Case Report

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ANESTHETIC AND SURGICAL CONSIDERATIONS IN AWAKE CRANIOTOMY FOR ELOQUENT AREA TUMOR

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ABSTRACT

Introduction: Awake craniotomy is a specialized neurosurgical technique in which the patient remains conscious during surgery, enabling real-time functional mapping of the cerebral cortex. This procedure is primarily employed when a brain tumor or lesion is situated near critical areas responsible for motor, visual, or language functions. Its application minimizes the risk of postoperative neurological deficits, ensuring the preservation of vital brain functions.
Objective: The objective of this case report is to highlight the use of the awake craniotomy technique for a patient with a brain tumor located in the left parietal lobe, emphasizing the surgical and anesthetic considerations necessary for successful outcomes.
Case Report: The patient, diagnosed with a brain tumor in the left parietal lobe, presented unique surgical challenges due to the tumor's proximity to the cortical centers governing movement and speech. To mitigate the risk of neurological impairment, an awake craniotomy was performed. Bilateral scalp nerve blocks were administered for effective pain management, alongside dexmedetomidine to provide conscious sedation. The "awake-wake-wake" protocol was followed, ensuring the patient remained alert throughout critical phases of the surgery. This allowed the surgical team to conduct real-time assessments of motor and language functions, optimizing tumor resection while preserving neurological integrity.
Conclusion: This case underscores the importance of the awake craniotomy technique in neurosurgical interventions involving eloquent brain regions. The use of dexmedetomidine and precise nerve blocks provided effective sedation and analgesia, enabling active patient participation during functional mapping. The procedure highlights the value of interdisciplinary collaboration between neurosurgeons and anesthesiologists to achieve optimal patient outcomes while minimizing neurological risks.

Keywords: Awake craniotomy; Bupivacaine; Dexmedetomidine; Tumor

ABSTRAK

Pendahuluan: *Awake craniotomy* adalah teknik bedah saraf khusus di mana pasien tetap dalam keadaan sadar selama operasi, memungkinkan pemetaan fungsional korteks serebral secara real-time. Prosedur ini terutama digunakan ketika tumor atau lesi otak terletak di dekat area kritis yang bertanggung jawab atas fungsi motorik, visual, atau bahasa. Penerapan teknik ini bertujuan untuk meminimalkan risiko defisit neurologis pascaoperasi serta menjaga fungsi vital otak.
Tujuan: Laporan kasus ini bertujuan untuk menyoroti penggunaan teknik kraniotomi sadar pada seorang pasien dengan tumor otak yang terletak di lobus parietal kiri, dengan penekanan pada pertimbangan bedah dan anestesi yang diperlukan untuk hasil yang optimal.
Laporan Kasus: Pasien dengan diagnosis tumor otak di lobus parietal kiri menghadapi tantangan bedah yang kompleks karena lokasi tumor yang dekat dengan pusat kortikal yang mengatur gerakan dan bicara. Untuk mengurangi risiko gangguan neurologis, dilakukan prosedur kraniotomi sadar. Blok saraf kulit kepala bilateral diberikan untuk manajemen nyeri yang efektif, dan dexmedetomidine digunakan untuk memberikan sedasi sadar. Protokol "awake-wake-wake" diikuti, memastikan pasien tetap waspada selama fase-fase kritis operasi. Hal ini memungkinkan tim bedah melakukan penilaian fungsi motorik dan bahasa secara langsung, sehingga reseksi tumor dapat dioptimalkan tanpa mengorbankan integritas neurologis.
Kesimpulan: Kasus ini menekankan pentingnya teknik kraniotomi sadar dalam intervensi bedah saraf yang melibatkan area otak yang berfungsi penting. Penggunaan dexmedetomidine dan blok saraf yang tepat memberikan sedasi dan analgesia yang efektif, memungkinkan partisipasi aktif pasien selama pemetaan fungsional. Prosedur ini menyoroti pentingnya kolaborasi multidisipliner antara ahli bedah saraf dan ahli anestesi untuk mencapai hasil terbaik bagi pasien sekaligus meminimalkan risiko neurologis.

Kata kunci: *Awake craniotomy*; Bupivacaine; Dexmedetomidine; Tumor

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INTRODUCTION

Awake craniotomy stands as a well-established technique for the excision of brain tumors situated in close proximity to critical cerebral centers (1). This approach facilitates maximal tumor mass reduction while preserving the integrity of pivotal functional areas, encompassing motor, speech, and visual centers (2). Various anesthetic modalities have been employed for awake craniotomy, including the "sleep-wake-sleep" technique, with or without mechanical ventilation, and the administration of local or regional scalp anesthesia to manage "wide awake" patients. The requisite level of sedation and analgesia fluctuates across different phases of the surgical procedure; however, paramount is the maintenance of the patient's wakefulness and alertness during brain function assessments (3).

Several sedative agents have been utilized in this context, notably dexmedetomidine, propofol, and remifentanil, each carrying distinct advantages and side effects (4,5). Dexmedetomidine is favored for its superior respiratory maintenance, whereas propofol is associated with a diminished occurrence of intraoperative seizures (6). The short duration of action of remifentanil makes it advantageous for managing pain during surgery and ensuring patient comfort in both conscious and unconscious states, although it carries a higher risk of side effects such as nausea, vomiting, and respiratory depression (7).

Effective patient education and preparation preoperatively, coupled with the expertise of anesthesiologists and surgical techniques aimed at averting the tension on intracranial structures sensitive to pain, constitute pivotal principles in enhancing the efficacy of pain control during surgery and ensuring postoperative patient contentment (8).

This case report aims to demonstrate the application of the awake craniotomy technique in managing a brain tumor situated in the left parietal lobe. It focuses on discussing the key surgical and anesthetic strategies that contribute to achieving a successful and safe outcome for the patient.

CASE REPORT

The patient was a 48-year-old man who underwent an awake craniotomy operation in Al-Zahra Hospital in Isfahan in March 2023. The patient's weight was 82 kg, height 177 cm, and body mass index 26, with initial symptoms of seizures. After examination and imaging, the initial diagnosis of glioblastoma was made in the left parietal lobe [Figure 1].

The patient's seizures were controlled with valproic acid tablets 500 mg per day. In the preoperative evaluation, since the tumor was anatomically located close to the patient's motor and speech centers, after an interdisciplinary consensus involving the anesthesia and neurosurgery team, the decision was made to conduct an awake craniotomy for intraoperative monitoring, with the goal of preserving speech functions. And the move was made. This should be done during tumor removal. Several counseling sessions were conducted two weeks before the operation by the anesthesiologist with the patient and first-class companion, and the necessary explanations and the necessity of cooperation during the operation were explained to them. Prearranged questions and exercises were conducted to evaluate the patient’s cognitive and language abilities. Also, the patient had a history of cough and allergy during the preoperative examination, and a pulmonary consultation was performed and he was treated with medication. In cardiovascular evaluation and consultation, non-obstructive surgery was reported. Sensory and motor function and preoperative tests were completely normal.

An informed consent form was obtained, and anticonvulsants were administered on the morning of the surgery. Upon entering the operating room, the patient was carefully positioned supine, and standard anesthesia monitoring was initiated, including electrocardiogram, pulse oximetry, and non-invasive blood pressure measurement. The initial vital signs recorded were a blood pressure of 115/75 mmHg, a heart rate of 85 beats per minute, and an arterial oxygen saturation of 96%. Excess oxygen of 3 to 5 L/min was measured through the

nasal cannula and exhaled carbon dioxide was measured through the capnograph. Then midazolam 3 mg and fentanyl 100 µg were administered intravenously. An arterial line was placed in the left radial artery under local anesthesia with lidocaine. In order to control the intracranial pressure, 5 vials of half percent hypertonic saline and 20 mg of Lasix were prescribed 30 minutes before administration. Conscious sedation with spontaneous breathing was initiated by targeted injection of dexmedetomidine at a dose of 0.7 µg per kg of body weight for ten minutes before scalp block and fixation of the head in a Mayfield frame. Then bilateral scalp nerves were blocked with bupivacaine 0.25% in 6 areas on each side including supraorbital, supratrochlear, oricotemporal, zygomatic and temporal, small and large occipital nerves with the amount of 2 cc in each area (total dose 24 cc) by an anesthesiologist. Dexamethasone 8 mg and ondansetron 4 mg were prescribed to prevent nausea and vomiting. After ten minutes, the dose of dexmedetomidine was reduced to 0.5 µg per kg body weight per hour. The surgery started without pain and with complete relaxation of the patient. During the operation, the patient opened his eyes by calling and sometimes by skin contact and fully executed the verbal and movement commands. His level of conscious sedation varied, but he remained conscious throughout the procedure.

Vital signs and hemodynamics were completely stable during the operation, and the patient was very calm and followed motor and verbal commands and had a good understanding of the instructions. In addition to being fully sedated, the patient was so aware of time and place during the operation that he asked us to tell his wife, who was outside the operating room, that he was fine and not to worry, which was a very interesting point. The amount of bleeding was calculated to be about 200 cc, and blood sugar and arterial blood gases were checked during the operation, which were reported to be normal. After the end of the operation, which lasted for 4 and a half hours, the patient was transferred to the recovery room, and after 2 hours of hospitalization in the recovery room and ensuring full consciousness and the absence of possible complications, the patient was transferred. He went to the intensive care unit and was discharged after two days in good general condition.

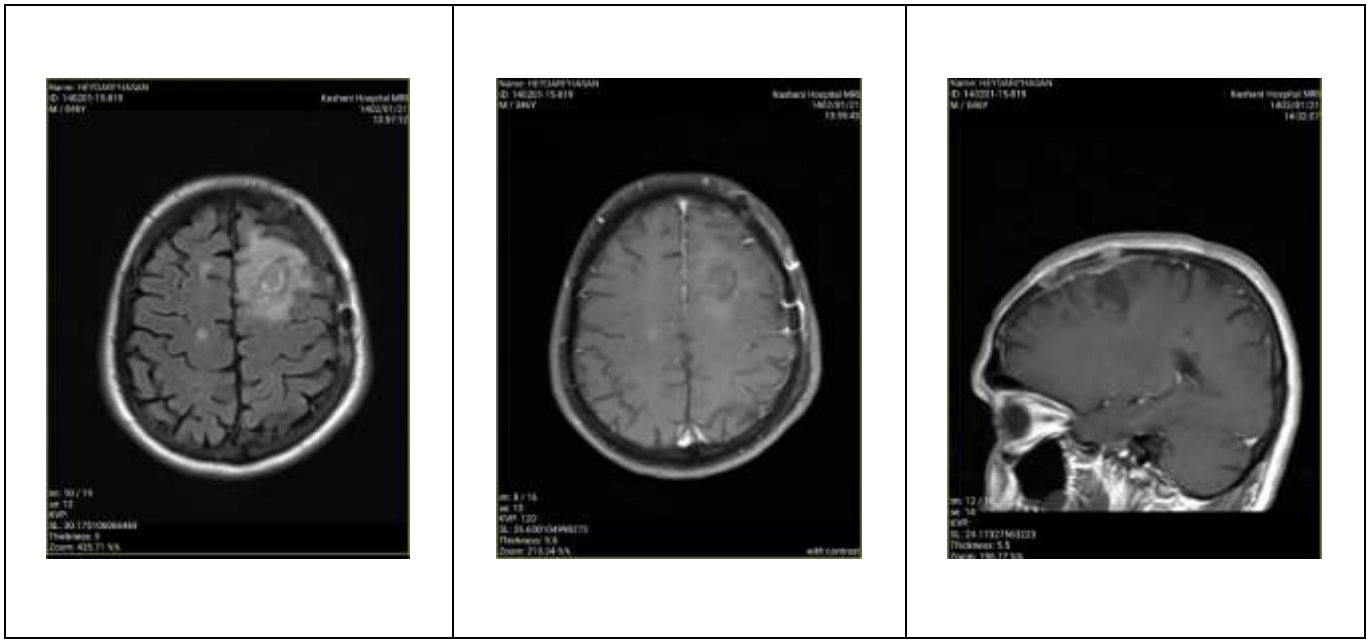

Figure 1. CT scan of the brain (parietal lobe tumor)

DISCUSSION

Awake craniotomy has gained increasing popularity in tumor surgery in recent years. However, it carries potential complications, including seizures, cerebral edema, nausea and vomiting, altered consciousness, neurological deficits, pain, and a loss of patient cooperation. As a result, this technique requires continuous monitoring, the use of short-acting agents, and careful consideration of regional blocks (such as local scalp anesthesia). A key concern during the procedure is ensuring a stable airway and maintaining patient cooperation. The avoidance of tracheal intubation helps prevent coughing or airway irritation, which could increase intracranial pressure and brain swelling. Intubation can also be challenging during such procedures. The incidence of nausea and vomiting can vary depending on factors such as the patient's medical history, the nature of the injury, medication administration, and the type of anesthesia used (9).

Successful awake craniotomy largely depends on careful patient selection, which includes assessing the airway, the patient's ability to cooperate, the risk of sedation failure, potential intraoperative complications, and ensuring proper psychological preparation before the procedure. Various drug regimens have been used across different protocols, with the most common being propofol, remifentanil, dexmedetomidine, and midazolam. Due to their short half-lives, both dexmedetomidine and propofol enable early awakening once the infusion is stopped, making them the preferred choices for awake craniotomy (10).

In the patient of this report, a scalp block was performed with bupivacaine and sedation with dexmedetomidine, which was completely satisfactory. A different approach was chosen, involving a combination of local anesthetics and conscious sedation, resulting in the implementation of the 'Awake–Awake–Awake' technique. Although no complications occurred during the operation. Combining these two methods made it possible to remove the maximum tumoral mass with minimal nerve damage for the patient. The skill and knowledge of the anesthesiologist in the selection and titration of the drug and the close emotional connection with the patient before and during surgery are key and important points for a successful conclusion.

CONCLUSION

Awake craniotomy technique, although challenging for anesthesiologists, is a very reliable and useful technique for assessing brain function during surgery and minimizing neurological complications. Therefore, it is recommended to use this method with the necessary precautions in mind. In addition, there is a need for more research and studies in this field. More studies are needed, especially in relation to possible complications during the operation and their control and treatment. Also, predicting and preparing for the management of complications during surgery is one of the most important key points. Since the patient is awake, in case of possible complications, one should keep calm and manage the crisis while not worrying and stressing.

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Conflict of Interest

There are no conflicts of interest disclosures.

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Patient Consent for Publication

Written informed consent for the publication of clinical details and any associated photographs was acquired from the patient (or the patient's parent/legal guardian, if relevant). The patient was assured that personal information would remain confidential and that measures would be implemented to guarantee anonymity. A copy of the

signed consent form is accessible and can be supplied to the journal upon request.

Authors's Contributions

MMI and MMA are responsible for the study design, data analysis and interpretation, and drafting and finalizing the article.

NA is responsible for drafting and finalizing the article.

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