International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Anesthetic Management in an Emergency Cesarean Section of a Parturient with Acute Hemorrhagic Stroke: A Case Report

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Abstract

This paper reports a case of a pregnant woman with acute hemorrhagic stroke who underwent an emergency cesarean section post-stroke due to fetal distress. Patient was initially scheduled for elective cesarean section but suffered hemorrhagic stroke a few hours prior to schedule. Identified risk factors of the patient include advanced maternal age, chronic hypertension and use of anticoagulation. Patient safely delivered abdominally under general anesthesia using total intravenous anesthesia, with both the mother and fetus having unremarkable perioperative course. Anesthetic modifications must be individualized and well-coordinated with the surgical and pediatric teams to ensure the well-being of both the mother and the fetus.

Keywords: Pregnancy, Hemorrhagic stroke, Intracranial hemorrhage, General anesthesia, Cesarean section

Introduction

Pregnancy-related intracranial hemorrhage (ICH) occurring during pregnancy is a rare complication associated with significant maternal and fetal morbidity and mortality. Pregnancy and the puerperium pose an increased risk for stroke of both hemorrhagic and ischemic etiologies, with incidence rates being three-fold higher compared to non-pregnant women [1].

A study by Bateman et al. reported a 6.1 pregnancy-related ICH rate per 100,000 deliveries with the in-hospital mortality rate for pregnancy-related ICH of 20.3% [1]. The rate of ICH is increased throughout pregnancy, particularly during the third trimester. Independent risk factors identified include advanced age, race, smoking and medical comorbidities such as aneurysms, hypertensive disorders of pregnancy, arteriovenous malformations and coagulopathies [2]. Physiologic changes during gestation that predispose to the occurrence of stroke among pregnant patients include a state of hypervolemia, increased circulatory demands, changes in vascular distensibility and changes in the balance of coagulation factors. Ultimately, pregnancy-related stroke poses a significant challenge in the anesthetic management of these patients during delivery. This case presents the anesthetic management and interventions during an emergency cesarean section in a patient who suffered acute hemorrhagic stroke perioperatively.

Case Description

A 36-year old G3P0 (0020) on her 28th week of gestation was admitted after intrapartum fetal monitoring

revealed elevated resistance indices in the umbilical artery indicating beginning fetoplacental insufficiency.

Patient is a known hypertensive since 2020, now with superimposed preeclampsia with severe features, chronic kidney disease stage III secondary to hypertensive nephropathy, with a history of malignancy (endometrial carcinoma in 2014) and overt diabetes mellitus. During this admission, the patient was monitored due to uncontrolled hypertension as well as intrauterine fetal growth restriction. Patient was given oral aspirin once a day and subcutaneous tinzaparin once daily to reduce the risk of miscarriage and improve pregnancy outcome due to history of recurrent pregnancy loss.

Patient has been admitted for almost 6 weeks when she was referred for slurring of speech with facial asymmetry and left upper extremity weakness associated with a blood pressure of 170/120. On neurologic exam, she had right preferential gaze with limited gaze to the left, shallow left nasolabial fold and left trapezius lag, with motor strength of 1 over 5 on the left upper and lower extremities. Glasgow coma scale during this time was E4V3M6. Cranial computed tomography (CT) scan was done approximately 4 hours after, revealing intracerebral hemorrhage, 42 ml in volume, on the right capsuloganglionic area (Figure 1).

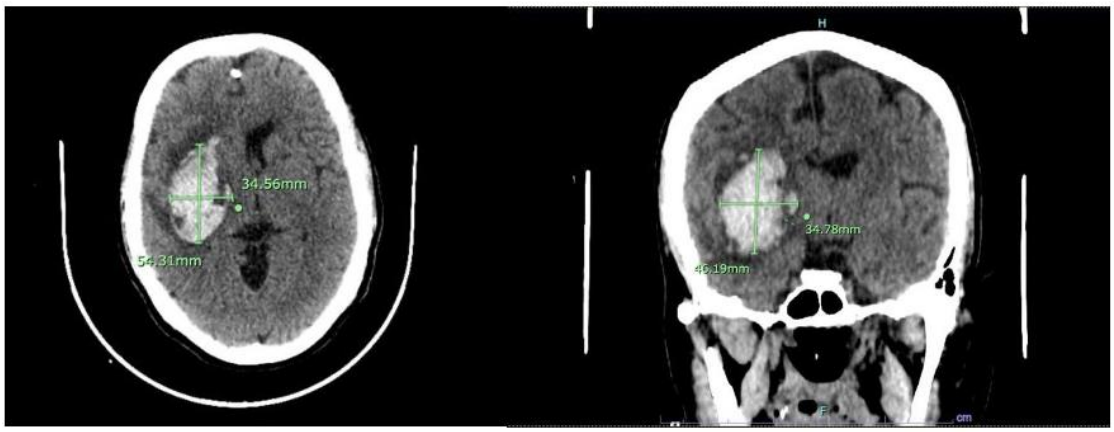

Figure 1. Axial (left) and coronal (right) cuts from the cranial computed tomography scan. Using the Kothari method, there is approximately 42 ml of bleed present in the right capsuloganglionic area.

Mannitol boluses for medical decompression and nicardipine drip were given. Patient was then closely observed post-ictus due to the risk of expanding hematoma. Around 11 hours post-ictus, the obstetric service decided to deliver the baby under cesarean section due to spontaneous fetal heart rate decelerations with subsequent decrease in sensorium to E3V1M6. At this time, the patient was on her 34th week of gestation.

Vital signs prior to induction were as follows: blood pressure of 150/100, heart rate of 108, respiratory rate of 20 breaths per minute and oxygen saturation of 98% at room air. Total intravenous anesthesia was the planned technique, hence, the surgical team started preparing the field prior to induction of anesthesia in order to reduce fetal exposure to anesthetic agents. An arterial line was inserted to closely monitor the patient's blood pressure during intubation. Remifentanil target-controlled infusion at 2.5 ug/ml was then initiated. Propofol at 2 mg/kg and rocuronium at 1.2 mg/kg were given to facilitate intubation. Endotracheal tube of 6.5 was inserted at level 19, with mechanical ventilator set at volume control

ventilation with PEEP of 4 cm H2O, tidal volume of 6 ml/kg and respiratory rate of 12 breaths per minute maintaining end tidal CO2 of 30-35 mmHg. Post-induction vitals were as follows: blood pressure of 140/80, heart rate of 95 and oxygen saturation of 99%. The surgery immediately commenced after, with remifentanil target-controlled infusion (TCI) at 1.5-3.0 ug/ml and propofol infusion at 100-200 mcg/kg/min maintaining the general anesthesia intraoperatively.

There were no episodes of sustained hypertension or hypotension noted intraoperatively. Total time of induction of anesthesia to delivery of the infant was 4 minutes, total intraoperative time of 1 hour 15 minutes, total anesthesia time of 1 hour and 41 minutes. Fetal outcome was as follows: APGAR score of 9,9, 34 weeks age of gestation by pediatric aging, symmetric small for gestational age of 1,095 kilograms. The baby was immediately handed over to the neonatal intensive care team. Prior to extubation, remifentanil was titrated down and sugammadex was given for TOF-guided reversal.

Post-operatively, the patient was closely monitored in the post-anesthesia care unit (PACU) and eventually transferred back to the room a few hours after. Sensorium remained the same as preoperative (E4V3M6) with no note of new neurologic deficits.

Cerebral CT angiogram was done at the PACU a few hours after delivery which revealed signs of slight progression of subfalcine herniation and beginning descending transtentorial herniation. Neurosurgery service opted to continue medical decompression and no neurosurgical intervention was done for this patient.

Patient was then referred to rehab service for initiation of rehabilitative management with the following goals: continue the neurologic recovery of the extremities, facilitate safe transitions to supported-unsupported sitting and progress accordingly, ensure adequate nutrition and eventually improve means of feeding and communication, and facilitate improvement with independence in activities of daily living.

Discussion

Pregnancy is considered to be a hyperdynamic state due to the high metabolic demand because of the growing uteroplacental unit. The combination of hypervolemia, increased circulatory demand, decreased blood pressure and increased venous stasis predispose pregnant patients to circulatory complications. It is also a hypercoagulable state owing to the elevation of procoagulant factors and decreased anticoagulant activity due to lower protein S concentrations and activated protein C resistance, leading to a 4 to 10-fold increased risk of thrombosis during pregnancy [3]. Elevated risk of ICH was found to be highest during the third trimester and the first 12 weeks of the postpartum period [6].

Hypertensive disorders of pregnancy play a significant role in the occurrence of stroke during the gestational period. In a cohort by Meeks et al., approximately one-third of women who experienced ICH had eclampsia or preeclampsia [4]. The maternal cerebral vasculature is highly vulnerable to the adverse effects of preeclampsia. Arteriolar dysfunction with compromised autoregulation may be implicated in the inability to compensate for acute hypertension eventually leading to spontaneous ICH, aggravated by preeclampsia-related coagulopathy [5].

Higher risk of pregnancy-related ICH is also associated with advanced maternal age which may be partly attributable to higher prevalence of other risk factors including hypertension and use of oral anticoagulation among older women [6]. Furthermore, the use of antiplatelet and anticoagulant medications in this patient contribute to the development of the hemorrhagic stroke.

Optimal anesthetic management for patients with pregnancy-associated stroke has not been well-elucidated. A multidisciplinary effort including proper communication between the anesthesiology,

obstetrics, neurology and neonatology teams must be done prior to delivery. -Consideration of whether to do neuraxial or general anesthesia for labor will depend on the status of both the mother and the fetus. In this case, the anesthesiologists opted to do general anesthesia due to the recent use of tinzaparin within 12 hours as this increases the risk of intraspinal and epidural hematoma formation, along with the decrease in sensorium of the mother and associated fetal distress.

The primary anesthetic goals for this patient were to maintain maternal hemodynamic stability and avoid abrupt changes in blood pressure and subsequent utero-placental ischemia as well as increased risk of expansion of the ICH. After the initial hemorrhage, the risk of hematoma expansion and perihematoma edema will result in secondary brain damage and worsened outcome if not managed intraoperatively.

Neuroprotective strategies were observed to prevent increase in intracranial pressure particularly from the sympathetic responses associated with rapid sequence tracheal intubation. Hypothermia has been shown to be neuroprotective in experimental and focal hypoxic brain injury models as it decreases cerebral metabolic rate of oxygen (CMRO2), suppresses glutamate release, reduces neuroinflammatory response and minimizes edema formation [7]. Glycemic control was also observed as hyperglycemia is known to aggravate neurological injuries (8).

Total intravenous anesthesia was done for this patient due to its several advantages including a reduction in ICP, hemodynamic stability and reduced incidence of postoperative nausea and vomiting (PONV) [1]. Propofol has well-known neuroprotective properties including lowering CMRO2, decreasing ICP primarily by lowering cerebral blood flow (CBF) and specific antioxidant properties in preventing injury during neurodegenerative processes (3). As it lacks analgesic properties, opioids are often supplemented. In this case, remifentanil TCI was administered which can also cause a reduction in propofol requirements [3]. In addition, although remifentanil readily crosses the placenta, it is well redistributed and metabolized by the fetus, leading to a lower umbilical artery-to-vein concentration ratio of the drug [9]. Furthermore, compared to total intravenous anesthesia, volatile anesthetic agents induce dose-dependent decreases in skeletal and smooth muscle tone leading to uterine relaxation predisposing a gravid uterus at risk of hemorrhage to excessive bleeding [10].

Conclusion

In conclusion, multidisciplinary management of the present case allowed for safe and successful emergency cesarean section under general anesthesia in a patient with ICH. With all the possible risk factors and etiologies of the patient's stroke, anesthetic technique must be individualized in order to ensure safety of both the parturient and the fetus. The use of total intravenous anesthesia as opposed to inhalational anesthetic technique may be desirable when approaching patients with increased risk of uterine bleeding such as those with recognized or unrecognized coagulopathies. Proper identification and perioperative management of these risk factors must be done to prevent these unwanted sequelae.

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