

Update in obstetric trauma management

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Summary

Trauma during pregnancy is the leading non-obstetrical cause of maternal death and remains the most common cause of foetal demise. It complicates 6% to 8% of pregnancies, 0.4% require hospital admission and 0.1% suffer major trauma (Injury Severity Score (ISS) >15).

Motor vehicle accidents and domestic violence account for most cases of maternal major trauma, while falls, burns, homicide, suicide, penetrating trauma, and toxic exposure account for the remainder.

Trauma management needs multidisciplinary team of emergency physician, obstetrician, anesthesiologist & surgeons. Major trauma causes obstetric & fetal complications & may end by maternal death. Perimortem cesarean section is important to save both mother & fetus. Pregnant trauma victims experience nearly 2-fold higher mortality compared to non-pregnant.

DEFINITION AND DIAGNOSIS

Trauma during pregnancy is the leading non-obstetrical cause of maternal death and remains the most common cause of foetal demise. It complicates 6% to 8% of pregnancies, 0.4% require hospital admission and 0.1% suffer major trauma (Injury Severity Score (ISS) >15).^{1,2}

The initial evaluation and management of the traumatized pregnant patient requires a multidisciplinary team to provide the optimal care for both mother and fetus. Although the resuscitation of the injured pregnant patient follows the same algorithmic protocol of all trauma patients, but it is essential to understand all of the anatomical and physiological changes that occur during pregnancy. Foetal outcomes are directly correlated with early and aggressive maternal resuscitation.³

Motor vehicle accidents and domestic violence account for most cases of maternal major trauma, while falls, burns, homicide, suicide, penetrating trauma, and toxic exposure account for the majority of the remainder.⁴

A 2013 systematic review of studies on trauma in pregnancy⁴ reported that the incidence rate of motor vehicle crash (MVC) during pregnancy has been estimated at around 207/100,000 pregnancies. While the incidence of domestic violence was 8307/100,000 live births. Blunt trauma accounts for 69% of trauma among pregnant women, whereas penetrating trauma accounts for only 1.5% of trauma during pregnancy.

Epidemiology of obstetric Trauma

Physical Violence

Interpersonal violence during pregnancy carries a high risk to both the mother and fetus. A global systematic review described a prevalence during pregnancy of 1-20%.⁴ Intimate partner violence constitutes the majority of cases and increases with poverty as seen in India (21-28%)⁵, and some Asian countries (4-48%).⁶ It is also related to the community culture, religion, poverty and large families. Das et al., in 2013 have reported that one in seven women suffered intimate partner violence during or shortly after pregnancy in Mumbai slums.⁵ A similar study in Vietnam suggested that exposure to intimate partner violence during pregnancy increases the risk of preterm birth and low birth weight.⁴

Ibrahim et al., studied violence during pregnancy in 1,857 Egyptian women aged 18 - 43 years and reported prevalence of violence among 44.1% of the studied group.⁷

Motor Vehicle Accident

Motor vehicle crashes involving a pregnant driver were associated with elevated rates of adverse pregnancy outcomes, including preterm birth, stillbirth, placental abruption, and premature rupture of membranes (PROM).

In 2013, Cathrine et al., suggested that among pregnant drivers who were involved in one or more

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Figure 1: The correct way to wear the seat belt

crashes, 2% were reportedly unbelted and 18% were driving in vehicles without airbags.⁸

The strong association between motor vehicle accidents and trauma in pregnancy raises the importance of the proper use of seatbelts. The correct way to wear the seat belt during pregnancy is keeping the lap belt low, on the pelvic bones, and placing the shoulder strap between the breasts (Figure 1).^{8,9}

Homicide & Suicide

The governmental health authorities in many countries have adopted a surveillance system, looking at the mortalities among pregnant women. They aimed to identify the most common non-obstetric causes of death including violence, homicide, suicide and intoxication.

In 2016, a study done by Wallace et al., reviewed the deaths in US states with enhanced pregnancy mortality surveillance from 2005–2010. They compared mortality among four groups of women: pregnant, early postpartum, late postpartum and non-pregnant/non-postpartum. They estimated pregnancy-associated mortality ratios and compared to non-pregnant/non-postpartum mortality ratio. They observed that homicide was more common in pregnant victims who were young, Black, and undereducated while pregnancy-associated suicide occurred most frequently among older White women. They also concluded that risk of homicide among pregnant/postpartum women was 1.84 times that of non-pregnant/non-postpartum women, while risk of suicide was decreased.¹⁰

APPROACH TO ASSESSMENT AND MANAGEMENT OF OBSTETRIC TRAUMA

Trauma in pregnancy can be classified into three different types: blunt abdominal trauma, pelvic fractures, and penetrating trauma. Obstetric trauma has been associated with serious complications including maternal injury, shock, internal hemorrhage, intrauterine fetal demise, direct fetal injury, abruptio placentae, and uterine rupture. Hence, a rapid efficient evaluation is critical to ensure the well-being of the mother and fetus.¹¹

Assessment and Management

A multidisciplinary team is warranted to optimize outcome for both the mother and fetus. This team involves trauma surgeons, emergency medicine physicians, obstetricians, neonatologists, nursing staff, and technicians. Whenever the patient's condition necessitates surgery, an expert obstetric anesthetist should be involved.¹² The team should consider the anatomical and physiological changes in pregnancy¹³, which could affect the type of injury and the mother's response to trauma.¹⁴

According to Obstetric Trauma Guidelines 2014¹⁴, the following sequence of actions should take place upon initial notification:

1. Gather vital information from the notifier using the MIST mnemonic:

- M** Mechanism of injury
- I** Injuries found or suspected
- S** Signs: respiratory rate, pulse rate, blood pressure, SpO₂, GCS or AVPU
- T** Treatment given

Primary Survey

Every female of reproductive age with significant injuries should be considered pregnant until proven otherwise. Immediately from the time of starting a primary survey, pregnant patients beyond 20 weeks gestation should be nursed in a left lateral tilt of 15–30 degrees to relieve the aorto-caval compression.

A 30-degree tilt can be achieved by placing a wedge under the patient's right hip, using pillows, rolled towels or bags of fluid, or by manually displacing the uterus to the left. The latter is preferred as it allows effective chest compression during cardiopulmonary resuscitation (Figure 2).^{14,15}

Gestational age can be identified from the fundal level. At 24 weeks gestation, the fundal level will be at the level of umbilicus.



Figure 2: Manual tilt of the uterus

A systematic approach based on the ABCDE survey should be applied to assess and treat an acutely injured patient.

ABCDE approach: A for Airway, B: Breathing, C: Circulation, D: Disability and E for Exposure.

The goal is to manage any life-threatening conditions and identify any emergent concerns, especially in a pregnant patient who may present with polytrauma complications.

Airway with cervical spine protection

Assess for airway stability:

Airway assessment includes signs of airway obstruction (use of accessory muscles, paradoxical chest movements and see-saw respirations). Intubation is considered early if there are any signs of decreased level of consciousness, or unprotected airway. Intubation is considered even earlier in pregnant patients compared with non-pregnant patients because pregnant women desaturate more rapidly and are more susceptible to irreversible hypoxic injury. Maternal hypoxia is associated with poor fetal outcomes.

However, the likelihood of failed intubation is higher in a pregnant patient. Hence, intubation of a pregnant patient should be attempted by the most senior and experienced airway-skilled practitioner.¹⁵ Direct laryngoscopy using a standard laryngoscope (Macintosh blade) is commonly performed. A short-handled laryngoscope should be available for pregnant women because enlarged breasts may impede insertion of a laryngoscope with a standard-length handle.¹⁶

Preparations for a difficult intubation should start early, with all available equipment for difficult airway management including rigid laryngoscopy with multiple blades, McCoy laryngoscope (with movable tip), different sizes of nasal and oral airway, small size of endotracheal tubes, supraglottic devices, stylets, illuminating stylet, (Gum-elastic) bougie, and video assisted laryngoscopy if available.

Availability of the fibre-optic would be helpful for intubation of patients with a known difficult airway or facial or cervical fractures. In limited resources countries, the anesthetist may assign another colleague to maintain manual in-line stabilization or keep the collar in place during intubation.¹⁵

Cricoid pressure can be considered during intubation to decrease the risk of regurgitation of gastric contents into the pharynx. However, cricoid pressure maybe adjusted or removed if it comprises the view.

Breathing

It's advised to give high flow oxygen (15L) to keep oxygen saturation of the traumatized pregnant about 100%¹⁴ or at least above 95%.¹⁵ This recommendation aims to avoid the well-known poor fetal outcomes from maternal hypoxia. Chest auscultation is mandatory to detect wheezes or decreased air entry caused by underlying chest injury. A nasogastric tube should be inserted in a semiconscious or unconscious injured pregnant woman to prevent aspiration of acidic gastric content. Suspected fracture base of skull should be excluded before insertion of the nasogastric tube.¹⁴

Blunt chest trauma may be complicated by life-threatening injuries; tension pneumothorax, hemothorax or aortic rupture. These injuries should be diagnosed by clinical assessment, chest x-ray, computed tomography or bedside ultrasonography. Management includes needle thoracostomy or chest tube.^{17, 18} In traumatized pregnant patient, chest tube should be inserted one or two rib spaces higher (in the third or fourth intercostal space) due to the elevation of diaphragm in pregnancy.¹⁴

Circulation

The mother's heart rate, blood pressure and neck veins should be checked, while signs of hemorrhage are inspected. The potential for significant internal bleeding is suspected in relation to the mechanism of injury. However, pregnant patients 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.¹⁴

Insertion of 2 large bore intravenous cannulae (14–16 gauge) is recommended for all seriously injured trauma patients to facilitate initial rapid crystalloid infusion and possible further blood transfusion if required. Administration of fluids and blood products during resuscitation should proceed according to standard trauma protocols. However, some modifications should be made in the pregnant trauma victim.¹⁵

Fluid resuscitation should be initiated if hypovolemia is suspected to maintain both maternal and fetoplacental perfusion. In the resource-limited environment, the use of cheaper crystalloid solutions is still recommended as crystalloid is effective in improving neonatal oxygenation if there is evidence of maternal hypo tension.^{19, 20} Commence resuscitation with up to 1–2L of crystalloid solution. Blood or blood product transfusion should be considered in subsequent fluid administration. If uncross matched blood is indicated, group O Rh-negative blood should be used to prevent antibody development. The goal is to transfuse blood and crystalloid to maintain hematocrit at 25–30% and urine output greater than 30cc/hr.¹⁵

Vasopressors are known to have adverse effect on uteroplacental perfusion. Hence, vasopressors in pregnant women should be used only for intractable hypotension that is unresponsive to fluid resuscitation. In cases of maternal hypotension unresponsive to intravascular volume expansion, the vasopressor of choice is ephedrine. Ephedrine has both β -2 and α -1 agonist properties, thus increasing uterine blood flow and maternal blood pressure.³

The focused assessment with sonography for trauma (FAST)

The focused assessment with sonography for trauma (FAST) examination is considered as the best practice at this time. A FAST evaluates four areas where fluid or blood may accumulate in the abdomen including the subxiphoid pericardial window, hepatorenal recess, perisplenic and suprapubic view.¹²

A large retrospective review suggested that FAST examination has a reasonable specificity and accuracy of > 90% to detect free fluid in pregnant trauma patients (positive FAST scan).¹³

Some authors believe that in the stable pregnant trauma patient, computed tomography (CT) scanning is indicated only if the FAST examination is positive. While a recent retrospective review study found that CT can accurately diagnose placental abruption, in the presence of a negative FAST examination.¹⁵ The obstetrical ultrasound assessment includes fetal heart rate, gestational age, presentation, placenta, abruption, evidence of fetal injury, and evidence of intraabdominal/pelvic fluid.

As cost of obstetric ultrasound becomes more affordable in Low and middle-income countries LMICs, it was found to improve patient management.²¹ The LMICs have published articles documenting the importance of the use of FAST in trauma care. Articles from South Africa, Liberia, Rwanda and Peru concluded that ultrasound is a reliable and affordable alternative to computer tomography (CT) in context of trauma.²²

Disability: neurological status

Assessment of neurological status includes assessment of consciousness level using Glasgow Coma Scale (GCS) or AVPU assessment (Alert, responds to Voice, responds to Pain, Unresponsive).

Pupillary response and blood sugar level should also be assessed.

Exposure

Patient's clothing and jewelry are removed in order to assess all areas of the body. It is mandatory to avoid hypothermia in traumatized pregnant patient, as it leads to metabolic acidosis and bleeding. Hence, it is advised to monitor the patient temperature aiming to keep the patient temperature above 36.5°C. The patient is kept warm by keeping her in warm environment and warming the intravenous fluids.¹⁴

Secondary survey

Secondary survey should only be started once the patient is stable with no any life-threatening injuries.

A detailed Top to Toe examination is performed, followed by fetal assessment.

History is obtained using **AMPLE** acronym to assist with gathering important information:

- A** Allergies
- M** Medication
- P** Past medical history
- L** Last meal
- E** Events leading to injury

Head-to-toe examination:

Abdominal examination in pregnancy is challenging and complicated by the enlarged uterus.

Particular attention is given to signs of injury around the pelvis; tenderness over the uterus, uterine contractions, vaginal bleeding or ruptured membranes.¹⁵

Fetal assessment:

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

CTG allows monitoring of the fetal heart rate and uterine contractions. Normal fetal heart rate ranges from 120 to 160 bpm.¹⁷

Types of trauma

Blunt trauma:

Damage control laparotomy (DCL) is considered as life-saving procedure with the potential to diagnose the destructive clinical outcomes that can be expected under the circumstances of blunt abdominal trauma with exsanguination.²³

In a systematic review of the current literature from January 2006 to July 2016, including a total of 95,949 patients, motor vehicle crash was the most frequent cause of blunt trauma, followed by falls, assault, both domestic and interpersonal violence.²⁴

Direct fetal injury is uncommon with blunt trauma owing to the absorption of forces by the uterus, placenta and amniotic fluid. However, foetal injury and death is an indirect result of maternal shock and death.²⁴

During the first trimester, the uterus is protected by the bony pelvis.²⁴ As the uterus enlarges, it displaces the bowel cephalad, rendering the fetus more vulnerable to injury. Thinning of the uterine wall with growth and the relative decrease in amniotic fluid volume also contribute to fetal vulnerability. Bladder and spleen injury and retroperitoneal bleeds are the most common injuries resulting from blunt trauma.²⁵

Pelvic fractures are commonly associated with blunt trauma and are associated with significant retroperitoneal hemorrhage as a result of engorged pelvic vessels.

Obstetric complications of blunt abdominal trauma include preterm labor, preterm delivery, preterm premature rupture of membranes, abruption, fetomaternal hemorrhage, and rarely, uterine rupture.

Penetrating trauma:

Penetrating trauma is due to knife wounds or gunshot injuries and requires immediate surgical exploration. The gravid uterus grows cephalic pushing in all the viscera and acts as a protective barrier in penetrating trauma. Therefore, uterine injury is common in these cases, thus causing direct fetal injury and

increasing both maternal and fetal mortalities.

Management of penetrating trauma does not differ in the pregnant patient than non-pregnant.¹² Exploratory laparotomy is not an indication for caesarean delivery, but the gravid uterus makes abdominal surgery difficult; hence caesarean section may be required.¹⁵

Burns:

The incidence of burn injuries during pregnancy ranges from 7% to 15%,²⁶ with the majority of cases in developing countries. Burn

occurs from direct thermal injury, inhalation injury to the airway, carbon monoxide, cyanide, or dissipation of electrical current. Maternal and fetal mortality risk depend on the amount of total body surface area burned (TBSAB) which can be calculated by the rule of 9's.²⁷ The rule of nines is meant to be used for: second-degree burns (partial-thickness burns), third-degree burns (full-thickness burns). For adults, the rule of 9's is:

Arm (including the hand):	9% each,
Anterior trunk (front of the body):	18%
Posterior trunk (back of the body):	18%
Genitalia:	1%
Head and neck:	9%

As severe burn in pregnant women is not common, thus lacking data to define an adequate therapy.

Fluid resuscitation is of paramount important in burn during pregnancy, being a hyperdynamic state with total body plasma volume is expanded. Thus, the risk of a hypovolemic shock is increased and can lead to placental insufficiency. However the resuscitation management is not different from that in the non-pregnant woman. Intravenous fluid replacement can be initiated using the Parkland formula (percentage of TBSA burned X 4mL per kg of body weight).²⁸

There are many resuscitation formulas adopted by different burn units as Ruijin's formula which is a modification of Evans formula. Ruijin's formula sets the ratio of crystalloid solution versus colloid solution at 1:1.²⁹ Appropriate modification of the volume of solution for fluid resuscitation based on vital signs and urine output of the patient is advised.

Much literature has indicated that septicemia and sepsis are the main causes of death in pregnant women, thus the administration of antibiotics is essential.

Inhalation injury for a pregnant patient needs special attention and needs early intubation. This type of injury causes significant edema that aggravates the physiological edema of the oropharynx and larynx associated with pregnancy. Carbon monoxide has increased affinity for the hemoglobin molecule and displaces oxygen. Fetal circulation has a 15% increase in carbonmonoxide which decreases the ability for oxygenation of the fetus, and may lead to fetal heart rate changes. Carbonmonoxide toxicity is treated by 100% oxygenation, or hyperbaric oxygenation if available.²⁷

Maternal mortality rate in the studies varies from 30% in the study of Ogbogu et al.,²⁸ to 70% in other studies.^{29, 30, 31}

The effect of burn on the fetus includes abortion or preterm delivery as confirmed by many studies. Factors determining the effects on the fetus include increased TBSA, hypovolemia, sepsis, pulmonary injuries (inhalation injury), catabolism and side effects of drugs.^{32,33}

Urgent caesarean delivery is recommended with burns of 55% or more for viable fetuses without delaying for antenatal corticosteroids. For burns of <55%, antenatal corticosteroids may be administered with expectant management.^{34, 35, 36}

Imaging during obstetric trauma:

The ideal imaging modality during pregnancy has not been determined, but computed tomography (CT) appears to have higher sensitivity than plain film x-ray outside of pregnancy.

Although radiographic evaluation of the pregnant patient raises concerns about potential fetal exposure, but diagnostic imaging is not contraindicated in pregnant patients, as it may demonstrate obstetrical complications such as abruption or uterine rupture. Initial radiographic assessment of trauma pregnant women should include imaging of the cervical spine, chest, and pelvis.³⁷

Computed tomography (CT) studies of the abdomen, pelvis, and lumbar spine should be done only if absolutely necessary, because these may subject the fetus to 3.5 rads (radiation absorbed dose). Because maternal head injury is one of the leading causes of maternal death and as head CT generates only 1 rad of exposure with proper shielding, this should be done as needed.

Radiation safety organizations recommend a total dose of no more than 5 rad for pregnant women.³⁸

The greatest risk to the fetus from radiation exists early during the pregnancy, during organogenesis (weeks 2–8) and neural tube development (up to week 15). Ultrasonography and magnetic resonance imaging (MRI) can be used when appropriate and provide no ionizing radiation to mother or fetus.³⁹

Ultrasonography can assess the status of the foetus for foetal heart tones, foetal activity, presentation, placenta, abruption, evidence of fetal injury and approximate gestational age.¹²

Obstetric and Fetal Assessment:

All pregnant trauma patients with a viable pregnancy (≥ 23 weeks) should undergo electronic fetal monitoring for at least 4 hours. Continuous fetal monitoring should be instituted as soon as the mother's status allows, preferably in the emergency department.

FAST was effective in diagnosing placental abruption, fetal cardiac activity, other fetal injuries,¹⁵ evaluation of the pouch of Douglas for hemoperitoneum and distinguishing between intrauterine and extrauterine fluid.¹⁰

Fetal harm may include fetal fractures, especially skull, clavicles, and long bones, intracranial hemorrhage and indirect injury due to fetal hypoxia secondary to: maternal hypotension, fetal hemorrhage, placental abruption or other injury, cord injury and uterine injury. Other fetal complications are spontaneous abortion, preterm delivery, and RBC isoimmunization.¹⁹

Rh immune globulin (RhIG): 40% of trauma victims will have fetal-maternal bleed. All Rh-negative trauma victims should be considered for 1 vial of RhIG (300 μ g/ IM). This is determined by the Kleihauer-Betke (KB) test. The test is an acid elution assay on blood drawn from the maternal patient. After lysing cells with acid, it shows the amount of fetal blood in the maternal system. Even with negative Kleihauer-Betke (KB) test. It should be given as soon as possible, and within 72 hours of the accident.^{14, 31}

If the mother's condition is stable, Caesarean delivery is not required in the event of fetal death. Method and timing of delivery can be planned with the obstetric consultant. If a laparotomy will be performed for other reason, the obstetrician should be notified immediately. However, Caesarean delivery is still not indicated unless there is pelvic fractures or bleeding from uterine injury.^{31, 40}

Cardiopulmonary Resuscitation (CPR) and Perimortem Caesarean Section (PMCS)

Effective CPR is difficult in near-term pregnant woman because of difficult chest compressions and aorto-caval compression by gravid uterus.

Modifications of CPR in traumatized pregnant patients:

1. Left lateral displacement of the uterus is mandatory to relieve the caval compression.
2. Defibrillation as in non-pregnancy state with removal of fetal uterine monitors prior to shock.
3. Advanced airway is established early with C-spine stabilized.
4. Closed-chest compressions: 100 per minute using 30:2 ratio with ventilations. The rescuer's hands are placed slightly above the inter-nipple line.
5. Intravenous line is established above the diaphragm.
6. Advanced Cardiac Life Support (ACLS) drugs as indicated; adrenaline, amiodarone, magnesium, atropine and sodium bicarbonate.
7. If no maternal response after 4 minutes of ACLS, immediate Caesarean delivery should be performed in the emergency department. Thoracotomy and open cardiac massage may be considered at this time if the patient or fetus is believed to be viable.

If fetal age is greater than or equal to 24 weeks: attempt to save life of both mother and fetus by delivering the fetus to relieve aorto-caval compression, thus increasing venous return to mother's heart & help resuscitation attempts. If the gestational age is less than 24 weeks, urgent Caesarean unnecessary as aorto-caval compromise unlikely.

Assessment of fetal heart tones should be done throughout, as allowed by circumstances.^{41, 42, 43}

Role of Anaesthesia in Obstetric trauma management

The anaesthesiologist has multiple concerns while supporting the pregnant patient with major trauma, namely, adequate resuscitation and supporting surgical haemostasis. Ideally, the obstetric anaesthesiologist being more familiar with the physiology of pregnancy can play an important role in resuscitation, in addition to providing anaesthesia for surgical intervention.⁴⁴

Women injured in Traumatic motor vehicle accidents have high incidence of surgical procedures and Caesarean delivery. Pregnancy is not a contraindication to operative management of pelvic fractures, or neurosurgical intervention. The later should not be delayed.^{32, 40}

Indications for emergency caesarean delivery include a stable mother with a viable fetus in distress and traumatic uterine rupture.

During surgery for the traumatically injured, the fetus can be at risk of hypoxemia, teratogenicity, and preterm delivery. However, commonly used anaesthetic medications in pregnancy are considered to be safe, including benzodiazepines and inhalational anaesthetics. When large haemodynamic changes are anticipated, fetal monitoring should be utilized where the surgical site allows for monitoring, to help assess the adequacy of placental perfusion.¹⁹

General anaesthesia should always be induced with rapid sequence induction and cricoid pressure in order to decrease the risk of regurgitation of gastric contents in the pharynx.⁴⁵

For rapid sequence induction of trauma patients, the following induction agents are commonly used; etomidate, propofol and ketamine. Propofol is widely used anaesthetic/sedative with pregnant patients because it has a rapid onset and short duration of action.¹⁴

The Advanced Trauma Life Support Guidelines of the American College of Surgeons recommend the use of etomidate under these circumstances for rapid sequence induction and intubation (RSI) of the trachea. However, ketamine has many desirable pharmacodynamic properties that make it a reliable alternative to etomidate, and should be considered when a traumatically injured patient requires emergency intubation. These properties are the rapid onset, no need to adjust dosing in organ failure, minimal impact on haemodynamic stability and reducing opioid requirement for analgesia.⁴⁶

Succinylcholine is an appropriate and safe drug, and it should be used for RSI and intubation for pregnant trauma patient, even if they have head-injury. The succinylcholine-induced intracranial pressure (ICP) increase has been a concern in the past, but recent studies have shown that clinical significance of this increase have been exaggerated.⁴⁵

For maintenance of anaesthesia, literature shows that perioperative opioids are recommended with little risk.¹⁴ Ketamine has an important role as a continuous infusion throughout the operation and Intensive care unit stays. Ketamine remains invaluable due to its ability to maintain cardiorespiratory stability while providing effective sedation and analgesia.⁴⁷ It may have the advantage of decreasing the incidence of depression and PTSD (post-traumatic stress disorder) that many trauma patients develop during recovery.⁴⁸

Tranexamic acid is recommended for management of severe bleeding with trauma. It is considered safe for the fetus and can be given for traumatized pregnant patients. However, It is unknown if the use of tranexamic acid in the pregnant trauma patient reduces mortality.⁴⁹

Prophylaxis for venous thromboembolism may be done with sequential compression devices, heparin, or enoxaparin. Both heparin and enoxaparin do not cross the placenta. If anticoagulation is required,

LMW heparin & fondaparinux are the safest choices during obstetric trauma.⁵⁰

Transfusion therapy:

The recommended transfusion therapy for traumatized pregnant include:

1. Rapid early replacement of coagulation factors & platelets to improves outcome
2. RBCs are given in high ratio.
3. Empiric transfusion based on clinical assessment rather than laboratory results.⁵¹

Obstetric Trauma outcome

Trauma during pregnancy has adverse effects on both maternal and newborn morbidity. The outcomes of pregnant women who suffer trauma depend on the type and extent of trauma. Obstetric patients who have even minor trauma are at a high risk of developing complication even after being rapidly stabilized, treated, and discharged.¹⁹

Penetrating trauma carries a fetal mortality rate of 30 - 80%, but the maternal mortality rates are low as the fetus protects the underlying organs of the pelvis. After blunt trauma, the morbidity and mortality depend on the severity of the force. Various series report morbidity rates of 5 - 45% in pregnant women suffering from blunt trauma. In many series, fetal demise is high when moderate to severe haemorrhage occurs.^{11, 15, 40}

Meanwhile, motor vehicle accidents during pregnancy were associated with increased adverse pregnancy outcomes, including preterm birth, stillbirth, placental abruption, and premature rupture of membranes. Crashes were especially harmful if drivers were unbelted.⁸

However, Deshpande et al. in 2017, have compared pregnant to non-pregnant after traumatic injury and found that pregnant women and girls had a lower injury severity score and were significantly more likely to experience violent trauma. Pregnant trauma victims had almost twice the rate of mortality compared to the non-pregnant.⁵²

Foetal survival rate from the study of Battaloglu et al. in 2016, was 56% following trauma. Foetal death in pregnant trauma patients most frequently occurred in the 2nd trimester.⁵³

Another study of Tanizaki et al., suggested that high level of Maternal alpha-fetoprotein (MSAFP) may be a predictor of poor foetal outcome following trauma during pregnancy regardless of the severity of the trauma or the mother's haemodynamic status.⁵⁴

CONCLUSION

Trauma is the leading non-obstetric cause of death and disability in pregnant women, especially in western countries. Resuscitation priorities in obstetric trauma are the same as non-pregnant; treat first which kills first. Resuscitation requires multi-disciplinary team of emergency physician, obstetrician, anaesthesiologists and surgeons.

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