



OBSTETRIC TRAUMA GUIDELINE



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1. Key messages

The Victorian State Trauma System provides support and retrieval services for critically injured patients requiring definitive care, transfer and management. This obstetric trauma guideline provides evidence-based advice on the initial management and transfer of major trauma patients who present to Victorian health services with obstetric trauma.

This guideline is developed for all clinical staff involved in the care of trauma patients in Victoria. It is intended for use by frontline clinical staff that provide early care for major trauma patients; those working directly at the Major Trauma Service (MTS) as well as those working outside of a MTS.

These guidelines provide the user with accessible resources to effectively and confidently provide early care for critically injured patients. They provide up-to-date information for frontline healthcare clinicians. The guideline has followed the AGREE methodology for guideline development and is auspiced by the Victorian State Trauma Committee.

Clinical emphasis points

- An obstetric trauma patient presents a complex scenario that requires multidisciplinary care of both the mother and unborn child. Minor trauma may lead to complications and require thorough investigation.
- The normal physiological changes of pregnancy affect the clinical assessment and management of obstetric trauma patients.
- Obstetric trauma patients require careful positioning to reduce the impact of aortocaval compression.
- Best fetal outcomes are the result of early maternal resuscitation.
- Early management in obstetric trauma aims to carefully manage fluid administration, maintain oxygenation and prevent hypothermia.
- Adult Retrieval Victoria (ARV) is the first point of call to initiate retrieval and transfer.



- Time-critical patients are retrieved to the Royal Melbourne Hospital, with other obstetric patients transferred to a hospital with obstetric and trauma capability.
- The main goal of early care is to ensure optimum resuscitation in the emergency setting as well as activation of the retrieval network, with timely transfer to an appropriate facility.







Make early contact with ARV for advice and to initiate retrieval where required.

- Maternal position - left tilt or manual uterine displacement
- Maternal oxygenation
- Fetal survival depends on effective maternal resuscitation

Early Activation

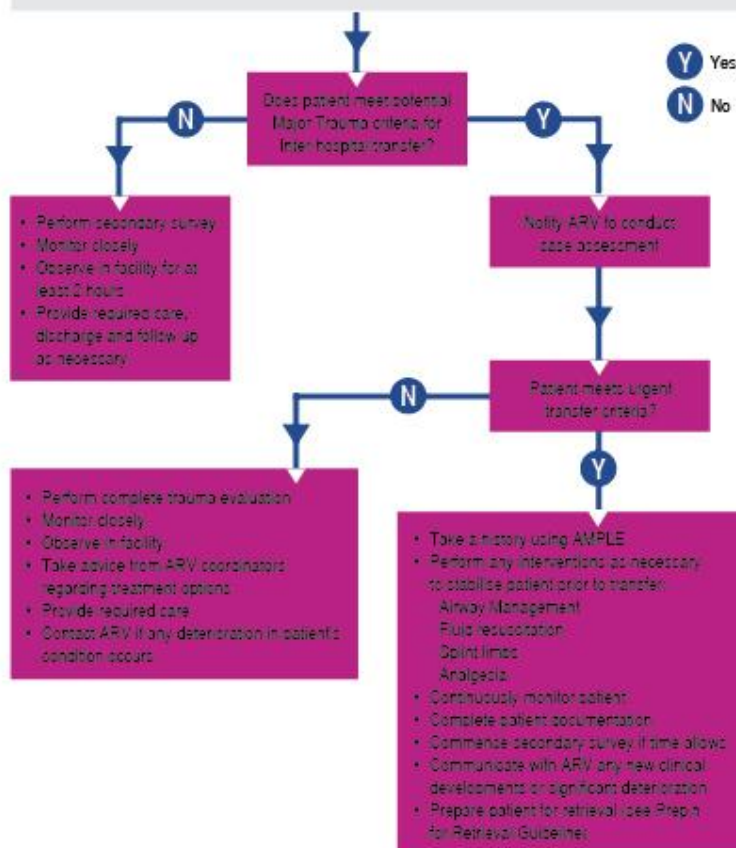
- Gather vital information
- Ensure safety using PPE
- Activate Trauma Team
- Set up to receive patient
- Designate roles

Primary Survey

 <p>AIRWAY / C SPINE:</p> <ul style="list-style-type: none"> • Protect Airway • Airway adjuncts as available • Secure the airway using any available means • Maintain full spinal precautions 	 <p>BREATHING:</p> <ul style="list-style-type: none"> • Identify and treat any life threats (i.e. pneumo) • Apply oxygen • Ventilate as necessary • SpO₂ monitoring • ETCO₂ monitoring 	 <p>CIRCULATION:</p> <ul style="list-style-type: none"> • Control life threatening haemorrhage • Insert x 2 large bore IV cannulas • Assess HR/BP/Shock Index • Take bloods • Identify source of haemorrhage • Continuous ECG monitoring 	 <p>DISABILITY:</p> <ul style="list-style-type: none"> • Assess level of consciousness • Check pupils • Check BSL 	 <p>EXPOSURE / ENVIRONMENT:</p> <ul style="list-style-type: none"> • Fully expose patient • Ensure normothermia 	 <p>ADJUNCTS:</p> <ul style="list-style-type: none"> • FAST scan • X rays: Lat c spine, Chest, Pelvis • 12 lead ECG
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15 - 30° left lateral tilt or manual displacement



EMERGENCY CAESARIAN SECTION is indicated where complications of trauma indicate that maternal survival is unlikely or if the mother is in cardiac arrest with a viable fetus of gestation > 24 weeks

Early Management

Airway management

- If there is potential that the patient's airway may deteriorate then intubation should be considered.
- Always have emergency airway equipment available.

Fluid resuscitation

- Left lateral tilt 15 - 20° or manual displacement of uterus.
- Crystalloid fluids: Initial treatment of hypovolaemia with normal saline is recommended, up to 20 - 30 mL/kg.
- Blood products: If minimal response to fluids, administration of packed red blood cells (PRBC) is advised if available.

Prevent hypothermia

- Use warmed IV fluids; cover the patient with warm blankets as well as

keeping the room warm, use a forced air warming machine if available.

In-dwelling catheter / Naso or orogastric tube

- Ensure the above are placed if necessary and time allows.

Glasgow Coma Scale

- Assess the patient's level of consciousness as well as pupillary size and reactivity, gross motor function and sensation.

Reassess

- Patients should be re-evaluated at regular intervals as deterioration in a patient's clinical condition can be swift.
- If in doubt, repeat ABCDE.

Obstetric Trauma Considerations

Pregnancy Related Complications

- Placental abruption.
- Uterine rupture.
- Premature labour.
- Feto-maternal haemorrhage.

Gynaecological assessment is important to identify early labour, cervical effacement, foetal presentation, perineal injury and haemorrhage.

CTG monitoring is important to institute where possible to assess fetal status.

3. Introduction

Trauma may occur in up to 6–7% of pregnancies.ⁱ Obstetric trauma patients present special challenges for the response team on arrival at a healthcare facility. The need for coordinated and synchronous assessment of both the mother and unborn child with the potential need for urgent interventions for both may create significant stress on staff and the health service.

Although management requires urgent assessment and treatment of both the mother and unborn child, a clear focus on resuscitative measures to stabilise the mother is crucial to optimising the outcome for both.

Mechanisms of injury in pregnant trauma patients leading to presentation at a health service vary considerably. More commonly they include motor vehicle accidents, falls and domestic assault.ⁱⁱ A high suspicion of injury in a pregnant patient, even in minor trauma, is important. The risk of significant injury increases with the severity of trauma and stage of pregnancy. Every female patient of child-bearing age should be asked for details of their last menstrual cycle and all females of child-bearing age should have a pregnancy test as part of their secondary survey.ⁱⁱⁱ

Additionally, the many physiological changes of pregnancy predispose pregnant trauma patients to further risks and introduce new challenges, with modifications in positioning, resuscitative efforts and transfer arrangements required.

Changes in pregnancy

Pregnancy causes physiological change in many body systems. As a result, normal models of trauma care must be modified for pregnant trauma patients. The adaptations of pregnancy that are important in trauma care include the following.^{iv}

Refer to Appendix 1: *Normal changes in pregnancy*.

Cardiovascular

- Increased cardiac output (by up to 40% or 1.5 L/min)
- Increased baseline heart rate (10–15 bpm above normal)
- Increased plasma volume, resulting in a mild dilutional anaemia
- 15–20% decrease in systolic blood pressure in the first half of the pregnancy (with the lowest blood pressures being recorded around 28 weeks' gestation) followed by a rise back to baseline at full term

Changes in resting heart rate, blood pressure and cardiac output may mask signs of hypovolemia, and pregnant women can experience blood loss of up to 30% of their circulating volume without significant changes or visible clinical signs. The first sign of the mother's shocked state may be fetal distress.

It is important to note that all pregnant women with longer than 20 weeks gestation should be managed in a left lateral tilt position (15–30 degrees) to reduce the impact of aortocaval compression by the enlarged uterus. Alternatively/additionally, the uterus may be manually displaced.

Refer to Appendix 2: *Maternal positioning diagram*.

Respiratory

Pregnant women have reduced respiratory function and oxygen reserve as a result of:

- increased oxygen consumption (up to 20% by the third trimester)
- increased respiratory rate, tidal volume and minute ventilation
- decreased residual volume and functional residual capacity
- increased airway oedema
- decreased chest wall compliance

They are predisposed to rapid changes in oxygen saturation and so intubation and ventilation are often more difficult than in a non-pregnant trauma patient.

Uterine

Until the end of the first trimester, the uterus is relatively protected by its position within the pelvic structures and its thick-walled anatomy. By full term, the uterus has reached its maximum height (at the costal margins), is exposed within the abdominal cavity, is thin-walled and contains a large volume of blood. The blood flow to the uterus at term is 800–1,000 mL/min. Therefore there is significant risk for massive blood loss from an injured uterus or pelvic structures.

Gastrointestinal

Pregnant patients are susceptible to aspiration due to slowed gastric emptying and increased acidity of the gastric contents. A full stomach should be assumed during management of any pregnant trauma patient. A nasogastric tube (NGT) or orogastric tube (OGT) should be inserted for patients who are intubated.

Haematological

White cell count, clotting factor amount and plasma proteins are increased in pregnant patients, increasing the risk of thromboembolism. Low or borderline platelet levels (100–150 × 10⁹/L) are common in pregnancy. Measured reference ranges of clotting remain the same in pregnancy.

Renal

Glomerular filtration rate and renal blood flow increase during pregnancy, sometimes with a decrease in serum creatinine and urea. Glycosuria is a common finding on urinalysis.

Complications associated with trauma

Trauma, minor or major, can have significant negative health effects on a mother and baby. It is estimated that 1-3% of minor trauma to a pregnant mother results in loss of the fetus, and there should be greater concern with increasing severity.^{v,vi}

Pregnancy specific complications to be considered in trauma include the following:

Placental abruption	Spontaneous abortion
Cardiorespiratory arrest	Uterine rupture
Labour and birth	Pelvic fractures
Preterm labour	Haemorrhage and shock

4. Early activation

Emergency medical services responding to the scene will notify ARV and the receiving hospital that a trauma patient is on their way. This may be a major, metropolitan or regional trauma service or occasionally an urgent care centre, depending on distance, facilities available and the patient's condition. Notification information may be crucial to managing a severely injured patient and can allow for communication to vital members of the response team as well as time to prepare the department for the patient's arrival.

The following sequence of actions should take place upon initial notification:

1. Gather vital information from the notifier using the MIST mnemonic:^{vii}
 - M** Mechanism of injury
 - I** Injuries found or suspected
 - S** Signs: respiratory rate, pulse, blood pressure, SpO₂, GCS or AVPU
 - T** Treatment given
2. Activate the trauma team and available support departments (medical imaging, pathology). In small health service settings this may only consist of a clinician and a nurse. Additional staff may be gathered from wards or on call. It may be necessary to utilise the skills of all available resources including emergency response personnel in the initial trauma management.
3. Set up the trauma bay to receive the patient, including equipment checks, documentation, medications and resuscitation equipment.
4. Designate roles and specific tasks to staff and maintain an approach based on teamwork. Ensure good communication between all parties involved in managing the trauma. Use closed-loop communication, which ensures accuracy in information shared between response staff. Repeat instructions, make eye contact and provide feedback. Misinterpreted information may lead to adverse events.
5. Personal protective equipment is vital in the care of trauma patients. Ensure all staff involved in patient care are wearing gloves, aprons and eye protection.

If there is no prior notification of the patient, then rapid activation of the trauma team request must take place and any additional resources notified. If it is anticipated that transfer to a MTS will be required, early retrieval activation is essential (phone ARV on 1300 368 661).

- Early retrieval activation ensures access to critical care advice and a more effective retrieval response.
- Early activation and timely critical care transfer improves clinical outcomes for the patient.

If you are undecided, call the ARV coordinator, who can provide expert guidance and advice over the phone or via tele/videoconference, and link to a MTS as required.

5. Primary survey

Wherever possible, immediately from the time of commencing a primary survey, pregnant patients beyond 20 weeks gestation should be nursed in a left lateral tilt of 15–30 degrees, rather than supine. Supine positioning may result in significant compromise in circulation and respiratory status. Where the patient is immobilised on a spine board, this may mean positioning a wedge beneath the board.

Refer to Appendix 2: Maternal positioning diagram.

Use a systematic approach based on the ABCDE^{viii} survey to assess and treat an acutely injured patient. The goal is to manage any life-threatening conditions and identify any emergent concerns, especially in a pregnant patient who may present with other underlying polytrauma complications.

In cases where a trauma presentation results in a cardiorespiratory arrest in a pregnant woman, resuscitation should follow the standard basic and advanced life support guidelines with three important modifications:

- immediate positioning of the pregnant trauma patient in a left lateral tilt of 15–30 degrees
- consideration of early intubation by an experienced airway clinician
- performing a perimortem caesarean section if there is no response to resuscitation within four minutes.

Refer to Appendix 3 Viable Fetus Chart

Airway with cervical spine protection

Assess for airway stability

Attempt to gather a response from the patient.

Look for signs of airway obstruction (use of accessory muscles, paradoxical chest movements and see-saw respirations).

Listen for any upper airway noises and breath sounds. Are they absent, diminished or noisy?

Place the pregnant patient onto her back with a left lateral tilt of approximately 30 degrees to minimise the effect of aortocaval compression. A 30-degree tilt can be achieved by placing a purpose-made wedge under the patient's right hip, using pillows, rolled towels or bags of fluid where a wedge is not available, or by manually displacing the uterus to the left.

Attempt simple airway manoeuvres if required

Open the airway using a chin lift, jaw thrust and neck tilt. **(Do not apply a neck tilt if a spinal injury suspected.)**

Suction the airway if excessive secretions are noted or if the patient is unable to clear it themselves.

Insert an oropharyngeal airway (OPA)/nasopharyngeal airway (NPA) if required.

If the airway is obstructed, simple airway opening manoeuvres should be performed, including suction, jaw thrust or chin lift. Care should be taken to not extend the cervical spine.

If the patient is already intubated, document the size and position of the endotracheal tube, including lip level, end-tidal carbon dioxide (ETCO₂) trace, cuff pressure, any intubation difficulty (or Mallampati grade).

Where possible, delegate ongoing airway management to an airway doctor/nurse and continue the initial assessment.

Maintain full spinal precautions if indicated.

Secure the airway if necessary (treat airway obstruction as a medical emergency)

Consider intubation early if there are any signs of decreased level of consciousness, unprotected airway or an uncooperative/combative patient, leading to distress and further risk of injury.

Intubation should be considered earlier in pregnant patients compared with non-pregnant patients because pregnant women desaturate more rapidly and are more susceptible to irreversible hypoxic injury. Crucially, maternal hypoxia is associated with poor fetal outcomes.

However, the likelihood of failed intubation is higher in a pregnant patient, and intubation is increasingly difficult with advanced gestation. Intubation of a pregnant patient should be attempted by the most senior and experienced airway-skilled practitioner. In failed intubation circumstances, sustained cricoid pressure should be maintained to prevent aspiration in the unprotected airway.

Preparations for a difficult intubation should start early, with fibre-optic intubation equipment available for those with a known difficult airway or facial or cervical fractures. Correct airway placement should be confirmed with auscultation, capnography and direct visualisation if possible.

Breathing and ventilation*Administer high flow (15 L) of humidified oxygen*

This is required so all obstetric trauma patients maintain a SpO₂ of 100%. This is due to well-known poor fetal outcomes from maternal hypoxia episodes.

Assess the chest

- Count the respiration rate – high rates are markers of potential lung injury and a warning that the patient may deteriorate. Differential diagnosis to exclude metabolic/traumatic causes is important as patients in the later stages of pregnancy have a reduced functional reserve capacity with increased minute ventilation. This leads to a rise in baseline respiratory rate.
- Note the depth, pattern and equal rise and fall. Remember that underlying chest injuries may also be present.
- Listen to the chest and assess for any wheeze, stridor or decreased air entry.

Record the oxygen saturation (SpO₂)

Consider NGT placement if the patient is in an altered conscious state; insert if intubated. Note relative contraindications with suspected skull fractures.

If required, intercostal catheter(s) should be inserted **one or two rib spaces higher** (in the third or fourth intercostal space) due to the elevation of diaphragm in pregnancy and potential for inadvertent abdominal insertion.

Circulation with haemorrhage control*Assess circulation and perfusion*

- Note that a pregnant patient may not display signs of haemorrhage until there is a 30% reduction in blood volume. Tachycardia with normotension may be considered

an early sign of potentially significant blood loss. If fetal monitoring is immediately available, it may be used as to suggest a maternal shock state.

- Check the mother's heart rate, blood pressure and neck veins.
- Inspect for any signs of haemorrhage and apply direct pressure to any external wounds. Consider the potential for significant internal bleeding related to the mechanism of injury, which may or may not lead to signs of shock.

Insert two large-bore peripheral intravenous (IV) cannulas, preferably bilaterally. If access is difficult consider intraosseous insertion if the equipment/skills are available.

Fluid resuscitation should be initiated if hypovolemia is suspected to maintain both maternal and fetoplacental perfusion; however, haemorrhage control may be impossible without emergent surgical intervention. Commence resuscitation with up to 1–2 L of crystalloid solution. Blood or blood product transfusion should be considered in subsequent fluid administration.

Review the patient's skin colour and check her temperature and capillary refill.

Recheck the patient's position and ensure a 15–30-degree tilt remains in situ. This position is known to significantly improve blood pressure and is an important intervention in pregnant patients.

If possible, perform a FAST scan. FAST scan may be difficult in pregnancy where the enlarged uterus displaces other organs or obscures views of the retroperitoneum, but a positive FAST scan remains a significant finding in pregnant trauma patients.^{ix} If the patient is haemodynamically **stable and there are no signs of significant internal bleeding** then the FAST scan may be delayed until the secondary survey.

Fluid resuscitation should be carefully monitored to achieve satisfactory blood pressure without contributing to ongoing blood loss from uncontrolled haemorrhage sites.

Disability: neurological status

Assess level of consciousness.

Perform an initial Glasgow Coma Scale (GCS) or AVPU assessment (Alert, responds to Voice, responds to Pain, Unresponsive); check the pupillary response.

Perform a blood sugar level test.

Ensure any alterations in level of consciousness are not related to a metabolic cause.

Exposure/environmental control

Remove the patient's clothing and any jewellery in order to fully assess all areas of the body.

A pregnant trauma patient may become hypothermic due to IV fluid administration and undressing for assessment, so it is important to monitor her temperature and keep her in a warm environment while administering warm IV fluids. Ideally, the patient should be kept above 36.5 °C.

6. Secondary survey

The secondary survey should only be started once the primary survey has been completed and any life-threatening injuries have been identified and treated. If during the examination any deterioration is detected, go back and reassess the primary survey.

Refer to Appendix 4: *Maternal Trauma Secondary Survey*.

History

Taking an adequate history from the patient, bystanders or emergency personnel of the events surrounding the injury can assist with understanding the extent of the injury and any other possible other injuries.

Use the AMPLE acronym to assist with gathering pertinent information:^x

- A** Allergies
- M** Medication
- P** Past medical history (including tetanus status)
- L** Last meal
- E** Events leading to injury

Note what first aid has already been given to the patient.

Head-to-toe examination

During this examination, any injuries detected should be accurately documented and any required treatment should occur, such as covering wounds, managing non-life threatening bleeding and splinting fractures.

Abdomen/obstetric examination

Obtaining an early and accurate history is important in identifying any information that may guide patient management and intervention.

Cornerstones include:

- the date of the last menstrual period
- current gestation or estimated delivery date
- any conditions related to the pregnancy or any complications identified
- plurality of the pregnancy (singleton, twins or other multiple).

Where the gestational age is not known or unable to be determined, it may be estimated by the height of the fundus.

Refer to Appendix 5: *Fundal height palpation*

Assess uterine tone – firmness greater than expected may indicate placental abruption.

Assess for uterine contractions.

Assess for uterine pain or tenderness, which may also indicate placental abruption.

Identify the fetal position including its orientation and head position.

A pelvic examination should only be undertaken with a speculum by an experienced doctor or obstetrician.

- Look for vaginal blood loss.
- Assess for fetal cervical effacement and dilatation.

- Inspect the perineum and external genitalia.

Inspect the abdomen, palpate for areas of tenderness, especially over the liver, spleen, kidneys and bladder. Look for any bruising, lacerations or penetrating injuries.

Check the pelvis. Gently palpate for any tenderness. **Do not spring the pelvis** as any additional manipulation may exacerbate haemorrhaging.^{xi} Apply a binder if a pelvic fracture is suspected.

Auscultate for bowel sounds.

Fetal assessment

Electronic monitoring of the fetus is instituted where there is ascertained fetal viability (greater than 24 weeks) and the appropriate equipment is available (cardiotocography/CTG).

Fetal assessment in pregnancies less than 24 weeks is difficult without specialist equipment and personnel.

CTG allows monitoring of the fetal heart rate and uterine contractions. An experienced operator is required to manage this and a negative result must not be disregarded.

If not available, the fetal heart rate should **only** be measured by auscultation using a Pinard horn or a handheld Doppler.

Normal fetal heart rate ranges from 120 to 160 bpm, with the average being 140 bpm and varies according to gestation. Fetal heart rates generally decrease towards the lower ranges of normal closer to full term.

Head and face

Inspect the face and scalp. Look for any lacerations and bruising including mastoid or periorbital bruising, which is indicative of a base of skull fracture. Gently palpate for any depressions or irregularities in the skull.

Look in the eyes for any foreign body, subconjunctival haemorrhage, hyphaema, irregular iris, penetrating injury or contact lenses.

Assess the ears for any signs of a cerebrospinal fluid leak, bleeding or blood behind the tympanic membrane. Check the nose for any deformities, bleeding, nasal septal haematoma or cerebrospinal fluid leak.

Look in the mouth for any lacerations to the gums, lips, tongue or palate. Note any swelling, which may indicate an inhalation injury. Inspect the teeth, noting if any are loose, fractured or missing.

Test eye movements, pupillary reflexes, vision and hearing.

Palpate the bony margins of the orbit, maxilla, nose and jaw. Inspect the jaw for any pain or trismus.

Neck

To assist with adequate access, ensure another colleague maintains manual in-line stabilisation while the collar is removed and throughout the examination.

Gently palpate the cervical vertebrae. Note any cervical spine pain, tenderness or deformity. Check the soft tissues for bruising, pain and tenderness.

Complete the neck examination by observing the neck veins for distension and palpating the trachea and the carotid pulse; note any tracheal deviation or crepitus.

The patient will need to be log rolled to complete the full examination. This can be combined with the back examination.

Chest

Inspect the chest, observing movements. Look for any bruising, lacerations, penetrating injury or tenderness.

Palpate for clavicle or rib tenderness.

Auscultate the lung fields; note any percussion, lack of breath sounds, wheezing or crepitations.

Check the heart sounds: apex beat and presence and quality of heart sounds.

Limbs

Inspect all the limbs and joints. Palpate for bony and soft tissue tenderness and check joint movements, stability and muscular power. Note any bruising, lacerations, muscle, nerve or tendon damage. Look for any deformities, penetrating injuries or open fractures.

Examine sensory and motor function of any nerve roots or peripheral nerves that may have been injured.

Assess distal perfusion for capillary refill, pulse and warmth.

Back

Log roll the patient. Maintain in-line stabilisation throughout. Inspect the entire length of the back and buttocks noting any bruising and lacerations.

Palpate the spine for any tenderness or steps between the vertebrae. Include a cervical examination at this stage.

Digital examination should be performed only if a spinal injury is suspected. Note any loss of tone or sensation.

Buttocks and perineum

Look for any soft-tissue injury such as bruising or lacerations.

Genitalia

Inspect for soft-tissue injuries such as bruising or lacerations. Check the patient for vaginal bleeding, fluid loss, cervical effacement and amniotic fluid.

Dipstick testing may be undertaken to assess pH of fluids discharged: normal measurements for vaginal secretion is pH 5.0 and amniotic fluid pH 7.0–7.5.

7. Planning and communication

For a trauma team to run effectively, there must be an identifiable leader who will direct the resuscitation, assess the priorities and make critical decisions.^{xii} Good communication between the trauma team members is vital, as is ensuring that local senior staff are aware and can provide additional support if required.

Once the initial assessment and resuscitation is underway, it is important to plan the next steps in immediate management. Priorities for care must be based on sound clinical judgement, patient presentation and response to therapies. Awareness of limitations in resources as well as training in the emergency field is vital. If escalation of care to senior

staff is warranted, then do so early in the patient care episode. Do not wait until the patient deteriorates to ask for assistance.

Frontline clinical staff should initiate contact with ARV early in the patient care pathway or, more importantly, as soon as it is identified that the patient meets the major trauma transfer criteria or may have sustained injuries beyond the clinical skill set of the hospital or urgent care centre. ARV can be contacted at any time throughout the patient care episode to offer or coordinate clinical advice and consultation.

ARV coordinators can facilitate a three-way conversation between the referral health service, specialist clinical resources and an ARV consultant to discuss the best, timely management of the patient.

All injured pregnant women should have an urgent obstetric examination.

Pre-hospital triage

Any pregnant trauma patient who meets the pre-hospital major trauma triage criteria should be transported to the Royal Melbourne Hospital. However, where the expected transport time to the Royal Melbourne is longer than 45 minutes, the patient is to be transported to the highest level of trauma service within 45 minutes (preferably with obstetric capability).

Regarding any obstetric patient who is more than 20 weeks' gestation and sustains trauma not meeting the time-critical criteria, there is still potential harm to the unborn child and so they should be transported to a hospital that has both obstetric and trauma capabilities.

Inter-hospital transfer

Once it has been identified that the patient requires specialist services, arrangements can be made for transfer to a MTS for further evaluation and management. This can occur concurrently with stabilising the patient.

The decision of when to transfer an unstable patient should ideally be made by the transferring and receiving clinicians in collaboration with the retrieval service. Clear communication is crucial: the transmission of vital information allows receiving clinicians to mobilise needed resources while the inadvertent omission of such information can delay definitive care. Information should be conveyed in both verbal and written (via the patient record) form and should include the patient's identifying information, relevant medical history, pre-hospital management and emergency department evaluation and treatment (including procedures performed and imaging obtained).

ISBAR is an acronym for facilitating health professional communication ensuring clarity and completeness of information in verbal communication.^{xiii}

- I** Identify: Who are you and what is your role? Patient identifiers (at least three)
- S** Situation: What is going on with the patient?
- B** Background: What is the clinical background/context?
- A** Assessment: What do you think the problem is?
- R** Recommendation: What would you recommend? Identify risks – patient and occupational health and safety. Assign and accept responsibility/accountability.

It is important that additional communication with the ARV coordinator is initiated when there is:

1. Significant deterioration in
 - conscious state
 - blood pressure
 - heart rate
 - respiratory status
 - oxygenation
2. Major clinical developments such as significantly abnormal diagnostic tests or new clinical signs
3. The need for major interventions prior to the retrieval team arriving (for example, intubation or surgery). This will ensure the retrieval team is prepared, the patient receives the appropriate care en route and that the patient is referred to the correct facility.

8. Early management

Early management continues the focus on assessment, management and intervention for the mother, as fetal viability and outcomes are directly related to maternal oxygenation and perfusion. Opportunities to assess fetal wellbeing should be sought, including necessary equipment.

Patient positioning	Wound care
Airway management	In-dwelling catheter
Radiology	Nasogastric tube
Pathology tests	Tetanus prophylaxis
Preventing hypothermia	Antibiotics
Analgesia and antiemetics	Cardiac arrest
Sedation	Blood matters
Monitoring	Reassess

Patient positioning

To reinforce: Pregnant patients should be positioned with a left sided tilt of 15–30 degrees to facilitate blood flow and venous return. This positioning reduces the aortocaval shunt caused by uterine pressure on the great vessels, and should be maintained while managing neutral spinal positioning on a spine board and while in transit.

Airway management

Intubation should occur if the patient is unable to maintain an adequate airway, has an oxygen saturation below 95 per cent or has a GCS under 9. Aim to keep the ETCO₂ reading around 35–40 mmHg. Blood gas analysis should be used to assist setting ventilation parameters (if available). ETCO₂ monitoring (if available) should also be used to assess respiratory status and adequacy of ventilation.

Always have emergency airway equipment available by the bedside.

Radiology

Notify radiology staff if available of the arrival of a pregnant trauma patient. Remember that in an emergency situation the optimal resuscitation, imaging and treatment of the mother will ensure the optimal chance of fetal survival.

Most diagnostic procedures pose no substantial risk to the mother or fetus, and necessary investigations should not be delayed or avoided because of concerns for the pregnancy. Radiation risks are greatest in the early stages of pregnancy (less than eight weeks); however, it is highly unlikely that the fetal-effective dose from diagnostic or most interventional procedures will exceed 100 mSv where complications are possible.

X-ray

Plain x-ray imaging of the head, neck, chest, pelvis or extremities pose no substantial risk and should be undertaken as indicated for trauma patient management. Shielding of the abdomen or pelvis may be considered where appropriate.

CT scanning

CT scanning of the abdomen and pelvis may increase the total radiation dose to the fetus and therefore should be used only after a benefit analysis. However, in a critically injured patient fetal outcomes are directly related to maternal outcomes, and the best care for the mother is also the best care for the unborn child.

If it appears that the patient will require transfer to a MTS, the decision to conduct a CT prior to retrieval must be carefully considered.

FAST

Consider need for FAST if available and staff trained in its use. In haemodynamically stable patients, FAST can be delayed until the secondary survey and is ideally performed by a second operator while the remainder of the secondary survey is completed.

Ultrasound

Ultrasound may be used to: assess a large organ injury; determine the presence of peritoneal fluid or blood; calculate gestational age and fetal heart rate; assess fetal wellbeing, movement and location of the placenta; and calculate amniotic fluid volume. However, ultrasound is not a reliable diagnostic tool for placental abruption and should not be used to exclude this diagnosis.

Pathology tests

In a ventilated patient, arterial blood gases can have a significant impact on the ability to monitor and adjust the adequacy of ventilation and perfusion. Ventilation parameters should be based on blood gas analysis and adjusted accordingly; aim for a carbon dioxide of 35–40 mmHg. In pregnant women, aim for a SaO₂ of 98% or higher.

If the mother is Rh negative, perform a Kleihauer test (within 48–72 hours).

Lab tests should be taken for FBC (full blood count), UEC (urea electrolytes and creatinine) and glucose as a baseline. A group and hold should be taken for all major trauma patients; consider requesting a cross-match as well if the patient is involved in a trauma presentation with a high index of suspicion for further injuries. Coagulation studies should be done if accessible to assist in the management of haemorrhage or if the patient is on anticoagulation therapy.

Preventing hypothermia

Prevention of hypothermia is crucial in pregnant trauma patients. Warmed IV fluids should be administered if high volumes are required and external warming therapies should be commenced. An ideal patient temperature of 36.5 °C is the target for attending staff.

Analgesia and antiemetics

Most antiemetics are safe in pregnancy and their use should be considered early, especially if transfer and retrieval is likely, to anticipate and prevent motion sickness. Analgesia should be carefully considered for a pregnant patient suffering a traumatic injury. The drug of choice will be based on clinical signs, the need for analgesia and whether the drug crosses the placenta into the fetal circulation. Short-acting agents are generally preferred, avoiding continuous infusions.

Most opioids are considered safe for use in therapeutic doses for short periods of time during pregnancy, and many are used routinely for labour analgesia despite crossing the placenta. In most circumstances, opioids would be considered an appropriate choice for analgesia in a pregnant trauma patient. Non-steroidal anti-inflammatory drugs (NSAIDs) are contraindicated in pregnancy and should be avoided.

Advice should be sought from a pharmacist or pregnancy medication advice service where concerns exist.

Sedation

Appropriate sedation may lower intracranial pressure by reducing metabolic demand. Further beneficial effects of sedation include a reduction in hypertension and tachycardia as well as improved patient–ventilator synchrony. Propofol has become a widely used anaesthetic/sedative with pregnant patients because it has a rapid onset and short duration of action.^{xivxv}

Monitoring

Monitoring the heart rate, respiration rate, blood pressure and oxygen saturation should take place at 15/60 intervals or less if indicated. All monitoring should be maintained until the retrieval team arrives.

A baseline ECG should be taken if time permits and facilities exist prior to transfer. Additionally, fetal monitoring should be commenced if capacity exists and gestation is 24 weeks or longer.

Wound care

Initial management of the wound in an emergency department is limited to controlling bleeding via external direct pressure.

If vaginal bleeding is unable to be controlled, then discussion with ARV and the obstetric specialists should take place to guide therapy. Vaginal packs **must not** be inserted.

In-dwelling catheter

A urinary catheter should be inserted in pregnant trauma patients and their urine output measured hourly. A urinalysis should be performed also to check for blood and protein. The desired urine output for adults is 0.5–1.0 mL/kg/hr.

Nasogastric tube

All patients should be kept nil orally in the initial post-resuscitation phase of injury.

If a base of skull fracture is suspected, and with any maxillofacial injuries, insertion should be avoided until the patient is transferred to the specialist centre. Alternatively, an OGT can be placed under careful direct visualisation. Care should be taken with inserting an NGT in pregnant patients due to mucosal congestion and the added risk of epistaxis.

Tetanus prophylaxis

Tetanus prophylaxis should be administered in any penetrating injury. Adult diphtheria tetanus vaccination (ADT) is a category A drug and is considered safe for use in pregnancy.

Antibiotics

Antibiotic prophylaxis should occur in all open and penetrating injuries as well as when there is suspicion of any base of skull fractures. The risk of local wound infections are particularly high in patients with a penetrating injury due to the presence of contaminated foreign objects such as skin, hair or bone fragments.

The routine prophylactic use of antibiotics remains controversial.

Cephalosporins, penicillins and metronidazole are category A or B medications and are usually considered safe for use where indicated in pregnancy. Tetracyclines and aminoglycosides are category D medications and their use should generally be avoided. Consultation with the ARV clinicians and obstetric specialists is indicated regarding the choice of antibiotics.

Cardiac arrest

A pregnant patient who has a cardiac arrest presents significant problems to the treating team outside a MTS.

Effective CPR is difficult to achieve in late pregnancy due to the effects of aortocaval shunting and compression of the great vessels by the enlarged uterus. An emergency (perimortem) caesarean section is considered part of the resuscitation protocol for cardiorespiratory arrest in a pregnant patient. CPR should be continued throughout. To provide any benefit, perimortem caesarean section should be commenced four minutes after the loss of maternal cardiac output, and delivery should be achieved by five minutes. This is a highly stressful and extremely rare situation.

The aim of delivery by caesarean section is to empty the uterus and therefore restore perfusion to vital maternal organs, improving the chances of maternal survival. Since the tolerance of the fetus to reduced blood flow and hypoxia is significantly less than that of the mother, this may also be the only chance for fetal survival. Emergency (perimortem) caesarean section therefore improves the chance of a successful resuscitation for both the mother and child. This is a decisive moment for responding teams and should be made in conjunction with appropriately qualified personnel with skilled support staff and appropriate equipment.

Blood matters

Irrespective of the cytomegalovirus (CMV) status of the mother (whether the status is known or unknown, or whether it is negative or positive), for red cell and platelet transfusions the units should be CMV antibody negative if possible.

Rhesus isoimmunisation and the use of anti-D^{xvi}

Prior to the administration of anti-D, a maternal blood sample should be taken for a Kleihauer test. This test measures the volume of fetal blood present in the maternal circulation and will determine whether more than one dose of anti-D is required. A blood group and antibody screen should also be performed to assess for the presence of any preformed anti-D antibody. Women with pre-existing antibodies have already been isoimmunised and do not require further anti-D to be given.

Where vaginal bleeding is present, administration should not be withheld to await pathology results.

Anti-D should ideally be offered within 72 hours of a sensitising event. If a dose has been missed, some benefit may still be obtained up to 10 days post event and anti-D should also be offered in these circumstances.

The recommended doses of anti-D are:

- 250 IU (50 mcg) for women 12 or fewer weeks' gestation
- 625 IU (125 mcg) for women at 12 or more weeks' gestation.

Reassess

The importance of frequent reassessment cannot be overemphasised. Deterioration in a pregnant patient can be rapid, leading to catastrophic haemorrhage, shock and other complications if not identified early. Patients should be re-evaluated at regular intervals as guided by the patient's condition.

If in doubt about any aspect of a patient's condition, repeat the primary survey and assessment.

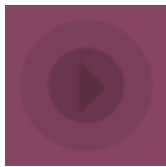
9. Retrieval and transfer

Transfer and retrieval response will be managed according to patient need following clinical consultation.

It is important to note that an exhaustive clinical workup and interventions is not always necessary or appropriate prior to transfer. Stabilisation and ensuring life-threatening problems are addressed, as well as taking measures to prevent deterioration en route, are essential aspects of early care. Delaying transfer to obtain laboratory results or imaging studies may simply delay access to definitive treatment. Often such studies must be repeated at the receiving facility.

All health services should avoid a patient deteriorating during an inter-hospital transfer by transferring these patients to a major trauma centre quickly. Currently in Victoria, obstetric trauma specialists and facilities are located in metropolitan Melbourne, with patients transferred to the combined Royal Melbourne and Royal Women's site as a first-line destination. Obstetric patients who do not meet time-critical major trauma guidelines for transfer may be referred to the nearest hospital with trauma and obstetric capacity.

In liaison with ARV clinicians, contact Paediatric Infant Perinatal Emergency Retrieval (PIPER) if required and the receiving hospital. Confirm with both about the interventions to be used to stabilise the patient before retrieval personnel arrive. ARV will coordinate communications and retrieval and will evaluate the practicality and clinical needs involved in transferring the patient from the source hospital. Once retrieval staff arrive on scene, be



prepared to give a thorough handover. Retrieval staff will assess the patient prior to transfer and may make changes to care to ensure the patient is safe during transfer.

Using a transfer checklist can help to ensure that important information is not omitted and the patient is packaged accordingly.

10. Guideline Implementation

These guidelines are designed to push for quality improvement using evidence-based practice across the entire care pathway. They aim to achieve consistent advancement in people's health and lead to access of good-quality care.

Putting these guidelines into practice benefits everyone; this includes the staff directly involved in patient care, those involved in managing the health facility, local healthcare organisations and members of the public. It can help to monitor service improvements, demonstrate that high-quality care is being provided and also highlight areas for improvement.

One of the most difficult aspects of working with guidelines is how best to implement them into routine daily practice. Many of us provide patient care according to usual routines ('how it's always been done') instead of looking at developments and change in practice to reflect the latest evidence-based research. Barriers to implementation can include organisational constraints, such as a lack of time, obstructive opinions of key people who may not agree with the evidence or do not want to change their practice, and lack of leadership to effect change. Additionally, there may be a perceived poor sense of competence by staff who question their skills.

In order for change to be effective there must be an identified need, a willingness to adapt and promote current practices, a driving force behind it and acceptance from all levels, be it individual, team or organisational.^{xvii} For these guidelines to be successfully implemented, the following is recommended.

High-level support and clear leadership

Successful implementation plans have a person on the board, such as a medical director, who drives the implementation agenda forward as well as a clear implementation policy approved at the highest level.

A nominated lead for the organisation

One person should be identified who is responsible for driving the education and development of these guidelines into practice. They should be involved in coordinating, disseminating and monitoring the implementation as well as for arranging educational events to promote the use of these guidelines in the workplace. The responsibility for this could be included into an existing role such as that of the clinical governance manager or anyone involved in quality assurance.

A multidisciplinary forum

The multidisciplinary forum should have decision-making powers and report to the chief executive or senior managers of the organisation. New guidelines should be reviewed after they are published and their relevance to the organisation assessed. A clinical lead for each guideline should be identified and steps taken to disseminate to the appropriate personnel. Implementation is most effective if a wide range of disciplines are involved in the forum.

A local policy

Organisations should have a clear, structured policy in place for implementing new guidelines. This policy should be endorsed at the highest level of management and be available for all.^{xviii}

What can you do as an individual?

Become a project champion. One way to begin implementation in your workplace is to take the initiative and volunteer to represent your department. Review these guidelines and compare them with the current ones you have in place. Note any changes to practice that need to be addressed in order to standardise your organisation with current best practice.

In staff meetings, bring up the idea of implementation and seek feedback from other staff members on the best way to do this. Collaborate with colleagues across all boards and emphasise the importance of team communication and cohesion. Print handouts, send out links to workmates and arrange for flowchart posters to be placed in relevant areas.

If you have a clinical educator at your site, inform them of the current updates and discuss ways they can influence training and provide moultage-based simulation scenarios. Often training with the staff you work with on a regular basis can help to foster communication and a real sense of teamwork.

Speak with your organisation about placing access to the Victorian trauma guidelines on your intranet to allow easy access to the site.

Visit <www.trauma.reach.vic.gov.au>, which will be updated regularly. It contains learning modules and moderated remote tutorials.

As always, your feedback is encouraged. If you have any comments or suggestions, or would like to share how you have adopted these guidelines into your practice, we would appreciate your thoughts.

Appendix 1: Normal Changes in pregnancy

Cardiovascular	
Blood pressure	Minimal change Slight ↓ in first and second trimester, normal in third
Heart rate	↑ 15–20% ↑
Cardiac output	↑ 30–40% 6–7 L/min during pregnancy
ECG	Non-specific ST changes, Q waves in leads III and AVF, atrial and ventricular ectopics
Systemic vascular resistance	↓ to 1,000–14,000 Due to progesterone and blood volume
Respiratory	
Respiratory rate	No change
Oxygen demand	↑ 15%
Functional residual capacity	↓ 25%
Minute ventilation	↑ 25–50% or 7–15 mL/min
Tidal volume	↑ 25–40% or 8–10 mL/kg
PaO ₂	↑ 10 mmHg or 104–108 mmHg
PaCO ₂	↓ 27–32 mmHg
Arterial pH	↑ 7.40–7.45
Bicarbonate	↓ 19–25 mmol/l
Haematological	
Blood volume (mL)	↑ 30–50% volume
White cell count (mm ³)	↑ to 5,000–14,000
Haemoglobin (g/dL)	↓ to 100–140
Haemocrit (%)	32–42
Plasma volume (mL)	↑ 30–50%
Red blood count volume (mL)	↑ to 1,900
Coagulation factors ↑ 30–50%	↑ factors VII, VIII, IX, XII
Platelet (mm ³)	200,000–350,000
Fibrinogen, plasma (mg/dL)	264–615
Renal	
Urea (mg/dL)	4–12
Sodium (mEq/L)	132–140
Potassium (mEq/L)	3.5–4.5
Chloride (mEq/L)	90–105
Calcium ionised (mEq/L)	4–5

Used with permission from: The Royal Melbourne Hospital. Trauma Service. Emergency and Trauma Services. Pregnancy and trauma guideline. Melbourne: Advisory Committee on Trauma. 2009 Nov.

Appendix 2: Maternal positioning diagram



The gravid uterus compresses the vena cava in supine position



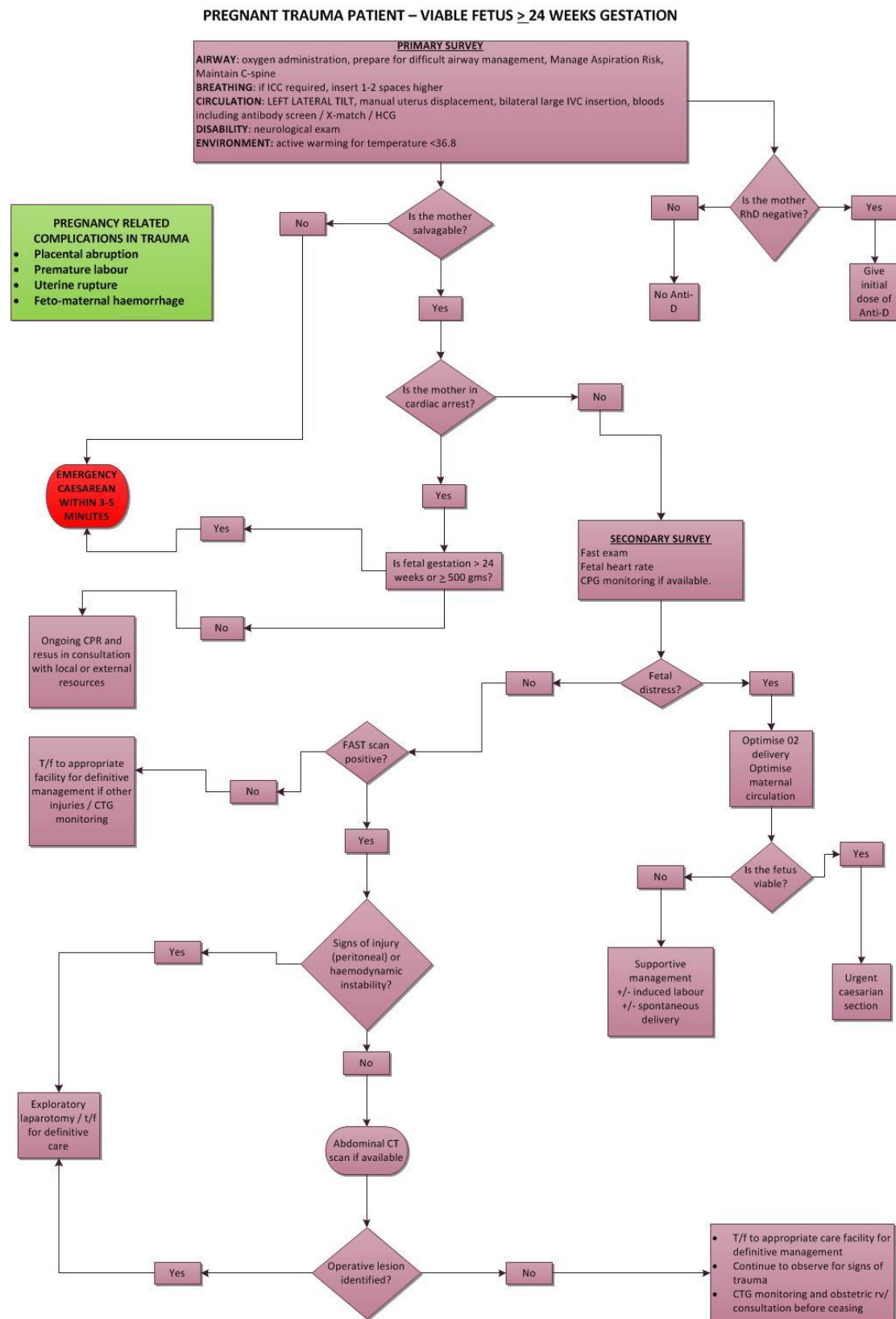
30° left lateral decubitus unloads vena cava



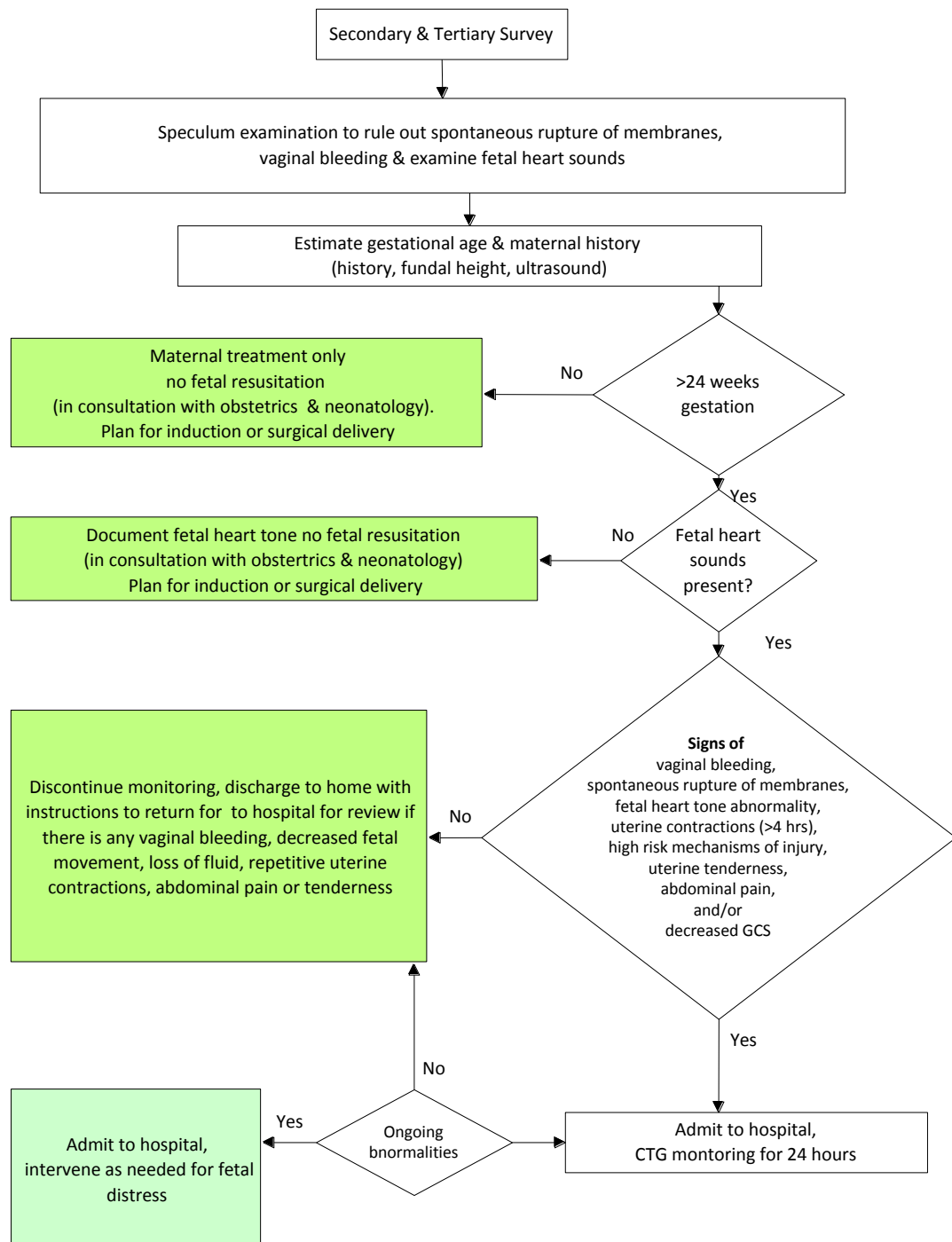
Alternative method: manual shift of uterus

Used with permission from Sally Pairman, Jan Pincombe, Carol Thorogood and Sally Tracy;
Midwifery: Preparation for Practice © 2006 Sydney, Elsevier Australia.

Appendix 3: Pregnant Trauma Viable Fetus Diagram



Adapted from Royal Melbourne Hospital Trauma Service: Pregnancy and Trauma Guidelines (2009) pp15 as endorsed by the RMH Advisory Committee on Trauma Nov 2009, Version 3

Appendix 4: Maternal Trauma Secondary Survey

Used with permission; The Royal Melbourne Hospital. Trauma Service. Emergency and Trauma Services. Pregnancy and trauma guideline. Melbourne: Advisory Committee on Trauma. 2009 Nov

Appendix 5: Fundal palpation chart

Identifying the top of the fundus



Walk your fingers up the side of the belly.

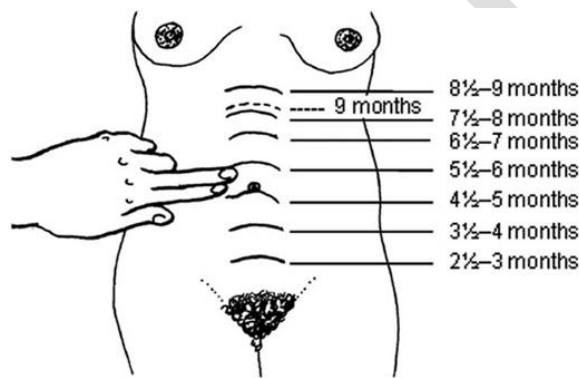


Find the top of the uterus (it feels like a hard ball under the skin).



You can feel the top by curving your fingers into the belly.

Measuring fundal height. Each increment is approximately two fingers' width.



Courtesy of: <http://www.open.edu/openlearnworks/mod/oucontent/view.php?id=40>

Trauma Victoria

The Victorian State Trauma System (VSTS) facilitates the management and treatment of major trauma patients in Victoria. The VSTS aims to reduce preventable death and permanent disability and improve patient outcomes by matching the needs of injured patients to an appropriate level of treatment in a safe and timely manner.

The system works to have the right patient delivered to the right hospital in the shortest time.

One of the best ways to facilitate this is to provide an education resource to all clinicians.

Trauma Victoria is a statewide education initiative directed towards clinical staff (doctors, nurses, allied health, paramedics) who provide early patient care for major trauma outside of a MTS.

Guidelines are in place to support awareness of **key aspects of the trauma system** and early trauma care and include **specialist trauma transfer** guidelines.

A web-based learning management system provides modules to support each of the principle guideline areas. Skills tutorials on key trauma procedural interventions will also be accessible.

Moderated remote tutorials will be offered in the future. Clinicians will join a multisite, multiparty videoconferenced meeting room for tutorials and discussions on relevant trauma subjects. It will allow local practitioners to tap into specialised clinical knowledge and to develop their learning to the fullest extent.

Regional simulation and team training will also be supported via a remote expert facilitator and will involve regional and subregional simulation trainers. It will build capacity among simulation trainers to enhance local trauma team training programs.

Facilitated visits will also be arranged whereby medical, nursing and allied health staff may be placed for brief rotations with a MTS in order to increase their experience and familiarity in major trauma management. The aim is also to promote the development of clinical relationships between organisations.



Created by Adult Retrieval Victoria on behalf of the Victorian State Trauma System.

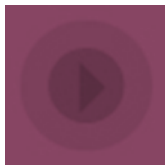
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AGREE II score sheet – obstetric trauma guideline

Domain	Item	AGREE II rating						
		1: Strongly disagree				7: Strongly agree		
		1	2	3	4	5	6	7
Scope and purpose	The overall objective(s) of the guideline is (are) specifically described.						X	
	The health question(s) covered by the guideline is (are) specifically described.						X	
	The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.						X	
Stakeholder involvement	The guideline development group includes individuals from all the relevant professional groups.							X
	The views and preferences of the target population (patients, public, etc.) have been sought.							X
	The target users of the guideline are clearly defined.							X
Rigor of development	Systematic methods were used to search for evidence.						X	
	The criteria for selecting the evidence are clearly described.						X	
	The strengths and limitations of the body of evidence are clearly described.						X	
	The methods for formulating the recommendations are clearly described.						X	
	The health benefits, side effects and risks have been considered in formulating the recommendations.							X
	There is an explicit link between the recommendations and the supporting evidence.						X	
	The guideline has been externally reviewed by experts prior to its publication.							X
	A procedure for updating the guideline is provided.							X



Domain	Item	AGREE II rating							
		1: Strongly disagree				7: Strongly agree			
		1	2	3	4	5	6	7	
Clarity of presentation	The recommendations are specific and unambiguous.								X
	The different options for management of the condition or health issue are clearly presented.						X		
	Key recommendations are easily identifiable.								X
Applicability	The guideline describes facilitators and barriers to its application.						X		
	The guideline provides advice and/or tools on how the recommendations can be put into practice.								X
	The potential resource implications of applying the recommendations have been considered.								X
	The guideline presents monitoring and/or auditing criteria.						X		
Editorial independence	The views of the funding body have not influenced the content of the guideline.								X
	Competing interests of guideline development group members have been recorded and addressed.								X
Overall guideline assessment	Rate the overall quality of this guideline. 1: Lowest possible quality 7: Highest possible quality								X
Overall guideline assessment	I would recommend this guideline for use.	Yes		Yes, with modifications			No		
		X							

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