

Anaesthetic management for combined emergency caesarean section and craniotomy tumour removal

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Abstract

Presentation of primary intracranial tumour during pregnancy is extremely rare. Symptoms of brain tumour include nausea, vomiting, headache and seizures which mimic symptoms of pregnancy-related hyperemesis or eclampsia. In very few cases, craniotomy tumour removal is performed earlier or even simultaneously with foetal delivery. A 40-year-old woman at 32 weeks of gestation in foetal distress presented to the emergency room with decreased level of consciousness Glasgow Coma Scale 6 (E2M2V2). Computed tomographic scan revealed a mass lesion over the left temporoparietal region with midline shift and intratumoural bleeding. In view of high risk of herniation and foetal distress, she underwent emergency caesarean section followed by craniotomy tumour removal. In parturient with brain tumour, combined surgery of tumour removal and caesarean section is decided based on clinical symptoms, type of tumour and foetal viability. Successful anaesthetic management requires a comprehensive knowledge of physiology and pharmacology, individually tailored to control intracranial pressure while ensuring the safety of mother and foetus.

Key words: Caesarean section, craniotomy, intracranial tumour, pregnancy

INTRODUCTION

The incidence of non-obstetric surgery during pregnancy is approximately 0.75%–2%. The incidence of occurrence of primary central nervous system (CNS) tumours in females is 6 in 100,000 population, which are less in comparison to that in non-pregnant women of the same age group. Symptoms such as nausea, vomiting, headache, visual disturbances and seizures are often mistaken for pregnancy-related hyperemesis gravidarum during early pregnancy or eclampsia during late pregnancy. Meningioma is the most common primary intracranial

neoplasm and many of these tumours grow faster during pregnancy as they contain oestrogen and progesterone receptors. Previously asymptomatic and undiagnosed tumours, therefore, may become symptomatic due to the increased growth of tumour or oedema. In addition, increased vascularity or pregnancy-related immunotolerance may also result in tumours becoming symptomatic in pregnant state. In most cases, surgical interventions are delayed until after delivery. However, tumours causing acute neurological deterioration posing a risk of herniation require immediate surgery. The management of combined caesarean section and craniotomy tumour removal is particularly challenging for the anaesthesiologist as it requires a balance of both maternal safety and neonatal consideration. Some neuroanaesthetic techniques or protective interventions may benefit the mother; however, it carries risks for harming the foetus. Rapid sequence induction may elevate maternal blood pressure (BP), hence intracranial

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pressure (ICP) while hyperventilation and mannitol may decrease uterine blood flow and induce foetal hypovolaemia. We describe the successful management of a patient who underwent emergency caesarean section which was followed by craniotomy tumour excision.

CASE REPORT

A 40-year-old woman (160 cm, 70 kg) at 32 weeks of gestation presented to the emergency department with decreased level of consciousness. Upon arrival, Glasgow Coma Scale (GCS) was 6 (E2M2V2) with BP of 150/90 mmHg and heart rate of 120 bpm. She had a previous history of caesarean section, and her past medical and neurological history was unremarkable. Differential diagnosis was made for infection (meningitis), haemorrhage (aneurysm, hypertension and pre-eclampsia) and any other causes of increased ICP including brain tumour. All her laboratory parameters were within normal limit. Computed tomography (CT) scan revealed a mass lesion of 6 cm × 7 cm × 10 cm over the left temporoparietal region, suggestive of a meningioma, with midline shift and intratumoural bleeding [Figure 1]. Obstetric examination revealed a single live foetus of 32-week gestation and was at distress. After a multidisciplinary consultation among the neurosurgeon, obstetrician and anaesthesiologist, it was decided that the patient was under a risk of cerebral herniation in view of the large intracranial mass with midline shift and intratumoural bleeding. Foetal cardiography (CTG) and ultrasound revealed foetus in distress. Therefore, an emergent craniotomy as well as caesarean section in one sitting was planned.

The patient was premedicated with ranitidine 50 mg and metoclopramide 10 mg intravenously. A left lateral tilt to prevent aortocaval compression and 15° reverse



Figure 1: Computed tomography scan revealed a large intracranial mass in the left temporoparietal region with midline shift and intratumoural bleeding

Trendelenburg to decrease ICP were applied to the operating table. One hundred percent oxygen was administered through face mask, and monitoring of non-invasive BP, electrocardiogram and pulse oximetry was done. A 20-gauge intravenous catheter was inserted into the right radial artery for continuous BP monitoring. Prior to induction, BP was 144/88 mmHg, heart rate was 110 bpm and there was 100% oxygen saturation. Lidocaine 1.5 mg/kg was administered. Induction was performed using 2 mcg/kg fentanyl, 2 mg/kg propofol and 1.2 mg/kg rocuronium, while maintaining cricoid pressure. Trachea was intubated using 6.5 mm inner diameter endotracheal tube without any difficulty. Anaesthesia was maintained using sevoflurane 2% with 50% air in O₂. Controlled ventilation was maintained at tidal volume of 6 ml/kg and respiratory rate of 14 breaths/min. End-tidal CO₂ (EtCO₂) was continually monitored and maintained at 30 ± 2 mmHg. After 8 min from the time of induction, a healthy girl neonate was delivered, with Apgar scores of 6, 7 and 8 at 1st, 5th and 10th min, respectively. Additional 50 mcg fentanyl was administered to maintain anaesthetic depth. After placental extraction, slow infusion of 500 cc of 0.9% NaCl containing 10 IU oxytocin was started to induce uterine contraction. Intraoperative haemodynamic and respiratory parameters were stable throughout the caesarean section and it was completed within 55 min. The estimated blood loss and urine output at the end of caesarean section was 500 and 100 ml, respectively. One unit of packed red blood cell (220 ml) with 700 ml ringerfundin was infused during the caesarean section.

Prior to craniotomy, central venous access was obtained at the right subclavian vein. Craniotomy tumour removal was performed in supine position with 30° head elevation. Mannitol 0.5 mg/kg was administered just after scalp incision. Anaesthesia was maintained using sevoflurane 2% with 50% air in O₂, rocuronium and continuous propofol infusion of 25–50 mcg/kg/min. Haemodynamic parameters were stable throughout the 5 h procedure. The central venous pressure was 11–14 cmH₂O. The tumour was resected with estimated blood loss of 800 ml and urine output of 1000 ml throughout the craniotomy. Five hundred millilitres of 4% gelatin solution, 2000 ml ringerlactate and 210 ml packed red blood cells were administered. The patient was then transferred to the Intensive Care Unit; trachea was extubated on the 4th post-operative day and discharged on 6th post-operative day. Her GCS was 15/15 with no neurological deficits. The neonate was healthy and discharged on day 2.

DISCUSSION

The management of obstetric patients with brain tumour requires a multidisciplinary approach involving

the neurosurgeon, obstetrician and anaesthesiologist. The timing of the surgery needs to be individualised according to various factors including neurological status of the mother, possibility of preterm labour, gestational age of the foetus and foetal lung maturity. Many aspects have to be considered, namely the physiological effects of pregnancy on tumour size and effect of labour on maternal cerebral circulation, autoregulation and cerebral perfusion pressure to achieve the optimal outcome. Certain principles are similar while others are conflicting. Anaesthetic technique should be designed to avoid foetal hypoxia, hypercarbia and hypotension. Neuroprotective measures such as hyperventilation or induced hyperosmolarity should be used with caution because hypocarbia, reduced uterine perfusion and foetal hyperosmolarity or dehydration pose serious threats to the foetus. Neuroanaesthetic technique must, therefore, strive to offer optimal care for the mother and minimize risks to the foetus while also ensuring the shortest possible exposure to anaesthetic drugs. Aspiration prophylaxis, pre-oxygenation, haemodynamic stability maintenance and vigilant monitoring are essential.^[1-4]

Intracranial neoplasms are rare during pregnancy. The tumours tend to grow during pregnancy due to fluid retention, increased blood flow and hormonal changes. Surgery for slow-growing benign tumours may be delayed until foetal delivery based on neurologic status; however, malignant or rapidly growing benign tumours should be excised despite concerns of pregnancy. The general effects of tumours are caused by increased ICP due to tumour mass added to the brain. Hydrocephalus may occur following obstruction of cerebrospinal fluid circulation. Cerebral oedema is a life-threatening complication and may cause displacement/herniation and compression of brain structures resulting in lethal effects including death.^[3-6]

In this case, the patient presented with decreased level of consciousness and CT scan revealing a large mass with midline shift and intratumoural bleeding. Therefore, from neurosurgical point of view, she required an emergency craniotomy. From the obstetrics point of view, CTG showed that the foetus was in distress and therefore, emergency caesarean section was planned simultaneously.

The management of combined anaesthesia for craniotomy and caesarean section requires a comprehensive knowledge of physiology of mother and foetus and physiology and pharmacology of CNS with the aim for safety of both mother and foetus. With neuroanaesthesia principles, endotracheal intubation must be facilitated carefully to prevent an increase in BP and therefore ICP. However, a rapid sequence induction for caesarean section will induce haemodynamic changes and an increase in ICP. In this case, both lidocaine and fentanyl were utilised to blunt the sympathetic stimulation during

tracheal intubation. High dose of rocuronium (1.2 mg/kg) was used along with Sellick manoeuvre 60 s prior to intubation. The patient was also premedicated with ranitidine and metoclopramide given the high risk of vomiting and aspiration during pregnancy.^[4,7-10]

It may be argued that opioid should be withheld due to concerns of neonatal chest wall rigidity and apnoea in the face of augmented stress response and increased ICP in the mother. All opioids administered to the mother prior to delivery may cause neonatal respiratory depression, and therefore skilled personnel in neonatal resuscitation is needed during the procedure. Short-acting opioids, such as fentanyl (2–5 mcg/kg) or remifentanyl (1 mcg/kg), however, are known to be safe. Lidocaine (1.5–2 mg/kg) may also be used in conjunction with opioids for blunting response to laryngoscopy. In this case, the neonate was unharmed with a combination of fentanyl and lidocaine during induction of the mother.^[2-4]

Foetus may be compromised indirectly by maternal hypotension, uterine artery vasoconstriction, maternal hypoxaemia, acid-based changes and any other changes in maternal physiology that reduce uteroplacental perfusion or compromise foetal gas exchanges. To preserve both cerebral and uteroplacental perfusion, maintaining haemodynamic stability is important, which is achieved through appropriate fluid administration and resuscitation, avoidance of aorticaval compression and invasive BP monitoring.^[1,5,7,8]

Inhalational anaesthetics are safe during caesarean section. Volatile agents as well as N₂O may elevate ICP due to cerebral vasodilatation but can be reversed by hyperventilation. Avoidance of N₂O while using high concentration of volatiles to maintain anaesthetic depth may also elevate ICP and inhibit uterine contraction leading to possible post-partum haemorrhage. For maintenance of balanced anaesthesia, volatile agents such as isoflurane or sevoflurane at 1–2 minimum alveolar concentration are effective. Pregnant patients require about 25% lower dose of most volatile anaesthetics. At these concentrations, only minor increases in uterine blood flow and uterine bleeding are induced while preserving cerebral autoregulation. In this case, use of N₂O was avoided and anaesthetic depth was maintained using low concentration of volatiles combined with continuous propofol, intermittent rocuronium and opioid. In addition, oxytocin was administered after caesarean section to prevent uterine haemorrhage. Use of ergometrine was also avoided as it may produce hypertension and a further increase in an already elevated ICP in the presence of deranged blood–brain barrier.^[6,9-11]

Diuresis is often accomplished with osmotic agents or loop diuretics to shrink the brain. This can cause significant negative fluid balance for the foetus which may

not have clinical significance if mannitol is administered after foetal delivery, as in this case. 30° head elevation was also done in an attempt to produce a 'slack' brain. Modest maternal hyperventilation to achieve an EtCO₂ of 28–30 mmHg to decrease cerebral volume may also be done if more surgical exposure is required.^[11-13]

CONCLUSION

The time of delivery and decision to combine caesarean section with craniotomy is normally based on the location and pathology of the intracranial tumour, clinical symptoms, gestational age and foetal viability. In such scenario, comprehensive understanding of maternal and foetal physiology along with a multidisciplinary approach involving neurosurgeon, obstetrician and anaesthesiologist is required to achieve a better perioperative outcome.

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Conflicts of interest

There are no conflicts of interest.

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