

RESUSCITATING A PARTURIENT FOLLOWING TRAUMA

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Violence and trauma is on the rise in our society. Under the present situation in the country a number of admissions to hospitals with multiple trauma due to fire arm and bomb blasts, are on the increase.

The management of these patients needs expertise and resources, especially where the patient is with special conditions. We report a case of a pregnant lady with a twenty week gravid uterus admitted with multiple injuries to Accident Service, National Hospital of Sri Lanka, following a bomb blast. In spite of resuscitation and undergoing emergency damage control surgery she succumbed to complications of her injuries three days later.

A twenty eight year old lady was admitted to the resuscitation room of the Accident service following a blast injury among mass casualty admissions. She was given red priority. On primary survey her airway and breathing were supported with intubation and ventilation and a cervical collar was applied. She had lost a large amount of blood due to traumatic amputation of the right upper limb and extensive damage to her anterior abdominal wall. Bleeding was arrested temporarily by applying pressure. Intravenous transfusion was commenced following insertion of intravenous cannulae. Monitoring of vital signs was commenced. She was taken to the operating theatre for damage control surgery for abdomen and right upper limb.

At the theatre, the surgeon identified that she was having a deficit of the right half of the anterior abdominal wall, laceration of the right lobe of the liver, which was sutured and packed to arrest bleeding. The lacerations of the transverse colon and the stomach were sutured. There was no damage to the gravid uterus which was approximately 20/52 size. Laparostomy was

performed. Right upper limb stump was cleaned and bleeding arrested.

Right sided intercostal tube was inserted as there was suspicion of haemothorax on the right side. Following haemostasis and fluid resuscitation, blood pressure was stabilized around 90 mmHg systole and 60 mmHg diastole. An infusion of dopamine was started. Right subclavian central venous catheter was inserted and Central venous pressure (CVP) measurement was around 9 cmH₂O.

Anaesthesia was maintained only with oxygen and nitrous oxide and analgesia was maintained with two 50µg fentanyl boluses. Surgery took about two hours and after satisfactory haemodynamic parameters were achieved, the patient was transferred to Accident service Intensive Care Unit (ICU). By this time 10 units of fresh blood, 5 units of fresh frozen plasma and 5 units of platelet rich plasma had been given. As correct blood loss assessment was difficult, it was assumed that about 5 litres of blood was lost during the whole process.

In the ICU she was paralysed and ventilated. Continuous transfusion of blood products were necessary to maintain her haemodynamic parameters. On the second post operative day she developed disseminated intravascular coagulation and finally she passed away on the third post operative day due to multiorgan failure in spite of all organ support measures.

Discussion

Incidence and Aetiology

Trauma occurs in approximately 5% of pregnancies. Conversely, trauma complicates one in twelve pregnancies. Trauma is one of the

leading causes of death in women of child bearing age ⁽¹⁾.

Aetiology of maternal trauma is most often motor vehicle accidents (55%), falls (22%), assaults (22%) and burns 1% ⁽¹⁾. Younger gravid patients are at a higher risk of trauma than older ones.

However, foetal deaths have different aetiologies; motor vehicle accidents 82%, gun shot wounds 6%, falls 3%, with maternal deaths accounting for 11% of foetal deaths ⁽¹⁾. Factors that predict foetal loss following trauma are, high injury severity score, high abdominal or thoracic abbreviated injury score, abnormal uterine activity and elevated base deficit ⁽¹⁾. All these are associated with increased risk of adverse foetal outcome. Normal levels of the above factors following trauma, are associated with increased rates of foetal survival.

Trauma during pregnancy increases the incidence of a poor outcome. The complications are preterm labour, low birth weight and foetal loss following prolonged maternal hypotension or hypoxemia, placental abruption, uterine rupture due to direct trauma to the uterus. All these complications can lead to maternal death.

Although life threatening trauma accounts for < 8% of total trauma, it is associated with a 40% - 50% risk of foetal loss. Foetal loss is much less common with minor injuries (1% - 5%). However, these injuries are much more common than life threatening trauma resulting in majority of foetal loss ⁽¹⁾.

Anatomical and physiological changes relevant to trauma in pregnancy

Anatomical changes:

Most obvious anatomical change in pregnancy is gradual uterine enlargement as the pregnancy progresses. The uterus becomes an intra-abdominal organ at approximately 12 weeks of gestation, vertex of uterus can be palpated at umbilicus at 20 weeks and uterus reaches the costal margin at 36 weeks of gestation and therefore increases the incidence of trauma to the uterus when exposed to abdominal trauma. Uterus is relatively thin walled, especially during the

latter stages of pregnancy making it more susceptible to injury. Although foetus is bathed in a sea of amniotic fluid, the placenta is relatively inelastic, making it more prone to abruption with even minor maternal trauma.

In late stages of pregnancy descent of the foetus into the pelvis can make it more susceptible to head injury, particularly with maternal pelvic trauma.

As the uterus enlarges, maternal organs are displaced upwards. Finally in the late stages of pregnancy, majority of the gastrointestinal tract may be found above the inferior costal margins. The diaphragm is displaced upwards and because of compression of the thoracic structures mediastinum and cardiac radiological images may appear widened.

Physiological changes

During pregnancy, maternal physiology undergoes many changes. These are largely secondary to the effects of progesterone and oestrogen which are produced predominantly by ovaries in the initial part and placenta in the later part ⁽²⁾. These changes can affect the normal responses to trauma. The majority of changes occur in the cardiovascular system although other systems are also affected.

In general, there is a mild increase in heart rate (10-15 bpm) and a mild decrease in mean blood pressure (5 – 15 mmHg), starting from the second trimester. Tachycardia and hypotension in the gravid trauma patient should not be attributed solely to pregnancy. Other important changes are, increase in red blood cell volume by 20-30% and rise in plasma volume by approximately 50% ⁽²⁾.

This leads to physiological anaemia of pregnancy and by 32nd -34th week of gestation, haematocrit of 30-34% is common and normal ⁽²⁾. Because of the increased plasma volume, significant losses can be sustained before changes are seen in monitored cardiovascular vital signs, masking the normal response to blood loss.

Cardiac output (CO) also increases in the second trimester which can contribute to increased oxygen demands of the pregnant patient. Maturing foetus causes marked increase in uterine blood flow, which can comprise 20% of the CO. Maternal

haemorrhage, may be compensated by decreasing uterine blood flow, therefore, maternal hypovolaemia may first be manifested as foetal distress rather than by maternal tachycardia, hypotension or dyspnoea.

Positional changes in blood pressure are well documented in gravid patients. Supine hypotension can cause 30% drop in CO. This can be alleviated by manual uterine displacement as left lateral decubitus position may not be feasible in a pregnant patient with trauma potential spinal injury. Placement of spinal board at a 15° angle until spinal injury has been ruled out can also be used to prevent supine hypotension syndrome⁽³⁾.

Respiratory changes in pregnancy are progressively related to increased minute ventilation. By the second trimester, hypocapnia is common and even a PaCO₂ value of 30mmHg on arterial blood gas is normal for pregnancy. Similarly compensatory metabolic alkalosis is also seen⁽⁴⁾.

Several other physiological changes in pregnancy affect normal response to trauma. Decreased gastrointestinal motility and laxity of the lower oesophageal sphincter, combined with the anatomical compression of the stomach, makes pregnant trauma patients more prone to aspiration. Early gastric decompression is warranted during evaluation.

Renal blood flow is increased by 50%, so normal upper limits of serum creatinine and urea are much lower, compared with non pregnant patients. Therefore normal values in pregnant patients may indicate impaired renal function⁽³⁾.

Neurological changes deserve careful assessment as changes accompanying pre eclampsia may mimic findings seen in head injury. Furthermore, computerised tomography (CT) may be harmful to the growing foetus⁽³⁾.

Assessment and Management

Pregnancy should be considered as a possible factor in the trauma management of all women of reproductive age. Therefore where feasible a brief focused obstetric history should be obtained.

If a woman is thought to be pregnant, standard trauma guidelines for pregnant patients should be followed. However aortocaval compression is deleterious to both the mother and the foetus and should be prevented by 15° left lateral tilt. This

can be achieved even with a suspected spinal injury by placing the patient on a rigid spinal board and tilting the whole board or by performing cautious manual uterine displacement in supine position.

Physical examination may be misleading due to physiological changes in pregnancy, which were discussed earlier. A non tender abdomen doesn't rule out serious foetal injury. Any marked tachycardia and hypotension should not be related to normal physiological changes in pregnancy. As maternal oxygen reserves are limited, high-flow oxygen should be given using non rebreathing mask with a reservoir and oxygen saturation should be monitored. Whenever emergency blood transfusion is necessary, without wasting time for grouping and direct testing, O negative blood can be used. Evaluation of pregnant trauma patient requires a multidisciplinary team, involving trauma surgeon, obstetrician, anaesthesiologist, paediatrician, nurses and radiology and laboratory personnel⁽¹⁾.

Trauma team should follow established protocol for evaluation and emergency management, keeping in mind the special changes in pregnancy. Clinicians should perform all necessary tests and procedures on the mother that are indicated, which include radiological imaging, ultrasonography and laboratory investigations⁽¹⁾. Laboratory tests must be compared with the normal values in pregnancy. Special emphasis should be made to coagulation testing as they are more prone to develop disseminated intravascular coagulation. Gynaecological assessment including vaginal examination and obstetric assessment of foetal heart sounds is necessary. Foetal distress might be the first sign of maternal haemodynamic deterioration⁽⁴⁾.

Airway management is the first priority in all trauma patients. Pregnant patients pose special challenges for several reasons, as described earlier. Therefore tracheal intubation should be instituted early and should be performed by an experienced team in the emergency room and the goal of ventilation should be to maintain a PaO₂ of more than 90mmHg and PaCO₂ around 28-32 mmHg. Intercostal tube if necessary should be inserted higher up than the usual position due to the diaphragm being pushed up by abdominal organs. As the pregnant women needs to lose more blood before clinical signs of hypovolaemia appears, in

resuscitation she typically requires higher volumes for replacement. During resuscitation controlling blood loss and adequate fluid replacement is paramount. Rapid fluid volume replacement is important in hypovolaemic shock but reduced colloid osmotic pressure of pregnancy may increase the risk of pulmonary oedema in over transfusion, particularly in preclampsia. Monitoring volume status may be inaccurate as there is poor correlation between central venous pressure and left ventricular filling pressure.

Vasopressors does not have a role in treating hypovolaemic shock and in pregnancy there is no exception.

The values of pH and PaCO₂, which are normal for pregnancy, should be maintained to prevent foetal distress. Additional mild hypocapnia is safe for the foetus but should not be lower than 24 mmHg.

Controversy about the type of fluid that should be used in fluid resuscitation is the same in pregnant patients. Use of mannitol in therapeutic doses, have been reported to be safe, but caution is needed to avoid hyperosmolarity more than 320m osmol/l which can cause foetal dehydration.

After life threatening injuries have been identified and treated in the primary survey, foetal evaluation can be performed and then proceed to secondary survey as for the non pregnant patients.

In addition to usual investigations Rhesus typing in pregnant mother is essential and all rhesus negative mothers should receive immunoglobulins to suppress the potential immune responses⁽³⁾.

Uterine contractions are common following trauma in pregnant patients, which can be an early sign of placental abruption. Ultrasound scan should be performed as a first line investigation before instituting tocolytics such as magnesium sulphate. This drug may exacerbate maternal hypotension by inducing maternal vasodilatation and in these situations invasive blood pressure monitoring is recommended.

Caesarean section may be indicated in the initial management of the injured pregnant patient in response to haemodynamic instability, either to control haemorrhage (like in placental abruption or uterine rupture) or occasionally to enable the exposure and control of non obstetric intra abdominal bleeding.

Isolated foetal indications for caesarean section such as foetal distress, is only appropriate in the presence of a viable foetus (POA>26 weeks) and maternal haemodynamic stability. In a haemodynamically unstable patient, who has foetal distress without signs of placental abruption, uterine rupture or intra abdominal bleeding, appropriate maternal resuscitation is the best approach to improve the intra uterine foetal condition.

In cases of non traumatic maternal cardiopulmonary arrest unresponsive to initial resuscitation, it is recommended to perform surgery to deliver the foetus within five minutes for effective resuscitation of the mother. Studies show that peri mortem caesarean section in trauma does not improve maternal outcome. With regard to foetal outcome it is much less effective than in non traumatic cardiopulmonary resuscitation. Consequently, the effectiveness of peri mortem caesarean delivery for saving both the mother and foetus in trauma is an unresolved issue.

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