Anesthetic Considerations for Awake Craniotomy

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LEARNING OBJECTIVES

- Identify indications for an awake craniotomy
- Discuss patient factors and how they change anesthetic management
- Discuss different anesthetic techniques for awake craniotomies as well as their advantages and disadvantages
- Identify possible complications during the case and discuss their management

HYPOTHESIS

Awake craniotomies (AC) are performed when a brain lesion is near a vital area of the brain such as the motor cortex (prefrontal gyrus), sensory cortex (postcentral gyrus) and language cortex. Interaction with the patient during resection aids in guiding the extent of tumor resection while minimizing neurologic deficits with the goal of maintaining quality of life for the patient postoperatively. There are a variety of patient and surgical factors that should be considered prior to an awake craniotomy. This case report will discuss anesthesia's roles during AC, a few important patient related factors, and potential complications and their management.

CASE PRESENTATION

35-year-old female with a right frontal parietal lobe glioma scheduled for an awake craniotomy and tumor resection. Past medical history is significant for seizures, anxiety, and morbid obesity with BMI of 55. Current home medications include diphenhydramine, estradiol, hydroxyzine hydrochloride, Keppra, Valium and multivitamins. Allergies reported to Phenergan and sulfa drugs. Anesthetic history is unremarkable. Anesthesia was performed using the asleep – awake – asleep technique. Induction was uneventful with 100 mcg fentanyl, 100 mg lidocaine, and 170 mg propofol followed by placement of an iGel 4. Dexmedetomidine and propofol infusions were started. Following induction, a right radial arterial line and secondary IV were placed on the ipsilateral arm. Patient received 1 g levetiracetam, 10 mg dexamethasone, 150 GM mannitol, and fluorescein. Neurosurgery then performed a scalp block, placed patient in pins, removed the skull flap, exposed the surgical field, and informed anesthesia they were ready to begin resection. Dexmedetomidine and propofol infusions were turned off after the skull flap was removed and the patient woke up, responding to commands. Intra-operative course was complicated by a seizure, patient anxiety, and patient weakness. Following tumor resection, an additional dose of 120 mg propofol was administered and an iGel 4 was placed again to maintain anesthesia while neurosurgery completed closure. After closing, infusions were turned off and the patient awoke in the OR to complete a neurologic exam. The immediate postoperative neurologic exam revealed 5/5 strength of the left upper extremity. Patient had 5/5 strength at the left hip and knee, however, was unable to perform dorsiflexion or plantar flexion of her left foot. Following her neurologic exam, patient was transported to the neuro-ICU.

DISCUSSION

Preoperative

Awake craniotomies present a unique set of anesthetic considerations. The first important consideration is patient selection. As with many things in anesthesia, patient refusal is the only absolute contraindication to AC. However, many other factors should be considered including claustrophobia, chronic cough, morbid obesity, cognitive disorders, and mood instability, which may be regarded as relative contraindications. This patient had a history of anxiety and morbid obesity. Pre-operatively, we spent approximately 25 minutes talking with the patient about the plan and expectations of the surgery. This proved to be beneficial as she informed us that she responds well to verbal reassurance and may need anesthesia to tell her directly to calm down. We assured her that someone from the anesthesia team would always be in her sight and that we would be available should she need anything (analgesics, anxiolytics, antiemetics, etc.) throughout the procedure. Establishing a good rapport with the patient is a critically important step in a successful awake craniotomy. During the awake portion of the case, the patient was visibly anxious and requesting medication. A total of 6.5 mg of midazolam was titrated throughout the awake portion to provide the patient anxiolysis. Given the patient's history of anxiety, it may have been beneficial to give her a dose of Valium in pre-op with the goal of avoiding intraoperative administration of benzodiazepines. Benzodiazepine administration comes with the risk of affecting neurocognitive function and respiratory depression.

Technique

Table 1 illustrates the different techniques for management of an AC. As previously mentioned, anesthesia elected to utilize the asleep – awake – asleep technique, with iGel placement during both asleep portions. The patient's history of morbid obesity was a large factor influencing our choice of this technique. Placement of an SGA minimizes the risk of airway obstruction and hypoventilation. Having an SGA allowed us to provide pressure support ventilation, providing some control in prevention of hypercarbia. Disadvantages of the asleep technique include an unpredictable wake up time and higher risk of emergence delirium. Given this patient's risk of obstruction, we placed an iGel and removed it right as she began showing signs of swallowing and grimacing in order to avoid the potential complication of bucking in pins.

Asleep – to – Awake Transition

Goals during the transition from the asleep to the awake portion of the case should be focused on maintaining a smooth emergence with rapid return of patient's baseline mental status. The most common drugs used to maintain anesthesia during the asleep portion include dexmedetomidine, propofol, remifentanil, and <0.5 MAC of volatile gas. We ran two infusions of 0.4 mcg/kg/h of dexmedetomidine with 75 mcg/kg/min of propofol to maintain anesthesia during the asleep portion. Dexmedetomidine is advantageous due to its minimal respiratory depression while providing additional sedation and analgesia. Propofol is advantageous as it is titratable and has minimal lingering effect after its termination. Remifentanil is beneficial as it is very titratable and a potent sedative. Typical dosing for remifentanil is between 0.01 – 0.04 mcg/kg/min. We chose to avoid both opioid infusions and the use of volatile agents during this case due to the potential for opioid or volatile induced nausea and vomiting, which could be catastrophic while patient's head is secured in pins.

TABLE 1

Awake Craniotomy		
Pre-awake phase (GA / ETT / LMA)	Awake phase	Post-awake phase (GA / ETT / LMA)
Pre-awake phase (GA / ETT / LMA)	Awake phase	Post-awake phase (MAC)
Pre-awake phase (MAC)	Awake phase	Post-awake phase (MAC)

DISCUSSION

Awake Phase

Different types of testing and patient evaluations will be conducted depending on the area of the brain the lesion is near. In this case, the patient's lesion was near the right motor cortex so left sided motor function and strength were assessed throughout the awake portion of the procedure. Preoperatively, the anesthesia team conducted a thorough neurologic exam in order to establish the patient's baseline motor strength. During the resection, her strength and motor ability were assessed periodically. At some point during the resection, the patient lost the ability of plantar flexion and dorsiflexion of her left foot. Different members of the anesthesia team were assessing motor strength throughout the case when directed by neurosurgery. An area for improvement could include more frequent assessments completed by a single provider, in order to maintain more thorough and consistent neurologic evaluations.

Intraoperative Complications

A common complication requiring intervention is intraoperative seizures. During cortical mapping, this patient began having seizure-like activity. Anesthesia immediately informed the neurosurgery team of this, and they flooded the cortex with ice cold crystalloid solution which fortunately resolved the seizure. Irrigation with ice cold saline is first line treatment and typically resolves most intraoperative seizures. Had irrigation not terminated the seizure, propofol and an additional dose of levetiracetam were immediately available as second- and third-line treatments.

Another complication that must be anticipated is the potential for an airway emergency which could occur at any point in the procedure. We had multiple sizes of supraglottic devices, a videoscope, and an endotracheal tube with a stylet readily accessible and within reach. It is important the anesthesia team is vigilant in monitoring patient's breathing to quickly recognize if airway obstruction were to occur, whether this be during sedation, following SGA removal, or when transitioning back to the asleep portion of the closing phase. If obstruction were to occur, anesthesia should notify the surgical team, turn off infusions, provide a jaw thrust, and mask with 100% oxygen.

DISCUSSION

Oral and nasal airways should be available as well. Given the suboptimal positioning of the patient in head pins and under drapes, anesthesia must act quickly and be prepared with options for airway management. In this case, during the awake – to – asleep transition, we were able to give the patient an additional dose of propofol and insert an iGel 4 under the drapes without complication. Given the unique challenges that an awake craniotomy presents, it is imperative that the anesthesia team is anticipating and fully prepared to handle the variety of complications that could arise.

CONCLUSIONS

The awake craniotomy is a complex surgery that requires intimate cooperation between the patient, anesthesia, and surgical teams, while offering great advantages to patient outcomes. It presents a unique set of challenges to the anesthesia provider beginning in the preoperative phase. The anesthesia provider must assess and build rapport in the first few moments of meeting with the patient, a critical element with respect to the success of AC. Patient factors must be considered to decide which anesthetic technique is most appropriate including airway management and drug combinations, each of which holds its own advantages and disadvantages. Anesthesia providers are challenged with critical thinking and stretched to use their interpersonal skills to create a safe surgical environment while supporting patient's psychological needs. The awake craniotomy is a perfect example that the practice of anesthesia truly is an art, based on science.

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