Anaesthetic management of a patient with 28 weeks of gestation presenting with right intraventricular recurrent meningioma posted for craniotomy and excision of the tumour.

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Abstract:
Mrs. Shanthi, a 34 year old multigravida, was admitted with history of inability in using left upper limb and left lower limb and history of amenorrhea for six months. She underwent surgery for right intraventricular meningioma six months back. She was diagnosed as a case of recurrent intraventricular meningioma. CT brain showed features of right intraventricular mass with midline shift and USG abdomen revealed single live intrauterine gestation of 28 to 30 weeks. She was posted for total excision of the tumour under endotracheal general anaesthesia. Intraoperative hemodynamic parameters were stable. She was extubated after surgery and shifted to Neuro ICU for observation. The postoperative period was uneventful. The biopsy result revealed high grade meningioma. On follow up, she had delivered an alive male baby by normal vaginal delivery without any complications.

Keyword: Meningioma, Pregnancy, Intracranial pressure, Tocolytics, Craniotomy.

INTRODUCTION:
Neuroanaesthesia during pregnancy encompasses anesthesia for intracranial and spinal surgery and for diagnostic and therapeutic interventions, but is required infrequently. Indications for neurosurgical interventions or interventional neuroradiology during pregnancy include intracranial vascular lesions (subarachnoid hemorrhage, intracranial hemorrhage, arteriovenous malformation and cavernous sinus thrombosis), ischemic stroke, symptomatic intracranial tumour, cerebral abscess, and spinal cord tumours and lesions. Pregnant woman coming for Neuro-surgical procedure pose a great challenge to anaesthesiologist. The physiological changes during pregnancy can have profound implication in the symptomatology and management. Brain neoplasm in pregnant women appears to occur at the same frequency as in non-pregnant women. Meningiomas account for 28% of all the primary brain tumours1. Here with we are presenting a case report of Anesthetic management of a patient with 28 weeks of gestation presenting with right intraventricular...
recurrent meningioma posted for craniotomy and total excision of tumour.

**CASE REPORT:**

Mrs. Shanthi, 34 years, from perambalur was admitted in medical ward with history of weakness in using Left Upper limb and Left Lower limb and diplopia for one day and history of amenorrhea for 6 months. She gave history of previous surgery for Right Intraventricular meningioma done at Govt. Stanley Hospital, Chennai on 15.02.10. There was no other significant medical/surgical illness. She was married and having 4 living children. Last child birth was 8 yrs before.

Patient was on Tab. Phenytoin 100 mg BD, Tab. Phenobarbitione 60 mg BD, and Tab. Acetazolamide250 mg TDS, Inj. Dexamethasone 4 mg BD, Inj. Furosemide 10 mg BD. On physical examination, she was conscious, oriented, thin built, malnourished, with severe pallor. HR- 92/mt, BP: 112/68 mmHg, CVS & RS were clinically normal. Examination per abdomen revealed uterus 28-30 weeks gestation, with FHR 152 bpm. Examination of CNS showed Left hemiparesis with GCS 15/15. Investigations showed Hb: 8.2 grams%, RBS: 93 mg%, Blood urea/Sr.Creatinine: 24/0.9 mg/dl. Serum Sodium/Potassium: 134/4.2meq/l. Blood Group was ‘O’ positive. ECG / CXR: were within normal limits. CT Brain showed features of post-surgery with Right Intraventricular mass lesion with significant midline shift and mass effect.

USG Abdomen showed Uterus 28 to 30 week’s gestation, single live intra uterine fetus with estimated fetal weight of less than 1 kilogram. Examination of Airway showed MPC class II, with normal dentition and neck movements. Her weight was 42 kgs; she was assessed for surgery under ASA III.

**ANESTHETIC MANAGEMENT:**

Plan of anesthesia was ETGA with controlled ventilation. After getting high risk consent explaining the risk of surgery and the fetal wellbeing, patient was wheeled in to O.T with Left uterine tilt with slight head up position with oxygen through face mask 5 liters/min. She was placed on supine position with 15° wedge under right hip. Standard monitors were applied (NIBP, SpO2, ECG, EtCo2 and urine output). Invasive blood pressure monitoring was carried out by cannulating left radial artery and connecting to pressure transducer. Baseline FHR is 145 beats per minute and monitored continuously by attaching a stethoscope in the left spinoumbilical line. Peripheral venous access started with 16 G cannula over Left cephalic vein and 18G cannula in Left dorsum of foot. She was premedicated with Inj. Glycopyrrolate 0.2 mg IV, Inj. Fentanyl 80 µg IV, Inj. Midazolam 2 mg IV, Inj. Ranitidine 50 mg IV. Inj. Isoxsuprime 10 mg was infused IV over 10 minutes in dilution with 100 ml of normal saline. Preoxygenation was done with 100% O2 for 5 minutes. She was induced with Inj. Propofol 100mg IV and paralysed with Inj. Succinylicholine 100 mg IV. Under RSI she was intubated with 7.0 mm cuffed oral endotracheal tube and fixed at 21 cms at the incisor level in Left angle of mouth. Bilateral air entry checked and found to be equal. She was connected to closed circuit with side stream EtCo2
monitor and maintained with N\textsubscript{2}O and O\textsubscript{2} in the ratio of 4: 2 liters per minute. Isoflurane was used at 0.6 - 1.0\%. She was put on left semi lateral Position (Janetta 15/15 with Left hemi paresis. Post op USG abdomen showed normal fetal parameters with FHR – 162 beats / min. Patient was given pain relief with Inj. Paracetamol 1 gram IV 8\textsuperscript{th} hourly and Tocolytics were continued with Tab. Isoxsuprine 10 mg 8\textsuperscript{th} hourly. Anticonvulsants and steroids were continued. She was shifted to postoperative ward on the third day and discharged on the 10\textsuperscript{th} postoperative day. Biopsy report showed High grade meningioma (grade IV) 

**Follow up:**
The patient had delivered an alive male baby on 26.10.10. It was a full term normal vaginal delivery and the baby did not have any complications.

**DISCUSSION:**

**Basic anaesthetic consideration:**
The problems faced by the anaesthesiologist in these situations were two fold. One is due to anesthetising a pregnant woman in her third trimester and the other is due to the effect of meningioma with increased intracranial tension. The anaesthesiologist must develop a plan so that these problems can be managed effectively.

**Problems expected due to pregnancy:**
The most common problem associated with pregnancy is maternal anaemia.(Hb < 11gm/dl ) or haematocrit < 33\%, which is usually

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**Intra op events:**
HR: 106/mt to 145/mt BP: 94/ 57 mmHg to 127/83 mmHg SpO2: 99-100\% EtCo2: 23 – 28 mm Hg FHR: 155 – 168 beats per minute Intravenous fluids: Normal saline 1500 ml was used Blood transfusion: 2 units of ‘O’ positive packed cells were transfused to compensate for the blood loss of 500 ml that occurred during the procedure. Urine output: 600 ml Total duration of the procedure was 3 hours

**Drugs:**
- Inj. Atracurium 25mg IV used initially and top up doses given according to neuromuscular monitoring. She was given Inj. Fentanyl 20 µg IV every 1 hr., Inj. Mannitol 100 grams IV infusion, Inj. Ondansetron 4 mg IV, Inj. Phenytoin 200 mg IV and Inj. Dexamethasone 8 mg IV Intraoperatively. After spontaneous attempts and recovery of patient’s consciousness, airway reflexes and adequate motor power, patient was reversed with Inj. Neostigmine and Inj. Glycopyrrolate 2.0/0.4 mg IV. After thorough oropharyngeal suctioning, patient was extubated.

**Post op period:**
Patient was shifted to Neuro ICU for High dependency care observation. Patient vitals were stable. CVS & RS were clinically normal. CNS – GCS

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secondary to iron deficiency, but it may also be due to the increase in the plasma volume (45%) in excess of an increase in the red cell mass, which is termed as dilutional anaemia. Moreover in terms of tissue oxygen delivery, the reduction in haemoglobin concentration is offset by the increase in cardiac output and the rightward shift of oxygen dissociation curve. During pregnancy, oxygen requirement increase and respiratory mechanics change due to the effect of gravid uterus and weight gain. The combination of decreased FRC and increased oxygen consumption promotes rapid oxygen desaturation during periods of apnoea. Pre-oxygenation of 3 to 5 min before induction is mandatory. Hence we have preoxygenated the patient for 5 minutes to prevent rapid desaturation. Airway assessment and management planning is necessary. Capillary engorgement of the mucosa throughout the respiratory tract causes swelling of the nasal and oropharynx, larynx and trachea. As a result of fat deposition and upper airway mucosal oedema, most pregnant women are considered to be difficult to intubate cases. Smaller than usual oral tracheal tubes are useful and additional equipment to manage difficult airway should be readily available. In our case the airway is MPC class II and we used 7.0 mm endotracheal tube for securing airway. Gastro oesophageal reflux and esophagitis are common during pregnancy. Upward and anterior displacement of stomach by the gravid uterus promotes incompetence of gastro oesophageal sphincter. Elevated progesterone level reduces the tone of the sphincter. Aspiration prophylaxis is considered to be important before anaesthesia during pregnancy, because pregnant women are more likely to experience both symptomatic and silent regurgitation. Ranitidine 150 – 300 mg is given orally 1 hour before anaesthesia. 30 ml of 0.3 M sodium citrate is recommended immediately before surgery. In cases of emergency slow I.V injection can be given immediately before surgery. Rapid sequence induction is advisable early within second trimester to avoid the risk of aspiration. Aortocaval compression is an important and preventable cause of foetal distress. These patients develop signs of shock including hypotension, pallor, sweating, nausea, vomiting and changes in cerebration when they assume supine position. The combination of systemic hypotension due to the effects of general anaesthesia and regional technique along with aortocaval compression can readily produce foetal asphyxia. Effective pelvic tilt of at least 15 degrees to the left to minimise aortocaval compression is required after 20 weeks of gestation by means of either hip wedge or side tilting table. Here we used the semi lateral position to prevent Aortocaval compression by the gravid uterus.

Anaesthetic requirement for inhalational agent is decreased by up to 40% during pregnancy, which normalises by the 3rd day after delivery. The mechanism is uncertain, but serotonergic, hormonal and endogenous opiate changes during pregnancy may be responsible.

**Problems due to meningioma:**

Meningiomas are common forms of brain tumour, usually well circumscribed, slow growing and benign. There appears to be no higher incidence of primary brain tumours in pregnant women as compared to general age matched population, however pregnancy may exacerbate clinical symptoms. The presence of oestrogen and progesterone receptors in the meningioma tissue is well established. The presentation includes signs of a mass lesion such as acute headache, nausea,
vomiting, acute visual loss etc., neurological deficit can result from the mass effect. Tumour enlargement also results in increased intra cranial pressure. Anti-convulsant therapy may need to be implemented or continued in the pre-operative phase, and the pregnancy induced changes occur in the clearance of unbound fraction and half-lives of some anti-convulsant drugs. Neurological advice should be sought.

Problems expected during neurosurgical procedure:
Craniotomies for excision or biopsy of the tumours are common neurosurgical procedures. Meningiomas are the most frequent tumours. The most frequent problem encountered is the fluctuation in the ICP during laryngoscopy and in the perioperative period, which can be reduced to minimum by the judicious use of the anaesthetic agents and techniques. Other complications are venous air embolism, cerebral oedema, hypertension, and complication with regard to position of the patient. Location of the tumour, size, and its vascularity status should be known as there is a potential for blood loss. Foetal monitoring is essential as the foetus may be compromised by maternal hypotension, hypoxemia, drugs, and acid base changes. There is risk of pre-term labour during the surgical procedure.

Pre-operative assessment:
The pre anaesthetic evaluation should include a detailed neurological examination which should focus on signs of increased ICP and focal neurological deficit and any neurological deterioration associated with pre-operative decrease in blood pressure should be noted to avoid intra operative systemic blood pressure from falling below critical perfusion levels. The patients should be evaluated for history of seizures, fluid and electrolyte status should be corrected if necessary. Pre-operative diagnostic studies must be done for location of the lesion, extent, to assess the vascularity or cranial nerve involvement. Imaging studies should be reviewed for the evidence of brain oedema, midline shift, ventricular size etc.

Pre-operative drug therapy and implications: Drugs administered during pregnancy or labour may cross the placenta and affect the foetus. The following are the list of drugs which were used in this patient.

Monitoring in the operation theatre: Monitoring of systemic oxygenation, ventilation, hemodynamic and body temperature has become standard in neuroanaesthesia. Routine monitoring includes E.C.G, pulse oximetry, invasive and non-invasive blood pressure, capnography, temperature, blood glucose, urine output and respiratory gas monitoring. In this patient we had used all the basic standard monitoring. Invasive blood pressure monitoring is recommended before induction of anaesthesia, so that hemodynamic changes are quickly observed and treated to preserve both cerebral and utero placental perfusion. Maintaining hemodynamic stability is important, which can be achieved through appropriate fluid administration, avoidance of aortocaval compression, the prophylactic or early use of vasopressors like ephedrine or phenylephrine and arterial B.P monitoring. The B.P should be regulated within narrow limits, close to the baseline values. In this case, an invasive monitor (IBP) was used to monitor
beat-to-beat variation in blood pressure and treat accordingly. A central venous catheter, Pulmonary artery catheter may be useful in monitoring fluid replacement. Bladder catheterisation is mandatory because of frequent use of diuretics, long standing neurosurgical procedures which helps in guiding fluid therapy. Specialised monitoring techniques such as intracranial pressure monitoring, electroencephalogram, evoked potential, electromyogram of cranial nerves, Trans jugular oximetry, Trans cranial ultrasound, and Trans oesophageal Echocardiography may be required in specific situation. Since these specialised monitors were not available in our institution, they were not used.

**Intracranial pressure:**
Normal ICP is defined as the pressure inside the lateral ventricles/ lumbar sub arachnoid space in supine position. The normal value is 10 to 15 mm of Hg in adults and around 2 to 4 mm Hg in neonates and infants.

**Monitoring of intracranial pressure:**
There are several ways of monitoring of intracranial pressure that vary in accuracy, ease of use and cost. They are,

<table>
<thead>
<tr>
<th>Drug</th>
<th>Use in pregnancy</th>
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<tr>
<td>Phenytoin</td>
<td>Foetal hydantoin syndrome characterised by growth and performance delay, cranifacial abnormalities, Neonatal coauguopathy</td>
</tr>
<tr>
<td>Phenobarbitone</td>
<td>Neonatal withdrawal, Neonatal coauguopathy.</td>
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<tr>
<td>Furosemide</td>
<td>May aggravate maternal hypovolemia and reduce placental perfusion may increase risk of neonatal hyper bilirubinemia and neonatal electrolyte imbalance.</td>
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<tr>
<td>Corticosteroids</td>
<td>May be associated with low birth weight. Chronic use may be associated with foetal adrenal suppression.</td>
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**Intraventricular devices-** fluid coupled catheter, with an external strain gauge or catheter tip pressure transducer

**Parenchymal catheter tip pressure transducer devices**

**Subdural devices-** catheter tip pressure transducer or fluid coupled catheter with an external strain gauge.

**Subarachnoid fluid-** coupled device with an external strain gauge.

**Epidural devices.**
Since these devices were not available, the ICP monitoring was not done.

**Various measures to reduce ICP:**

**Nitrous oxide:**
The passage of nitrous oxide across the placenta is rapid and its excretion through the lungs is also rapid. Its use in labour has no known clinically significant side-effects for the fetus or newborn.

**Pharmacological measures:**

**Osmotic diuretics:**
Mannitol is used to reduce intracerebral oedema; however it affects the foetus by inducing maternal...
hypotension and uterine hypoperfusion. Mannitol given to the pregnant woman slowly accumulates in the foetus, and foetal hyperosmolality leads to physiological changes such as reduced foetal lung fluid production, reduced urinary blood flow, and increased plasma sodium concentration. Hence Mannitol in doses of 0.25–0.5 g/kg appears safe. IV fluid therapy during cerebral and spinal neurosurgery should consist of isonatremic, isotonic, and glucose-free solutions to reduce the risk of cerebral oedema and hyperglycaemia. In this patient we use Mannitol at a dose of 0.5 g/kg BW.

Furosemide is a loop diuretic that crosses placenta and induces dose-dependent foetal diuresis which may increase amniotic fluid volume. Maternal serum osmolality should be followed intraoperatively and maintained between 300 to 310 mosm/kg.

Steroid therapy: The administration of steroids to reduce peritumour oedema (e.g., dexamethasone 4 mg IM or IV injection four times a day) also acts to accelerate foetal lung maturity by increasing surfactant production.

Ventilatory management: Due to increased ventilation during pregnancy, the normal arterial carbon dioxide tension (PaCO₂) at steady-state is 30–32 mmHg. Severe hyperventilation (PaCO₂ <25 mmHg) may cause uterine artery vasoconstriction and leftward shift of the maternal oxyhemoglobin dissociation curve. Hence the maternal PaCO₂ is kept in the range of 25–30 mmHg. In our patient we kept EtCO₂ in the range of 23–28 mmHg.

Cerebral perfusion pressure: When the ICP increases, cerebral ischaemia occurs, which the brain can tolerate for a very short period. Maintenance of adequate cerebral blood flow depends upon a balance between the pressure within the skull (I.C.P) and the mean arterial pressure (M.A.P).

\[ C.P.P = M.A.P - I.C.P \]

Uterine perfusion pressure: Determinants of uterine blood flow - Three major factors decrease uterine blood flow during pregnancy, which are systemic hypotension, uterine vasoconstriction, and uterine contractions. Uterine blood flow = uterine artery pressure - uterine venous pressure.

Uterine vascular resistance

Effects of general anaesthesia on uterine blood flow:

Induction Agents: Barbiturates have minimal direct effect on uterine blood flow; however, there are two indirect mechanisms by which they might reduce uterine blood flow. Propofol at doses of 2 mg/kg produces no changes in UBF from baseline. With Ketamine, the effects of anaesthetic induction with uterine blood flow appear similar to the effects of barbiturates.

Inhalation Agents: Usual clinical doses (i.e., 0.5 to 1.5 minimum)

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in UBF from baseline. With Ketamine, the effects of anaesthetic induction with uterine blood flow appear similar to the effects of barbiturates. **Inhalation Agents:** Usual clinical doses (i.e., 0.5 to 1.5 minimum alveolar concentration \([\text{MAC}]\)) of Halothane, Isoflurane, Enflurane, Desflurane, and Sevoflurane have little or no effect on uterine blood flow, although deeper planes of anaesthesia are associated with decreased maternal blood pressure, cardiac output, and uterine blood flow. Here we have used less than 1 MAC concentration of volatile agent.

**Temperature regulation:**
Induced hypothermia is no longer recommended as a means of neuronal preservation. The foetal temperature parallels maternal core temperature. Preservation of normal body temperature may be achieved with forced air warmer and monitored with a urinary bladder or oesophageal temperature probe.

**Foetal monitoring:**
Foetal monitoring is mandatory with the use of external Tocodynamometer and Doppler for FHR monitoring, as there is a risk of premature labour or foetal compromise. Since these devices are not available, we used stethoscope to monitor the Foetal heart rate.

**Foetal concerns:**
The foetus may be compromised indirectly by factors that reduce uteroplacental perfusion or compromise foetal gas exchange. Although FHR monitoring is possible after 16 weeks of gestation, changes in the baseline (severe bradycardia and tachycardia) are only predictors of neonatal mortality after 24 weeks of gestation and baseline changes also occur in the healthy foetus. FHR variability is only useful variable after 26 weeks of gestation and drugs in-

**Position for neuro-surgery:**
The semi lateral position also known as Janetta position is achieved by lateral tilting of table 10° to 20°, combined with a generous shoulder roll. Extreme head rotation sufficient to cause compression of the contra lateral jugular vein by the chin should be avoided. To prevent aortocaval compression, pelvic tilt of at least 15° to left should be instituted. Head up position is advocated to prevent...
the complication of venous air embolism and favour the venous drainage.

**Blood loss and replacement:**
Blood loss can be rapid and substantial during Neuro-surgical procedures, particularly in intracranial tumours. Blood transfusion should be based on the patient risks of developing complication from inadequate oxygenation. Neuro-surgical patients are frequently transfused to maintain haemoglobin levels of 9gm/dl (Hct of 27% to 28%). To prevent large volume of crystalloid, since this may result in cerebral oedema, blood components such as packed RBC are preferred over whole blood. Here we used 2 units of packed RBC’s as a measure to prevent volume overload and to prevent cerebral edema.

**Post-operative expected complications:**
The decision between extubation and elective post op ventilation should be individualised depending on the patient. Factors that influence the decision are nature of the procedure pre-operative physical status, presence of respiratory disease, duration of the procedure; amount of intravenous fluids given. The patient is extubated awake in the lateral position because of the possibility of regurgitation. The endotracheal tube should not be removed if there is potential for significant upper airway oedema. Care must be taken in the post op period as there is maximum swelling and cerebral oedema 12 to 18 hours post procedure. If substantial oedema is there, a waiting period of 24 to 36 hours is usually indicated. Cranial nerve involvement may present as diminished gag reflex which should be considered while extubating. If the delivery has not taken place, uterine displacement should be maintained in the post-operative period and monitoring of the foetal heart rate and uterine tone should continue for 24 hours. Early extubation has the advantage of assessing the neurological deficit present, if any and since the intraop hemo-dynamic parameters were stable, we extubated the patient on table and then shifted to Neuro ICU for observation.

**Post-operative pain management:**
After intracranial procedures, the pregnant patient should be admitted to an intensive care unit for observation and further management. Although generally less painful than extra cranial surgery, craniotomy pain is moderate to severe in 50% of patients. Analgesia is best obtained using a multimodal approach combining local anaesthetic infiltration or scalp blocks, opioids, and paracetamol. Here we used intravenous paracetamol for providing analgesia. The cyclooxygenase inhibitor Non-steroidal anti-inflammatory drugs are generally avoided because of their effects on platelet function and potential bleeding after intracranial surgery, or because of their potential foetal complications like renal failure, necrotizing enterocolitis, and persistent foetal circulation after birth.

**Deep vein thrombosis prophylaxis:**
Pregnancy is a hypercoagulable state and confers a substantially increased risk of thromboembolism after surgery, and hence non - pharmacological prophylaxis (anti thromboembolic [TED] stockings, calf stimulation, calf compressors, or pedal pumps and early mobilisation) should be used perioperatively.

**CONCLUSION:**
Neurosurgery is infrequently required during pregnancy, but mandates a multidisciplinary approach and careful consideration of the timing of both surgery and delivery. Proper pre-operative assessment of the mother and foetus, intra operative management and intensive post-operative care using standard protocols.
REFERENCES:


