Case Report

Awake craniotomy for tumor resection

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Abstract

Surgical treatment of brain tumors, especially those located in the eloquent areas such as anterior temporal, frontal lobes, language, memory areas, and near the motor cortex causes high risk of eloquent impairment. Awake craniotomy displays major rule for maximum resection of the tumor with minimum functional impairment of the Central Nervous System. These case reports discuss the use of awake craniotomy during the brain surgery in Alzahra Hospital, Isfahan, Iran. A 56-year-old woman with left-sided body hypoesthesia since last 3 months and a 25-year-old with severe headache of 1 month duration were operated under craniotomy for brain tumors resection. An awake craniotomy was planned to allow maximum tumor intraoperative testing for resection and neurologic morbidity avoidance. The method of anesthesia should offer sufficient analgesia, hemodynamic stability, sedation, respiratory function, and also awake and cooperative patient for different neurological test. Airway management is the most important part of anesthesia during awake craniotomy. Tumor surgery with awake craniotomy is a safe technique that allows maximal resection of lesions in close relationship to eloquent cortex and has a low risk of neurological deficit.

Key Words: Awake craniotomy, monitored anesthesia care, propofol, remifentanil

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INTRODUCTION

Awake craniotomy for tumor resection presents many challenges for the neurosurgeon and the anesthetist. Brain tissue surgery poses an inherent risk of permanent neurological deficit, especially for tumor resection in the eloquent cortex. Awake craniotomy allows for intraoperative speech, motor, and sensory testing, with the goal of maximum tumor resection while avoiding postoperative neurological morbidity.

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The anesthetic management for this surgery must be included sedation, analgesia, respiratory, and hemodynamic control, and a responsive, co-operative patient for neurologic testing intra-operatively.[1]

Reliable preservation of healthy brain tissue will be accessible if the patient can be awake during the procedure and be able to respond to the stimuli.

By the way, there is absolute evidence that the degree of tumor resection along with tumor progression increase free life expectancy and survival.[2]

Despite the fact that awake craniotomy had been tried since the 19th century as a trial for removal of epileptic foci under local anesthesia,[3] this kind of approach was not found as a desirable method because of its unpleasant scenario, gradual advances in anesthetic methods and facilities resulted in revitalization of the old technique. In the new era, the indications for

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awake craniotomy have expanded to include: Resection of brain tumors involving eloquent areas and removal of supratentorial tumors, regardless of the involved area of the cortex.[4]

When you decide to map the eloquent cortical areas during brain surgery, the patient has to be conscious and able to communicate during cortical stimulation. At this point, the responsible anesthetist is facing a great challenge to find a technique that not only provides adequate sedation, analgesia, respiratory and hemodynamic control, but also an awake and cooperative patient for neurological testing.

Many neurosurgery institutes have established their specific anesthetic techniques for awake craniotomies, however, the superiority of any of them has not been proved.[5,6]

Several anesthetic methods can be used for awake craniotomy. The goal of all techniques is to render the patient alert, co-operative, and being able to participate in verbal and motor testing during the procedure.

Also, maximum resection should be facilitated, with minimum impairment of neurological function.

Awake craniotomy for tumor resection as much as we know had not been performed or has never been published in Iran.

The purpose of this communication is to report successful application of awake craniotomy in Isfahan, Iran.

CASE REPORTS

Case 1

A 56-year-old female patient with weighing 46 kg with left-sided body hyposthesia since last 3 months was operated under craniotomy for brain tumor resection. Anatomical location was in the right parietal lobe. On perioperative evaluation, airway was normal, mallampati was class I, and neck movement was within normal limits and didn't have any abnormal anatomical picture and no movement restriction in jaw joints. Heart and lung examination were normal. Patient GCS (Glasgow Coma Scale) was 15/15 and examination of cranial nerves was normal. Laboratory studies, including CBC (complete blood count), BUN (Blood Urea Nitrogen), Cr, Na, K, BS, PT (Prothrombin time), PTT (Partial thromboplastin time), INR (International Normalized. Ratio), were normal and her blood group was A+. Any abnormality couldn't be seen on the chest radiography.

Case 2

A 25-year-old female patient weighing 49 kg had severe headache of 1 month duration. Examination of cranial nerves and sensorimotor function of the limbs were normal. On perioperative evaluation, the airway was normal, mallampati was class I, and neck movement was within normal limits. She didn't have any abnormal anatomical picture or no restriction in jaw joints' movement. Heart and lung examination were normal. Patient's GCS was 15/15 and cranial nerves examinations were normal. Laboratory studies, including CBC, BUN, Cr, Na, K, BS, PT, PTT, INR, were normal and her blood group A+. Any abnormality couldn't be seen on the chest radiography.

When the patients were visited in preoperative anesthesia clinic being awake during surgery, type of anesthesia, surgery and the need of patient cooperation was described for them even if it was hard for them. Without prescription of premedication, we got electrocardiogram, pulse oximetery, non-invasive blood pressure NIBP. Under regional anesthesia, we got arterial line for continuous checking of blood pressure. Then we started invasive blood pressure IBP monitoring, and catheterized their bladder. Before starting sensory nerve block, first 1 micg/kg fentanyl and then 25 mg propofol was injected. Scalp nerves block include supraorbital, supra-auricular, lesser and greater occipital with 0.5% marcaine plus epinephrine 1/200,000 was done. The area that pins fixed head separately was infiltrated by lidocaine 2%. Continuous CO2 sampling via nasal canola was done. Oxygen 6 L/min was established through a face mask. To avoid fatigue and discomfort, shoulders, arms, and lower extremities were supported through pillows. Then, continuous intravenous infusion of remifentanil 0.3 micg/kg was started. For sedation, a bolus dose of propofol 1 mg/kg was infused and continued by infusion at 30 micg/kg/min. We didn't carry out monitoring of bispecteral index due to proximity to the surgical side and the need to sterilize skin on the forehead. During the surgery, systolic BP of 56-year-old patient at 110-150 mmHg and 25-year-old patient at 100-130 mmHg was retained. Respiration in 56-year-old patient at 10-15/min and 25-year-old patient at 9-15/min was retained. In both the patients, ET CO_2 was maintained at 32-40 mmHg and during surgery, pulse oximetery was maintained at 97-100%. During surgery, for removing lesion, the patients were awake and obeyed the surgeon's commands and moved their limbs and fingers. After removal of the lesion, the patient was asleep, dura matter was sutured. The bone of head was placed and scalp was sutured. The patients, after removing the fixative pin of head slowly woke up, without any unexpected problem.

DISCUSSION

Craniotomy for a cerebral tumor designed to maximize tumor removal with a few side-effects on motor, sensory, language, and cognitive functions was possible. A number of different anesthetic approaches that have been executed for doing awake brain tumor surgery include:

- Monitored anesthesia care (MAC): The patient is sedated and remains spontaneously breathing throughout the whole operation that risks related to general anesthesia, e.g., airway issues, are avoided[5]
- Asleep-awake-asleep (AAA) technique: The patient is anesthetized during phase one. A laryngeal mask (LM) or an endotracheal tube (ET) is used for ventilation. During phase two, the patient is aroused and activated and the LM or the ET is removed. Mapping is executed when the patient is awake. At the end of mapping, the patient is re-anesthetized and LM or ET is re-entered[7]
- Asleep-awake (AA) method: After anesthesia induction, LA is executed. Next, the craniotomy is executed, the patient is aroused and activated, and the LM is removed. Nasal prongs are set to distribute oxygen and monitor end-tidal CO_2. An infusion of a small dose of remifentanil will be started if the patient senses any uncomfortableness.[8]

Propofol and remifentanil are the most common anesthetics that used for AAA and AA in Europe.[9] The rapid onset and fast elimination of both drugs and the antiemetic attribute of propofol make these drugs more benefitting for awake craniotomy. An equivalent study between fentanyl plus propofol with remifentanil plus propofol found the patients' well filling degrees were alike in the two groups, but respiratory complications were doubled as well as fentanyl group.[10]

In awake craniotomy, patients need a good level of sedation during the opening and closure of bone flap without any respiratory depression. This establishes full consciousness during brain stimulation and maximum comfort of patient throughout the procedure.

There is no preference among different techniques that are used for tumor resection in awake patients.

In different anesthetic techniques that have been developed, aiming for tumor resection in an awake patient, isn't a preference.[5,6]

We selected techniques with maximum resection and minimum damage of neurological function.

Airway management may present troubles. When the patient is sedated and consequently at a risk of respiratory depression, it may be difficult to mask, ventilate, or enter a LM or an ET as the head is fixated in the head frame. In surgery, when the MAC method is used, these problems primarily occur in phase one when heavy sedation is often required because the patient is in more pain. The incidence of airway obstruction has occurred at rates from 0% to 20% and desaturation from 0% to 28%.[10,11] In equivalence, airway obstruction in the AAA and AA procedures was reported in 0-7% of cases, in contrast, desaturation was not seen.[7-12] The incidence of respiratory complications decreased when the anesthetic group is an expert.[13,14]

In brain tumor, resection due to the long duration of procedure, we need some sedation that helps the awake patients to stay motionless during the surgery. We need a level of sedation that helps the patient to be alert, conscious, and cooperative during surgery and functional assessment. We must maintain adequate skull block for successful surgery because higher doses of analgesics and sedatives can interfere with functional assessment or airway patency. Bupivacaine 0.5% combined with adrenaline 1:200,000 can be used to carry out the block.[15-17]

We must prevent airway obstruction because it can lead to hypoxia, hypercapnia, and increase in brain tension. There is no ideal airway management technique for awake craniotomy because all of them have benefits and disadvantages and we must choose the most appropriate technique according to each patient's condition and available facilities.

Tumor surgery under conscious sedation, associated with frameless computer-guided stereotaxis and cortical stimulation with repetitive neurologic and language assessments, can be a safe and reliable technique that allows maximal resection of lesions in close relationship to eloquent cortex. This procedure could be done without any additional usage of hospital resources and overall patient tolerance was good, with a low risk of postoperative neurological deficits or surgical undesired outcomes. Further incorporation of intraoperative managing with the current tools could help to reach better results in tumor debulking.

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