

症 例

Combined Spinal and Epidural Anesthesia for Cesarean Section in a Parturient with Cerebral Arteriovenous Malformation

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Abstract

A parturient with intracranial arteriovenous malformation presented for elective cesarean section. Combined spinal and epidural anesthesia was employed because it could provide sufficient analgesia and could produce hemodynamic stability. She received subarachnoid block with 7.5 mg of 0.5% isobaric bupivacaine and incremental epidural boluses of 0.75% ropivacaine to a total volume of 6 ml. Intraoperative maternal hemodynamics was stable, and a healthy baby with Apgar scores of 9 and 10 at 1 and 5 min was delivered. Both the mother and baby were discharged six days later uneventfully. Spinal anesthesia with isobaric bupivacaine combined with epidural anesthesia in small incremental local anesthetic may be an applicable anesthetic alternative for cesarean section in patients with intracranial arteriovenous malformation.

Key words; combined spinal and epidural anesthesia: CSEA, cesarean section, arteriovenous malformation: AVM

Introduction

Intracranial arteriovenous malformation (AVM) is a congenital vascular malformation. The risk of intracranial hemorrhage did not increase with pregnancy¹⁾, however, intracranial hemorrhage from AVM may be a severe life-threatening complication. Sharma et al²⁾ and Ong et al³⁾ applied either spinal anesthesia and epidural anesthesia for pregnant patient with AVM, but combined spinal and epidural anesthesia for pregnant patients with AVM has not been well documented. So, the use of combined spinal and epidural anesthesia for cesarean section in a parturient with AVM was reported.

Case Report

A 30-yr-old woman (156.4 cm, 59.6 kg) who was diagnosed as having intracranial AVM at age 10 yr, presented at 26 weeks of gestation. Her medical history included subarachnoid hemorrhage caused by cerebral AVM 20 years ago. Surgical removal of the AVM and intracranial hematoma had been performed and she was fully recovered. However, remaining AVM was detected by magnetic resonance imaging (MRI) at the age of 25 and gamma knife stereotactic radiosurgery failed to remove it completely. Additional operation was necessary but has not been performed. One year later, she admitted to our hospital with pregnancy. Cerebral MRI was scheduled, however, variable deceleration of fetus developed and

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urgent cesarean section was performed at 35 weeks 2 days gestational age under general anesthesia uneventfully. Age of 28, she received MRI, which revealed residual AVM. For complete removal, gamma knife stereotactic radiosurgery was recommended, however, she refused to receive it. This time she was pregnant again and she was scheduled for an elective cesarean section at 38 weeks 4 days of gestation.

No premedication was used. Routine anesthetic monitoring was performed, including 5-lead electrocardiogram, pulse oximetry, and blood pressure measurement by conventional manchette. Before induction of anesthesia, her heart rate was 60 beats/min in normal sinus rhythm, blood pressure was 140/62 mmHg, and pulse oximeter reading (SpO₂) was 98%. Combined spinal and epidural anesthesia was performed separately with the patient in the right lateral position. First, the epidural catheter was inserted at the T12-L1 vertebral interspace. Then, spinal anesthesia was performed with 7.5 mg of isobaric 0.5% bupivacaine at the L3-L4 interspace using 27-gauge pencil point spinal needle. The patient was turned to the supine position with left uterine displacement. Oxygen was administered via facemask at 5 l/min until the end of the surgery, and SpO₂ was 99% during the surgery. The extent of anesthesia was below T10 by cold stimulation at 10 min after the spinal injection. Epidural bolus of 0.75% ropivacaine 3 ml was used. Five min after the first epidural injection, sensory block level exceeded only to T7. Then another 3 ml was injected through the epidural catheter. Five minutes after the second epidural injection, hypesthesia extended to T4 dermatome level. During the procedure, ephedrine was not required, and her systolic blood pressure was maintained at 100–120 mmHg and heart rate was maintained at 60–85 beats/min. A healthy 2,472 g boy was delivered with Apgar score of 8 and 9 at 1 and 5 min, respectively. After the delivery, oxytocin 10 IU and droperidol 1.25 mg were slowly infused intravenously. Then, fentanyl 100 µg and 0.75% ropivacaine 2 ml was administered epidurally. Intraoperative

fluid loss, including blood and amniotic fluid, was 658 ml, total fluid administration was 950 ml, and urine output was 80 ml.

Postoperative analgesia was obtained using patient controlled epidural analgesia with a concentration of 0.05% ropivacaine and 4 µg/ml fentanyl (basal infusion rate 4 ml/min, bolus dose 2 ml, and a 10-min lock-out time) for 4 days without complications. After 6 days, the patient discharged.

Discussion

Subarachnoid hemorrhage (SAH) due to cerebral AVM commonly occurs in young patients aged between 20 and 25 yr⁴, the overall risk of hemorrhage of AVM is estimated at 2 to 4% per year⁵. In pregnant patients with AVM, the risk of cerebral hemorrhages is 3.5%¹, and it is highest at between 15 and 20 weeks of gestation⁴. Increase in intracranial pressure is one of the important risk factors for SAH caused by cerebral AVM. In order to avoid the rise in intracranial pressure due to Valsalva maneuver associated with vaginal delivery, cesarean delivery has been recommended in patients with AVM that was not treated appropriately⁶. In this case, because AVM has not been completely cured, elective cesarean section was selected.

For controlling blood pressure and heart rate, the choice of the anesthetic method for cesarean section in patients with AVM is important, and should be decided on a case by case basis. Sudden increase in blood pressure and intracranial pressure due to laryngoscopy and tracheal intubation was anticipated in general anesthesia despite high dose remifentanyl administration. However, the safety of administering remifentanyl to a pregnant woman has not been established. To avoid such adverse effect and fetal drug exposure, spinal anesthesia has been recommended⁷. In addition, by allowing patients in awake state, we can easily monitor the level of consciousness, and maternal aspiration can be prevented in spinal anesthesia. Nevertheless, general anesthesia combined with epidural anesthesia was chosen in the first urgent cesarean section, because surgery was

performed before MRI examination, and a status of AVM and a presence of hydrocephalus had not been evaluated preoperatively. Fortunately, no complication was occurred in the first urgent cesarean section. In the second elective cesarean, preoperative examinations were completed and no abnormal signs and symptoms were detected other than residual AVM. Therefore, spinal and epidural anesthesia was selected in the second elective cesarean section.

In spinal anesthesia, a decrease in blood pressure would be the major problem. It is likely that extensive sympathetic blockade due to large dose of local anesthetic is associated with a decrease in blood pressure. To avoid using large dose to spinal anesthesia, we employed combined spinal and epidural technique and sought to use smaller dose of local anesthetic to spinal anesthesia. Hyperbaric bupivacaine is a commonly used drug for spinal anesthesia at cesarean section, and we use 10 mg of hyperbaric bupivacaine for normal cesarean section. However, isobaric bupivacaine produces stable hemodynamics compared with hyperbaric bupivacaine⁸⁾. Therefore, isobaric bupivacaine could be preferable to hyperbaric one in this case. The ideal dose of isobaric bupivacaine is uncertain, however, doses between 7.5 and 15 mg were reported in the previous studies^{9~11)}. It is possible that high dose causes unstable blood pressure and heart rate. Thus, we used smaller dose of isobaric 0.5% bupivacaine at 7.5 mg that produced stable blood pressure and heart rate. However, hypesthesia was obtained only below T10 in this case. Because sensory blockade to T4 is essential for cesarean section, supplemental epidural anesthesia was required. When epidural injection applied after spinal anesthesia, epidural top-up might occur. However, this volume effect might be insufficient beyond 20 min¹²⁾ or after two-segment regression of spinal anesthesia¹³⁾. In the present case, epidural injection was performed 10 min after the spinal anesthesia. Epidural top-up effect was expected to obtain in this case, however, it was difficult to predict the extension of sensory block level. Large volume of epidural injection could cause rapid upward extension of sen-

sory anesthesia. Small volume epidural injection could be preferable, but it may produce inadequate analgesia. A high dose local analgesic would provide sufficient epidural analgesia, even though epidural top-up was not obtained. In addition, ropivacaine is a slower onset drug than bupivacaine¹⁴⁾. Therefore, we chose to use small volume (3 ml for each) and high dose (0.75%) of ropivacaine. Small dose spinal anesthesia combined with epidural anesthesia using ropivacaine could produce stable blood pressure and heart rate during cesarean section without administering vasopressors. In addition, patient controlled epidural analgesia can provide adequate postoperative pain relief¹⁵⁾. Postoperative pain would be one of the factors for rising of intracranial pressure. Combined spinal and epidural technique would be useful for preventing high spinal block and hypotension during cesarean section and for providing effective postoperative pain relief in patients with cerebral AVM.

Despite achieving sensory block level over the T4, some patients complained of visceral pain, nausea, and vomiting during cesarean section¹⁶⁾. Nausea and vomiting could increase intracranial pressure²⁾, which may result in SAH. Fentanyl via the spinal or the epidural route is effective for reducing visceral pain during cesarean section¹⁶⁾. Because visceral pain develops after delivery¹⁶⁾, we gave fentanyl after the delivery via the epidural route. Visceral discomfort did not occur in the present case. We previously reported that although visceral pain did not develop by using fentanyl, but nausea and vomiting occurred¹⁶⁾. To reduce the incidence of nausea and vomiting, we used droperidol intravenously. Epidural fentanyl and droperidol effectively prevented visceral pain, nausea, and vomiting in the present case.

Oxytocin and ergot derivatives are widely used to facilitate uterine contraction and reduce the risk of postpartum hemorrhage. However, those uterotonic drugs have adverse hemodynamic effects. Oxytocin has a mild vasoconstrictive effect on renal, splanchnic, and skeletal muscle arteries and a powerful vasoconstrictive effect on umbilical arteries and veins and in coronary vessels¹⁷⁾. In addition, it has a vasodilative

effect on vascular smooth muscle leading to a decreased systemic vascular resistance¹⁸. On the other hand, ergot derivatives have a potent vasoconstrictive effect and can induce a significant increase in arterial pressure¹⁷. A slow oxytocin infusion could be the safe method to augment uterine contraction. In the present case, blood pressure was stable during and after the oxytocin infusion.

In summary, a case of combined spinal and epidural anesthesia for cesarean section in a parturient with AVM was presented. Spinal anesthesia with small dose of isobaric bupivacaine combined with epidural anesthesia in small incremental local anesthetic may be an applicable anesthetic alternative for cesarean section in patients with intracranial AVM.

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