

Anesthesia Management for Awake Craniotomy: Report of Two Cases

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Abstract: Introduction: Awake craniotomy (AC) started with epilepsy treatment and was extended to other procedures. Several techniques have been used successfully. We will describe show two cases successfully where using the technique with local anesthesia anesthesia and sedation protocols were used successfully. Cases Information: The 1st case is a male, 38 years old, 78 kg, ASA II classification, musician, previously healthy when he started with seizures. Imaging tests showed an expansive frontotemporal lesion on the left near the speech region, and tumor resection by awake craniotomy and with a speech monitoring technique in the perioperative period was indicated. At the time of resection, was allowed to play his guitar, with previously with asepsis and permission from the HICC, having been discharged from the ICU on the second day and to residency without neurological deficits. The 2nd was a male patient, 22 years old, 63 kg, 170 cm, with neurofibromatosis with seizures and past thoracolumbar spine arthrodesis brought to operating room due to and tumor recurrence. An MRI of the skull was performed for postoperative control, showed tumor recurrence in an eloquent area, and surgical resection was indicated. After discussing the case with the patient, family members and the anesthetic team, it was decided to perform a craniotomy with the patient awake for better monitoring and safe delimitation of the resection area. The tumor resection was delimited by speech obtaining an almost total resection of the tumor. Conclusion: Based on the report from two cases, AC may have certain benefits for patients undergoing craniotomy, including shorter hospital stay, fewer neurological deficits, and shorter surgery time, with early discharge from the ICU and into residency with their families.

Keywords: Neurosurgery, Awake Craniotomy, Ropivacaine, Lidocaine, Dextroketaimine, Dexmedetomidine, Propofol

1. Introduction

One of the first studies describing anesthesia for craniotomy with the patient awake was performed in 354 patients with epilepsy in 1988 [1]. Craniotomy with the patient awake is considered the gold standard for resection of brain tumors located within or near the eloquent areas. In patients undergoing craniotomy while awake, it is intended to avoid procedures related to general anesthesia, such as tracheal intubation and mechanical ventilation, in addition to the hemodynamic changes of this technique.

One of the first studies describing anesthesia for craniotomy with the awake patient awake was performed in 354 patients with epilepsy in 1988 [1]. Craniotomy with their awake patient awake is considered the gold standard for resection of brain tumors located within or near the eloquent areas [1, 2]. In patients undergoing craniotomy while awake, it is intended to avoid procedures related to general anesthesia, such as tracheal intubation and mechanical ventilation, due to the elevated possibility of hemodynamic instability related to these procedures.

Anesthesia has evolved a lot after the since "awake craniotomy" (AC) initial publication and there is currently

considerable variation in the anesthetic techniques for AC ranging from the “sleep-awake-sleep” technique, with or without the use of an airway, anesthetic care and adequate monitoring [2]. In a recent meta-analysis with 47 studies, 18 were found with the sleep-awake-sleep technique (SAS), 27 monitored anesthetic care (MAC), one reported both techniques and one used the awake-awake-awake (AAA) technique, concluded that SAS and MAC techniques were feasible and safe, whereas data for AAA technique are limited [3].

The advantages of surgical aspects and anesthetic techniques for performing awake craniotomy were recently published [4]. The purpose of the presentation of these two cases is to provide strategies for anesthetic management related to craniotomy in two awake patients aged 35 years (musician) and another aged 22 years (cash operator).

2. Case Report 1

Male, 38 years old, 78 kg, ASA II classification, musician, previously healthy when he started with seizures. Imaging tests showed an expansive frontotemporal lesion on the left near the speech region, and tumor resection by awake craniotomy and with a speech monitoring technique in the perioperative period was indicated.

Preoperative laboratory tests within normal limits, hemoglobin 15 g/dL, hematocrit 40%, platelets 225,000/mm³, sodium 134 mmol/L, potassium 3.7 mmol/L. Too many normal tests. Mallampati I airway assessment, Wilson index 0, interdental distance greater than 3 cm and thyrodental distance greater than 6 cm. Functional capacity between 4 and 10 MET.

In use of phenytoin 100 mg 8/8 hours and dexamethasone 4 mg 6/6 hours, and in psychological preparation. In the pre-anesthetic consultation with the anesthesiology team, he received explanations and guidance under the agreed procedure and signed the Free and Informed Consent Term and authorization for later publication. The patient was a musician and, due to the area of surgery, it was agreed with the Hospital Infection Control Commission (HICC) that after cleaning the guitar, it would be used during the procedure.

In the operating room, two peripheral venous accesses with extracath (#18G) were punctured in each arm, and radial artery for continuous monitoring of blood pressure and blood collection for examinations. Monitoring with continuous ECG, pulse oximetry, BIS in the frontal region, temperature and diuresis through an indwelling bladder catheter. Injected ondansetron (4 mg), dexamethasone (10 mg), and cefazolin 2 g every 3 hours.

Positioning the patient on the operating table, still awake, with padding and protection of bony prominences, cushion below the knees to relieve lumbar curvature. Oxygen nasal catheter at 2 l/minute was installed, dexmedetomidine induction was started (1 µg/kg in 10 minutes) followed by a maintenance dose that varied between 0.2 and 0.7 µg/kg/min. Target Controlled Infusions [TCI] of propofol was also started when the patient was not alert, keeping the BIS

around 55 and 60. After the patient is asleep, bladder catheterization was performed. A thermal blanket with forced hot air was used. A barrier with surgical drapes was installed just above the shoulders and the face was uncovered and with direct visualization of the examiner.

Scalp block was then performed with 0.25% bupivacaine with epinephrine in the supra trochlear (2 ml), supra orbital (2 ml), auriculotemporal (3 ml), greater occipital (3 ml) and lesser occipital (3 ml) nerves bilaterally, by the anesthesiologist, and local anesthesia (2 ml of the same substance) at the contact points of the Mayfield fixator pins on the head. Before the incision performed local infiltration with 0.25% bupivacaine at the incision site. Finally, the dura was anesthetized before its incision, with a gauze soaked in 1% lidocaine under the dura for two minutes.

During the craniotomy, the patient was kept under deep sedation and immediately after the use of the craniotome, propofol was suspended, and dexmedetomidine was maintained at 0.4 µg/kg/h. Close to the time of the neurological test, at least 30 minutes before, dexmedetomidine was completely discontinued.

Noise reduction during surgery and at the time of neurological assessment with alarm settings, beeps and complete silence in the operating room (OR), where only the examiner and the patient could communicate at the time of the test. At the time of the speech test, the BIS was maintained at 91, with the patient being fully responsive, alert, without complaints. The guitar was properly sanitized and delivered to the patient who started his music, which was monitored at the same time the neurosurgeon was mapping the lesion (Figure 1). At times when the area corresponding to speech was stimulated, the patient was affected by aphasia and at points where the area of speech did not correspond, he was able to play the guitar and sing normally. No seizure episodes occurred during the test.



Figure 1. Patient playing guitar during neurosurgery awake.

After completion of the tests and delimiting the safe area for resection of the lesion, dexmedetomidine was restarted at 0.7 µg/kg/min and associated with propofol at 1mg/ml with a BIS maintained around 60. Saturation with a nasal catheter was 99% throughout the procedure and no respiratory assistance was required at any time. At the end of the surgery, venous analgesia was performed with 2g dipyron, 100 mg ketoprofen and 10 mg subcutaneous morphine.

Tumor resection was performed with safety and comfort for the patient, there was no need for blood products and at the end of the surgery the patient was referred to the ICU and

discharged within 24 hours to the ward without neurological deficits.

After returning for evaluation of the surgical procedure, the patient stated that he did not remember that he had played the guitar in the perioperative period and that he would accept it again if he underwent this anesthetic technique.

3. Case Report 2

Male patient, 22 years old, 63 kg, 170 cm, with neurofibromatosis with seizures and past thoracolumbar spine arthrodesis (Figure 2). Mallampati II, mouth opening greater than 3 cm, thyromental distance greater than 6 cm, no limitations in cervical mobility. Preoperative laboratory tests within normal limits, hemoglobin 16.2 g/dL, hematocrit 47.1%, platelets 215,000/mm³.



Figure 2. Past thoracolumbar spine arthrodesis.

History of seizure for just over a year when brain tumor was diagnosed. He received a craniotomy at the time with tumor resection (histiocystic sarcoma), and is progressing without deficits in the use of phenytoin 100 mg 8/8 hours and clonazepam 2 mg 12/12 hours.

An MRI of the skull was performed for postoperative control, showed tumor recurrence in an eloquent area, and surgical resection was indicated (Figure 3). After discussing the case with the patient, family members and the anesthetic team, it was decided to perform a craniotomy with the patient awake for better monitoring and safe delimitation of the resection area.

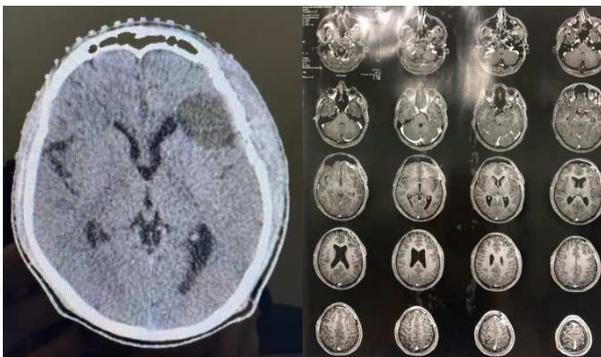


Figure 3. Cranial MRI for postoperative control.

During the pre-anesthetic consultation with the anesthesiologist, the patient received clarification and guidance on the agreed surgical procedure and signed the Free and Informed Consent Term and authorization for later publication.

In OR monitoring with continuous ECG, pulse oximetry, BIS in the frontal region, temperature and diuresis through an indwelling bladder catheter. Venous access was punctured in the right upper limb with extracath #16G and left upper limb with extracath #14G, both under local anesthesia with 1% lidocaine. Injected ondansetron (4 mg), dexamethasone (10 mg), and cefazolin 2 g every 3 hours.

Oxygen nasal catheter at 2 l/minute was installed, and sedation with dexmedetomidine (0.7 µg/kg in 10 minutes) was started, followed by a maintenance dose (0.4 to 0.6 µg/kg/h) and propofol TCI. With the patient sedated (BIS 55), the left radial artery was punctured for continuous blood pressure monitoring and blood collection for exams. Scalp block was then performed with 0.25% bupivacaine with epinephrine in the supra trochlear (2 ml), supra orbital (2 ml), auriculotemporal (3 ml), greater occipital (3 ml) and lesser occipital (3 ml) nerves bilaterally, by the anesthesiologist, and local anesthesia (2 ml of the same substance) at the contact points of the Mayfield fixator pins on the head. Before the incision performed local infiltration with 0.25% bupivacaine at the incision site. Finally, the dura was anesthetized before its incision, with a gauze soaked in 1% lidocaine under the dura for two minutes.

With the BIS at 55, a craniotomy was performed and dexmedetomidine was maintained at 0.4mcg/kg/h, and the propofol infusion was suspended. The patient was comfortable, calm, responding to commands, without airway obstruction that required a rescue device. Close to the moment of the speech tests (30 minutes before) the sedation was completely suspended, there were no complaints of pain and with BIS around 84 to 89, the tests were performed which lasted 90 minutes. Tumor resection was delimited by speech obtaining an almost total resection of the tumor.

After the delimitation of the resection area, the patient was kept sedated with propofol and dexmedetomidine with BIS at 60, nasal oxygen catheter. He did not need blood components or vasoactive drugs. At the end of the procedure, he was referred to the ICU where he was discharged in 12 hours, without deficits, without interurrences. At the end of the surgery, venous analgesia was performed with 2g dipyrone, 100 mg ketoprofen and 10 mg subcutaneous morphine. Pathological anatomy results showed epithelioid glioblastoma, received complementary treatment with chemotherapy, maintained levetiracetam and clonazepam.

4. Discussion

There are several anesthetic techniques for performing AC, but an experienced anesthesiology team is essential. Some special care is needed in the preparation and care of the patient with a AC proposal, a relationship between the entire surgical team, including the OR technicians, with silence being

fundamental in this procedure. The 1st patient was a musician, a concern with the motor and speech part became even more important. The idea of having the patient playing his instrument in the perioperative period, with the participation of the HICC, was an excellent conduct for monitoring, because in addition to the ability to emit sounds, pronunciation, clarity and memory were evaluated in this speech test. The 2nd case was resection of tumor recurrence and the AC technique and the presence of speech was essential to limit the tumor resection, without neurological complications.

In both patients, the anesthetic technique used was conscious sedation, and thus regional anesthesia is necessary with a long-acting anesthetic. Anesthesia of the scalp nerves was termed as scalp block. Sensory innervation of the scalp and forehead is supplied by the trigeminal nerves and spinal nerves, in 2010 a review of the technique was published [5]. In this review of the technique during AC, the basis anatomy, historical evolution, current technique, potential advantages, disadvantages, complications, contraindications and future applications, were analysed in this article [5]. Innervation of the anterior part of the scalp and forehead is provided by the trigeminal nerve and its three divisions (ophthalmic, maxillary, and mandibular division) [5]. The posterior part is innervated by the greater occipital nerve, which originates from the posterior region branch of the second cervical nerve root [5]. In both cases, the blocks for surgery were performed by the anesthesiologist with 0.25% bupivacaine associated with epinephrine. The dura mater must also be anesthetized before its incision, as its innervation is not covered by the scalp block, which was performed with gauze soaked in 1% lidocaine.

Since its inception, AC has been indicated for lesions in the cortex, but its indication has been extended to the resection of several supratentorial tumors, regardless of their location and histology [6], thus avoiding the side effects and complications of general anesthesia. Several anesthetic techniques have been indicated and used for AC surgery, but an anesthesiology team familiar with the various techniques is essential for this procedure. One of the main goals for performing anesthesia for an AC fundamentally include the patient's cooperation and cognitive ability [7]. In both cases, anesthesia and analgesia were performed with several drugs such as: propofol, dexmedetomidine, lidocaine, bupivacaine and drugs to prevent nausea and vomiting during and after the procedure.

In a study comparing propofol-dexmedetomidine versus propofol-remifentanyl during awake craniotomy for epilepsy surgery, it was shown that the association with dexmedetomidine provides fewer side effects for conscious sedation during awake craniotomy, and association with had more side effects [8, 9]. In our group, we preferred the association with dexmedetomidine rather than the use of remifentanyl, a fact that occurred in both cases. Dexmedetomidine is an α^2 receptor agonist with potent sedative, anxiolytic and analgesic properties which is commonly used for intraoperative and intensive care sedation [10], as observed in both cases.

About two-thirds of patients report moderate to severe pain

after craniotomy in prospective studies, and there is no consensus on pain management in these patients [11]. A systematic review and meta-analysis carried out in 2013 showed that the regional scalp block was associated with significant reduction in pain for several hours after craniotomy [12]. The regional scalp block is a simple technique, quickly performed, safely, and reliably, and the findings of this meta-analysis recommend its use for postoperative analgesia in any craniotomy procedure.

5. Conclusion

Based on the report from two cases, AC may have certain benefits for patients undergoing craniotomy, including shorter hospital stay, fewer neurological deficits, and shorter surgery time, with early discharge from the ICU and into residency with their families. Conscious sedation with the mixtures used in these two cases facilitated and improved the result of the surgery, but a preoperative evaluation is essential for the patient's understanding of the procedure and monitoring during the surgical procedure is a success factor in the technique.

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