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Multimodal Anesthesia Approach for Craniotomy and Tumor Resection Adjacent to the Eloquent Area in Awake Patient: Case Report.

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Introduction: Intra-axial brain tumors, especially those adjacent to the eloquent area, have a challenging surgical resection due to their surgical limits. Awake craniotomy (AC) is an established neurosurgical procedure for the treatment of certains pathologies. Several techniques such as airway management, local anesthesia, sedation protocols are already establised.

Case Report: A 40-year-old patient, 85 kg, 170 cm, ASA II classification, with a low-grade temporal glioma with previous resection seven years ago, was elected to the new neurosurgery due to tumor recurrence. Without pre-anesthetic medication, patient monitored with: cardioscope, non-invasive blood pressure, pulse oximetry. After conscious sedation and analgesia were initiated intravenously with magnesium sulfate, lidocaine, dextroketamine, and dexmedetomidine, for deep venous puncture in the internal jugular vein and right radial artery catheterization. Scalp block was performed with 0.5% ropivacaine and 1% lidocaine for perioperative analgesia. Propofol was added in a continuous target-controlled infusin for the surgical incision. Hemodynamically stable patient with oxygen through a nasal catheter. The surgery was uneventful, lasting a total of 300 minutes and 95% of the tumor was resected. At the end, the patient was referred to the Intensive Care Unit (ICU) and 20 hours later to the ward.

Conclusion: AC may have certain benefits for patients undergoing craniotomy including shortened hospital stay, fewer neurological deficits, and shorter surgery time. The patient was discharged from the ICU to the ward 20 hours after the surgical procedure.

Keywords: Neurosurgery; Awake craniotomy; Ropivacaine; Lidocaine; Dextroketamine; Dexmedetomidine; Propofol

Introduction

Intra-axial brain tumors, especially those adjacent to the eloquent area, have a challenging surgical resection due to their surgical limits. Resection involving such prime areas is associated with postoperative neurological deficits [**1**]. Computer-assisted resection of 98% or more of the glioblastoma multiforme (GBM) tumor is a independent variable associated with greater survival time [**2**].

Awake craniotomy (AC) is an established neurosurgical procedure for the treatment of certains pathologies. Several techniques such as airway management, local anesthesia, sedation protocols are already establised. A recent systematic review with 47 studies with three anesthesia techniques: asleep-awake-asleep technique (SAS), monitored anesthesia care (MAC), and the awake-awake-awake technique (AAA), showed that SAS and MAC technique for AC seem to be similarly safe without serious complications, whereas evidence for the AAA technique is limited [**3**]. Thus, AC requires a multidisciplinary teamwork and personal experience for the success of the procedure.

The case report will show a patient who underwent a second resection of a low-grade glioma adjacent to the eloquent area, using a AAA technique, with various anesthetic

substances associated with regional anesthesia.

Case Report

A 40-year-old patient, 85 kg, 170 cm, ASA II classification, with a low-grade temporal glioma with previous resection seven years ago, was elected to the new neurosurgery due to tumor recurrence. The recurrent tumor was located adjacent to the eloquent cortex and partially encompassed the middle cerebral artery. The patient´s preoperative clinical evaluation did not present other relevant data.

After meeting the surgeon and anesthetist with the patient and family members, it was decided to perform the surgical procedure with the awake-awake-awake technique, obtaining the Informed Consent Form and authorization for publication.

No pre-anesthetic medication was performed in the ward. In the operating room, after monitoring with cardioscope, non-invasive blood pressure, pulse oximetry and venoclysis, conscious sedation and analgesia were initiated intravenously with 2 g of magnesium sulfate, 100 mg of lidocaine, 15 mg dextroketamine, and dexmedetomidine (loading dose of 1µg/kg for 10 minutes and maintenance at 0.7 µg/kg/h) for deep venous puncture in the internal jugular vein and right radial artery catheterization. Because the incision mattered where the BIS should be placed, it was not used in this surgery. Immediately after conscious sedation, scalp block was performed with 15 ml of 0.5% ropivacaine and 10 ml 1% lidocaine for perioperative analgesia, with subsequent placement of Mayfield position and fixation of the head in a lateral position.

Prior to the beginning of the surgery, propofol was added in a continuous target-controlled infusin (0.4 µg/ml) for the surgical incision. Before opening the dura mater, due to the potential for pain during this part of the surgery, local anesthesia was performed using gauze soaked with 0.5% ropivacaine. Immediately before tumor resection, an out-of-field neurosurgeon performed standardized verbal and visual tests to facilitate identification of areas of speech and performance of cortical mapping, concurrently with electrical stimulation by the main surgeon. Any changes to these were notified.

The patient remained hemodynamically stable throughout the surgical procedure, easily awakened to calls, eupneic with oxygen support through a nasal cannula. The surgery was uneventful, with a total duration of 300 minutes and 95% of the tumor was resected. At the end of surgery, the patient was referred to the Unit Care Intensive (UCI). Discharged to the ward 20 hours after the end of surgery, with no new additional neurological deficits.

Discussion

Intraoperative mapping of the linguist tract is performed as a essential parte of vigil procedures to identify with eloquent accuracy pathways associated with speech and motor functions in the individual patient. This critical part for AC was performed by an out-of-fiel neurosurgeon prepared for this exam identifying the areas and facilitating tumor resection. The patient remained hemodynamically stable throughout the surgical procedure, easily awakened to calls, eupneic with oxygen support through a nasal cannula. The surgery was uneventful, with a total duration of 300 minutes and 95% of the tumor was resected.

Since anesthesia is performed with conscious sedation, the regional anesthesia must be performed with long-lasting anesthetics. After monitoring with cardioscope, non-invasive blood pressure, pulse oximetry and venoclysis, a scalp block [**3**] was performed with a solution of lidocaine plus ropivacaine, for subsequent fixation of the Mayfield pins.

In a 2013 review article, including 8 studies with 951 patients comparing 411 using AC and 540 using GA supports the claim that the technique using AC allowed faster hospital discharges with the awake group being discharged on average more than 2 times faster (4 days compared to 9 days) [**4**]. However, recently, it has been suggested that the use of AC in non-eloquent regions may contribute to longer survival with fewer postoperative deficits, increasing the extent of resection and delaying anaplastic transformation [**5**].

Several anesthetic techniques have been successful implemented for AC surgery, but an experienced anesthesiology team is critical to the success of the procedure. During the pre-anesthesia consultation, one of the main objectives is to properly select the patient, as their cooperation is essential for the success of the technique. Regardless of anesthesia technique or agents used, the patient's airway must be protected. The patient underwent conscious sedation and intravenously analgesia with magnesium sulfate, lidocaine, dextroketamine, and dexmedetomidine. Local anesthesia with ropivacaine and lidocaine was also used for the scalp and dural incisions.

In the case of airway obstruction, pain, or a patient’s inability to tolerate the procedure there may be a need to convert to a general anesthetic. Twenty-one patients were operated on, being three patients were considered ineligible after the first step. In the remaining 18, the responses of 10 patients fell within the normal range and 8 shown some degree of impairment on at least 1 preoperative evaluation, but not enough to be excluded from wake up surgery [**6**].

Scalp block consists of infiltration of anesthetic site in well-defined anatomical sites in order to obtain a sensitive block [**7**]. The main nerves to be blocked are: supra-orbital, supratrochlear, auriculotemporal, zygomaticotemporal and occipital. A scalp block was performed in the patient with the association of 0.5% ropivacaine and 1% lidocaine, with no need for new infiltration.

In a retrospective study with 55 patients it showed that AC for tumor resection using a dexmedetomidine-based anesthetic and scalp blocks in no airway complications or conversion to general anesthesia [**8**]. The anxiolytic and analgesic properties of dexmedetomidine enabled patients to remain awake and be surveilled during tumor resection. In the present case report, dexmedetomidine, dextroketamine, and low doses of propofol associated with regional anesthesia were used, without any airway complications or conversion to general anesthesia. Anxiolytic and analgesic properties dexmedetomidine and dextroketamine allowed patients to remain awake during tumor resection.

Two cases of CA with the use of a laryngeal mask (LMA) were recently published, being important when requiring greater depth and anesthetic ventilation control, in situations where tracheal

intubation may be hampered by positioning [**9,10**]. Due to the complications reported with the use of LMA, these events included aspiration, airway trauma, loss of the airway on insertion, failed insertion, displacement after insertion, loss of airway during maintenance, and extubation-related problems [**11**]. Due to these problems, our group prefers not to use LMA in this type of surgery.

The integration of the entire team is essential for the success of AC. The anesthesiologist, who is responsible for the patient's vital functions and provides conditions for the neurosurgeon to perform the tumor resection smoothly and with a cooperative patient. In our opinion, the most important environmental factor, often overlooked, is the silence within the OR. Patients describe noise as one of the most disturbing factors during the procedure [**12**]. Noise can arise from different sources, from OR personnel to the striking of surgical instruments and should be minimized [**13**]. Warnings must be used on the OR doors and walls, reminding that the surgery is performed with the patient awake.

Conclusion

Awake craniotomy has several anesthetic benefits and surgical advantages. Regarding the surgical aspects we found: better preservation of engine and speech function, shorter hospitalization, reduced postoperative neurologic deficits improved survival [**14**]. Regarding anesthetic aspects, they show: less physiological disturbance, avoidance of mechanical ventilation, avoidance the adverse impact on immunity associated with general anesthesia [**14**]. In the present case, with 95% of the tumor resection lasting 300 minutes, the patient was discharged from the ICU to the ward 20 hours after the surgical procedure. Propofol, dexmedetomidine, dextroketamine and scalp nerve block provide the reliable conditions for intraoperative brain mapping.

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