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Awake Craniotomy in a Patient With Obstructive Sleep Apnea

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Stem Case and Key Questions Content

A 45 year old female with intractable seizures presents for left temporal craniotomy with excision of a cavernous angioma. WADA testing demonstrates that speech is located on the left side of the brain. Due to the location of the angioma and location of speech control, the surgeon requests speech testing during the resection of the lesion. The patient's medical history is significant for seizure disorder, depression, obesity with a body mass index of 37(weight 250lbs/70inches tall), OSA requiring CPAP and postop nausea and vomiting with general anesthesia. She is allergic to morphine. Current medications include estradiol, levetiracetam, lovastatin, pregabalin and sertraline.

1. What are the goals/ reasons for performing the case awake?

2. Discuss the impact of the patient's BMI/OSA for undergoing an awake craniotomy?
a. Is it important to meet the patient preoperatively, what information would be important to gather at this time?

3. How will you monitor this patient? Are there any other special considerations /preparations for this case?

4. What potential complications might urgently present in a patient undergoing an awake craniotomy? What technique(s) would help prevent/reduce these risks? The patient will need to be placed in the Mayfield 3-point head holder because the surgeon will be using a navigation system to assist in the surgery.

5. What are the anesthetic options for this case?
a. Does the patient need to be awake for the entire procedure?
b. What are the advantages and disadvantages for this patient for either being awake or asleep with the airway controlled prior to speech testing?

6. Which agents will you choose to provide anesthesia/sedation (monitored anesthesia care) for the case?

7. How will the patient's OSA modify the agents you choose and how they are administered?
After discussion with the patient and the surgeon, it is decided to keep the patient awake from the start of the case. During the drilling and removal of the bone flap, the patient experiences

increased anxiety and discomfort and begins to move.

8. How will you treat this?
After the completion of the craniotomy and dural opening the patient becomes somnolent and the airway is now obstructed.

9. What are your options or therapies could you consider to relieve the airway obstruction?

10. What are your plans for airway management should it become necessary to secure the airway? The surgeon is completing her exposure and would like the patient ready for neurological testing in 45 minutes.

11. What are your goals for your anesthetic at the time of speech mapping?

12. What are the context sensitive half-lives of the medications you have chosen?

13. The surgeon requests that you participate in the speech mapping process? Is this a reasonable request?

14. What problems can occur during the time of speech mapping?
a. the patient has a seizure during mapping, what can be done preoperatively to help reduce the risk?
b. how will you treat?
The surgeon informs you that the brain looks tight. More brain relaxation is required.

15. What are the options at this point? How will you accomplish this? The resection of the angioma is complete; Two hours of closure remain.

16. Will you change or modify the anesthetic plan at this point? If so how?

Model Discussion Content
Indications for Awake Craniotomy
Awake craniotomies may be required because the site of surgery either directly involves eloquent parts of the brain or are in close proximity to such an area. [1, 2, 3]. The awake patient allows intraoperative testing of motor, speech or sensation function while removing brain tissue. This allows maximum removal of tumor/epileptic focus with minimal loss of neurological function.

Contraindications for Awake Craniotomy
An uncooperative patient or patient that is not able or willing to participate
is the only true absolute contraindication. However, other factors such as OSA, movement disorders, significantly increased intracranial pressure, difficult airway history, severe reflux disease, active vomiting or decreased pulmonary reserve are relative contraindications that must be taken into consideration when deciding whether a patient is a candidate for an awake craniotomy or not.

Preoperative Planning/ Preparation for Awake Craniotomy Planning

Awake craniotomies are very challenging cases that require substantial preoperative preparation to be successful. [4] The anesthesiologist and the surgeon must talk and plan the entire surgery. The expectations of the surgeon must be set at a level where the anesthesiologist can provide a safe and feasible anesthetic. Many topics must be discussed, including positioning anesthetic technique and how the functional testing will be conducted. The preparation also includes spending time with the patient preoperatively. Meeting the patient for the first time on the morning of surgery is likely to result in an overly anxious patient that is difficult to sedate and unprepared to meet the challenge ahead. Preoperative teaching of the patient needs to include: discussing the procedure and what to expect, risks and answering the patient's questions.

It is very helpful to give the patient a chance to mull over the plan and to become more comfortable with their very active role. There are several different approaches to the anesthesia care of these patients. Regardless of which is chosen a field block and appropriate nerve block (greater/lesser occipital, superior orbital, supra trochlear and greater auricular) for the placement of head pins (if utilized) [18] and for the incision, should be performed by the surgeon or the anesthesiologist based on the location of the incision.

Asleep/Awake/Asleep (Airway control during asleep portions) There are several options to this technique. Control of the airway may be achieved with either an endotracheal (ETT) tube or an LMA. The ETT can be placed asleep or wake. Placing the ETT awake via the nasal passage has several advantages. It allows the patient to experience what it feels like to have the tube in place. Secondly, the ETT can be pulled back into the nasal passage to allow speaking mapping and then placed again once the mapping is complete. Awake intubations can be facilitated by several airway blocks to minimize the airway irritation and stimulation caused by the ETT. These include the superior laryngeal nerve block and a trans-tracheal block. If an LMA is appropriate, it can be placed after the patient is asleep and removed prior to testing. The patient may be asleep for the craniotomy and exposure of the lesion; then awakened for testing. They may again be fully anesthetized for the closure. This is the so called asleep-awake-asleep technique. [2, 3, 5, 6,14,15] Awake (spontaneously ventilating) for entire procedure. Other variations have been described in the literature including the awake [1, 3, 5, 7,14,15] technique used for this patient. Sedatives/analgesics are chosen to provide adequate relaxation and comfort so that the patient will be able to tolerate the exposure part of the surgery. This must be balanced with maintaining adequate ventilation and oxygenation. Then, the sedation is decreased or stopped prior to neurocognitive testing. A discussion of medications is found below. No one technique appears more correct than another. Rather, the anesthetic technique must be determined by the patient's preoperative co-morbidities and the patient's ability to cooperate. It is important to individualize this decision based on the patient's characteristics and surgical requirements. Advantages of having the patient asleep for the craniotomy is excellent pain control without hypoventilation or airway obstruction. There is easier management of increased intracranial pressure with hyperventilation. The disadvantage of the asleep-awake technique is that the transition from asleep to awake may be stormy and prolonged. The patient may be confused, agitated, moving, nauseated or vomiting and airway obstruction may occur after removal of an airway device. A delay in the time until the patient can participate in speech or sensory testing may also result. After the resection and neurological testing are complete it may be reasonable to induce general anesthesia for the closure. The patient is likely to be restless and uncomfortable after a long day and the closure will be more stimulating and painful. This will allow for adequate analgesia without airway compromise. The disadvantage is securing

the airway under the drapes may be difficult. In addition, the ability to monitor the patient's neurological status for unexpected events such as hemorrhage/stroke is lost. Maintaining the airway is obviously one of the most important issues in managing these cases. It is important to have oral and nasal airways, LMA's and a fiberoptic bronchoscope in the room and ready to use. The sterile field and drapes may preclude an intraoperative direct laryngoscopy or use of some airway devices such as the Glide scope. It is prudent to prepare the nasal passages for the placement of a nasal airway or fiberoptic intubation. This can be accomplished with Oxymetazoline spray to the nacres and viscous lidocaine. The OSA this patient had, is a common problem (affecting 2% of females and 4% of males) [8] for patients presenting for surgery. This complicates the airway management and the use of sedative medications. Up to 1 in 5 adults can have mild symptoms of OSA. [9]. Sedative medications can exacerbate the symptoms of OSA. [8, 9, 10, 11]. The recommended treatment of OSA is CPAP. Application of standard CPAP or BIPAP devices is usually not possible due to interference with the surgical field by the head straps used to secure the device to the face. A head up or more seated position will improve ventilation of the morbidly obese patient with OSA. A way to provide CPAP would be to place the ETT connector in the soft nasal trumpet, which allows connection to the anesthesia circuit. Now CPAP can be provided without the CPAP mask. In patients with OSA it is important to look at the patients sleep study as it may reveal obstructive (majority), central, or combination of obstructive and central. Reducing the bolus amounts for patients with central apnea is prudent. Nausea prophylaxis at the beginning of the case is important when opioids will be used. Naloxone and flumazenil should be in the room in case of apnea from narcotics or benzodiazepines. Maintaining the patient's anti-seizure medications or loading with additional medication prior to neurocognitive testing will help prevent intraoperative seizures.

Medications
A variety of sedatives and analgesics may be used. Traditional choices have been neuroleptic anesthesia (droperidol and opioid) where patients are in a trance like state. The patient is usually in a cataleptic state with intense analgesia. The drawbacks are prolonged CNS depression and no suppression of sympathetic outflow to painful stimuli. Propofol (bolus and infusions) [1, 2,3, 5,12] has also been used. The context sensitive half-life of propofol is approximately 40mins even for prolonged infusions. Opioids may be added as a bolus with or without infusions. [1, 2, 3, 12,16]. Opioids, such as remifentanil with very short half-lives have an advantage of intense analgesia and are cleared quickly which provide for good neurocognitive testing. Benzodiazepines are used for amnesia and anxiolysis. [1, 2, 3, 12,16] Ones that have shorter duration of action are ideal. General anesthesia with vapor has been used up until the time of testing when the patient is awakened. [2] Recently dexmedetomidine has been used for both asleep-awake-asleep [2, 3, 5,6,17] and awake techniques. [1, 3, 5, 7,17] Dexmedetomidine is a centrally acting alpha agonist that has sedative and analgesic properties without causing respiratory depression [5,12,13,17]. Dexmedetomidine provides a sedated, yet cooperative patient. Dosing of dexmedetomidine varies, some protocols start with a bolus of 0.5 to 1 mcg/kg and then an infusion of 0.2 to 0.7 mcg/kg/hour. However, it may be necessary to exceed this range. The medication must be titrated to desired effect. When decreased or discontinued prior to neurocognitive testing, patients have been able to successfully perform the tasks. However, other sedatives may enhance its sedative properties so care must be taken to titrate them appropriately. Dexmedetomidine can also cause hypotension and bradycardia. Glycopyrolate administration prevents the bradycardia and has the added benefit of drying the airway. Medications must be available to control the extremes of blood pressures as well. These include but are not limited to beta blockers, phenylephrine, and ephedrine. Vasoactive infusions of

medications may be necessary. Patient positioning must be done with much greater care than is commonly done. Patient comfort is critical as the position may need to be tolerated for several hours. Access to the airway must be maintained. Neck flexion needs to be avoided to prevent airway obstruction. Even with planning, the airway may need to be managed in a very awkward position.

In summary, the anesthesiologist must provide anesthesia and anxiolysis while maintaining an adequate airway, controlling blood pressure and keeping the patient in a state in which they can perform the motor, speech or sensory testing. It requires a surgeon who is comfortable with operating on an awake patient and a patient who is capable and motivated for a potentially long day with the ability to remain still for the many hours a craniotomy requires.

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