

Successful Management of an Emergent Cesarean Section for a Patient with a Ruptured Arteriovenous Malformation



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Objectives

Discuss hemodynamic requirements in a parturient with a ruptured arteriovenous malformation.

Discuss anesthetic techniques that can be used for an emergent cesarean section and which techniques are best suited for maintenance of the anesthetic.

Discuss potential adverse outcomes of mismanagement of an anesthetic on this patient population that might lead to further emergent procedures.

Introduction

A 24-year-old 71.5 kg female (BMI 30.8) G4P2 with no known allergies presents to the emergency department after she was found on the bathroom floor with left sided facial droop and hemiparalysis. Patient is 37 weeks pregnant and having contractions Q15 minutes. OSH imaging showed 2.5 x 1.3cm ICH in the R Pontomedullary region. GCS of 14, CN VI palsy, left sided facial droop, extremely flaccid LUE and LLE. Able to follow commands with RUE and RLE. Patient presents as mildly anemic, Hgb 11.3 GM/dL with an otherwise insignificant history.

OB examination is stable, and the patient is not in active labor. Neurosurgery and OB/MFM team recommend emergent c-section scheduled for the next morning, along with the possibility of performing an endovascular coiling of the AVM. A neonatal team was present on the day of surgery for care of the newborn, along with a neurosurgery team for the potential coiling.

Case Presentation

The patient was brought into the operating room and placed under ASA standard monitoring. A wedge was placed under the right hip and the head of the bed remained elevated at 30 degrees. An awake arterial line was started on the left radial artery using an ultrasound for guidance. General anesthesia was induced with propofol and rocuronium. A McGrath was used to place the 7.0 ETT via video laryngoscopy. Once the tube had been secured, the surgical team began the cesarean section with birth marked three minutes after intubation. The neonatal team took charge of care for the newborn, who remained healthy and stable throughout the procedure. A total intravenous anesthetic (TIVA) was used for maintenance of the general anesthetic, with propofol (70-200 mcg/kg/min, 327.5mg total) and remifentanyl (0.1-0.2 mcg/kg/min, 6.9mg total). A BIS monitor was used to maintain anesthetic depth between an EEG depth of 40-60. Boluses of Esmolol (20mg bolus, 100mg total) and Nicardipine (0.25mg bolus, 1.5mg total) were used to maintain systolic blood pressures below 140mmHg throughout the intraoperative course. Hyperventilation was employed throughout the procedure to maintain EtCO₂ below 30mmHg. Upon delivery a bolus of 3 units of Oxytocin was given, with an additional 30 unit infusion over the next hour. Midazolam was then added to the anesthetic to help ensure a full MAC was achieved. Shortly after birth, oxygen saturation dropped to 80%. Albuterol was given through the ETT with an improvement of oxygen saturation to 98% after subsequent administration of an alveolar recruitment maneuver.

Case Presentation

Fentanyl (50 mcg) was titrated to control intraoperative pain with hydromorphone (1mg) used for post-operative pain. Ondansetron was used as an antiemetic with the propofol infusion being the second modality of PONV control. Neuromuscular blockade was reversed with Sugammadex. The patient was transferred to the ICU on 4L of O₂ via nasal cannula with continued monitoring and availability of emergency medicine and airway equipment. Labetalol was given before leaving the OR and Nicardipine was available for bolus to continue maintenance of SBP <140mmHg during transport. EBL throughout the procedure was 500mL. Postoperative evaluation of the patient revealed no significant derangements from the neurological baseline upon initial presentation.

Postoperative Course

Following the procedure, the newborn was transferred to a children's hospital and all care of the baby was completed at that location. The patient stayed in care for seventeen days, with care ending due to lack of insurance. Throughout the stay, the patient remained hemodynamically stable with no neurological decline further from the ICH. Serial CT scans showed no increase in the size of the hematoma, with MRI scans showing signs of slight resorption and a decrease in blood products found in the patient's fourth ventricle. No hydrocephalus was ever noted throughout the stay within the hospital, but the patient did develop diplopia, which later resolved. However, there was no worsening of the patient's left sided symptoms. The patient worked with occupational therapy and made significant progress. Patient was able to demonstrate independence with the use of a wheelchair. Her left sided hemiparalysis improved to focal weakness with numbness and lack of sensation. Plans and education were given to continue therapy when discharged home at the end of her stay. As there was no progression of the ICH, with improvement in patient's symptoms, the decision was made not to pursue neurosurgery for an aneurysm coiling.

Discussion

The anesthetic management of the parturient requires thoughtful consideration to the underlying symptoms and conditions that the patient presents with. In this case, the parturient presented with an ICH, which is complicated by increased blood volume and cardiac output commonly found in pregnancy (1). This physiological state put the patient at increased risk of further rupture, which could have led to ischemia with subsequent damage to the structures in the brain. The anesthetic management was chosen so that rapid conversion to neurosurgery could take place as efficiently and safely as possible if it was required. The surgical approach of a c-section over, vaginal delivery was chosen because uterine contractions can lead to increased CSF and venous pressure as well as a Valsalva effect from vaginal delivery worsening the same variables. (2) Some anesthetic considerations were increases in ICP from the type of anesthesia and potential neuromonitoring that would be needed for a coiling procedure. Neuraxial anesthesia can be quick and effective way to control analgesia for labor and delivery; however, as this was an emergent case, general anesthesia was chosen to better control the cardiovascular changes that occur during the delivery. Volatile anesthetics have been shown to increase ICP, while propofol has been shown to potentially decrease ICP (3). Volatile anesthetics can also interfere with SSEPs/MEPs (4), which is why the decision was made to use a TIVA with propofol and remifentanyl. Hyperventilation was employed throughout the procedure to decrease ICP along with the use of beta blockers and calcium channel blockers with an intraoperative goal of keeping systolic blood pressures below 140mmHg. Hypertension in the setting of hemorrhage within the brain has been shown to increase morbidity, mortality, and the risk of permanent ischemic changes (5). This patient was also found to have infiltrates in the fourth ventricle. When an ICH affects the volume of CSF in the ventricles this can lead to hydrocephalus and consequently fatal brain herniation (6). Any increase in ICP due to volume would have resulted in increased pressure in these areas, thus increasing the risk of an emergency. Positioning the head of the bed to a thirty-degree elevation was another added measure as a safeguard against increased cerebral blood flow. Studies have demonstrated a decrease

Discussion

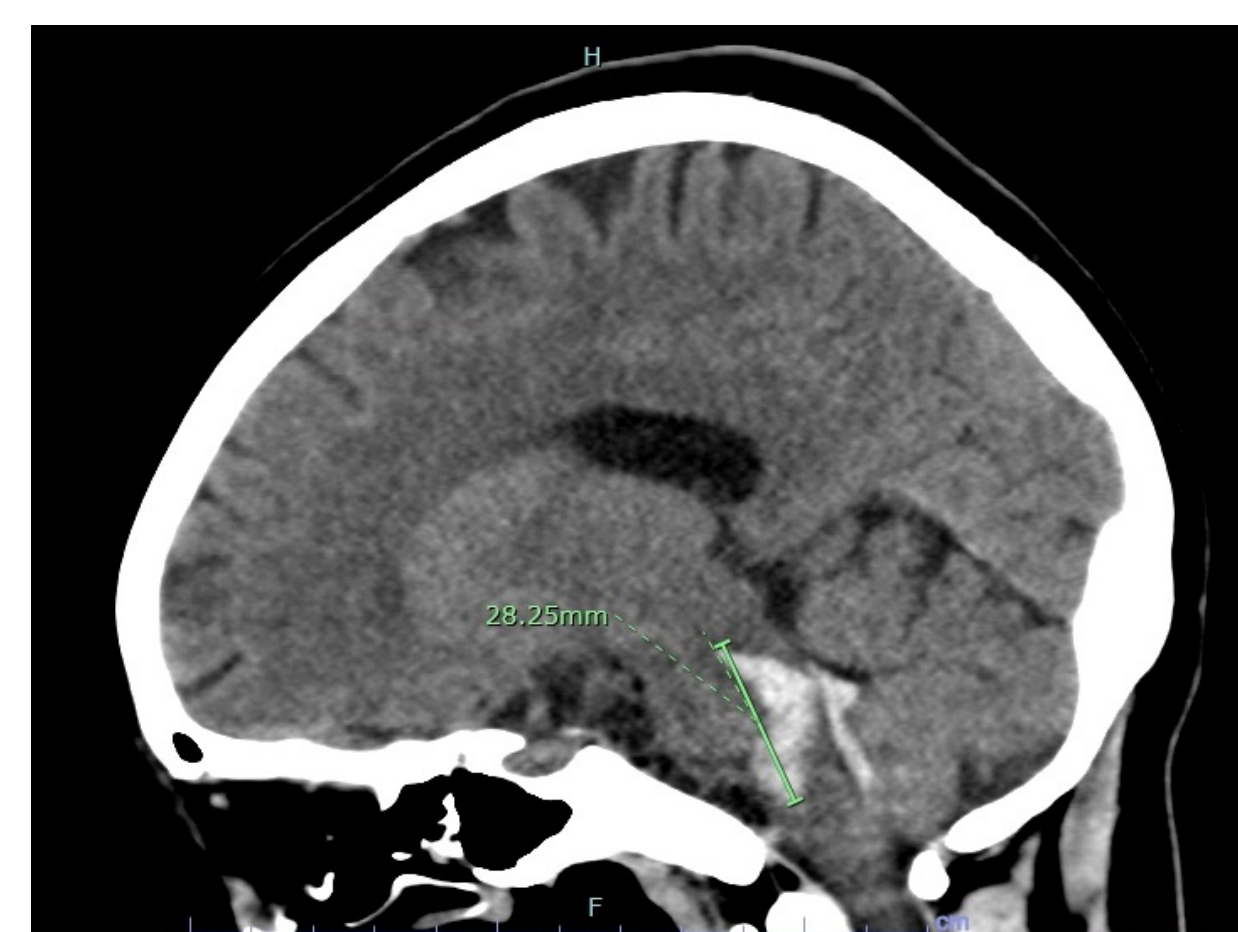
in mean pressures and CBF with elevations to the head of the bed above fifteen degrees (7). Maternal cardiac output is greatest immediately following delivery, with a potential increase of 60-80% above pre-labor values (8). In order to combat these changes, it was important to maintain a sufficient anesthetic in depth along with appropriate medications for controlling heart rate and blood pressure. Midazolam is commonly used to induce anxiolysis and can help sedate nervous patients, however due to its high lipophilicity, it can cross the placental barrier. This could potentially lead to deficits upon the delivery of the child. If given after delivery Midazolam can help improve sedation along with increasing patient comfort in the post-operative period. This patient was past 37 weeks gestation so the baby was deemed to be full-term, however care must be taken to prevent medications crossing the placental barrier that could lead to complications upon delivery. In this case the baby was born with a healthy APGAR score and no deficits were appreciated.

Conclusions

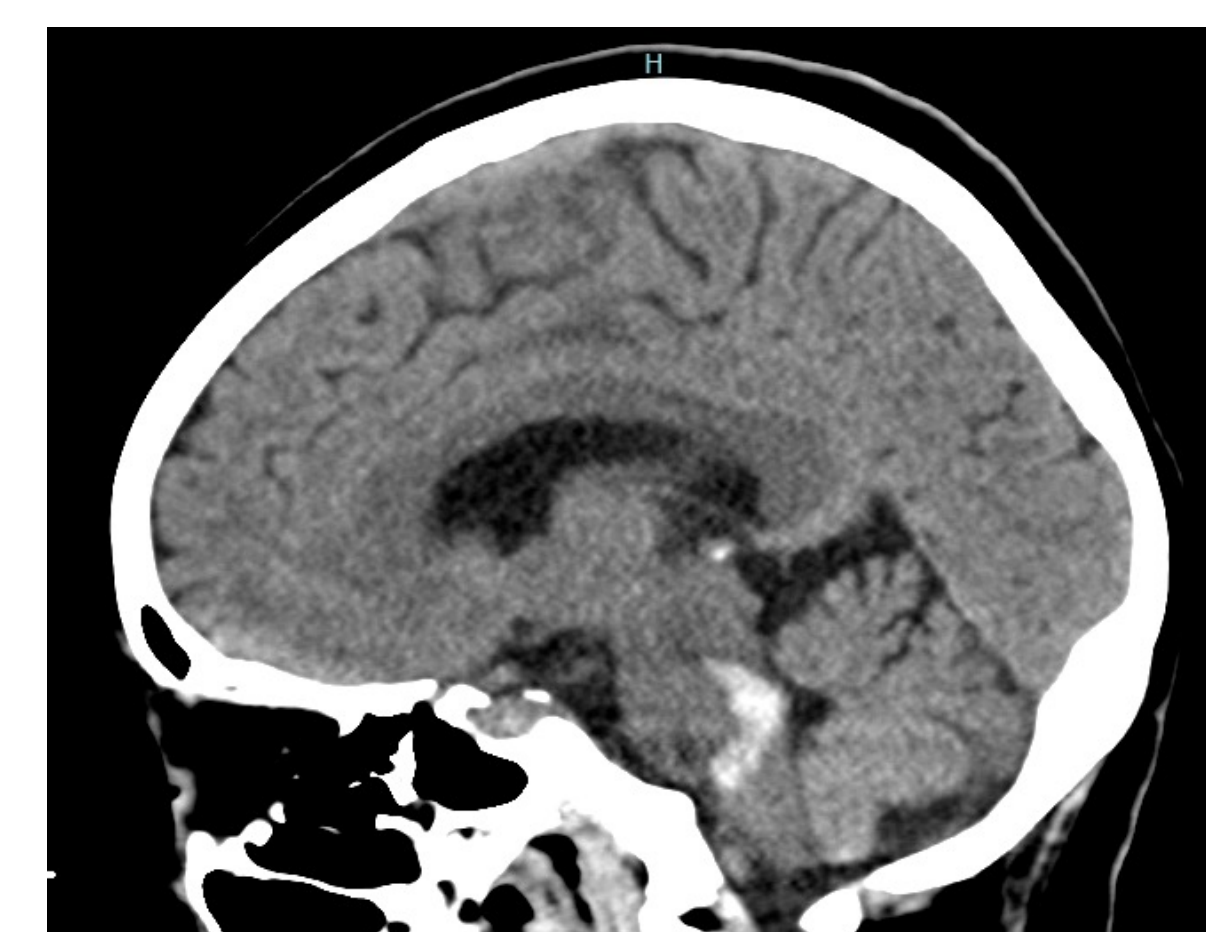
This patient presented with a challenging set of hemodynamic parameters that required careful consideration and cooperation of the anesthesia team with the surgical team. This management shows that a general anesthetic through total intravenous administration is a safe and effective option for management of a parturient with an ICH due to its hemodynamic stability and ability to prevent sympathetic response to intubation and surgical stresses. The use of TIVA with remifentanyl also allows the flexibility of the anesthetic course to transition to neurosurgery if required. Due to the rapidly changing hemodynamics of the delivery period, it is important to have sufficient tools and management options in place to correct these changes if they occur. This case demonstrates the protective ability of general anesthesia for cesarean delivery for the well-being of both the mother and newborn.

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Left: CT imaging of pontomedullary region showing intracerebral hemorrhage. Infiltrates are noted in the intraventricular space of the fourth ventricle.



Right: Serial CT imaging of the pontomedullary region demonstrating no further progression of the hemorrhage and a lack of infiltrates within the fourth ventricle.