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Case Report

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Awake brain surgery in epilepsy: a case report and review of the literature

Abstract

Awake craniotomy is a frequent procedure in the practice of neurosurgery. In functional neurosurgery, this anesthetic technique has been described for Deep-Brain- Stimulators (DBS) placement in Parkinson's disease and for tumor resection in eloquent areas. We describe a case of transoperative identification of epileptogenic foci with successful real-time resection. A 26-year-old patient who presented to our emergency room with seizures of difficult control despite a three-drug scheme. Brain image was performed that showed evidence of a left temporal lobe glioma. Due to the eloquent situation of the tumor, a resection under Awake-Sleep-Awake (AAA) technique was performed. Conclusion: Awake craniotomy is a very well stablished neurological procedure that has been increasing in frequency and indications. Profound knowledge of the perioperative and anesthetic management is key for the anesthesiologist to successfully perform the intricate procedure of managing the sleep and awake periods, as well as all its potential complications. Awake craniotomy allows for a very precise resection, having a positive impact in the short- and long-term quality of life of these patients.

Keywords: Awake craniotomy, epilepsy surgery, neuroanesthesia

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Javier Bryan Nieto Rizo MD,[1] Oscar Daniel Guerrero Ortiz,[2] Daniela Della Valle Gutiérrez[3]

[1]Neuroanesthesiology attending at National Institute of Neurology and Neurosurgery, Mexico

[2]Neuroanesthesiology fellow and chief of Neuroanesthesiology Residents at National Institute of Neurology and Neurosurgery, Mexico

[3]Neuroanesthesiology fellow at National Institute of Neurology and Neurosurgery, Mexico

Correspondence: Javier Bryan Nieto Rizo, Subespecialist in Neuroanesthesiolgy, Specialist in Anesthesiology, Graduate in medicine, Mexico, Email javier.nieto.riz@gmail.com

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Introduction

Approximately 20 – 30% of people worldwide with epilepsy are pharmaco- resistance, and of these 10 – 50% may be eligible for surgery. Patients that fail to respond after two different first-line antiepileptic drugs are likely refractory and should be considered for surgery. Based on this estimate and the total prevalence, the number of possible epilepsy surgery candidates worldwide is between 1 million and 7.5 million people.[1] Awake craniotomy is a common procedure in the practice of functional neurosurgery, performed while the patient is fully awake, maintaining the ability of language and cooperation with the surgical and neuropsychology team is key.[2] This technique has been used for Parkinson's disease surgery, tumor resection and more seldom, epilepsy foci resection, such as in our case.

The aim of this anesthetic technique is to reduce the risk of injury in eloquent brain areas and improve the patient's quality of life avoiding complications caused by a conventional craniotomy. Other advantages over non-awake tumor resection are shorter hospital stay and lower incidence of perioperative morbidity. The anesthesia management technique for awake craniotomy is decided considering appropriate analgesia, sedation, hemodynamic stability, and adequate control of the airway.[3] During the procedure, the patient cooperability allows for an adequate clinical and neuropsychological testing. The success of awake craniotomy depends on careful patient selection and comes in hand with effective communication between the anesthetist, electrophysiologist, and neurosurgeon, generating a work plan.

This anesthetic technique has absolute contraindications such as patient refusal and inability to follow orders, others are anxiety, obesity, difficult airway, uncontrolled seizures, inability to maintain the position for several hours and gastroesophageal reflux. Mainly relying in the analgesia and anesthesia provided by a long-acting scalp nerve block, the careful titration of sedation with short-acting agents confers the adequate conditions for patient comfort and cooperability.

Case report

A 24-year-old female patient, who was admitted at our emergency room presented with a generalized tonic-clonic seizure despite three-drug antiseizure scheme. After initial medical attention and stabilization of her acute condition, a brain MRI was obtained showing a temporal mass compatible with an oligodendroglioma. The patient's seizure semiology was described as of presenting up to three times a week a 1-minute tonic-clonic generalized seizure with a confusion postictal period of 5 minutes. Her usual medication was levetiracetam 500 mg BID, carbamazepine 400 mg BID, and magnesium valproate 200 mg TID. At physical exploration, the patient was alert and awake, time, person, and place oriented, with all mental functions preserved. A Glasgow Coma Scale (GCS) of 15 was conferred. Cranial nerves exploration was without alterations and language was emitted fluently and congruently. She had no motor or sensitive deficit. Laboratory tests were among normal ranges, no clinical signs of sleep obstructive apnea were present neither a difficult airway was anticipated. A simple contrast-enhanced MRI of the skull showed a T1 hyperintense temporal left lobe mass of heterogeneous content compatible with intralesional calcifications.

During surgery a standardized Trans anesthetic monitoring was employed, an arterial line was placed to ensure an accurate arterial tension control and a large bore IV was obtained for intravenous infusions. After preoxygenation, intravenous induction was performed with propofol 75-85 mcg/kg/min and remifentanil 0.08-0.10mcg/kg/min muscle relaxation with rocuronium 30 mg was performed. After an adequate anesthetic plane, a supraglottic device (Fast-Track) #5 was used for intubation, after that a protective mechanical ventilation was implemented. A 12-points scalp nerve block with 0.75% of ropivacaine was set and the patient was put in lateralized surgical position.

When the awake period was near (approximately 10-15 min) all infusions (IV anesthetic and opioid) were reduced, and after metabolic lysis and redistribution of drugs, the patient was checked for airway reflex and awake status, since the patient had an adequate neurologic state, the laryngeal mask was removed. In this period all neuropsychological and clinical tests took place, including cortical stimulation in search for epileptogenic foci. After satisfactory tumor resection, the second asleep period began, and remifentanil and propofol perfusions were restarted, C-Mac videolaringoscopy aided intubation was performed. Trans anesthetic period went uneventful and hemodynamic control was attained in all periods of anesthesia. Tumor resection was successful with a 600 ml bleed. The patient was extubated and transported to post anesthetic unit under spontaneous ventilation and fully awake with no neurological deficits (Figure 1,Figure 2).

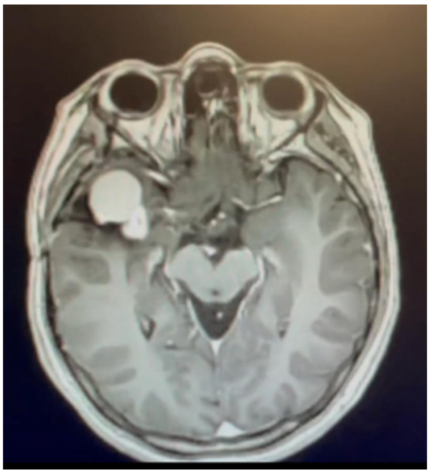

Figure 1 Axial image of the brain showing a temporal lesion.

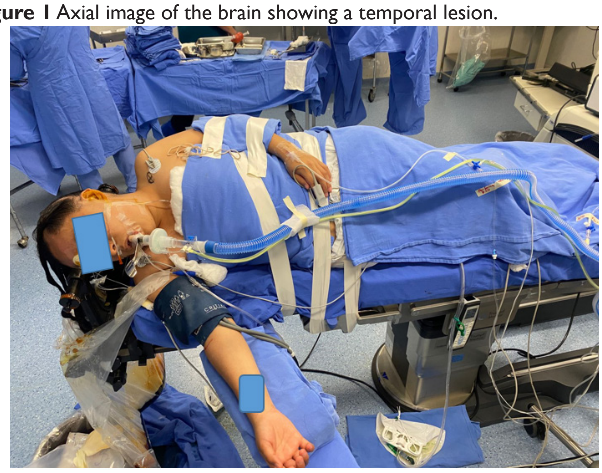

Figure 2 Patient under general anesthesia with supraglottic device (Fast-Track) during the first stage of asleep- awake- asleep anesthesia technique.

Discussion

Preoperative evaluation

The choice of anesthetic agents for awake craniotomy depends largely on the need for functional cortical mapping and intraoperative electrocorticography. Various intravenous anesthetic drugs affect cortical monitoring tracings, therefore the agents chosen should have the least possible effect on suppression or hyperactivation.[5] Awake craniotomy requires a highly cooperative patient along with an expert surgical team. Appropriate patient selection and preparation are essential for the success of awake craniotomy. the path to successful awake craniotomy begins with the preoperative patient interview, this particular step, is highly important since gaining the patient's trust aids in mitigating anxiety and facilitates the constant face-to-face interactions between the patient and caregivers needed during the awake phase of AAA anesthesia.[4]

Preoperative airway evaluation is particularly important in anticipation of awake craniotomy, since access to the airway and options for airway management are limited during these procedures due to patient position, often with head lateralized or flexed. A plan for elective or emergent airway management should be determined preoperatively, as per guidelines. In addition, patients who are at risk for airway obstruction with sedation (e.g., severe obesity, patients with obstructive sleep apnea) should be identified.[6]

Monitoring

Anesthesia monitoring is essential during awake craniotomy for early detection of physiological changes and prevention of future complications.[5] Standard American Society of Anesthesiologists (ASA) monitors includes electrocardiogram [ECG], non-invasive blood pressure [BP], pulse oximetry, oxygen analyzer, continuous end-tidal carbon dioxide [$ETCO_2$] analyzer. The decision to place an intraarterial catheter, or to monitor for venous air embolism, should be based on patient factors and the surgical procedure.[2] Central venous catheterization may be done for infusion of fluids and vasoactive agents. Cortical monitoring should be placed on the same side as brain lesions to avoid interfering with contralateral sensorimotor monitoring. A processed EEG monitor may be used to register the anesthesia depth, therefore regulate the dose of anesthetic agents needed and for rapid awakening during intraoperative language testing.[3]

Anesthesia technique for awake craniotomy

Regional scalp block

Regional anesthesia plays a center role in the AAA anesthetic technique. For it to be successful, it relies in the satisfactory anesthesia and analgesia delivered by the scalp nerve block. The scalp nerve blocks a 6 nerves (trigeminal and C2-C3 cervical branches), and 12-anatomic points regional anesthesia technique first described in 1986 wins its central place by providing 8-14 hours of trans anesthetic and postsurgical analgesia.[5] It also allows a significant reduction of intraoperative opioid administration, a controlled hemodynamic response to allogenic and reflexogenic stimuli, a decrease in the use of other intravenous analgesics and comfortable awake period for the patient, among other benefits. The most common drugs used are long-acting local anesthetics, such as 0.75% ropivacaine and 0.25% bupivacaine with or without 1:200,000 epinephrine. The volume of the local anesthetic of choice can vary from 1.5-5 ml depending on each anatomic point of injection which commonly comprises, the supraorbital, supratrochlear, zygomaticotemporal, auriculotemporal, greater occipital and lesser occipital nerves.[7]

The anesthesia techniques available in awake craniotomy are local anesthesia with or without sedation and anesthesia with the AAA technique, being the main difference between these two the mandatory airway management in AAA anesthesia. If the AAA technique is chosen, the airway will have to be secured with an endotracheal tube or with a supraglottic device, the patient will remain under general anesthesia during skull pinning, craniotomy, and dural opening.

Afterwards, the patient will be awakened so that he or she can participate during the cortical mapping. Once the cortical mapping is complete, general anesthesia is induced again and the airway is secured.[2] For AAA, the hypnotic drug of choice is propofol since it can be titrated to achieve the desired level of anesthesia and sedation, it decreases cerebral blood flow and has an anticonvulsant effect.[3] For the anesthesia induction and manipulation of the airway, continuous perfusion doses ranging from 90-120 mcg/kg/min will be used and for maintenance doses around 60 mcg/kg/min are frequently adequate.

A fast-acting opioid such as remifentanil can also be titrated with doses varying from 0.04-0.08 mcg/kg/min. Muscle relaxants may

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also be used, especially when airway and ventilation manipulation is needed. Once the patient regains consciousness, sedation can be continued with propofol in doses between 20-50 mcg/kg/min and remifentanil with doses from 0.01 to 0.06 mcg/kg/min since this can be titrated according to the patient's comfort.[6] Dexmedetomidine, an alpha 2 adrenergic agonist has also been used as an alternative for sedation in awake craniotomy. Used in doses ranging from 0.3-0.5 mcg/kg/hr. The main advantage of dexmedetomidine is that it does not cause respiratory depression and does not interfere with electrocorticography, however care must be taken with its adverse effects such as hypotension and bradycardia.[2]

Conclusion

Neurosurgical procedures that require an awake patient have increased in popularity in recent years, since they provide advantages for the surgeon and have been shown to increase patient survival. The anesthesiologist must count with the physiological, neurophysiological, pharmacological, and technical knowledge in order to keep the patient as comfortable as possible during the procedure, pain-free, hemodynamically stable while allowing an optimal cortical stimulation and lesion resection.

Acknowledgments

None.

Conflicts of Interest

None.

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