

## Review Article

# Trauma in pregnancy – A brief review

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### Abstract

Pregnancy ensues a different normal physiology. This changed physiology adds to the vulnerability of mother to trauma. Treating two lives in one patient adds to the responsibility of the treating physician and increases the anxiety of both the patient and the physician. Incidence of trauma in pregnancy amounts to 6 to 7 % with leading cause being motor vehicle accident. The incidence increases with increasing gestation. This article reviews the incidence of maternal trauma, impact of trauma on altered maternal physiology, resuscitation, principles of management, prevention and diagnostic considerations in pregnant trauma patients.

### Introduction

Trauma during pregnancy is associated with high foetal mortality and maternal morbidity. The uniqueness of the condition of treating two patients in one increases the responsibility of treating physician and adds on to anxiety of both the victim and the treating physician. However it is important that the stability of mother holds priority.

Occurrence of trauma in pregnancy occurs in upto 7% of all pregnancies. The number is still underestimated as many pregnancies are undiagnosed in first trimester. The incidence is maximum in third trimester. Motor vehicle crashes are the major cause of maternal trauma during pregnancy accounting for 55% of trauma followed by falls (22%), assaults (22%) and burns (1%) [1]. Trauma accounts for 6 to 75% of deaths in pregnant females. The leading cause of mortality in these is head injury and haemorrhagic shock. Obstetric trauma has been associated with risk factors such as young age, alcohol use, drug use and domestic violence [2-6]. Some studies have found pregnancy to be itself a risk factor for trauma [7,8].

Foetal death in first trimester is related to maternal hypotension leading to uterine hypoperfusion [9]. Deaths in the next two trimesters are due to direct trauma to the uterus. 11% of the foetal deaths are due to maternal deaths. 82% are related to motor vehicle accidents, while rest are accountable to firearm injuries and falls (6 & 3 %) [10]. Foetal deaths has been amounted as 60 % in major trauma to pregnant female and is as high as 80% in presence of maternal shock [11].

Mother not only provides nutrition to the foetus but also protects the foetus by the amniotic fluid and the thick walled uterus around it. Studies have reported preterm labour, low birth weight, foetal distress and foetal death in pregnant females sustaining even minor injuries. Patients in third trimester are at risk of early labour, placental abruption, amniotic rupture, and foetal-maternal blood transfusion [12-16]. Among the causes placental abruption is the leading cause of foetal death and accounts for upto 60 to 70 % foetal losses after the pregnant female sustains severe injury [7,17-20].

### Implication of physiologic changes in pregnancy on manifestation of trauma

Pregnancy causes physiologic changes, so even normal appearing tests may actually be abnormal in pregnant patients.

1. The normal pregnant patients hyperventilate and maintain an end tidal CO<sub>2</sub> lower than the normal values, thus a value in the normal range is actually alarming and a sign of hypoventilation and impending respiratory failure in pregnant trauma patients.
2. There is diminished respiratory reserve making hypoventilation less tolerated.
3. Increase in plasma volume, so patient might have lost a significant amount of blood before any signs of hypovolemia appear.
4. The baseline heart rate is higher (by 10 to 15 beats per minute) and blood pressure is lower than the normal particularly in second trimester in these patients making diagnosis of hypovolemia even difficult.
5. Bleeding may be internal like in concealed placental abruption making decision to resuscitate difficult especially in view of delayed signs of hypovolemia.
6. There is generalized edema in pregnancy. So crystalloid and colloid should be used with caution for volume replacement. However if the total body water is depleted crystalloid may be used for initial replacement. Among crystalloid use of excessive normal saline should be avoided due to risk of hyperchloremic metabolic acidosis.
7. Airway edema, weight gain, decreased functional residual capacity, reduced compliance, increased airway resistance, increased oxygen requirement, lax lower esophageal sphincter and delayed gastric emptying may lead to potential airway disaster [21].
8. The abdominal examination for any sign of injury becomes fallacious from second trimester onwards due to enlarged

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uterus and stretching of abdominal musculature and peritoneum which masks important signs.

9. There is also a higher rate of orthopaedic injury due to ligamentous laxity, lower centre of gravity and greater back strain. Also exacerbation of lordosis and kyphosis and shifted centre of gravity due to enlarged uterus makes injury to back more susceptible.
10. The enlarged uterus leads to shifting of bowel upwards leading to an increased risk of bowel injury in superior abdominal injury.

## Management of pregnant trauma patients

### Principals of pre-hospital care

Any female of reproductive age group should be treated as pregnant until proven otherwise. At any time maternal life should be given priority over the foetus. The general care is same as any other patient with a few notable exceptions:-

1. Due to compression of Inferior Vena Cava by the uterus these patients should be maintained in the left lateral decubitus position or if not possible then left uterine displacement must be done.
2. In severely injured patients two large bore intravenous access should be taken above the diaphragm.
3. Transport to the nearest hospital providing obstetric care is essential [22].
4. Since the child is in a dependent state and susceptible to hypoxia and hypotension, any signs of these should be addressed immediately by giving supplemental oxygen (maintaining maternal oxygen saturation minimum of 95%) and sufficient intravenous fluid to maintain appropriate blood pressure [22].
5. Mother should be transferred to the nearest ER or trauma care unit if severely injured, foetal age more than 23 weeks, non-viable foetus, any major suspicion of obstetric trauma.
6. Military anti-shock trousers or pneumatic anti-shock garment has been used to support blood pressure in hypotensive trauma patients during transport. In pregnant patients it is important to note that only the leg compartment should be inflated and abdominal compartment should be left due to its adverse effect on uterine blood flow [22]. Initial pressure of 50 mm hg should be done and response of patient should be seen. It must be inflated further only if patient is still hypotensive. These suits also splint the pelvis fractures after the initial inflation. These suits are however harmful in second and third trimester of pregnancy and are relatively contraindicated in these cases except in ruptured ectopic pregnancy [23,24].

### Primary survey

The routine airway, breathing and circulation should be accessed and intervention made as needed. Following are the changes in the management of pregnant patient from the general population-

**Airway-** A smaller size endotracheal tube is recommended [25]. Cricoid pressure should be given to prevent aspiration in view of increased risk due to increased abdominal pressure, lax lower esophageal sphincter, delayed gastric emptying. Chances of failed intubation are 8 times higher during pregnancy [26]. Consideration

should be given to difficult airway and difficult airway cart must be kept ready. Insertion of nasogastric tube is indicated in unconscious and semi unconscious patients to avoid aspiration [27].

**Breathing-** saturation should be maintained above 95% via supplemental oxygen by face mask, nasal cannula or any means available. Chest tube insertion is done 1 to 2 intercostal spaces higher than the normal [28].

**Circulation-** two large bore intravenous line should be secured above the diaphragm due to enlarged uterus pressing on the iliac vessels. Initial resuscitation is with fluid and blood if needed. In case of urgent need for transfusion O negative blood should be used. Maternal hypotension should be treated aggressively. Fluids are the initially used for resuscitation, and vasopressors are less preferred. Vasopressors should be used only when blood pressure cannot be maintained even after fluid resuscitation. Vasopressors have adverse effect on uteroplacental blood flow [22]. Among vasopressors, epinephrine and norepinephrine may compromise the uterine blood flow and are best avoided [29]. However dopamine (5ug/kg) and ephedrine can be used without additionally compromising the uterine blood flow Bicarbonate should be used with caution as it leads to maternal hyperventilation [30].

Pregnant patients in second or third trimester should be nursed in left lateral decubitus position to avoid supine hypotension syndrome. Another option is left tilt of body by a wedge/backboard (in suspected spinal injury patients) or left uterine displacement. These also facilitate chest compressions if needed [31]. Supine hypotension may decrease venous return by as much as 30% [32]. For moribund pregnant patients following trauma the current recommendation is to deliver the foetus if viable within 5 minutes of start of cardiopulmonary resuscitation.

### Secondary survey

The gestational age is determined. Foetus above 24 weeks is considered viable in the US. Thus a fundus level upto umbilicus may be considered viable given the error in this method (20 weeks corresponds to umbilicus). History taking is important as certain maternal conditions have a major impact on management like in preclampsia, patients have leaky capillaries and compromised renal function and are prone to develop pulmonary edema in case excessive fluid is given. They also have greater susceptibility to anaemia and hypovolemia due to vasoconstricted state. Other pre-injury conditions must also be looked into like previous caesarean section, preterm labour, anaemia, any chronic illness etc. History related to trauma such as presence of vaginal bleeding, anaemia, leakage of amniotic fluid should also be taken. All patient should be thoroughly examined. Patients should be examine with scrutiny especially for any concealed haemorrhage. Vaginal examination should be done for effacement, any leak, bleeding, laceration etc.

### Foetal monitoring

History should be taken for foetal age. All pregnant women more than 20 weeks should be monitored by cardiotopography for atleast 6 hours [1,33-37]. Although a few earlier studies has recommended using monitoring upto 48 hours due to the late manifestation of abruptio placentae [38,39]. There have been recommendations for all pregnant trauma patients of 23 weeks or more with the following, to be admitted for observation for 24 hours – uterine tenderness, significant abdominal pain, vaginal bleeding, sustained contractions, rupture of the membranes, atypical or abnormal foetal heart rate pattern, high risk mechanism of injury, or serum fibrinogen <200 mg/dL. Foetal heart rate

monitoring should be done in more than or equal to 23 weeks gestation. Before 23 weeks foetal viability should be confirmed. A combination of electrophysiologic monitoring and physical examination gives 100% negative predictive value for adverse foetal outcome [40,41].

### Rh antigen and alloimmunisation

All Rh negative pregnant women at risk should be given 300 micrograms of Anti D immunoglobulin within 72 hours of trauma. 300 micograms of immunoglobulin prevents alloimmunisation by 30 ml of foetomaternal haemorrhage. Mostly foetomaternal haemorrhage is contained to less than 30 ml of blood. Additional dosing may then be supplemented by Kleihauer-Betke test [42]. Rh antigen develops by 6 th week gestation age [43]. As little as 0.001 ml of blood may sensitize a RH negative mother. Kleihauer-Betke should be performed in all Rh negative patients with more than 12 week-gestation [44,45]. In a study by Muench et al, Kleihauer-Betke studied as a predictor of preterm labour [45].

### Radiology in pregnant trauma patients

Imaging investigations are of paramount importance in pregnant patients with trauma. Imaging allows for early diagnosis and complete assessment of all injuries, guiding best management plan to surgeons and avoiding unnecessary interventions and surgery. Focussed assessment with sonography in trauma (FAST) is economical, readily available, portable, and most important of all devoid of any ionising radiations. It gives large amount of substantial information in a very short scan time. It can detect hemoperitoneum, major visceral organ injury, pleural/pericardial effusion and pneumothorax. Ultrasound is useful in assessing the foetal age, foetal well-being, confirmation of foetal demise, any foetal injuries, placental location and placenta praevia. Doppler ultrasound can provide vital information regarding vascular injury both in maternal and fetal circulation, guiding appropriate management for timely delivery of baby or termination of pregnancy as case may be.

### Ionising radiation and foetus

Imaging by radiographs and CT in pregnant patients pose a major concern of deleterious effect on fetus by exposure to ionising radiation used in these modalities. According to American College of Radiology (2008) practice guidelines for imaging pregnant or potentially pregnant patients and supported by the American College of Obstetricians and Gynecologists and the National Council on Radiation Protection and Measurements, fetal radiation doses of less than 50 mGy are not associated with increased fetal anomalies or fetal loss throughout pregnancy [46-49].

CT examinations should be done with low dose exposure settings and multiple scans should be avoided as far as possible. The American college of radiology recommends usage of iodinated contrast only in absolutely necessary cases and informed consent be obtained from the patient. The effect of iodinated contrast on foetus have not been found detrimental though thyroid profile in neonate in first week is recommended if mother is exposed to iodinated contrast during pregnancy. Radiographs are especially useful for the evaluation of bony injuries, pneumothorax, pneumoperitoneum and CT scan is essential for evaluation of complex bony injuries, visceral and vascular injuries. According to ACOG a single exposure does not induce any harm and terminating the pregnancy is not needed, however multiple exposure should be avoided by replacing X ray with ultrasound and MRI whenever possible [11].

During 2 to 7 weeks of gestation (organogenesis) and 8 to 15 weeks (foetal period) the foetus is most susceptible to ionising radiation

[15]. At 8 to 15 weeks gestation the foetus is at high risk of central nervous system effects. Spontaneous abortion, microcephaly, microphthalmia, behavioural defects, cataract, growth restriction and mental retardation may occur at exposure more than 5 mGy [15]. There is a definite increase in likelihood of fetal carcinogenesis if there is exposure above the threshold limit. Common radiological procedures provide radiation dose as follows- abdominal radiograph 0.001–0.003 Gy (0.1–0.3 rads), lumbar spine radiograph 0.001 Gy (0.1 rads), CT abdomen and pelvis 0.02–0.05 Gy (1–5 rads) [16].

MRI has been found to be safe during pregnancy in most studies. MRI is especially useful for evaluation of complex neurologic, spinal and soft tissue injuries in stable patients. Gadolinium is a category C drug according to the US FDA used as a contrast in MRI study. The American College of Radiology recommends to avoid its use during pregnancy and if used the risk and benefit should be discussed with the patient [17].

Thus if needed a modality which does not cause any radiation exposure such as MRI and US should be used, and if this is not possible then lowest dose of radiation should be used.

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