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CASE REPORT

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Neuro-Anesthetic Management of Craniotomy-Surgery in Removal Tumor of Left Parasagittal Meningioma Patients: A Case Report

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Abstract

A 45-year-old female presented with complaints of headache and lower limb weakness since 3 months before admission to the hospital and slurring of speech. Patient was known hypertensive with a blood pressure of 130/80 mmhg, a regular pulse rate of 90 times/min, a breath rate of 18 times/min, and an oxygen saturation of 98%. Mallampati 1, good flexion and extension movements of the neck and temporomandibular joints.

Keywords: Meningioma; Munroe Kellies Law; Neuro-anaesthesia; Parasagittal Tumour

Introduction

Meningioma is a challenge for neurosurgeons worldwide because of its malignancy nature, and the expected surgical results are perfect after total excision. These lesions can occur at any age, but most commonly in the elderly. Meningioma incidence in women is higher than in men.

The three main symptoms that often occur are headache, altered mental status, and paralysis [1–3]. In addition to facilitating surgery, anaesthetists also need to perform neuroanesthesia to control intracranial pressure (ICP) and brain volume, protect nerve tissue from injury and ischemia by implementing brain protection techniques, and reduce bleeding during the operation [4,5].

Several things are essential to avoid during surgery, namely, hypoxemia, hypercapnia, anemia, and hypotension because they will harm the central nervous system and surgery results. It is essential to maintain brain autoregulation and response to CO2 to prevent ICP.

Cerebral blood flow (CBF) is maintained at a mean arterial pressure (MAP) of 50–150 mmHg. Exceeding this limit, even with maximal dilation or maximal constriction of the cerebral blood vessels, CBF will passively follow the cerebral perfusion pressure (CPP). If CBF is significantly reduced (MAP 150 mmHg), the pressure will damage the constriction of blood vessels, and CBF will rise suddenly.

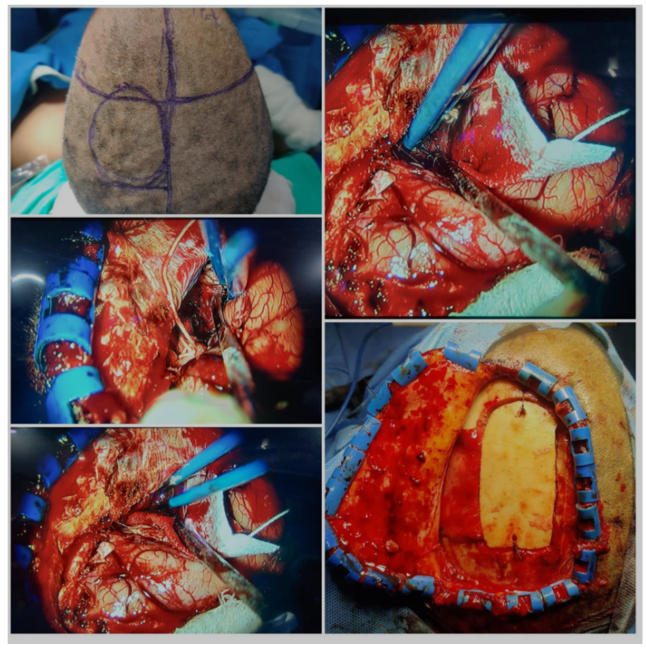
Intracranial components consist of brain tissue, blood, and cerebrospinal fluid. The volume composition of these three components can change according to Monroe Kellie's law, but the total volume is always constant because the intracranial volume is always the same. Therefore, the increasing volume of one component will be followed by a decrease in the volume of another component. Good neuroanesthesia includes the prevention of disruption of each of the intracranial components [6,7].

Case report

A 45-year-old female presented with complaints of headache and lower limb weakness since 3 months before admission to the hospital and slurring of speech. Patient was known hypertensive with a blood pressure of 130/80 mmhg. On physical compos mentis patient with a blood pressure of 130/90 mmHg, a regular pulse rate of 90 times/min, a breath rate of 18 times/min, and an oxygen saturation of 98%. Mallampati 1, good flexion and extension movements of the neck and temporomandibular joints.

Auscultation of the chest, a vesicular breath sounds, and no wheezing and rhonchi were found — laboratory tests within normal limits. Chest radiograph with a posteroanterior position is normal limits. Electrocardiography (ECG) with left axis deviation is normal with a heart rate 100 times/min sinus rhythm. The computerized tomography (CT) scan of the head showed a hyper-dense lesion in the left frontal and parietal bone area measuring 3.9 × 2.8 × 2.5cm with significant surrounding edema noted in the left fronto-parietal lobe in parafalcine region. Deviation of the midline to the right is 7.8mm. The patient was diagnosed left parasagittal meningioma, with the American Society of Anesthesiology 2 of physical status.

In anaesthesia management in the operating room, the patient is positioned in a supine and gives hyperventilation approximately 20 times/min while being given oxygen (O2) through a facemask. The patient was induced with 100mg of fentanyl, 100 mg of propofol, 6mg of vecuronium and sevoflurane was started at 1.2 volume %. Intubation was performed using a Macintosh laryngoscope with a 7.0 size flexo-metalic endotracheal tube (ETT). Maintenance of anaesthesia with 1.2–2% sevoflurane and BIS score of 55 maintained with adequate volatile anaesthetic titration during surgery. Monitoring is done by evaluating systolic, diastolic, mean arterial blood pressure, end tidal carbon dioxide (CO_2), oxygen saturation, bismonitoring and ECG wave. Urine output through a urine catheter. The operation lasted foe 3 and half hrs, with the patient in the supine position. The amount of bleeding was 700ml, and the diuresis was 800 ml. Patients received 1500 cc crystalloid, 40 mg mannitol, performed surgery for 3 h with a transbasal approach. When the periosteum is opened, the dura does not appear tense, and when the dura is opened, a slack brain appears. The tumor was excised under a microscope. The dura mater and other layers are closed until the operation is complete. At the end of procedure after spontaneous respiration and adequate reversal patient was extubated on table with maintained adequate saturation and other vitals. Post-operative Day 1, the GCS of the patient was E4V5M6 with improvement of the preoperative lower limb weakness. On Postoperative day 4 the patient was ambulating without support and with no residual weakness noted.



Discussion

Meningioma originates from the meninges and connects directly to the meninges on the brain's surface. Most of the meningioma grows slowly, and complaints and disorders result from pressure on the area around the mass. Most meningioma can be treated surgically, especially if the tumour location allows for complete extraction of the tumour and is accompanied by dura layer adhesions [7,8]. Patients with tumours causing increased ICP may experience headache, nausea and vomiting, ataxia, syncope, and visual and cognitive impairments. Focal neurological signs are presented due to the mass compression in the surrounding area. Visual disturbances occur in a predictable pattern according to the location of the mass to the optic nerve, optic tract, optic radiation, and visual cortical area. Evaluation of a patient suspected of having an intracranial mass begins with the history and neurological examination. Radiological examination is essential for determining the patient's diagnosis and location of the tumor and postoperative assessment of patients with a supratentorial period.

The main purpose of anesthesia, in this case, is not only to facilitate surgery but also to control ICP and brain volume, prevent secondary brain injury, and reduce the occurrence of bleeding during surgery. Factors to avoid include hypoxemia, hypercapnia, anemia, and hypotension. Brain autoregulation and response to CO2 must be maintained to prevent it.

Autoregulation of blood flow to the brain under normal conditions ranges from 50cc/100 g/min with a basal brain oxygen consumption of 3.3cc/100 g/min and a glucose consumption of 4.5 mg/100 g/min. This condition can occur when the MAP is maintained between 50 and 150 mmHg. MAP below 50 mmHg can cause ischemia in brain tissue, while pressures above 150 mmHg will cause damage to the blood-brain barrier resulting in brain edema or severe bleeding.

In the case of brain tumor removal, a target PaO2 of 100−200 mmHg is expected. The provision of high oxygen levels with a PaO2 >200 mmHg should be avoided because cerebral vasoconstriction can occur and cause brain tissue ischemia [3,8,9]. Changes in the partial pressure of CO_2 in the arteries ($PaCO_2$) will result in changes in brain blood flow because CO2 is a potent vasodilator in brain blood vessels. Every mmHg change in $PaCO_2$ between 25 and 80 mmHg will change brain blood flow by about 4%. In brain tumor surgery, the $PaCO_2$ is maintained between 25 and 30 mmHg to decrease CBF. $PaCO_2$ pressures below 20 mmHg should be avoided as they can cause severe vasoconstriction and cause brain tissue ischemia. Several studies have shown that propofol has a protective effect on the brain. Propofol decreases CBF (30%), CMRO2 (30%), and ICP. Muscle relaxants are known to increase CBF, but the agents that increase CBF the least are vecuronium and rocuronium. Sevoflurane was used in this case because the effects of cerebral vasodilation and increased CBF were the lowest of all the anesthesia gases. Sevoflurane also has a neuroprotective effect in the form of antiapoptosis [9]. The decrease in cardiac output by sevoflurane is also lower than isoflurane or halothane, thus avoiding excessive fluid administration or the use of vasoconstrictors. Sevoflurane is also safe to use in cases of asthma because it does not irritate the airway. Early extubation following the use of sevoflurane facilitates early neurological examination [6].

Lidocaine is local anesthesia in the amide class. Lidocaine can be administered intravenously at a dose of 1−1.5 mg/kg-BW to prevent the increased hemodynamic response and airway response to intubation. The start of action of lidocaine is 60−90 s. In this case, lidocaine was not administered [10]. Mannitol 20% is an osmotic diuretic with an osmolarity of 1086 mOsm/L, with a dose of 0.25–0.5 g/kg, reducing ICP rapidly. Mannitol was administered before drilling for the cranium.

Conclusion

The strength of this case report is this is a rare case in our hospital and full of challenges for the neurosurgeon and neuroanesthesia. Neuroanesthesia management was difficult, so we need knowledge, skills, and medical equipment for procedure and monitoring. The good management of neuroanesthesia will support the success of maintaining stable hemodynamic and better outcome.

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