

## Anaesthetic Management of Traumatic Brain Injury in Pregnancy for Emergency Craniotomy

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### Abstract

Management of head injury requiring emergency craniotomy in a parturient is indeed challenging. Unexpectedly mild head injury can threaten the life of mother or fetus. A multidisciplinary approach to management which is individualized according to severity of injury and gestational age is appropriate. Neuroanaesthetic approach should strive to provide balance between therapy for mother and risks for fetus. Evidence based recommendations from randomized controlled trials to manage such cases is limited. We report a case of 27 year old woman in late 2nd trimester with extradural and subdural hematoma requiring urgent decompressive craniotomy. Post-operatively, she was managed for two days in the intensive care unit with regular monitoring of Fetal Heart Sound (FHS). Pregnancy continued till term with good outcome of mother and child.

**Keywords:** Pregnancy; Traumatic head injury; Craniotomy; Neuroanesthesia

### Introduction

Trauma is currently the leading non-obstetric cause of maternal mortality during pregnancy and central nervous system trauma contributes significantly to risk of both maternal and fetal death [1]. Head injury during pregnancy can have deleterious effect on fetal viability, primarily due to systemic effects of trauma like hypotension, hypoxia and acidosis. Severe head injury in pregnancy presents unique challenges because two lives are potentially at risk, both of whom need evaluation and management. We report the intraoperative and postoperative management of a case of traumatic brain injury in mid trimester pregnant patient with successful outcome. Maintaining hemodynamic stability and minimizing stress response with a view to ensure adequacy of uteroplacental blood flow was our top priority.

### Case History

A 27 years old female at 26 weeks of gestational age with BMI of 28.1 (height 160 cm and weight 72 kg), pillion rider on bike came to casualty 2 h after a motor vehicle accident. The GCS was E2M5V1, pupils equally reacting, respiratory rate of 32/min and she was responsive to painful stimulus. History of multiple episodes of vomiting with loss of consciousness was obtained, without any history of seizures. In view of low GCS and to prevent aspiration, decision was taken to intubate her. Standard monitoring was done with electrocardiogram (ECG), pulse oximetry (SpO<sub>2</sub>) and noninvasive blood pressure (NIBP). Heart rate (HR) was 112/min with blood pressure (BP) of 98/67 mmHg. Two large bore intravenous cannulas were secured, and fluids started. Injection ranitidine and metoclopramide was given. Rapid sequence induction and intubation was done with lignocaine 1 mg/kg, propofol 2 mg/kg, fentanyl 1µg/kg and succinylcholine 2 mg/kg to facilitate tracheal intubation using Mcgrath video laryngoscope with manual in line stabilization of head. She was intubated with reinforced cuffed tube and positive

pressure ventilation instituted. After induction BP was 120/70 mmHg with HR of 88/min. A bolus dose of atracurium 0.5 mg/kg was given. A Ryles tube and foleys catheter were inserted. A wedge was kept under right hip for left uterine displacement. A Secondary survey done showed no other injuries. Focused assessment with sonography for trauma was negative except for single live intrauterine fetus. Fetal Heart Sound (FHS) was confirmed by obstetrician and ultrasound scan was negative for signs of placental disruption or fetal distress. Blood sample was taken for electrolytes, complete haemogram, coagulation profile and blood sugar. She was then taken for Computer tomography (CT) Head and neck with shield over abdomen. CT scan revealed 7.0 × 3.0 cm biconvex epidural haematoma (EDH) over posterior parietal region and subdural haematoma (SDH) over fronto-temporal region of left cerebral hemisphere. There was irregular hypodense area of haemorrhagic contusion in posterior parieto temporal region with moderate mass effect and right sided midline shift of 5.0 mm. There was a linear fracture involving left temporo-parietal bone, cervical spine was normal. In view of mass effect and brain edema decision was taken to do an emergency craniotomy for evacuation of EDH and SDH.

Risk of fetal loss was explained and high risk consent obtained. Electronic external cardiac monitor was placed over mother's abdomen for continuous monitoring of FHS. Patient was shifted to OR with transport monitor, portable ventilator and maintaining left uterine displacement, within 30 min of her arrival. In OR, ET tube was connected to ventilator and settings were adjusted to maintain PaCO<sub>2</sub> between 30-32 mmHg. Intra-arterial blood pressure monitoring was established. A central venous line was secured through right subclavian vein. Anaesthesia was maintained with 50:50 oxygen: air and sevoflurane (0.5-1 MAC) mixture and fentanyl infusion 2 µg/kg/hr. Neuromuscular blockade was maintained with atracurium infusion 10 mg/h. After induction of anaesthesia, systolic blood pressure decreased to 95 mmHg, which was corrected with fluid resuscitation and two boluses of Phenylephrine 50 µg each.

Prophylactic antibiotic and anticonvulsant was given as per surgeon's choice. The patient was positioned supine with head placed in Mayfield pins and turned towards right side, maintaining left uterine displacement. A left parietooccipital craniotomy was performed, EDH and SDH was drained and temporal craniectomy was done. Since dura was stretched and brain was swollen, mannitol 20 gm was given intravenously slowly. There was approximately 450 ml of blood loss which was replaced with isotonic crystalloids. Patient remained haemodynamically stable throughout the surgery with systolic blood pressure in the range of 110-130 mmHg and HR of 85-90/min. EtCO<sub>2</sub> was kept in the range of 25-28 mmHg. Fetal Heart Rate (FHR) remained in the range of 140-154/min. Intraoperatively normothermia was maintained. Postoperatively patient was shifted to intensive care unit with a decision to keep her sedated and paralysed for next 36 h in view of brain edema.

She was kept sedated with midazolam infusion 50 µg/kg/h and fentanyl infusion 1.5 µg/kg/h and paralysed with atracurium infusion 10 mg/h. MAP was maintained in the range of 80-90 mmHg. ABG and blood glucose level were checked periodically. FHS was monitored by intermittent auscultation. There was no episode of fetal bradycardia. After tapering and stopping the sedation GCS was E4M6VT. She was weaned and extubated successfully on day two. Anticonvulsants were continued till term. She was discharged on day seven from hospital with regular FHS and full GCS, continuing anticonvulsant therapy till term. She remained on regular follow up and delivered a healthy female baby with Apgar score of 8/10 by normal vaginal delivery.

## Discussion

Trauma can complicate 7-8% of all pregnancies; motor vehicle accidents and domestic violence are the two predominant causes for it [2] most frequent causes of trauma related fatality in pregnancy involves head and neck injuries, respiratory failure, and hypovolemic shock [3].

As trauma in pregnancy is on rise worldwide, we are likely to encounter such cases more frequently in near future. So anaesthesiologists should be ready to face such new challenges. Hypoxia and hypotension are two important enemies of both pregnancy and head injury, so cardiopulmonary resuscitation in mother should be achieved rapidly. Aggressive fluid resuscitation is encouraged even in normotensive patients, as signs of hypovolemia may be masked in pregnancy due to relative hypervolemic and hemodilutional state. Expedient maternal resuscitation is the most effective method of fetal resuscitation. Abnormality in FHR pattern is also first sign of maternal hemodynamic compromise. Since our patient was more than 23 weeks of gestation, FHR monitoring was initiated in the emergency room itself.

Choosing an appropriate anaesthetic drug is another dilemma, as one drug may have favourable obstetric effect but unfavourable neurological effect. Also randomized controlled trials are difficult to conduct in pregnant humans. However high bolus doses or prolonged exposure to drugs should be avoided whenever possible. The main anaesthetic concerns during surgery were to maintain haemodynamic stability so that adequate uteroplacental perfusion and fetal oxygenation could be maintained, and to maintain adequate depth of anaesthesia to avoid any increase in intracranial hypertension. Drug infusions were titrated with strict monitoring of arterial blood pressure

and continuous fetal heart rate monitoring. Opioids are compatible with both neurosurgery and pregnancy. Though remifentanyl is probably safer than any other opioid, non-availability of same in India necessitated the use of fentanyl infusion. Sevoflurane at 1MAC is more effective in inhibiting uterine contraction than desflurane used at same MAC [4]. Both Hypocapnia and hypercapnia can reduce uterine blood flow, resulting in fetal hypoxia and acidosis; PaCO<sub>2</sub>>32 mmHg during pregnancy represents hypercapnia which is associated with increased cerebral blood flow and fetal respiratory acidosis. We instituted mild hyperventilation to maintain PaCO<sub>2</sub> of 30-32 mmHg in order to avoid any fetal stress and hypoxia. Deliberately inducing maternal hypothermia will lead to fetal hypothermia and acidosis, if severe. So normothermia was maintained intraoperatively.

Though propofol belongs to category B, two studies have reported the onset of acidosis in pregnant patient when is used for extended period over 10-12 h [5]. Dexmedetomidine infusion was another option for post-operative sedation; no data is available regarding prolonged infusion in parturient [6]. As per hospital protocol and in view of brain edema, we sedated and paralysed the patient for around 36hours, with midazolam and fentanyl infusion with regular monitoring of FHS. Benzodiazepines offer no advantage over propofol or dexmedetomidine, nevertheless they are often chosen for ICU sedation [7]. Whichever drugs are chosen should be administered carefully in titrated and monitored doses with regular monitoring of FHS and hemodynamics. Remifentanyl is safest among opioids but non-availability of same necessitated the use of fentanyl infusion. No adverse effects have been reported with neuromuscular blocking agents as they cross the placenta in minimal concentration only. There is no data on the use of cis-atracurium infusion in pregnancy. Although most of anaesthetics are safe to use in 2nd trimester, whenever possible prolonged infusion should be avoided.

Management of traumatic brain injury in pregnant patient is a tight rope walk. Initial stabilization of the mother should take priority, but further assessment and subsequent management should consider both the mother and child. However, more studies are required to elucidate the safest and most cost-effective strategies for the management of trauma in pregnancy.

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