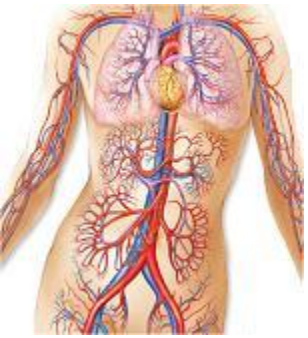
Trauma
In Pregnancy
(Trauma For Two)

Double Jeopardy



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- Evaluation of the pregnant trauma patient presents unique challenges since the presence of a fetus means that there are two patients potentially at risk,
- both of whom require evaluation and management.
- Knowledge of pregnancy-related anatomic and physiologic changes is also important in the evaluation and management of these women

Physiological changes in pregnancy

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 bpm	Increased CPR demands
Cardiac output	Increased by 40% 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	Sequesters blood during CPR
Arterial blood pressure (BP)	Decreased by 10–15 mmHg	Decreased reserve
Venous return	Decreased by pressure of gravid uterus on inferior vena cava (IVC)	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%	Hypoxia develops more quickly
Residual capacity	Decreased by 25%	Decreased buffering capacity, acidosis more likely
Arterial pCO_2	Decreased	Decreased buffering capacity, acidosis more likely
Laryngeal oedema	Increased	Difficult intubation
Mucosal congestion	Increased	Predisposition to airway bleeding
Other changes		
Gastric motility	Decreased	Increased risk of aspiration
Lower oesophageal sphincter	Relaxed	Increased risk of aspiration
Uterus	Enlarged	Diaphragmatic splinting reduces residual capacity and makes ventilation more difficult Aortal compression causes supine hypotension, reduced venous return and significantly impairs CPR Heart rotation to the left – left axis deviation on ECG can be normal in 3rd trimester
Weight	Increased neck and mammary fat levels	Difficult airway management
Pelvic vasculature	Hypertrophied	Potential for massive retroperitoneal haemorrhage with pelvic fracture, uterine trauma
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 60%. Serum urea, nitrogen, creatinine reduced	'Normal' serum urea nitrogen and creatinine may reflect seriously compromised function

Adapted from Royal College of Obstetricians and Gynaecologists. Maternal collapse in pregnancy and puerperium. Green-top Guideline No. 56. 2011.

Key Points

- All reproductive-age female trauma victims should have a pregnancy test because 8 percent of pregnant trauma victims have not yet had their pregnancies diagnosed.
- Generally, medications, tests, treatments, and procedures required for the mother's stabilization should not be withheld because of pregnancy
- Pregnant women beyond 20 weeks' gestation should be placed in the lateral decubitus position or in lateral tilt to prevent supine hypotension.
- Abruptio placentae is the leading cause of fetal loss. Frequent uterine contraction, abnormal fetal heart tracing, vaginal bleeding, and uterine pain and tenderness are signs of abruption.
- All pregnant patients with a viable fetus (beyond 22 to 24 weeks' gestation) should have continuous fetal monitoring (tocodynamometry) initiated as soon as it is feasible.
- Because it is often difficult to determine degree of force, significant trauma should be anticipated with any mechanism of injury that is more than very minor
- Always evaluate for possible pregnancy-related cause of an accident, e.g., seizure secondary to eclampsia in 3rd trimester patient

Incidence

- 7 percent of pregnant women will suffer physical trauma during their pregnancy.
  - 8% in first trimester
  - 40% in second trimester
  - 52% in third trimester
- Conversely, of reproductive-age women presenting with trauma, approximately 3 percent are pregnant,
- 8 percent of whom were not known to be pregnant prior to presentation.
- Because most physical trauma suffered during pregnancy is relatively minor, many of these women will not present for medical care
- Preterm Labor in 11.4 % & P. Abruption in 1.58 %
- Penetrating abdominal trauma during pregnancy, in which there were no maternal mortalities compared with a fetal death rate of nearly two-thirds

Causes of Trauma

- Motor Vehicle Accident 54.6 %
- Domestic abuse & Assault 22.3 %
- Falls 21.8 %
- Penetrating inj. 1.3 %

The severity of the trauma

- A critical factor to consider is that the severity of the trauma does not always accurately predict adverse fetal outcome.
- Recognizing this, a general recommendation should be made that women who suffer any degree of truncal trauma during pregnancy should be evaluated.
- This is particularly true once fetal viability has been established (i.e., beyond 22 to 24 weeks of gestation).
- Case series of trauma during pregnancy and subsequent fetal loss bear this out, as 60 to 80 percent of all fetal losses result from relatively minor maternal trauma
- The adverse effects, when they occur, are immediate (within the first few days of the trauma).
- the following immediate adverse effects:
- Rupture of membranes within 4 hours of injury.
- Onset of labor within 4 hours of injury that resulted in delivery during the same hospitalization.
- Placental abruption within the first 72 hours of injury.
- Fetal death within 7 days of the traumatic event

Trauma Complications

- Vaginal bleeding
- Preterm rupture of membranes within 4 hours of injury
- Uterine rupture
- Placental abruption (minor trauma is low (1.6%), but in major trauma is (37.5%) within the first 72 hours of injury..
- Maternal pelvic fractures
- Fetal death within 7 days of the traumatic event
- Fetal fractures, especially skull, clavicles, and long bones
- Intracranial hemorrhage
- Indirect injury is generally due to fetal hypoxia secondary to: maternal hypotension, fetal hemorrhage, placental abruption or other injury, cord injury, uterine injury
- Other:

  spontaneous abortion,
  preterm delivery,
  cesarean delivery and
  RBC isoimmunization

. Rare: amniotic fluid embolus, chorionic villus embolus

Ruptured amniotic membranes

- Vaginal fluid leak– avenue for infection.
- By itself, not an emergency

Uterine Rupture

- Life-threatening emergency, 10% maternal mortality
- Fetus almost always dies
- Sharp or blunt abdominal trauma can lead to uterine rupture
- Signs and symptoms include shock, nonreassuring fetal heart rate tracing or fetal death, uterine tenderness, peritoneal irritation, and vaginal bleeding

Abruptio Placentae

- Accompanies 1-5% of minor injuries, 20-50% of major injuries.
- the frequency of abruption after a motor vehicle accident with severe injury, nonsevere injury, or no injury was 13, 7.4, and 8.5 percent, respectively
- the rate can be much higher (40 to 66 percent) in women who sustain severe trauma to the abdomen
- a significant abruption can be asymptomatic or associated with minimal maternal symptoms.
- Sonographic and laboratory assessments (eg, platelet count, fibrinogen concentration) support the diagnosis if abnormal, but may be normal despite mild to moderate pathology.
- Ultrasound is of limited usefulness in diagnosing abruption; an abruption is likely if a subchorionic hematoma is observed, but many abruptions are not visualized sonographically

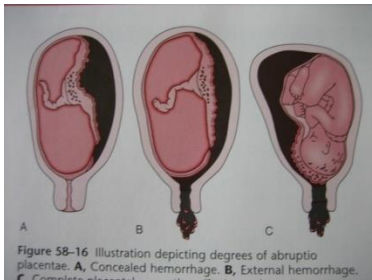
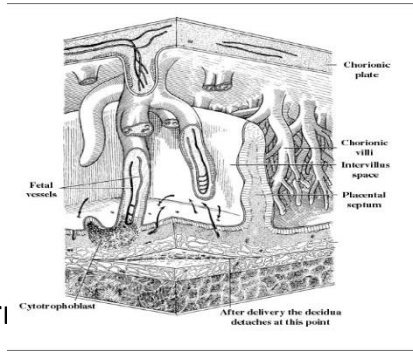


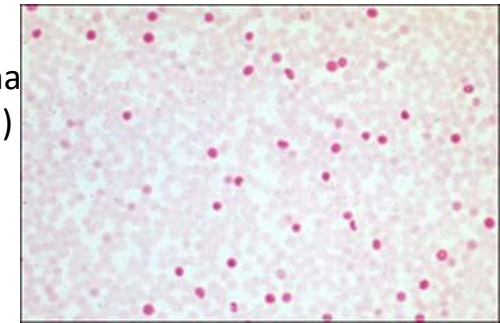
Figure 58–16 Illustration depicting degrees of abruptio placentae. **A,** Concealed hemorrhage. **B,** External hemorrhage.

Placental trauma (+/- abruption): Feto-maternal hemorrhage



- More common with anterior placenta?
- Chorionic villi break, releasing fetal RBCs into lakes of maternal blood.
- Dangers:
  - Iso-immunization of Rh- mother by Rh+ fetal cells.
  - Fetal exsanguination / anemia / hydrops / brain damage.
  - Premature labor (due to release of thrombin, lysozymes or prostaglandins into materi

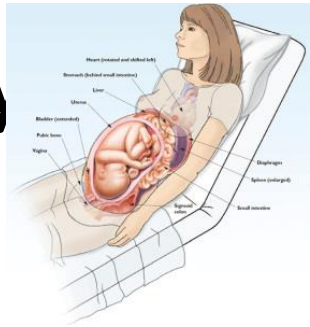
  .Kleihauer- Betke preparation
- Maternal blood smear eluted with acid wash.
- Adult hemoglobin washed away
- Fetal hemoglobin stays behind– a few brightly stained fetal cells amongst a sea of '"ghostly" maternal cells
- One dose of RhoGam (anti-D antibody to destroy fetal Rh+ RBCs) is routine with trauma to Rh- mother (regardless of KB results).
- Kleihauer – Betke prep sometimes used to assess:
  - Need for repeated RhoGam doses (large FMH)
  - Probability of pre-term labor (?)
- Pregnant trauma patients who are Rh(D) negative with no preformed anti-D antibodies should be given CSL Rh(D) Immunoglobulin-VF, as follows:
- • 250 IU: 1st trimester (<13 weeks gestation)
- • 625 IU: 2nd and 3rd trimester (≥13 weeks), and 1st trimester multiple pregnancies.
- • 2nd and 3rd trimester patients: quantitative assessment of fetomaternal haemorrha
- is required (Kleihauer Test / flow cytometry) to determine if additional doses of Rh(D)
- Immunoglobulin are required



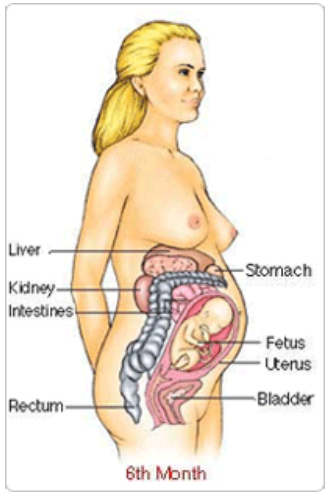
Injury to the uterine vasculature

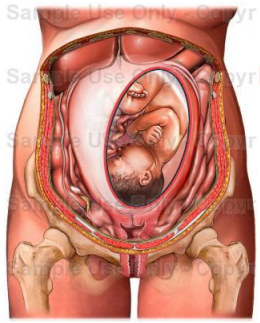
- is uncommon, largely because the vessels are located quite lateral and posterior in later gestation.
- However, because of the tremendous volume of blood flowing through the uterine vessels, injury to these vessels is likely to result in rapid deterioration of vital signs.
- Unstable vital signs in the presence of a penetrating abdominal wound indicate the need for immediate laparotomy.
- In the absence of unstable vital signs, peritoneal lavage has been shown to accurately diagnose hemoperitoneum during pregnancy, and it can be helpful in determining whether exploratory laparotomy is necessary

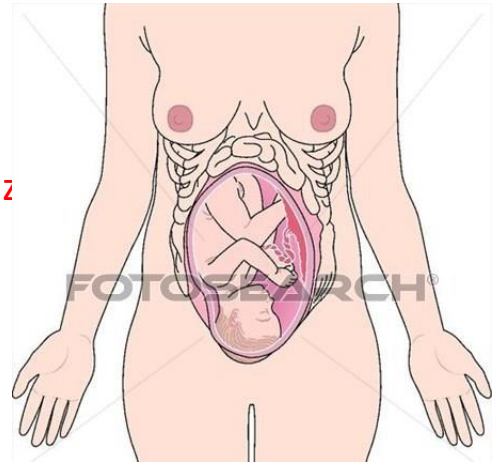
Injuries unique to pregnancy



- Premature Contractions
  - Rarely progress to preterm delivery
  - Tocolysis is not proven in trauma.(arely progress to preterm delivery
  - Tocolysis is not proven in trauma
- Abruptio Placentae
  - Different elastic properties in uterus & placenta “shearing”
  - 3 % of minor trauma and upto 50 % in severe
- Uterine Rupture
  - Rare, 0.6 % of severe abdominal trauma
  - Direct trauma after 12 wks of gestation
  - Prior Surgery (C/S or Myomec.) -- the risk
- Maternal-Fetal Hemorrhage
  - Trimesters 1 3%, T2 12%, T3 45%
  - 4-5 X more common in injured pregnant women
  - Causes isoimmunization & fetal death
  - Kleihauer-Betke test - volume of fetal blood 0.01- nsitiz test. to determine amount of Rhogam needed







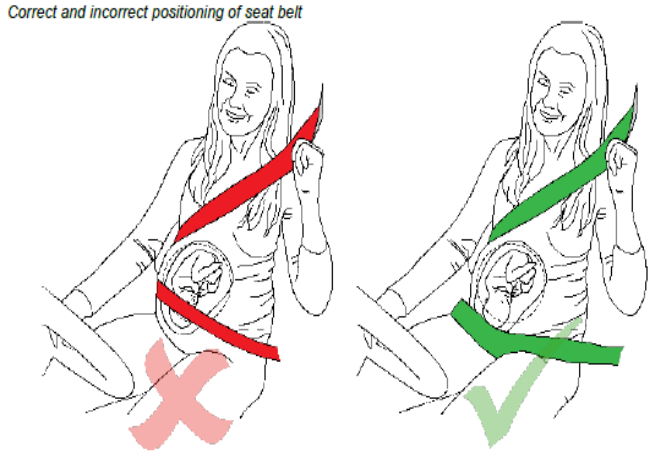
Causes of Death

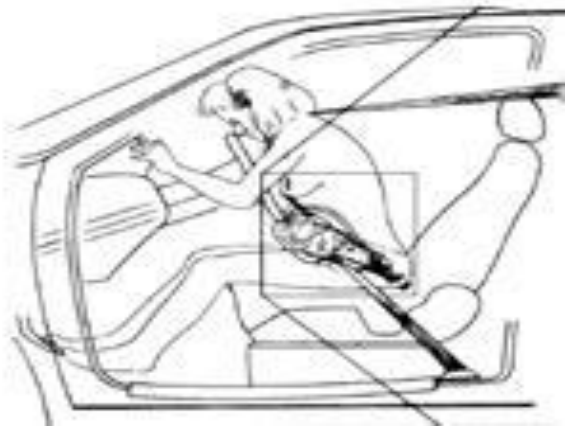
Figure 2. This photograph shows the penetrating hole in the face and an exit hole in the thorax

- Causes of maternal death
- Most maternal deaths are due to head trauma or hemorrhagic shock.
- Causes of fetal death
- In severe maternal injury, it is maternal death.
- In “minor” injury, it is placental abruption
- overall maternal mortality is low (3.9 %). Fetal mortality, on the other hand, is high, ranging between 40 and 70 %.

Injury Patterns in Pregnancy

- Motor Vehicle Accidents (Blunt Abdominal Trauma)
- Slips & Falls
- Burns (Thermal Injuries)
- Electrical Injuries
- Domestic Violence
- Penetrating Injuries
- Toxic poisoning (Poisoning - Carbon Monoxide Poisoning)
- Suicide & Homicide
- Sexual Assault



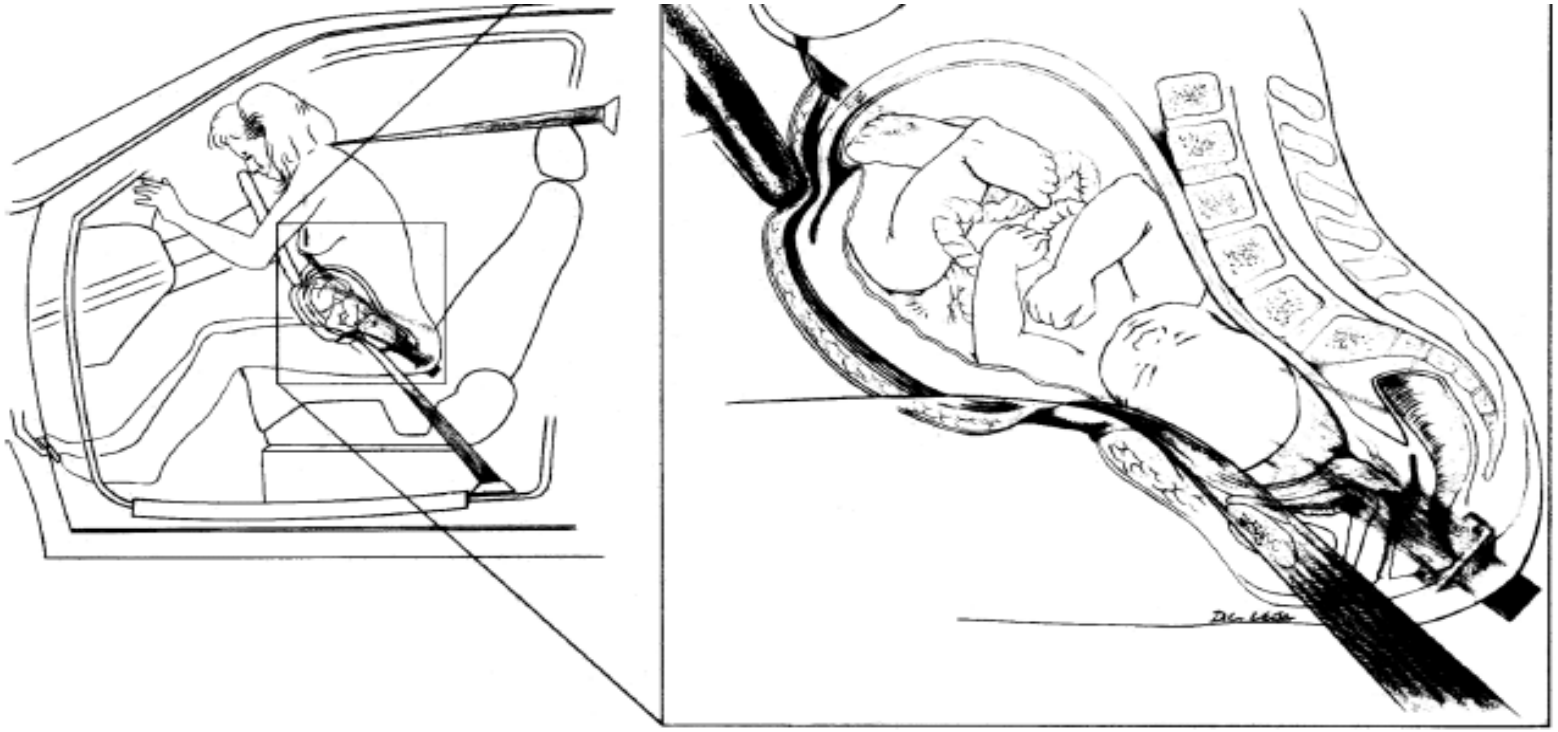


Blunt Abdominal Trauma

Causes Of Blunt Abdominal Trauma

- It is most commonly caused by Motor Vehicle accidents, which account for 50 to 65 percent of all cases (from steering wheel or improper placement seat belt)
- followed by Falls and
- Direct Blows to the abdomen.
- Domestic Violence is remarkably common during pregnancy; rates as high as 20 percent have been reported

Blunt Abdominal Trauma from steering wheel



Source: Pearlman MD, Tintinalli JE, Dyne PL: *Obstetric and Gynecologic Emergencies: Diagnosis and Management*: http://www.accessemergencymedicine.com

Illustration of abruptio placentae resulting from impact with steering wheel. See text for description. (Illustration by Darryl Leja, University of Michigan. From Pearlman and Tintinalli,[14] with permission.)

Blunt Abdominal Trauma from improper placement seat belt

- **Pregnant women need to wear seat belts properly:**
- **One strap under uterus, the other between breasts.**
- **Many women don't wear them for fear of hurting the baby.**
- **Improper placement <u>can</u> injure fetus.**

INCORRECT

INCORRECT

INCORRECT

INCORRECT

CORRECT

Seat Belts & Pregnancy

The shoulder belt should go over the shoulder, collar bone and down across the chest – between the breasts. Wear the lap belt as low as possible under the abdomen and the unborn child.

ALWAYS WEAR A FULL SEAT BELT

Penetrating Trauma

Penetrating Trauma

- Knife and gunshot wounds during pregnancy are not uncommon in urban settings.
- 73% were handgun-, 23% knife-, and 4% shotgun
- Fall on sharp object and bull horn injury are common in rural Indian women
- Understandably, there is considerable concern for fetal well-being when gunshot or knife wounds penetrate the abdomen.
- Knife and gunshot wounds suffered elsewhere in the body should be managed just as they are in the nonpregnant individual except that the fetus should also be monitored if viable (beyond 22–24 weeks of gestation) once the woman has been stabilized.
- However, penetrating wounds to the pregnant abdomen involve different considerations, because fetal or placental injury becomes an important issue
- Penetrating trauma in pregnancy is associated with - Increased foetal mortality (as high as 73%) - Increased hospital stay, - Complications such as intestinal perforation . Haemo peritoneum due to intra abdominal organs like liver .spleen. Pregnant uterus. Big vessels etc

Take Care

- Penetrating injuries are more likely to affect the foetus, especially those penetrating the pregnant uterus
- If a thoracostomy tube is indicated, it should be placed 1-2 intercostal spaces above usual fifth intercostal space landmark to avoid abdominal placement & liver injury as the diaphragm is lifted up by the pregnant uterus
- Pelvic fractures do not necessarily preclude vaginal delivery
- If peritoneal lavage is indicated, an open technique is preferred
- a placement of a Foley catheter and nasogastric tube

Gunshot Wounds

- Most authors agree that gunshot wounds to the abdomen should be explored in all cases, since the course of the bullet cannot be predicted. Furthermore, due to cavitation and shock waves, tissue damage well outside of the projectile's path can be significant.
- When extrauterine injuries do occur following penetrating abdominal trauma during pregnancy, they typically occur as a result of gunshot wounds.
- All gunshot wounds to the abdomen should be explored

Knife Wounds

- Knife wounds to the abdomen are much less likely to cause extrauterine injuries, and these injuries typically have a better prognosis than gunshot wounds.
- The individual circumstances of knife wounds should be carefully weighed prior to making a decision to perform a laparotomy.
- Stab wounds to the lower abdomen are much less likely to cause visceral injuries than upper abdominal wounds. However, any midline lower abdominal wound can cause bladder or ureteral injury.
- Grubb demonstrated that in nonpregnant patients, stab wounds to the abdomen do not penetrate the peritoneum in about one-third of cases.
- These extraperitoneal wounds generally do not require exploration unless they have injured a large blood vessel in the abdominal wall (e.g., the inferior epigastric artery). However, because of the enlarged gravid uterus, attenuation of the abdominal wall during pregnancy makes it more susceptible to peritoneal penetration

POISONING DURING PREGNANCY

POISONING DURING PREGNANCY

- Poisoning relates mostly to intentional poisoning and / or suicide attempts
- Accidental poisoning is not as widely reported and its actual incidence unclear

Carbon Monoxide Poisoning

Carbon Monoxide Poisoning

- In the United States, carbon monoxide (CO) is the leading cause of death by poisoning.
- As many as 8.4 percent of CO poisoning victims are pregnant.
- CO diffuses readily across the placenta and can cause fetal tissue hypoxia. As the placental blood flow increases, so too does the diffusion of CO, such that CO diffusion capacity is directly proportional to fetal weight.
- Fetal hypoxia results from both accumulation of CO in the fetus and also through decreased levels of oxygen in maternal hemoglobin due to displacement by CO.
- Fetal carboxyhemoglobin levels are 10 to 15 percent higher than maternal levels, and elimination of CO is less rapid in the fetus.
- Severe acute CO poisoning can result in permanent fetal neurologic injury, or even fetal death. Chronic CO exposure (e.g., cigarette smoking) may result in intrauterine growth restriction.

Hyperbaric Oxygen

- Treatment of acute CO poisoning with hyperbaric oxygen works by both increasing the levels of dissolved oxygen in the blood and by increasing the rate of dissociation of CO from hemoglobin.
- Treatment of CO poisoning during pregnancy begins by
  - removing the victim from the source of CO and
  - beginning 100 percent oxygen.
- Strong consideration should be given to using hyperbaric oxygen for 2 hours at 2 atmospheres; this has been used successfully and safely during pregnancy.
- Longer use of hyperbaric oxygen may be teratogenic, and abortion after first-trimester hyperbaric oxygen exposure has been reported. However, given the serious potential effects of hypoxia on the fetus, hyperbaric oxygen appears to be the treatment of choice for pregnant women suffering from CO poisoning.

Electrical Injuries

- The experience with electrical injury during pregnancy is limited.
- In this series of six pregnancies complicated by electrical injury,
- There was one delayed fetal death complicated by growth retardation and oligohydramnios, and
- Two of the three other live births were complicated by oligohydramnios.
- Because of this, recommend serial ultrasound examinations to follow fetal growth and amniotic fluid volume.

Thermal Injuries

- We recommend that severely burned women (more than 50 percent body surface area) In second- and third-trimester
- Should be delivered immediately because maternal death is almost certain otherwise, and fetal survival is not improved by allowing the pregnancy to continue
- Fetal mortality is approximately 63% when the body surface area burn is 25-50% and approaches
- 100% when the body surface area burn is >50%.
- Maternal and fetal deaths are usually a result of inadequate fluid resuscitation, hypoxia or septicaemia.

SLIPS & FALLS DURING PREGNANCY

SLIPS & FALLS DURING PREGNANCY

- It is known that pregnancy increases joint laxity and weight gain, enlarged and distended abdomen ,walking on slippery floors , hurrying,carrying heavy objects can affect gait and predispose pregnant women to slips and to falls
- Dynamic postural stability decreases with pregnancy, especially during the third trimester
- Approximately 1 in 4 pregnant women will fall at least once while pregnant
- Types of Injuries
- The fracture of the lower extremity/ pelvis.
- spine are the most commonly associated injuries
- Blunt injury to abdomen and pregnant uterus.
- The majority of falls occur indoors and 39% involve falling from stairs.
- Falling on sharp object may lead to penetrating injury also
- Obstetrical complication
- 4-fold increase in preterm labor
- An 8-fold increase in placental abruption
- 2-fold increase in foetal distress
- A 2.9-fold increase in foetal hypoxia

DOMESTIC VIOLENCE

TYPES OF DOMESTIC VIOLENCE

- Beating --- hurt on abdomen—with leg. Stick.
- Pushing down from stairs.
- Pushing her out of door
- Torched with burning objects –wood , candle , Hot Iron ,hot iron rod ,intentional Kerosene stove burn/ cooking gas stove accident s
- Sharp objects like kitchen knife,
- NO food / drink even water for whole day and night.
- Abusement.
- Electric shock.
- Pushing the head against pillar / wall.

SUICIDE & HOMICIDE IN PREGNANCY

SUICIDE & HOMICIDE IN PREGNANCY

- Estimated rates of suicide and homicide in pregnancy were about 2.0/100,000 and 2.9/100,000 live births, respectively
- Suicide are more common in post natal period due to puerperal psychosis and accounts for approximately 20% of postpartum maternal deaths
- Interestingly, pregnancy may be protective in those women who are otherwise at high risk for suicide or homicide Risk factor
- Substance abuse appears to be the best identifier for detecting women at risk for suicide
- Another major risk factor for attempting suicide, especially during the postpartum period, is foetal or infant death
- Suicide attempt by intentional self-poisoning clearly affects both foetus and mother; maternal death occurs in 1.8% of cases after suicide attempts by ingestion of medication
- Often associated with / precipitated by DV/IPV

Modalities for Evaluating Trauma

Modalities for Evaluating Trauma

- Lab Tests
- Plain Films – X-rays
- Ultrasound
- CT
- MRI
- Cardiotocographic Monitoring
- DPL (Diagnostic Peritoneal Lavage)
- Several invasive tests short of exploratory laparotomy
- Exploratory Laparotomy

Lab Tests

- Basic trauma lab includes
- Type and
- Cross match,
- Rh status, and
- Antibody test.
- Regardless of Rh status, a positive Kleihauer-Betke (KB) test may predict the risk of preterm labor. With a negative test, post-trauma electronic fetal monitoring may be limited to a shorter period. With a positive test, significant risk of preterm labor may require longer monitoring therefore K-B testing has important advantages to all maternal trauma victims.
- However, a positive test does not necessarily indicate pathologic fetal-maternal hemorrhage.
- Results of a Kleihauer-Betke test rarely affect clinical decision making.[1]
- For example, a fetus that suffers a massive fetomaternal bleed may exsanguinate, but clinical decision making will be dictated by an abnormal fetal heart tracing rather than Kleihauer-Betke testing, as the results from the latter frequently take hours to obtain
- Nonetheless, in the Rh-negative woman, the possibility of isoimmunization due to fetomaternal hemorrhage is real and Rh immune globulin should be administered to Rh-negative women who have suffered blunt abdominal trauma. A 300-g dose is sufficient to cover 30 mL of whole blood (equivalent to a 15-mL RBC bleed). Fetomaternal hemorrhage greater than that requires additional Rh immune globulin. Because the Kleihauer-Betke test can identify these occasional large bleeds, its use in the Rh-negative woman may still have utility
- If placental trauma or abruption is suspected, add coagulation profile (fibrinogen and fibrin degradation products) with INR-PTT.

Plain Films

- Risk of 1 rad to fetus is approx. 0.003
- < 5-10 rads causes
  - No risk on congenital malformation, abortions or intra-uterine growth retardation.
  - Smaller risk of increase in childhood cancer
- Radiation doses > 10 rads
  - 6 % chance of severe mental ret.
  - < 3 % chance childhood cancer.

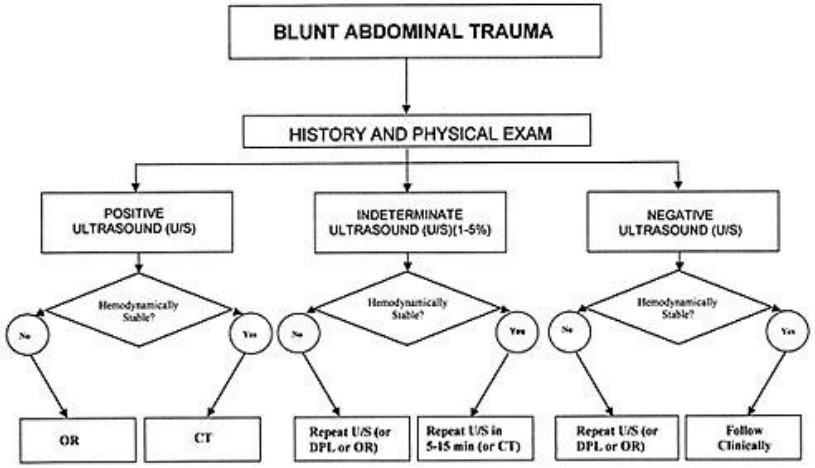
- The following plain films must be taken
- > Chest
- > Pelvis
- > Lateral C spine

Radiographic examination	Dose to Ovary/Uterus-mrad
Low Dose Group:	
Head	<1
C-Spine	<1
Thoracic Spine	<1
Chest	<1
Extremities	<1
High Dose Group:	
Lumbar Spine	204 – 1260
Pelvic	190 – 357
Hip	124 – 450
Intravenous pyelogram	503 – 880
Urethrocystogram	1500
KUB	200 – 503

Ultrasound

- Best modality to assess both fetus and mother

- Not sensitive:
  - Colonic lesions
  - Biliary tree lesions
  - Sub-placental hematoma



- Safe procedure

- This targeted ultrasound assesses 4 areas for evidence of free fluid: the subxiphoid; the right upper quadrant; the left upper quadrant; and the suprapubic area

CAT SCAN

- Complementary to U/S & DPL
- Penetrating wounds of flank & back
- Can miss diaphragmatic and bowel injuries
- Portability
- Spiral CT reduces radiation exposure by 14-30 %

Radiographic examination	Dose (mrad)
Computed Tomography	
Head (1 cm slice)	< 50
Chest (1 cm slice)	< 1000
Upper Abdomen (20 slices 2.5 cm above uterus)	< 3000
Lower Abdomen (10 1 cm slices over the uterus/fetus)	3000 – 9000
Angiography	
Cerebral	< 100
Cardiac Catheterization	< 500
Aortography	< 100

MRI

- MRI may be required for certain trauma, such as spinal cord injuries.
- Generally it is considered safe in pregnancy.
- Paramagnetic contrast agents have not been studied in pregnant women. Use of these agents in pregnancy should be based on risk-benefit analysis with consultation from appropriate specialists.

Cardiotocographic Monitoring

Variability

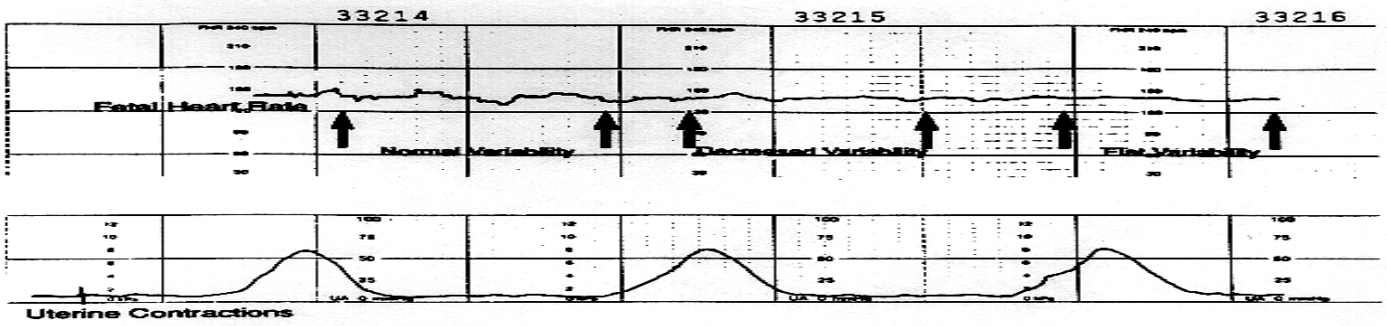


Figure 2. Fetal heart rate tracing that depicts normal, decreased, and absent variability.

Decelerations: Early and Late

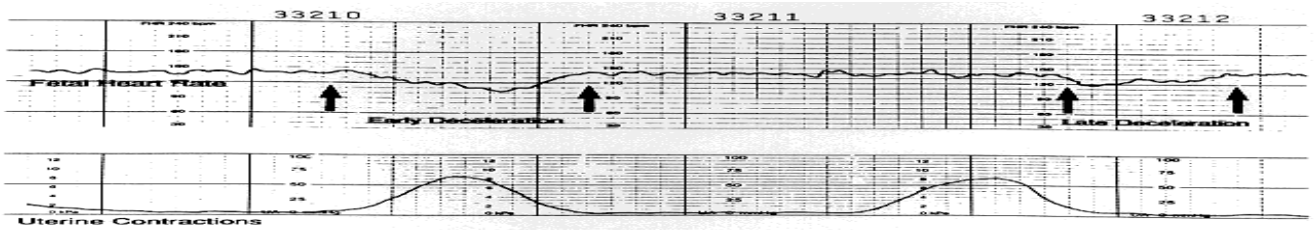


Figure 3. Tocodynamometry tracing that depicts early (Type I) and late (Type II) fetal heart rate decelerations.

Decelerations: Variable

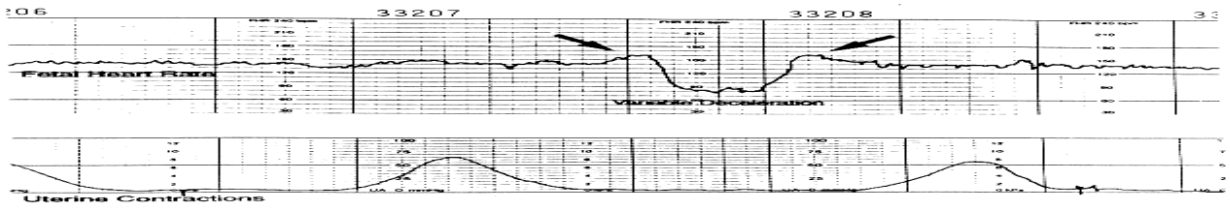


Figure 4. Tocodynamometry tracing that depicts a variable (Type III) fetal heart rate deceleration in relation to uterine contractions.

Diagnostic Peritoneal Lavage

- CT & U/S are better in stable patient.
- Hypotensive unstable pt and if bedside U/S is not available
- Can be performed in any trimester
- Gravid uterus does not reduce the accuracy of DPL for OR
- Limited in detecting bowel perforation and does not assess retroperitoneal hemorrhage or intra-uterine pathology

Several Invasive Tests Short Of Exploratory Laparotomy

- Can be utilized to determine if there has been significant intraperitoneal injury.
- Injection of radiopaque material into the entrance wound followed by a two-view radiograph may demonstrate spillage into the gastrointestinal or genitourinary tract. Such a finding would be an indication for laparotomy.
- Second, amniocentesis to determine whether the amniotic cavity contains blood or bacteria has been advocated. However, the presence of blood or bacteria does not necessarily mandate delivery, and careful consideration with obstetric consultation should precede this decision

Exploratory Laparotomy

- Whether or not to perform exploratory laparotomy will depend on
- The patient's hemodynamic stability and
- The presence or absence of hemoperitoneum.
- It will also depend on the type of penetrating object.

Abdominal surgery in pregnancy and subsequent mode of delivery

- If a woman, for whatever reason, undergoes abdominal surgery in the early phase of her pregnancy, it does not make subsequent caesarean delivery inevitable.
- The mother may be anxious that her abdominal scar is still too fresh and therefore not strong enough to withstand the rigors of labor. This is not so and even a two week old scar can and will withstand labor

General Principles of Trauma Management

Goals of Treatment of the Severely Injured Pregnant Patient

- Goal 1 –SAVE THE MOTHER
- Goal 2 –Save the Fetus if possible

The management of pregnant women with moderate to severe injuries can be divided into:

- Initial treatment and imaging priorities in the pregnant trauma patient are the same as for the non-pregnant patient
- > Primary survey
- > Resuscitation
- > Secondary survey
- > Definitive treatment
    - SAVE THE MOTHER FIRST!!!
    - Limit fetal radiation to 5 rads
    - Limited role for emergency cesarean section
- > Discharge
- > Many of the steps will occur simultaneously once the woman is received in the trauma centre or an emergency department

Primary survey

- > The primary survey is to identify and treat life threatening conditions
- **Airway and cervical spine**
- > Any woman with trauma who is unconscious or has a neck injury above the clavicle should be regarded as having a cervical neck injury until proven otherwise
- **Breathing**
- > Oxygen should be administered at rates of at least 10 litres per minute
- **Circulation and haemorrhage control**
- > Assess peripheral circulation, skin colour and pulse rate and character
- > Control obvious external haemorrhage
- > Position woman on her left side with lateral tilt 15˚ to 30˚
- > If lateral tilt is not possible because of spinal injuries or other trauma, the uterus should be manually displaced to alleviate aorto caval compression
- > Establish intravenous access with at least two large bore 16 gauge cannulae or larger in peripheral veins. Central veins are not the first choice of venous access

- > Treat hypovolaemic shock with intravenous fluid or blood as indicated. The assessment of shock in young women is difficult and must not be based on blood pressure (BP). A normal BP does not mean a normal circulation. In shocked young people BP is maintained well until very late and in the pregnant woman mild hypotension is commonly encountered. The pulse rate and its character, peripheral perfusion and skin colour provide a more accurate assessment of the circulation. Sufficient intravenous fluid should be administered to improve these parameters in women with blunt injury. If the woman remains unstable despite ongoing resuscitation operative intervention is indicated
- > An unstable woman must not be taken to the CT scanner
- > With penetrating trauma, haemorrhage can only be controlled effectively by surgery. Resuscitation to normal BP results in an increase in mortality (Bickell et al. 1994). Until an operating theatre and surgeon can be organised, IV fluid administration should be limited to that sufficient to maintain a palpable radial pulse
- **Disability**
- > Initial neurological assessment using Glasgow coma scale and pupillary response
- **Exposure and environmental control**
- > The woman must be undressed to allow for a full physical examination
- > The woman must always be kept warm or rarely cooled. Hypothermia is one of the main dangers in trauma contributing to worsening acidosis, coagulopathy and infection

Prenatal Trauma Management

Vitals			
Position	Hypotension treatment and prophylaxis > 20 wks, left lateral decubitus		
Hypotension	See Treatments	IV fluids	Transfusion
Hypertension	Criteria = >140 s, >90 d		Treat >160s, >110d
Fetal Uterine Monitoring	> 20 weeks, initiate ASAP		
	If unable to offer OB intervention, stabilize & arrange prompt transfer		
Vaginal Bleeding	Treat hypotension as above, OB consultation, Rh negative gets RhIG		
LAB [in addition to usual trauma studies]			
CBC	Low hematocrit		
Type screen Kleihauer-Betke	Rh negative		
Coagulation Profile	INR, PTT, fibrin degradation, fibrinogen, i-Coombs		
Diagnostic Imaging			
▸ Ordered for the same general indications as in non-pregnancy. ▸ Coordinate with radiologist; consider ultrasound to replace x-ray where possible ▸ Shield abdomen-pelvis and neck when possible			
Treatments (medications listed are commonly recommended)			
IV Fluids	Larger fluid requirements when hypotensive, avoid dextrose (D5) loads		
Oxygen	To avoid fetal hypoxia, high concentration O2		
Intubation & RSI	Generally similar to non-pregnancy		
Analgesia	As needed - inform OB of doses, times if fetal delivery anticipated		
Antiemetics	metoclopramide		5-10 mg IV or IM
	ondansetron		4-8 mg IV
Antibiotics	ceftriaxone		1 g IV
	(if penicillin allergy) clindamycin		600 mg IV
Transfusion	CMV antibody-neg		leukocyte-reduced
Rh-negative	RhIG 1 ampule (300 g) IM		
Tetanus	Td safe		
BP >160 s,>110 d Hypertension	labetalol 10-20 mg IV bolus		
Seizures	Eclamptic	magnesium sulfate 4-6 Gm IV load over 15-20 minutes	
	Non-eclamptic	lorazepam 1-2 mg/min IV	
CPR ACLS > 20 wks	Left lateral decubitus; no response after 4 minutes CPR, consider cesarean of viable fetus		
Disposition			
Admission and Monitoring	4 hours fetal monitoring of potentially Viable Fetus		
Discharge	Prompt follow up with OB		
Source; Dr. Roemer, Dr. Katz, Dr. Becerra, Dr. Ogburn, Jr., Dr. Bowes, Jr., and Dr. B. Roemer			

Table 4. Medications In Pregnancy

Medications	Considerations
Tetanus	Safe to give.
Antibiotics	Avoid fluoroquinolones and gentamycin. Most others are safe.
Rapid sequence medications	May be used.
Analgesia	Narcotics may be used unless delivery is imminent. NSAIDS should be avoided because of potential compromise of the uterine blood supply.
Sedation	Propofol may be given. Benzodiazepines are class D and should be avoided if possible.
Seizure medications	Phenytoin, valproic acid, and benzodiazepines should not routinely be given in pregnancy but can be used in critical situations such as status epilepticus. Remember to consider eclampsia as a potential etiology in the seizing patient.
DVT prophylaxis	Pregnant patients are at increased risk for DVT. Low molecular weight heparins and SQ heparin can be used in pregnancy.

Resuscitation

- > Monitor response to initial treatment with pulse rate and peripheral perfusion.
- Blood pressure can be a distraction; if low it confirms the woman is significantly hypovolaemic but a normal BP does not necessarily imply a normovolaemic, fully resuscitated woman
- > Radiology
- > The following plain films must be taken
- > Chest
- > Pelvis
- > Lateral C spine

Secondary survey

- > A complete physical examination is performed to identify all other injuries.
- Orogastric tube and urinary catheter are inserted
- > Continue to regularly assess maternal pulse, blood pressure, urine output as appropriate
- > Obstetric evaluation
- > Fundal height
- > Uterine tone, contractions, and tenderness
- > Fetal heart rate
- > Vaginal bleeding or evidence of spontaneous rupture of the membranes
- > Pelvic examination
- > Cardiotocography for at least 4 hours if **24 weeks or more**
- > Abdominal and obstetric ultrasound

- > Radiographic imaging (CT scan) as indicated when the woman is stable
- > Laboratory investigations for all trauma in pregnancy should include:
- > Complete blood picture and coagulation studies
- > Group and save
- > Biochemistry
- > Kleihauer test
- > Laboratory investigations for women with moderate to severe trauma in pregnancy:
- > Group and cross-match
- > Coagulation studies
- > Serum electrolytes
- > Renal function test
- > Serum glucose
- > AST and ALT
- > Amylase
- > Arterial blood gas analysis
- > Kleihauer test – quantify with flow cytometry, if the Kleihauer test indicates significant feto-maternal haemorrhage
- > Urinalysis

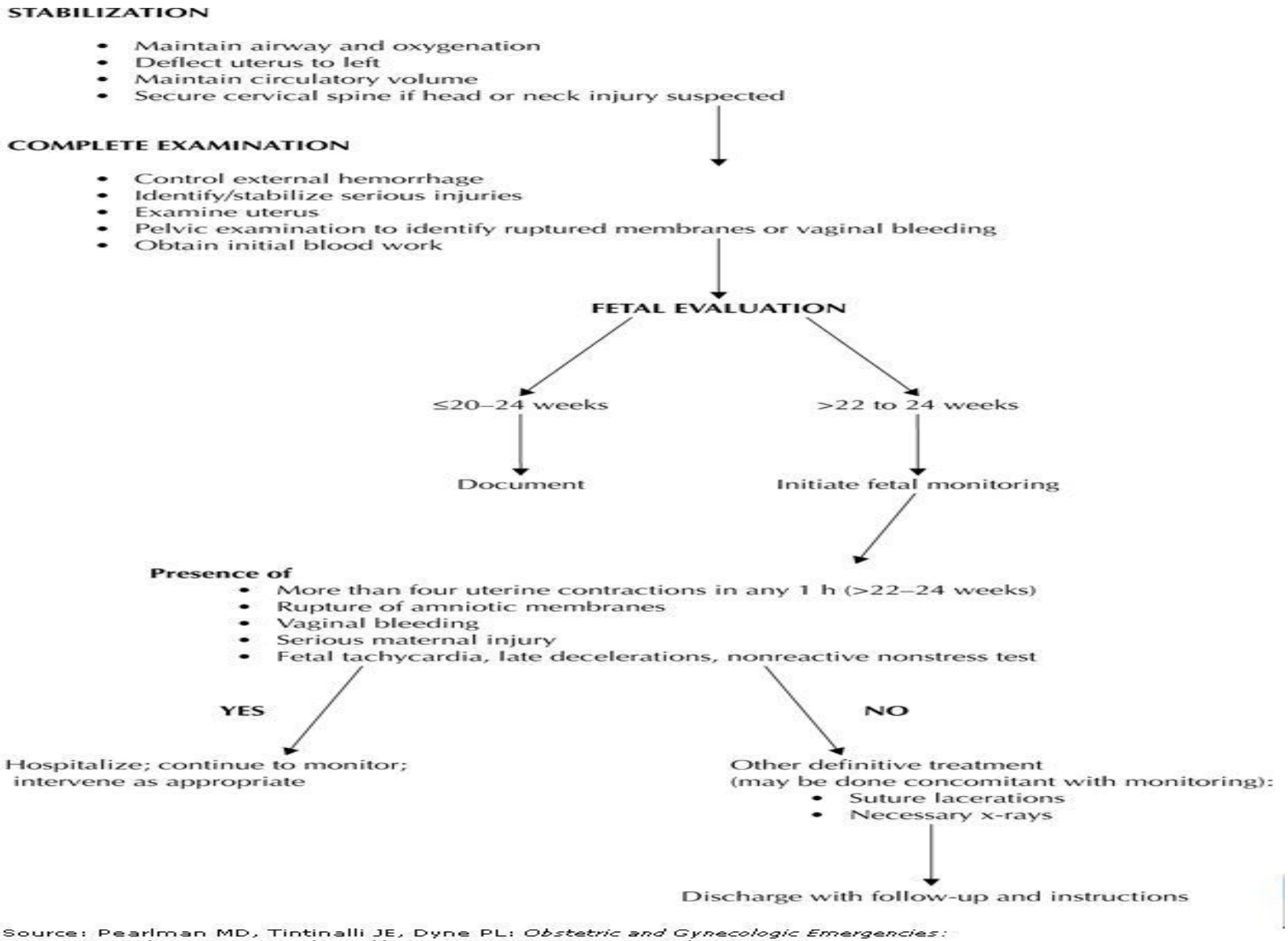
Definitive care

- > Ongoing management of any further injuries should be undertaken at good Medical Centre and Intensive Care Unit).
- The pregnant woman should be retrieved or transferred as soon as possible
- > In the presence of abdominal trauma (particularly with ultrasound evidence of intra peritoneal fluid), persistent hypotension and tachycardia despite appropriate fluid resuscitation is an indication for immediate midline laparotomy to definitively control intra abdominal bleeding (abruption, uterine rupture, splenic rupture, vascular injury etc)
- > If a caesarean section is necessary trauma surgeons should be present to assess and treat any maternal injuries
- > Consider venous thromboembolism prophylaxis
- > Administer Rh (D) immunoglobulin (625 IU CSL for gestation > 12 weeks) if the woman is Rh negative and has no pre-existent Rh (D) antibodies

- > Women suffering trauma in pregnancy should be admitted for fetal assessment if the gestational age is thought to be ≥ 20 weeks
- **Cardiotocography**
- > If the gestation is known to be or could be 24 weeks or more, electronic fetal monitoring (EFM) should be continued for a minimum of 4 hours following the initial abdominal trauma
- > Maternal trauma may be associated with placental abruption
- > In severe maternal trauma, CTG may be important, primarily as a monitor of maternal wellbeing. Placental circulation may be compromised before hypovolaemia is otherwise apparent.
- > If the gestational age is unknown, a fundal height at the level of the umbilicus (20 centimetres or more) can be used as a guide until more accurate dating is possible
- > Medical review after 4 hours continuous EFM
- > If discharge criteria (see below) are not met, intermittent EFM should be continued for 24 hours (at least one 20 minutes trace every 4 hours)
- > Indications for more extensive fetal monitoring are:
- > Uterine contractions > 1 every 15 minutes
- > Uterine tenderness
- > Signs of fetal compromise on cardiotocography
- > Evidence of vaginal bleeding
- > Rupture of the membranes
- > Positive Kleihauer test
- > Ultrasound suggestive of placental or cord abnormality
- > Any evidence of serious maternal injury

Discharge

- > Review after 4 hours of initial electronic fetal monitoring
- > Discharge criteria:
- > No signs of fetal compromise
- > No uterine activity
- > No ruptured membranes
- > No vaginal bleeding
- > No evidence for feto-maternal haemorrhage on Kleihauer test
- > Normal ultrasound findings
- > Ensure all Rh (D) negative women with abdominal trauma have received a dose of 625 IU CSL Rh D immunoglobulin even if the Kleihauer test is negative
- > Discharge home with instructions for the woman to return if:
- > Any signs of preterm labour
- > Abdominal pain and / or vaginal bleeding
- > Change in fetal movements



Source: Pearlman MD, Tintinalli JE, Dyne PL: *Obstetric and Gynecologic Emergencies: Diagnosis and Management*: http://www.accessemergencymedicine.com

gorithm for management of blunt abdominal trauma during pregnancy. (From Pearlman MD: Motor ehicle crashes, pregnancy loss and preterm labor. *Int J Obstet Gynecol* 57:127, 1997. Used with ermission.)

Peri-mortem Caesarean section

In the event of cardiac arrest, when initial resuscitation attempts fail,

delivery of the fetus by emergency caesarean section may improve the chances of successful resuscitation of the mother and fetus.

Caesarean section improves the chances of survival by relieving aortocaval compression caused

by the gravid uterus. Even with lateral displacement of the uterus, maternal cardiac output is

significantly impaired during CPR.

The UK Resuscitation Council recommends that caesarean section be performed early, aiming for delivery within 5 minutes of cardiac arrest;

however the gestational age of the fetus is important in determining specific management:

Gestational age < 20 weeks. Urgent caesarean need not be considered since aortocaval compression

by the uterus is unlikely to compromise maternal cardiac output.

Gestational age 20 – 23 weeks: Caesarean delivery within 5 minutes to maximize chances of maternal

survival but at this gestation, neonatal survival is unlikely.

Gestational age > 23 weeks. Caesarean delivery within 5 minutes to help save both mother and baby.

The neonate delivered during a peri-mortem caesarean section is likely to be severely acidotic and hypoxic and a paediatric team should be present to continue neonatal resuscitation and support following delivery

Perimortem Cesarean Section

- **Technique:**
  - Make sure it is indicated first and that resuscitative team is ready
  - Vertical incision from xyphoid to pubis
  - Continue straight down through abdominal wall and peritoneum
  - Cut through uterus and placenta (if anterior) longitudinal or transverse
  - Bluntly open uterus and remove fetus
  - Cut and clamp cord

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

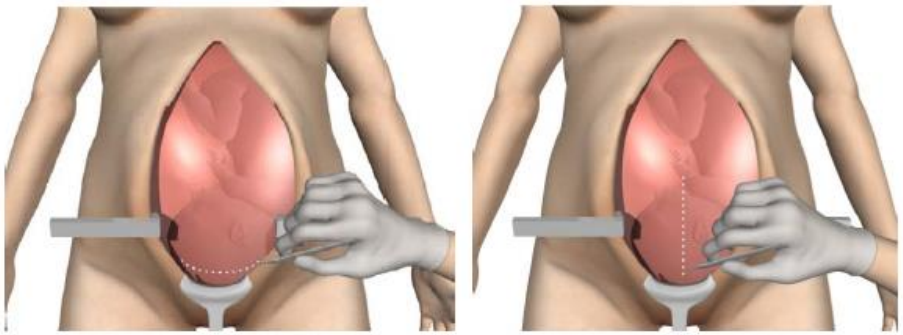
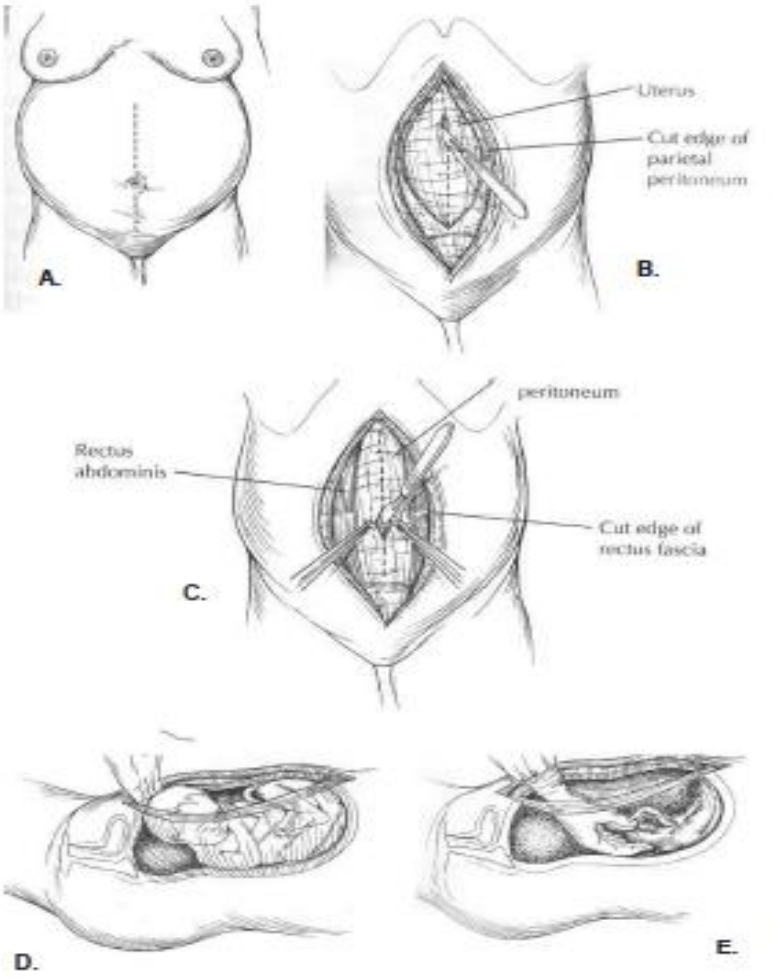


Figure 7. Technique For A Perimortem Cesarean Section



A. Abdominal incision. B. Incision through the fascia and muscles into the peritoneum. C. Vertical uterine incision. D. Delivery of the fetus. E. Removing placenta and membranes, and wiping the uterus clean with a sponge. *Reprinted from Pearlman Mark D, Tintinally Judith E. Emergency Care of the Woman, Copyright 1998© McGraw–Hill. All rights reserved.*

Summary 1

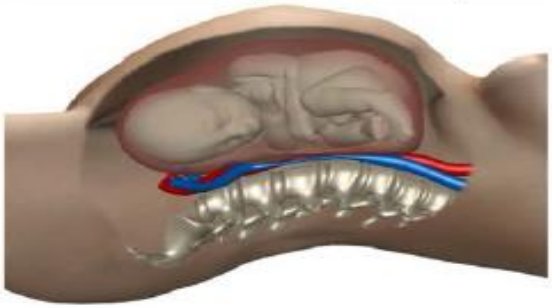
- Motor Vehicle Accidents, falls and assaults are the commonest traumatic mechanisms in pregnancy.
- Think of the possibility of domestic violence / partner abuse.
- Pregnant women need to wear seat belts properly.
- Don’t over-react to the fact that patient is pregnant.
- ACLS and all usual diagnostic studies should be performed. Ultrasound may be useful, but perform needed x-ray studies!
- Management of pregnancy is part of secondary survey.
- Abruption is commonest cause of fetal death in non-life-threatening trauma to mother.
- Abruption most likely with abdominal trauma.
- Abdominal trauma can also cause feto-maternal hemorrhage, uterine rupture, rupture of membranes and pre-term labor.
- Feto-maternal hemorrhage *may* be a cause of pre-term labor.
- KB prep may have value in screening for severe feto-maternal hemorrhage and risk of pre-term labor.
- One dose of RhoGam is routine in trauma to Rh- mother, regardless of KB results.

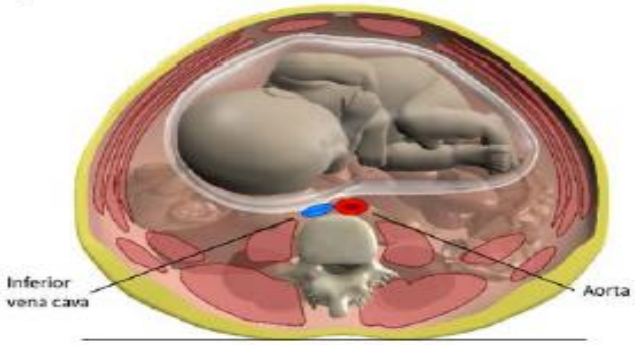
Summary 2

- Pregnant women are vulnerable to apnea and have swollen airways.
- They may be tolerant of blood loss, with delayed fall in BP. LUD is important for 3 reasons:
  - Maternal hemodynamics
  - Fetal oxygenation
  - DVT prophylaxis
- Fetal oxygen uptake is proportional to placental blood flow.
- The fetus will drop heart rate in response to hypoxia. This is the basis for FHR monitoring after maternal trauma.
- This response is related to the “mammalian diving reflex.”
- To deliver an intact newborn, perimortem cesarean section should deliver baby within 5 minutes of cessation of maternal circulation and oxygenation.

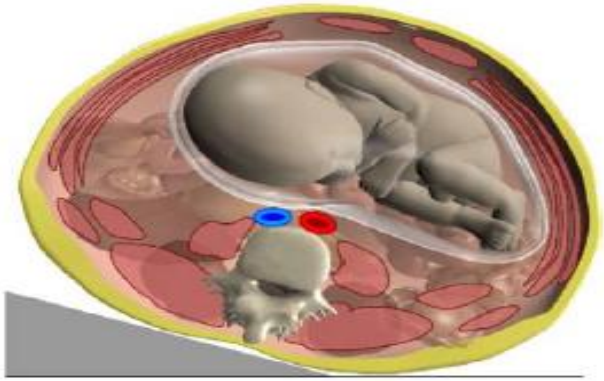
- **Conclusion**
  Trauma has become the most frequent cause of maternal death in the United States of America. The main principle guiding therapy must be that resuscitating the mother will resuscitate the fetus.

Inferior vena cava compression when positioned supine





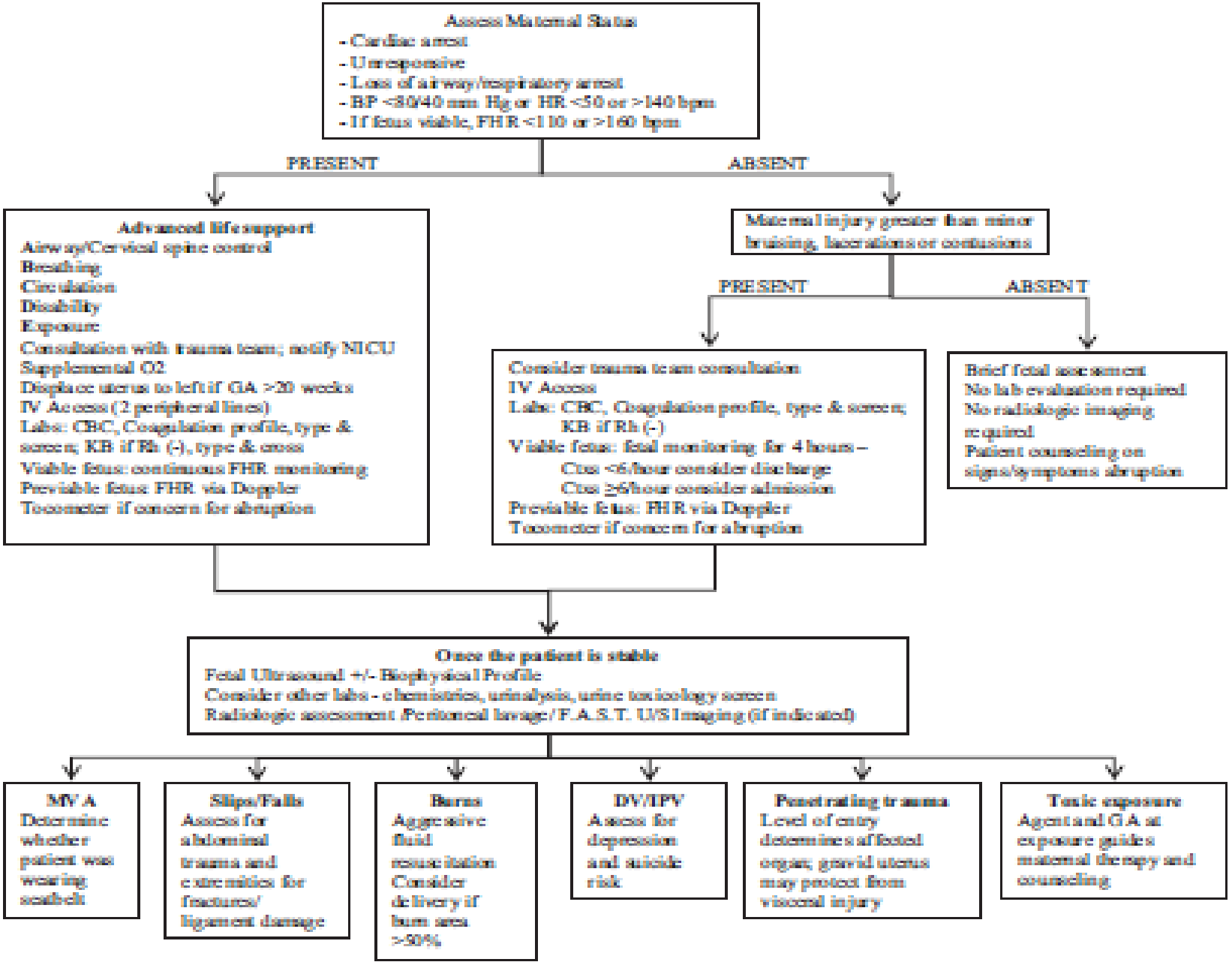
Left lateral tilt (right side up) 15-30 degrees to relieve compression



Manual displacement of the uterus to relieve compression

FIGURE

Management algorithm for trauma in pregnancy

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