Letter to the Editor

Korean J Anesthesiol 2014 December 67(Suppl): S85-S86
http://dx.doi.org/10.4097/kjae.2014.67.S.S85

Anesthetic management of a preterm neonate intracranial aneurysm clipping

Bo Ram Kim, Jun Hyun Kim, Kyung Woo Kim, Won Joo Choe, and Jang Su Park

Department of Anesthesiology and Pain Medicine, Ilsan Paik Hospital, Inje University School of Medicine, Goyang, Korea

Pediatric intracranial aneurysms are uncommon. Moreover ruptured aneurysms are extremely rare in preterm neonate. In this article we report a case of a 1 month old infant with a ruptured middle cerebral artery (MCA) aneurysm.

Aneurysm clipping surgery was scheduled for a 1 month 3 day old female neonate, weighing 2,450 g. She was born at a gestational age of 34 weeks and 2 days weighing 2,300 g. After birth, she was mechanically ventilated due to respiratory distress. On the 11th day after birth, she developed sepsis of unknown origin. She presented with abrupt anemia (hemoglobin dropped from 9.5 g/dl to 6.1 g/dl), and brain computerized tomogram (CT) with contrast enhancement was done identifying a intracranial hemorrhage. External ventricular drainage insertion was done. After the drainage, 3-dimensional CT angiography of the head and neck was done. About a 4.2 × 7.7 mm sized aneurysm, at the left MCA bifurcation site was found.

She was transported to operating room for clipping. Before anesthesia, her heart rate was 131 beats/min and blood pressure 68/37 mmHg (arterial catheter at right radial artery) with an infusion of dopamine 10 μg/kg/min and dobutamine 20 μg/kg/min. We connected her endotracheal tube with a ventilator and volume control mechanical ventilation was applied with FIO_2 0.5, tidal volume of 20 ml, respiratory rate of 40 breaths/min and positive end-expiratory pressure 4 cmH_2O. Peak airway pressure was maintained at about 17–20 cmH_2O and peripheral pulse oxygen saturation was maintained at 100% and the end-tidal carbon dioxide was maintained at 28–32 mmHg during anesthesia. Anesthesia was maintained with sevoflurane (0.6 vol%) and remifentanil (0.5–1 μg/kg/min). During four hours after the induction, a mean blood pressure of 40–55 mmHg was maintained, but after that time, epinephrine infusion (0–0.6 μg/kg/min) was added because of a reduction in the blood pressure.

Total anesthesia time was 7 hours 5 minutes. The patient recovered and was discharged 39 days after the surgery.

Intracranial aneurysms occur rarely in preterm neonate so the cause is presumed to be various. In the case of this neonate, a definite causal bacterium was not identified in the culture, but because there was a precedent for sepsis, it is thought to be a septic aneurysm caused by infection.

Neonates cannot localize pain due to a premature central nerve system, and it is known that they cannot interpret pain, because there is no memory of a pain experience. However Anand and Carr [1] stated that the pain sensation is conveyed to the brain region such as the sensory motor cortex and thalamus even in neonates. Appropriate anesthesia and analgesic are necessary even in neonates. For anesthesia methods, there is total intravenous anesthesia (TIVA) using propofol and anesthesia with inhalation agents.

Propofol reduces the oxygen consumption in the brain, decreases the cerebral blood flow, and contracts the cerebral vessels. A target controlled infusion (TCI) model is required to perform TIVA using propofol, and TCI models applicable for infants is the 'Paedfusor' model which can be applied to patients 1 year or older with a weight of 5 kg or more. Our case was a 1 month 3 day old neonate weighing 2,450 g, so currently there are no applicable TCI models.

There is controversy regarding the effect of volatile agents on the brain. Jevtoric-Todorovic confirmed that neuroapoptosis

Corresponding author: Jun Hyun Kim, M.D., Department of Anesthesiology and Pain Medicine, Ilsan Paik Hospital, Inje University School of Medicine, 2240 Daehwa-dong, Ilsanseo-gu, Goyang 411-410, Korea. Tel: 82-31-910-7160, Fax: 82-31-910-7184, E-mail: urdesire@hanmail.net

occurred in neonate rats when they were exposed to nitrous oxide, isoflurane, and midazolam for 6 hours [2]. Considering the above study, there was the possibility of potential neurotoxicity from the volatile agents; thus in this case, the authors used a minimum amount of 0.6 vol% sevoflurane and added a high dose of opioid. Using a high dose of opioid during anesthesia not only reduces the stress response but can also reduce the amount of anesthetic agent; therefore, it can reduce the neurotoxic effects [3]. Most complications anticipated when using opioids in infants or neonates are respiratory hold or apnea which appears during awakening or the recovery stage after surgery. In our case, the neonate was maintained in an intubation state and received ventilator care after surgery so it was not considered to be a problem.

When anesthetizing brain nerves, mild hypothermia (32–34°C) may be maintained to reduce brain oxygen consumption, cerebral blood flow, and intracranial pressure, but the effect is not definite in young patients. Regarding indications for hypothermia, Abraham limited it to neonates with a gestational age of 36 weeks or more who developed hypoxic ischemic encephalopathy within 6 hours of birth, and also restricted it to those who satisfied two more separate criteria [4]. The temperature of the neonate measured in our case was 34.8–37.4°C, and although warm air was turned on intermittently to raise the temperature, there were limitations in stably maintaining body temperature due to loss and replenishment of fluid during surgery, and a relatively large body surface area compared to the weight.

The total amount of infused fluid was 169 ml including leukocyte-depleted RBC 10 ml, and the predicted maintenance fluid requirement was calculated to be 100 ml and blood loss of 90 ml. The fluid administered was Lactated Ringer's solution 69 ml, 5% dextrose water 50 ml used to mix the inotropics, and normal saline 40 ml. Electrolyte imbalance was not observed in the blood test performed after surgery. Inotropics were used to maintain blood pressure during surgery, and 24.5 ml of urine was confirmed after surgery so the I/O balance is considered to be appropriate.

A surgical case of intracranial aneurysm in a neonate is very rare, but it is believed to be on the rise as more low-birth weight neonates survive because of the development of medical technology. More cases and prospective studies are needed to search for an anesthesia method which is more ideal and has a better outcome for neonatal aneurysm patients.

References

1. Anand KJ, Carr DB. The neuroanatomy, neurophysiology, and nerurochemistry of pain, stress and analgesia in newborns and childiren. Pediatr Clin North Am 1989; 36: 795-822.
2. Jevtovic-Todorovic V, Hartman RE, Izumi Y, Benshoff ND, Dikranian K, Zorumski CF, et al. Early exposure to common anesthetic agents causes widespread neurodegeneration in the developing rat brain and persistent learning deficits. J Neurosci 2003; 23: 876-82.
3. Mellon RD, Simone AF, Rappaport BA. Use of anesthetic agents in neonates and young children. Anesth Analg 2007; 104: 509-20.
4. Peliowski-Davidovich A. Hypothermia for newborns with hypoxic ischemic encephalopathy. Paediatr Child Health 2012; 17: 41-6.