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Brief communication

Brain tumor surgery with an awake patient, experience in a regional hospital

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Abstract

Objective: To describe the experience of three patients who underwent craniotomy for tumor resection under the awake-awake-awake modality and to develop an anesthetic intervention scheme with medications available at the institutional level, to keep patients with a sufficient level of consciousness to allow interaction during the transoperative period.

Methods: We present the case of three patients who underwent craniotomy and tumor resection under the awake-awake-awake modality. Non-invasive monitoring and blocking of the scalp and surgical area were used.

Results: Three male patients with intracerebral tumors underwent surgery, extensive resection of the lesions was achieved, the patients did not require invasive airway management, and they adequately went through the planned stages of the procedure. All patients were referred to the recovery service conscious and oriented, with stable vital signs. The process for using medications and the available resources were optimized with a proposed anesthetic protocol.

Conclusion: the awake-awake-awake technique allows the patient to remain more comfortable and cooperative during the stages of surgery, the adequate blocking of the scalp leads to less drug use and better responses. The technique used and the medication protocol developed allow the procedure to be performed without the need to secure the airway in the first and last phases. It is possible to perform neurosurgical interventions with an awake patient in hospitals in rural areas of Costa Rica.

Keywords: awake patient, brain tumors, anesthetic techniques, conscious sedation, scalp block, neuromonitoring.

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Awake craniotomy is performed for the localization and resection of tumors located near eloquent areas of the brain, using direct electrical stimulation (DES) mapping of subcortical fibers, as it offers a unique opportunity to investigate the functional connectivity of the brain. This is an original method that allows real-time anatomical-functional correlations, especially concerning neural pathways, to be carried out in awake patients undergoing brain surgery.[1]

In this context, it is particularly important to have an adequate selection of patients, both physically and psychologically, so it is advisable to avoid the inclusion of patients with a difficult airway, obesity, gastroesophageal reflux, anxiety, and uncooperative or disoriented.[2]

In addition to keeping the patient breathing and hemodynamically stable, the purpose of anesthesia is to ensure a level of sedation and analgesia that will allow cooperation during the trans-operative period to perform neurological tests, while providing a comfortable environment and good communication with the surgical team.[3,5] Prior to anesthesia, optimal analgesia, anxiolysis and sedation, as well as medications for the prevention of nausea and vomiting. Subsequently, sensory blockade is performed at the scalp level and

the patient is positioned in optimal positioning for the surgical procedure. [3,6]

Despite the lack of consensus, several techniques and anesthetic medications have been proposed to perform this type of procedure; however, there is always the latent risk of having intrinsic or extrinsic complications of the patient that can trigger the need for endotracheal intubation.

The purpose of this work was to describe the experience with three cases subjected to this type of intervention under the awake – awake – awake modality. Likewise, to develop a medication scheme adapted to the offer of the institutional basic 2, which allows the management of the patient with a sufficient level of consciousness to engage in a conversation with the explorer during the trans-operative period. This is partly because the type of neurosurgical interventions can be performed in hospitals of the second level of care in the Caja Costarricense de Seguro Social (Costa Rica Social Security Fund) because they are regional hospitals located in peripheral territories of the country.

The purpose of anesthesia is to ensure a level of sedation.

Methods

This is a descriptive report on the experience of 3 patients undergoing brain surgery with the awake patient technique who were treated during the period between May and September 2022, at the Dr. Escalante Pradilla Hospital, located in the southern part of the province of San José, a regional institution typified as a second level of care.

All patients were evaluated before the surgical event by the neurosurgery, psychology, nursing, and anesthesiology team to explain the procedures and evacuation of user doubts. The selected patients did not show significant or disabling neurological deficits at the time of surgery, they were functionally intact.

All users voluntarily agreed to perform the surgical and anesthetic procedures, providing their informed consent. Part of the information about each case was obtained from the clinical record and in situ was recorded during the perioperative period, as described.

Upon arrival at the operating room, the user is greeted by the nursing team and the anesthesiologist. An interview is conducted to determine the user's status and fasting. All pass to the corresponding operating room where they are transferred to the operating table. In all cases, non-invasive monitoring of vital signs is used: pulse oximetry, electrocardiogram, blood pressure, entropy, and capnography. Supplemental oxygen is applied by nasal cannula at 2 L/min and a thermal blanket is placed at 38°.

Each patient on supplemental oxygen was sedated with midazolam and ketamine. Propofol and the rest of the medication protocol were started (Table 1). Once a state of deep sedation (ENTROPY 60-40)[4,5] is reached, urine catheterization and venous access are performed, if necessary. No patient undergoes invasive monitoring.

Table 1. Relationship of drugs with their dosage and administration schedule to be used in patients undergoing craniotomy with the awake patient technique. Hospital Dr. Escalante Pradilla, Caja Costarricense de Seguro Social (Costa Rican Social Security Fund), 2022

Drugs	Minimum dose	Maximumdose	Bolus	
Propofol Phase 1 & 3	0,1 mg/kg/min	3 mg/kg/min	0.5 mg/kg	1 mg/kg
Propofol Phase 2	0,025 mg/kg/min	0,05 mg/kg/min	0.5 mg/kg	1 mg/kg
Midazolam	2.5	5 mg	Prior to surgery	
ketamine	5 mg /	10 mg	Prior to surgery	
Fentanyl	0.01 ug/kg/h IV		Prior to surgery	
Dexamethasone	8 mg IV		Prior to surgery	
Diphenylhydantoin	125 mg IV		Prior to surgery	
Granisetron	3 mg IV		Prior to surgery	
Cimetidine	200 mg IV		Prior to surgery	
Metamizole	2.5 g IV		Prior to surgery	
Mannitol	20 g IV		Prior to surgery	
Cephalotine	2 g IV		Prior to surgery	
Acetaminophen	1 g IV		Prior to surgery	
Verapamil	0.05 mg/kg/h	0.1mg/kg/h	Hypertensive crisis	
Sodium Chloride 0.9% Cold Solution	Irrigar corteza a demanda en caso de crisis convulsiva			

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Then, after asepsis and antisepsis, scalp 6.7 was blocked with 40 mL of 0.5% bupivacaine. The patient is positioned in the Mayfield head, and the contact points are infiltrated with 0.5% bupivacaine; 5 mL is used at each point.

Antisepsis is performed and the patient is dressed in sterile clothing. Before the surgical incision, the incision area is infiltrated with 2% lidocaine with epinephrine 1:80000. Neurosurgeons proceed with craniotomy and then proceed to phase two of the medication (Table 1) to prepare the user for the interrogation of psychologists and cortical electrostimulation tests (ENTROPY 95 or higher). At this time, the coronoids are also placed on ice so that, in case of seizures, they are applied to the cerebral cortex.

Once the lumpectomy has been performed, phase three is reached, and the patient is asleep again (ENTROPY 60-40), so that he can rest until the end of the procedure. Once the surgical act is concluded, the user is transferred to the recovery service where they are monitored for at least an hour until they are transferred to the salon. In the 3 cases handled as described, at no time was the airway invaded.

Results

We registered 3 cases of patients with intracerebral tumors aged between 26 and 60 years, all male, who underwent craniotomy with the awake-awake-awake technique (phase 1, phase 2, phase 3) (Table 2). The medication used in the trans operatory with its diagrams is shown in Table 1, with noteworthy adjustments in the dose of propofol according to the current phase.

During all procedures, users had adequate ventilatory and hemodynamic stability. Opioids were used only in phase 1, and scalp-blocking analgesia was supplemented with bupivacaine. Capnography was recorded using a device adapted to the nasal cannula, which was ligated in the middle of the whisker, and one of its ends was connected to the capnograph line. Then, during phase 2 (awake), it was observed that the patients were very lucid and cooperative, even performing activities of their daily lives (playing the flute, for example, figure 1). No opioids were administered in phase 2. Later, after tumor resection, users moved on to phase 3 to conclude the procedure.

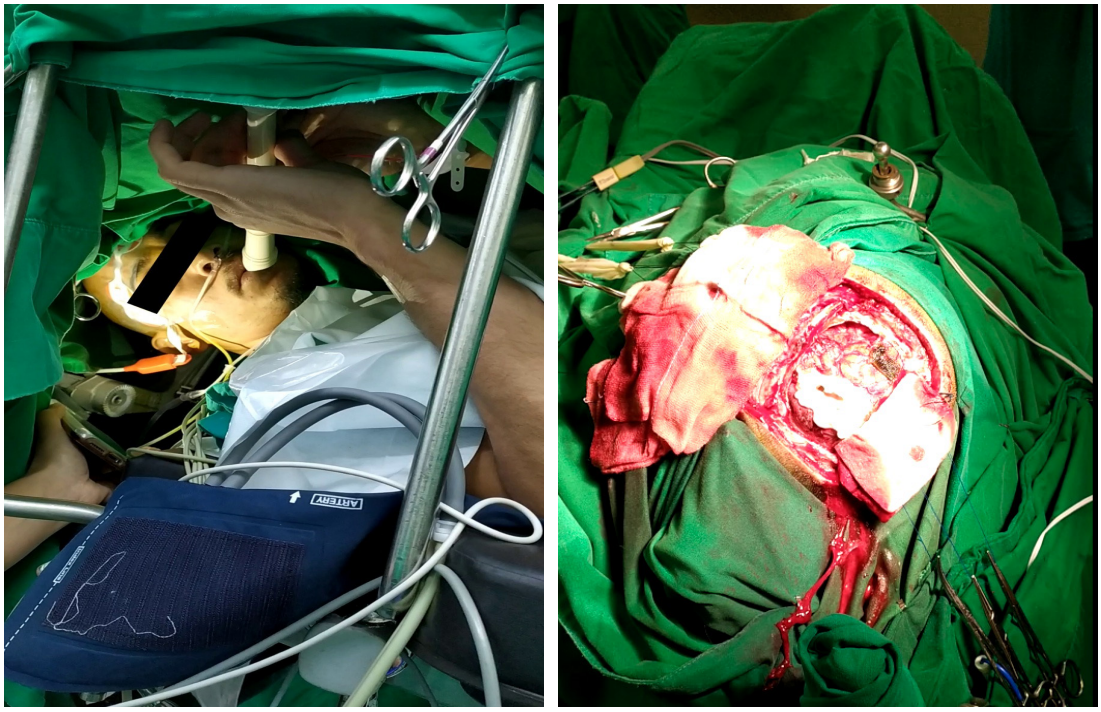

Figure 1. A patient undergoing craniotomy with the awake patient technique who is playing the flute during the transoperative period (A) is shown an image of the craniotomy and the brain surface (B).

Table 2. Characteristics of 3 patients with intracerebral tumors who underwent craniotomy with the awake patient technique, Hospital Dr. Escalante Pradilla, Caja Costarricense de Seguro Social (Costa Rican Social Security Fund), 2022

Gender	Edd (years)	Histological Diagnosis	Site of Injury	Preoperative neurological status	Postoperative neurological status
More	26	Diffuse astrocytoma DEE IDH mutation	Right temporal lobe	No déficit	No deficit
More	46	Low-grade astrocytoma	Left temporal lobe	No deficit	No deficit
More	59	Low-grade astrocytoma	Left temporal lobe	No deficit	No deficit

In addition, urinary catheterization, scalp block, and fixation on the Mayfield frame were performed after anesthetic induction (entropy less than 60) according to the protocol described in Table 2.

In no case was intubation or airway support required, and none of the users presented seizures. All patients were transferred to recovery service conscious and oriented.

Discussion

Neurosurgical procedures for brain tumors are becoming more and more frequent, so it is essential for the neurosurgeon that the patient is conscious and cooperates during the location and resection of the lesion. This entails greater technical difficulties in the anesthetic area, including the most significant: airway management.

In our experience, the surgical act is divided into three phases:

1) Phase one: when a user arrives conscious and oriented to the operating room, where he is interrogated and the induction and deepening of anesthesia is started, the craniotomy is performed.

2) Phase two: the user moves on to a conscious phase, where he interacts with the neuropsychologist and the neurosurgeon to delimit and remove the injured area, achieving the greatest preservation of the eloquent area under study.

3) Phase three: the user no longer needs to be conscious and cooperative, so they move back to an unconscious phase (phase one) to rest and conclude the transoperative.

The experience is considered very relevant because it reveals the effective care and resolution of complex needs that demand specialized interventions, such as the resection of a brain tumor with the application of novel techniques such as craniotomy with the patient awake, in which context the role of the anesthesiologist in differentiating anesthetic interventions is essential to ensure the patient's collaboration at the right time and thus avoid the requisition of the patient's laryngeal mask and invasive monitoring in all cases.

As has been pointed out, in phase 2, the anesthetic requirements are adequate when the craniotomy has been completed, and the users become communicative and cooperative, without reporting pain. After the exploration and resection of the tumor lesion and corroborated hemostasis, users are taken to stage 3, that is to say, now asleep, to conclude the surgery. It is important to reiterate that in none of the cases was there a need to manage the airway, all arrived conscious and cooperative to the recovery service.

The patients chosen for their neurosurgical resolution with this technique derived a better post-surgical evolution, without incapacitating lesions of the eloquent areas, less cognitive deterioration, and less post-surgical pain, which further supports the benefit it represents for the patient.

The anesthetic management of users for occupying lesion craniotomy under the awake – awake – awake technique, or as we mentioned in this writing: phase 1, phase 2, and phase 3 is a procedure that requires a multidisciplinary approach, a very refined selection of users and an anesthetic technique that allows the patient, the neuropsychologist and the neurosurgeon to be tuned to achieve the widest resection of the lesion with minimal deterioration of the user's cognitive and motor conditions. 2,3,6 In addition, there is no doubt that careful blocking of the scalp and infiltration of the surgical wound allowed in all cases to dispense with opioids in phase 2 of the procedure, thus making the patient more cooperative.

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From this experience, it is considered that the awake – awake – awake technique has been ideal for obtaining the post-surgical results achieved and avoiding the placement of devices for airway management at all stages.5 All this as a result of having carried out an adequate selection and assessment of patients by neurosurgeons, neuropsychologists, anesthesiologists, and nurses in the operating room service.

Finally, these procedures were carried out using drugs and monitoring available in our institutional environment (Caja Costarricense de Seguro Social / Costa Rican Social Security Fund), which guarantees that they can be carried out throughout the national territory where the human and technical teams with the appropriate training are gathered. In conclusion, it has been demonstrated that conscious sedation for resection of brain tumors is a procedure that can be performed in regional hospitals.

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