CASE REPORT

Anesthesia in Awake Craniotomy Patients

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ABSTRACT

Background: Awake craniotomy is a neurosurgical procedure performed while the patient is conscious and cooperative, commonly used to remove brain tumors or epileptic foci located close to brain regions that control in real-time critical functions such as speech, movement, or vision.

Case: A 26-year-old male presented to Haji Adam Malik Hospital, Medan with progressive blurred vision in both eyes and headaches over three months diagnosed with secondary headache due to intracranial space-occupying lesions (SOL) (thalamic glioma). The patient was referred to a neurosurgical colleague for further treatment in the form of a craniotomy. The craniotomy was performed using awake anesthesia techniques for the excision of diffuse glioma in the thalamic region. The awake anesthesia technique involved intravenous premedication with 0.25 mg atropine sulfate, 5 mg dexamethasone, 50 mg phenytoin, 2.5 mg diazepam, 100 mcg fentanyl, and dexmedetomidine administered at 20 mcg/hour to achieve the desired sedation level. Prior to incision, infiltration was performed in the area to be incised using 0.75% ropivacaine 20 ml mixed with 2% lidocaine 4 ml, and before the burr hole was made in the cranium, 50 mcg fentanyl was administered intravenously. The surgery proceeded according to protocol, and the patient was transferred to the recovery room.

Discussion: Awake craniotomy requires clear communication for brain mapping, making severe aphasia and respiratory disorders like sleep apnea contraindications. Dexmedetomidine is favored for sedation due to its minimal respiratory effects. Local analgesia with ropivacaine and lidocaine ensures pain control and hemodynamic stability, reducing opioid use. The lack of bispectral index monitoring to assess sedation depth is a noted limitation.

Conclusion: Considering the benefits and challenges associated with awake surgery, the use of this method should be considered on an individual case basis to ensure surgical success and patient safety.

Keywords: anesthesia; awake craniotomy; neurosurgery; craniotomy; space-occupying lesions (SOL)

INTRODUCTION

Awake craniotomy is a neurosurgical procedure performed while the patient remains conscious and alert. This procedure is commonly utilized for the resection of brain tumors or focal epilepsy located near regions of the brain responsible for essential functions such as speech, movement, or vision. By assessing these critical functions in real-time, the procedure helps to minimize the risk of damage to important brain areas.[1]

Analgesia and sedation during the awake anesthesia technique in awake craniotomy must be carefully managed to ensure that the patient remains conscious and cooperative throughout the procedure. During the identification and avoidance of critical brain areas, the surgeon will ask the patient to perform tasks such as counting or moving specific body parts. This approach allows for optimal tumor removal or focal epilepsy treatment while minimizing the risk of postoperative neurological deficits. The execution of awake craniotomy requires both the neurosurgeon and the anesthesiologist to be highly skilled and well-coordinated. Advanced imaging tools, such as functional magnetic resonance imaging (fMRI), can be utilized for brain mapping to assist during the procedure.[2]

Although this procedure presents certain challenges, the awake anesthesia technique in awake craniotomy offers several advantages, including maximizing tumor resection, reducing the risk of postoperative neurological deficits, and enabling a quicker discharge from the hospital compared to craniotomy under general anesthesia.[3] The objective of this case report is to document the methods and outcomes of this procedure, as well as to evaluate its effectiveness and safety in reducing the risk of postoperative neurological deficits.

CASE

A 26-year-old male presented to Haji Adam Malik Hospital, Medan with a complaint of blurred vision in both eyes. This symptom had been experienced by the patient for the past 3 months and had progressively worsened, with the blurred vision being particularly pronounced in the right eye. The patient also reported a history of intermittent headaches for the past 4 months, which improved with analgesics. There were no reports of altered consciousness, nausea, or vomiting. Additionally, there was no history of weakness in the limbs, localized lumps, or fever. The patient was initially brought to Haji Adam Malik Hospital, Medan for preliminary management and was subsequently referred by the neurology division with a diagnosis of secondary headache due to space-occupying lesions (SOL) intracranial, for further evaluation and treatment by the neurosurgery division, which included craniotomy surgery.

The patient was compos mentis with a glasgow coma scale (GCS) of E4V5M6 prior to the surgery. Vital signs were within normal limits, with a blood pressure of 125/70 mmHg, a pulse rate of 88 beats per minute, a respiratory rate of 20 breaths per minute, and an oxygen saturation of 98%. Physical examination revealed a clear airway, with vesicular breath sounds and no rhonchi or wheezing. SpO2 was 94-96% with nasal cannula at 3 liters per minute. Pupils were isocoric, with positive light reflexes, and cranial nerve examinations were within normal limits. Urinary output was normal, and the abdomen was soepel with normal peristaltic. Reflexes of the upper and lower extremities were normal, and no pathological reflexes were observed.

X-ray examination of the patient showed a VP shunt implanted in the left chest wall, with no radiological evidence of cardiac or pulmonary abnormalities (Figure 1).

Magnetic resonance imaging (MRI) of the brain with contrast revealed a predominantly right-sided bilateral thalamic mass, consistent with a thalamic glioma. The mass was accompanied by a subfalcine herniation extending approximately 0.6 cm to the left, and left frontal sinusitis (Figure 2). Complete blood count results were as follows:

Hb/ht/leu/plt: 13.1/48.3/10280/239000
Ur/cr: 18/0.7
Na/K/Cl: 131/4.6/101
Pt/Aptt/INR: 11/27.7/0.99
Random blood glucose: 138

Figure 1. Preoperative X-ray image

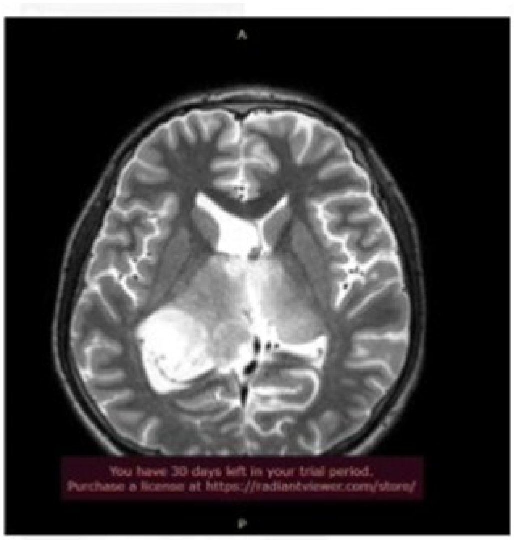

Figure 2. Preoperative brain MRI

An awake craniotomy with awake anesthesia technique was planned for the patient, using sedation and anesthesia medications including 0.25 mg atropine sulfate, 5 mg dexamethasone, 50 mg phenytoin, 2.5 mg diazepam, 100 mcg fentanyl, and dexmedetomidine at 20 mcg/hour (loading dose 0.5 to 1.0 mcg/kg, maintenance dose 0.2 to 0.7 mcg/kg per hour) to achieve the desired level of sedation.[4,5] Prior to the incision, infiltration was performed in the incision area to prolong the anesthetic duration beyond the first analgesic request,[6] using 0.75% ropivacaine 20 ml mixed with 2% lidocaine 4 ml. Before the burr hole was made in the cranium, 50 mcg fentanyl was administered intravenously.

During the operative procedure, the patient was able to communicate effectively, maintained active contact, and was fully conscious, with stable hemodynamic status. There were no incidents of desaturation, the patient did not report significant pain, and no occurrences of nausea or vomiting were observed.

(a)

(b)

Figure 3. (a) Hemodynamics before induction during the procedure (b) Hemodynamics after induction during the procedure

Figure 4. During intraoperative

Figure 5. Hemodynamics during operative

DISCUSSION

Awake craniotomy focuses on the identification and excision of lesions affecting critical areas of the brain involved in motor, language, and cognitive functions. It is crucial to conduct a comprehensive evaluation prior to the procedure to identify both absolute and relative contraindications in the patient.[7]

Communication is a crucial element during surgery. Conditions that impede communication, such as decreased consciousness, difficulty speaking, and excessive anxiety, are considered contraindications for performing this procedure.[7] Patients with severe aphasia are contraindicated for this procedure due to the difficulty in establishing effective communication necessary for intraoperative mapping. Additionally, patients with respiratory conditions, such as sleep apnea, are also contraindicated due to the potential difficulty in airway management, raising concerns about the risk of respiratory failure during surgery.[8]

Anesthetic drugs such as propofol, remifentanil, fentanyl, and dexmedetomidine can be used as sedation in the awake anesthesia technique.[9] Dexmedetomidine possesses sedative, anxiolytic, and analgesic properties. It is preferred in many cases because it rarely causes respiratory depression.[10] A retrospective study involving 55 patients found no incidents of respiratory complications in any of the patients who received dexmedetomidine during the awake anesthesia technique.[11] A study comparing propofol-remifentanil and dexmedetomidine during awake craniotomy for supratentorial tumors in 50 adult patients demonstrated no difference in sedation effectiveness or the ability to perform brain mapping. However, respiratory side effects were more frequently observed in the propofol-remifentanil group.[12] High doses of dexmedetomidine can cause bradycardia, hypotension, and prolonged recovery from sedation effects. However, such doses are rarely required during awake craniotomy.[13]

Local analgesia via a scalp block provided optimal analgesic effects in this patient when combined with other intravenous analgesics (multimodal analgesia). The scalp block technique involves blocking six nerves: the supraorbital nerve, supratrochlear nerve, auriculotemporal nerve, zygomaticotemporal nerve, greater occipital nerve, and lesser occipital nerve. Although rarely reported, maxillary nerve block along with greater and lesser occipital nerve blocks has been described as an alternative to the classic scalp block for craniotomy.[14]

In this case, diazepam, phenytoin, and fentanyl were used as premedication to help the patient remain calm. Fentanyl is the primary choice in neuroanesthesia for pain prevention. Due to its highly lipophilic properties, fentanyl provides a rapid analgesic effect.[15] A pioneering study, using a double-blind randomized technique to investigate local infiltration, compared the effects of local infiltration with 0.5% bupivacaine against normal saline injection in patients undergoing craniotomy. The findings revealed that cardiovascular hemodynamics were more stable in patients who received bupivacaine.[16] In addition, a study also reported that local anesthetic infiltration at the skull pinning site was associated with a lower bispectral index and improved hemodynamic stability.[17] In this patient, a local infiltration of ropivacaine combined with lidocaine was used. Lidocaine provides a rapid onset of local anesthesia, while ropivacaine offers a longer duration of analgesia compared to lidocaine. Infiltration of 0.5% ropivacaine in the scalp prior to incision has been reported to provide adequate analgesia during and after surgery, as well as reduce opioid consumption.[18]

This patient received dexamethasone as an adjuvant. A study comparing the infiltration of bupivacaine combined with lidocaine with and without adjuvants found that adding dexamethasone, magnesium sulfate, or both to a scalp block before an awake craniotomy resulted in improved block effectiveness during the intraoperative and postoperative periods.[19]

During the operative procedure, the patient in this case was able to communicate effectively, maintained active contact, and was fully conscious, with stable hemodynamic status. There were no incidents of desaturation, and the patient did not report significant pain or experience nausea and vomiting. Awake craniotomy with intraoperative brain mapping allows for maximum tumor resection while monitoring neurological function. This procedure is often used for lesions involving eloquent areas of the brain, such as Broca's area, Wernicke's area, or the primary motor cortex. It has also been employed for epilepsy focus resection and deep brain stimulation for Parkinson's disease or obsessive-compulsive disorder. Given its effectiveness, it has been proposed for use in brain tumor surgeries regardless of the tumor's location.[5]

Awake craniotomy offers several anesthetic and surgical benefits. Patients undergoing awake craniotomy can avoid procedures associated with general anesthesia, such as endotracheal intubation and mechanical ventilation. Hemodynamic and physiological disturbances related to general anesthesia are reduced, and postoperative pain, nausea, and vomiting are less frequent in awake craniotomy compared to craniotomy under general anesthesia. However, seizures, hypertension, respiratory depression, nausea and vomiting, and mild brain swelling can occur during awake craniotomy. Macroglossia and inadvertent intracerebral injection of local anesthetics during scalp nerve blocks have also been reported. Although complications during awake craniotomy are typically minor and easily managed, urgent interventions are required in cases of seizures and airway obstruction.[5]

A limitation in this patient’s case was the absence of the use of the Ramsey sedation score, relying solely on interview techniques during the procedure.

CONCLUSION

The awake anesthesia technique in awake craniotomy is an innovative method, particularly for cases where tumors or epileptic foci are located near eloquent area or regions controlling vital functions such as speech, movement, or vision. This approach reduces the risk of damage to these critical areas of the brain.

Nevertheless, the awake craniotomy technique requires specialized skills and close collaboration between the neurosurgeon and the anesthesiologist. Furthermore, not all patients are suitable candidates for this procedure, as a comprehensive evaluation is necessary to ensure proper patient selection, the smooth execution of the surgery, and the patient's safety.

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