injury* 2016;47(1):184-7.
55. Parikh P, Sunesara I, Lutz E, Kolb J, Sawardecker S, Martin JN, Jr. Burns during pregnancy: implications for maternal-perinatal providers and guidelines for practice. *Obstet Gynecol Surv* 2015;70(10):633-43.
56. Pasalar M, Mohammadi A, Rajaeeard A, Neghab M, Tolide-ie H. Epidemiology of burns during pregnancy in Southern Iran: effect on maternal and fetal outcomes. *World Applied Sciences Journal* 2013;28(2):153-8.
57. Guo SS, Greenspoon JS, Kahn AM. Management of burn injuries during pregnancy. *Burns* 2001;27(4):394-7.
58. Wallner C, Kern P, Teig N, Lehnhardt M, Behr B. The interdisciplinary management of severe burns in pregnancy. *Burns Open* 2017;74-7.
59. Brownlee G, Lyon M, Lisec C. Best practice management of burns during pregnancy, and our experience over 20 years at a tertiary burns unit. In: Australian and New Zealand Burn Association Annual Scientific Meeting; Brisbane Convention and Exhibition Centre; 2018.
60. Kennedy BB, Baird SM, Troiano NH. Burn injuries and pregnancy. *J Perinat Neonatal Nurs* 2008;22(1):21-30.
61. Maghsoudi H, Samnia R, Garadaghi A, Kianvar H. Burns in pregnancy. *Burns* 2006;32(2):246-50.
62. Department of Health. Reporting a reasonable/reportable suspicion of child abuse and neglect. [Internet]. 2015 [cited 2019 Jul 14]. Available from: www.health.qld.gov.au.
63. Department of Health. Responding to an unborn child high risk alert. [Internet]. 2015 [cited 2019 Jun 18]. Available from: www.health.qld.gov.au.
64. Meguerdichian D. Complications in late pregnancy. *Emerg Med Clin North Am* 2012;30(4):919-36.
65. Brown HL. Trauma in pregnancy. *Obstet Gynecol* 2009;114(1):147-60.
66. Sela HY, Weiniger CF, Hersch M, Smueloff A, Lauf er N, Einav S. The pregnant motor vehicle accident casualty: adherence to basic workup and admission guidelines. *Ann Surg* 2011;254(2):346-52.
67. Kopelman TR, Berardoni NE, Manriquez M, Gridley D, Vail SJ, Pieri PG, et al. The ability of computed tomography to diagnose placental abruption in the trauma patient. *J Trauma Acute Care Surg* 2013;74(1):236-41.
68. Royal College of Obstetricians and Gynaecologists. Antepartum haemorrhage. Green-top Guideline No. 63. [Internet]. 2011. Available from: <http://www.rcog.org.uk>.
69. Raja AS, Zabbo CP. Trauma in pregnancy. *Emerg Med Clin North Am* 2012;30(4):937-48.
70. Queensland Clinical Guidelines. Preterm labour and birth. Guideline No. MN14.6-V7-R19. [Internet]. Queensland Health. 2014. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
71. Solomon N, Playforth K, Reynolds EW. Fetal-maternal hemorrhage: a case and literature review. *AJP Rep* 2012;2(1):7-14.
72. Wylie BJ, D'Alton ME. Fetomaternal hemorrhage. *Obstet Gynecol* 2010;115(5):1039-51.
73. Pearlman MD, Tintinalli JE, Lorenz RP. A prospective controlled study of outcome after trauma during pregnancy. *Am J Obstet Gynecol* 1990;162(6):1502-7; discussion 7-10.
74. Australian & New Zealand Society of Blood Transfusion Inc. Guidelines for laboratory assessment of fetomaternal haemorrhage. 2002 [cited 2013 July 01]. Available from: <http://www.anzsbts.org.au>.
75. Dhanraj D, Lambers D. The incidences of positive Kleihauer-Betke test in low-risk pregnancies and maternal trauma patients. *Am J Obstet Gynecol* 2004;190(5):1461-3.
76. Cabral AC, Reis ZS, Apocalypse IG, Osanan GC, Lage EM, Leite HV. Combined use of the cardiofemoral index and middle cerebral artery Doppler velocimetry for the prediction of fetal anemia. *Int J Gynaecol Obstet* 2010;111(3):205-8.
77. Schenone MH, Mari G. The MCA Doppler and its role in the evaluation of fetal anemia and fetal growth restriction. *Clin Perinatol* 2011;38(1):83-102, vi.
78. National Blood Authority Australia. Guidelines on the prophylactic use of Rh D immunoglobulin (anti D) in Obstetrics. 2003.
79. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists. Guidelines for the use of Rh (D) Immunoglobulin (Anti-D) in obstetrics in Australia. College Statement C-Obs 6 2015.
80. Pal M, Williams B. Prevalence of maternal red cell alloimmunisation: a population study from Queensland, Australia. *Pathology* 2015;47(2):151-5.
81. Queensland Clinical Guidelines. Early pregnancy loss. Guideline No. MN17.29-V5-R22. [Internet]. Queensland Health. 2017. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
82. Australian Red Cross Blood Service. Blood products and transfusion practice for health professionals. [Internet] 2016 [updated 31 August 2014; cited 2016 October 10]; Available from: www.transfusion.com.au
83. Qureshi H, Massey E, Kirwan D, Davies T, Robson S, White J, et al. BCSH guideline for the use of anti-D immunoglobulin for the prevention of haemolytic disease of the fetus and newborn. *Transfus Med* 2014;24(1):8-20.
84. Shamshirsaz AA, Clark SL. Amniotic fluid embolism. *Obstet Gynecol Clin North Am* 2016;43(4):779-90.
85. Ellingsen CL, Eggebo TM, Lexow K. Amniotic fluid embolism after blunt abdominal trauma. *Resuscitation* 2007;75(1):180-3.
86. Rainio J, Penttilä A. Amniotic fluid embolism as cause of death in a car accident—a case report. *Forensic Sci Int* 2003;137(2-3):231-4.
87. Clark SL. Amniotic fluid embolism. *Obstet Gynecol* 2014;123(2 Pt 1):337-48.
88. Fitzpatrick KE, Tuffnell D, Kurinczuk JJ, Knight M. Incidence, risk factors, management and outcomes of amniotic-fluid embolism: a population-based cohort and nested case-control study. *BJOG* 2016;123(1):100-9.
89. Thongrong C, Kasemsiri P, Hofmann JP, Bergese SD, Papadimos TJ, Gracias VH, et al. Amniotic fluid embolism. *Int J Crit Illn Inj Sci* 2013;3(1):51-7.
90. Erez O, Mastrolia SA, Thachil J. Disseminated intravascular coagulation in pregnancy: insights in pathophysiology, diagnosis and management. *Am J Obstet Gynecol* 2015;213(4):452-63.
91. Lefkou E, Hunt B. Bleeding disorders in pregnancy. *Obstetrics, Gynecology and Reproductive Medicine* 2018;28(7):189-95.
92. Queensland Clinical Guidelines. Venous thromboembolism (VTE) prophylaxis in pregnancy and the puerperium. Guideline No. MN14.9-V5-R19. [Internet]. Queensland Health. 2014. [cited 2019 July 4]. Available from: <http://www.health.qld.gov.au>
93. Pearce C, Martin SR. Trauma and considerations unique to pregnancy. *Obstet Gynecol Clin North Am* 2016;43(4):791-808.

Appendix A: Prehospital criteria for major trauma

If any of the following criteria (except systolic BP*) present, consider the trauma 'Major' and respond accordingly.

R Vital signs criteria		
	Conscious state	Altered level of consciousness
	Respiratory rate	Less than 10 or greater than 30 breaths/minute
	SpO ₂ (room air)	Less than 95%
	Heart rate	Greater than 120 bpm
	*Systolic BP	Less than 90 mmHg
<i>*Interpret BP in conjunction with gestation, other vital signs, injury pattern and mechanism of injury</i>		
R Injury pattern criteria		
	Injuries to the head, neck, chest, abdomen, pelvis, axilla, or groin that: <ul style="list-style-type: none">• Are penetrating• Are Significant blunt injuries• Are Sustained from blasts• Involve two or more of those regions	
	Limb amputation above the wrist or ankle	
	Suspected spinal cord injuries	
	Burns > 20% or other complicated burn injury including burn injury to the hand, face, genitals, airway, or respiratory tract	
	Serious crush injury	
	Major open fracture, or open dislocation with vascular compromise	
	Fractured pelvis	
	Fractures involving two or more of the following: femur, tibia, or humerus	
R Mechanism of injury criteria		
	Ejection from vehicle	
	Fall from height ≥ 3 metres	
	Explosion	
	High impact motor vehicle crash with incursion into the occupant's compartment	
	Motorcyclist impact >30km/hour	
	Motor vehicle crash >60km/hour	
	Vehicle rollover	
	Road traffic crash in which there was a fatality in the same vehicle	
	Entrapped for > 30 minutes	
	Pedestrian impact	
	Struck on head by falling object >3m	

Adapted from: Queensland Government. Queensland Ambulance Service (QAS) Clinical Practice Manual (CPM) Clinical Practice Guideline: Trauma/Pre-hospital trauma by-pass. 2017 and Queensland Government, Retrieval Services Queensland. RG1001 Early notification of trauma guidelines 2017

Appendix B: Injury Severity Score

The Injury Severity Score (ISS) assesses the collective effect of multiple injuries. It is based on an anatomical injury severity classification known as the Abbreviated Injury Scale (AIS). Each individual injury is assigned an Abbreviated Injury Scale (AIS) score. The AIS classifies each injury as follows:

- 1: Minor
- 2: Moderate
- 3: Serious
- 4: Severe
- 5: Critical
- 6: Maximal (unsurvivable)

Each of the AIS injury scores are then assigned to one of six body regions:

- Head or neck
- Face
- Chest
- Abdominal or pelvic contents
- Extremities or pelvic girdle
- External

The three most severely injured body regions have their score squared and added together to produce the ISS. Scores range from 0 to 75. If an injury is assigned an AIS of 6 (unsurvivable), the ISS is automatically assigned to 75. An ISS greater than 12 constitutes major trauma.

Appendix C: Resuscitative hysterotomy procedure

Large vertical abdominal incision required. Uterine incision may be either vertical or horizontal

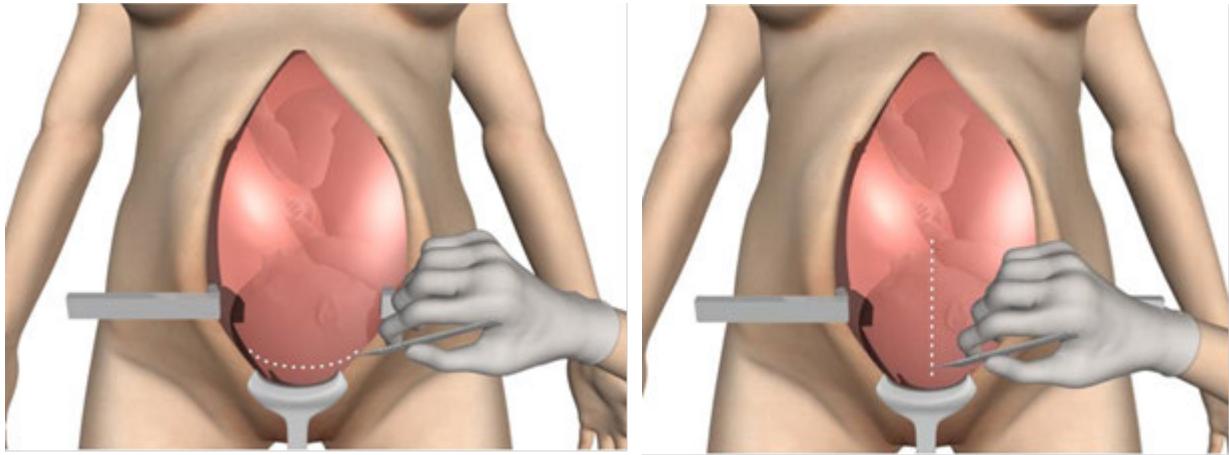


Image produced by: Clinical Multimedia Unit, Metro North Hospital and Health Service, Queensland.

Appendix D: Average haemodynamic and laboratory values in pregnancy

Mean values for haemodynamic changes throughout pregnancy

	Pre-pregnancy	1 st Trimester	2 nd Trimester	3 rd Trimester
Heart rate (beats/minute)	70	78	82	85
Systolic BP (mmHg)	125	112	122	115
Diastolic BP (mmHg)	70	60	63	70
Central venous pressure (mmHg)	9.0	7.5	4.0	3.8
Femoral venous pressure (mmHg)	6	6	18	18
Cardiac output (L/minute)	4.5	4.5	6.0	6.0
Uterine blood flow (mL/minute)	4000	4200	5000	5600

Source: Suresh MS, Latoya Mason C, Munnur U. Cardiopulmonary resuscitation and the parturient. Best Practice and Research: Clinical Obstetrics and Gynaecology. 2010; 24(3):383-400.

Pathology Queensland reference intervals

	Gestation (weeks)	Reference range	Units
White Blood Cells (WBC)	1–12	5.7–13.6	x 10 ⁹ /L
	13–24	6.2–14.8	x 10 ⁹ /L
	25–42	5.9–16.9	x 10 ⁹ /L
	>42	5.7–16.9	x 10 ⁹ /L
Neutrophils	1–12	3.6–10.1	x 10 ⁹ /L
	13–24	3.8–12.3	x 10 ⁹ /L
	25–42	3.9–13.1	x 10 ⁹ /L
	>42	3.6–13.1	x 10 ⁹ /L
Eosinophils	1–>42	<0.6	x 10 ⁹ /L
Lymphocytes	1–12	1.1–3.5	x 10 ⁹ /L
	13–24	0.9–3.9	x 10 ⁹ /L
	25–42	1.0–3.6	x 10 ⁹ /L
	>42	0.9–3.9	x 10 ⁹ /L
Platelets	1–12	170–390	x 10 ⁹ /L
	13–24	170–410	x 10 ⁹ /L
	25–42	150–430	x 10 ⁹ /L
	>42	150–430	x 10 ⁹ /L
Red Blood Cells (RBC)	1–12	3.52–4.52	x 10 ¹² /L
	13–24	3.20–4.41	x 10 ¹² /L
	25–42	3.10–4.44	x 10 ¹² /L
	>42	3.10–4.52	x 10 ¹² /L
Haemoglobin	1–12	110–143	g/L
	13–24	100–137	g/L
	24–42	98–137	g/L
	>42	98–143	g/L
Haematocrit	1–12	0.31–0.41	
	13–24	0.30–0.38	
	25–42	0.28–0.39	
	>42	0.28–0.41	
Mean Cell Haemoglobin (MCH)	1–>42	27.5–33.0	pg
Mean Cell Haemoglobin Concentration (MCHC)	1–>42	320–360	g/L
Erythrocyte Sedimentation Rate (ESR)	1–12	<30	mm/hour
	13–24	<64	mm/hour
	>24	<72	mm/hour
Bicarbonate (Total CO ₂)	All	18–26	mmol/L
Creatinine	All	32–73	mmol/L
Protein (Total)	14–40	61–75	g/L
Albumin	27–40	33–40	g/L
Urate	1–14	0.10–0.25	mmol/L
	15–27	0.10–0.30	mmol/L
	>27	0.10–0.35	mmol/L

Appendix E: Seat belt positioning in pregnancy

Improper seat belt use is a major risk factor for adverse outcomes during motor vehicle collisions.³

Correct positioning of the seat belt includes:

- Lap belt over hips below uterus
- Sash between breasts above uterus

Correct application of the seat belt

- Reduces maternal/fetal injuries
- Reduces ejection mortalities
- Improves fetal survival

Use of a lap belt only is not recommended. It increases uterine flexion and may increase placental abruption.

Correct and incorrect positioning of seat belt

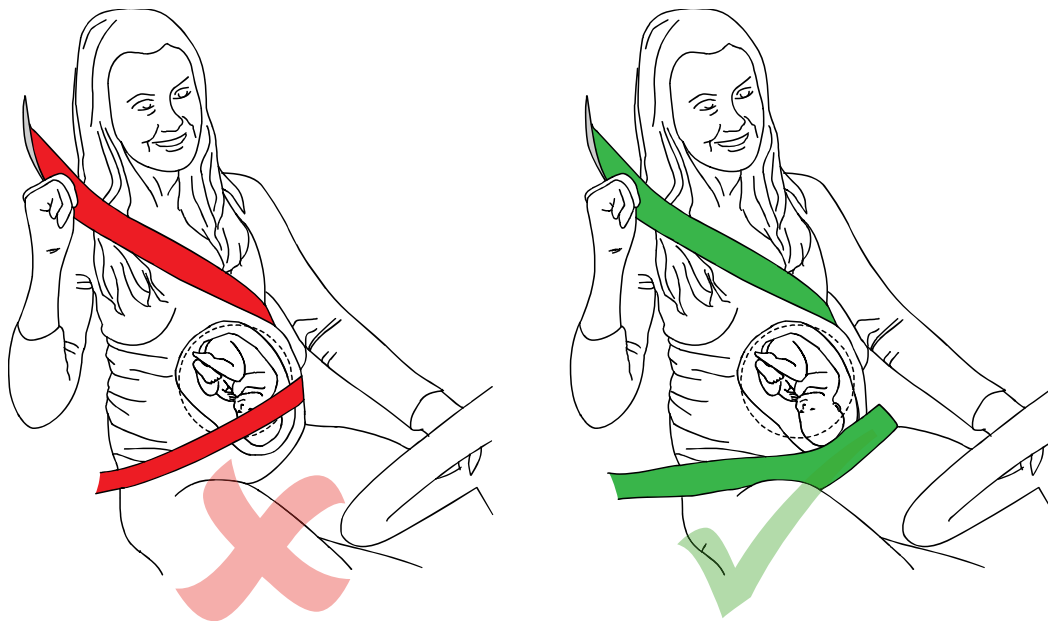


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Appendix F: Estimating gestational age by fundal height

Measure the vertical distance in the midline from the symphysis pubis to the top of the fundus in centimetres. This measurement correlates approximately with the gestational age.

Considerations that may impact on accuracy include:

- Multiple pregnancy
- Growth restriction
- Poly/oligohydramnios
- Breech or abnormal lie

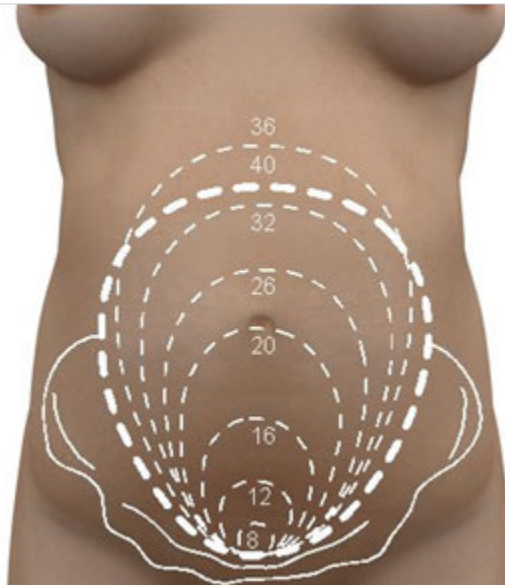
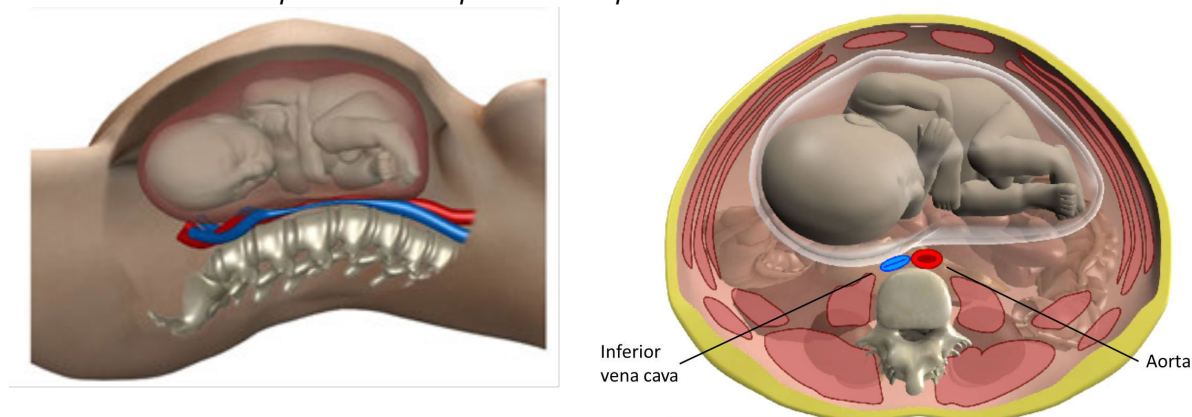


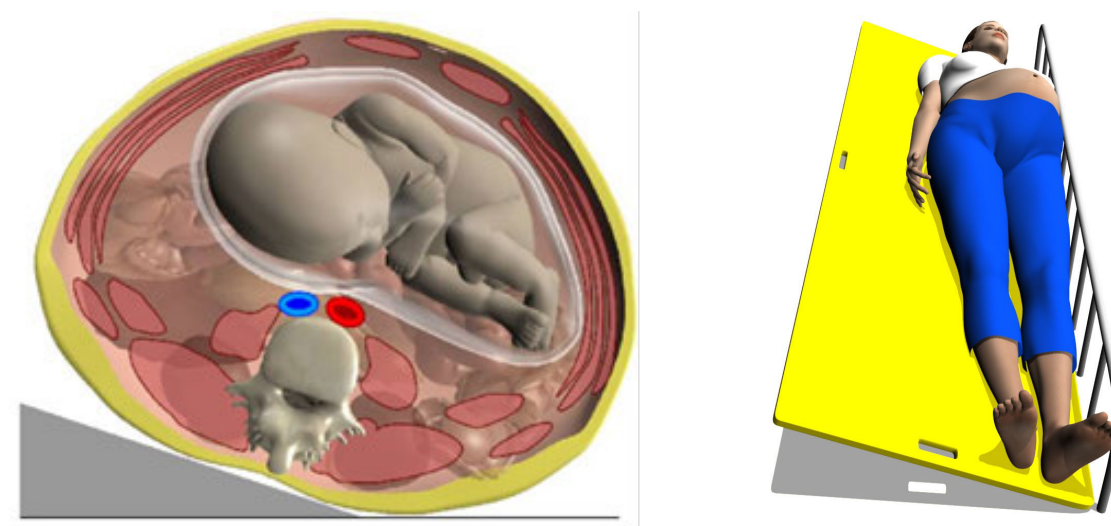
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Appendix G: Positioning to relieve aortocaval compression

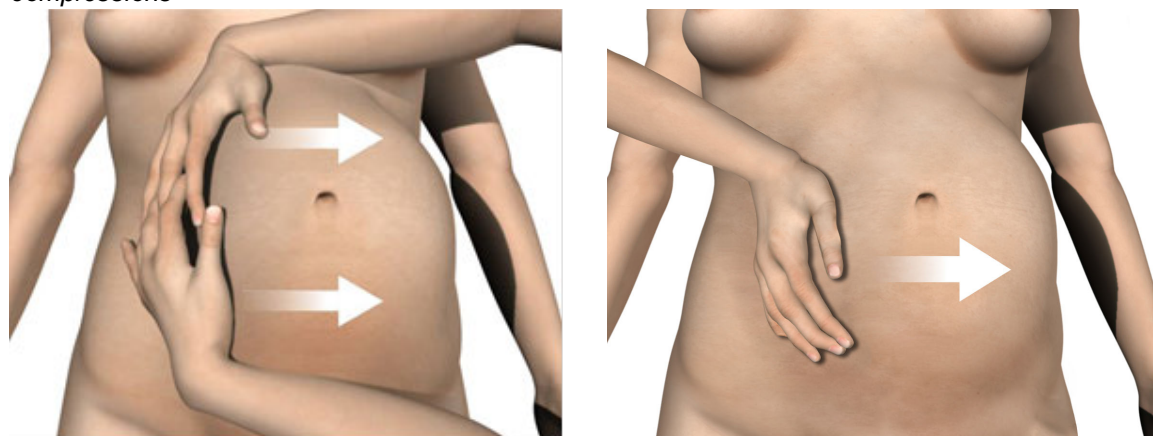
Inferior vena cava compression when positioned supine



Left lateral tilt (right side up) 15-30 degrees to relieve compression



Manual displacement of the uterus to relieve compression—preferred position for cardiac compressions



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Appendix H: Approximate fetal effective doses (mSv) from common radiological examinations

Note: Treat all doses as indicative only. Individual doses can differ from tabulated values by as much as a factor of 10, except for those examinations remote from the lower abdomen.

Examination	1 st Trimester	3 rd Trimester
Conventional radiography		
Skull	<0.01	<0.01
Chest	<0.01	<0.01
Cervical spine	<0.01	<0.01
Thoracic spine	<0.01	<0.01
Lumbar spine	2	6
Abdomen	1.5	2.5
Pelvis	1	2
Intravenous pyelogram (IVP)	2	10
Extremities	<0.01	<0.01
Mammography	<0.01	<0.01
Barium meal	1	6
Barium enema	7	25
Computerised Tomography (CT)		
Head	<0.005	<0.005
Neck	<0.005	<0.01
Chest without portal phase	0.1	0.6
Chest with portal phase	1	7
Chest (pulmonary embolism)	0.1	0.4
Chest/abdomen/pelvis	12	13
Abdomen/pelvis – single phase	12	12
Abdomen/pelvis – multiple phase	15	30
Thoracic spine	0.2	1.0
Lumbar spine	10	25
Pelvimetry	–	0.2

NB: < = less than

Source: Australian Radiation Protection and Nuclear Safety Agency. Radiation protection in diagnostic and interventional radiology; Radiation protection series RPS 14.1. 2008.

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