

ANESTHESIOLOGY™ 2014

OCTOBER 11-15 | NEW ORLEANS, LA

Session: L025
Session: L049

Delayed Emergence After Craniotomy – No Delays Accepted

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Disclosures: Hospira, Funded Research; Parker Hannifin, Inc., Consulting Fees

Stem Case and Key Questions Content

It is 15:30 on a Wednesday in the operating room and you are relieving your colleague who has started a craniotomy in a 63 year old right handed white female. This patient was diagnosed with an intracranial meningioma. You get a quick report that she has been treated for hypertension and because of a good functional class has not been a candidate for any “extraordinary” work up. She mentions that apart from a moderate hypotension nothing exciting has happened and the good resident in the room has managed the patient well by starting a phenylephrine infusion. When you sign in to the cases you notice that the resident in the room is in fact one of the most competent ones. The surgeons are already closing the skull bones and tell the resident to page you for the wake up.

1) Discuss the importance of an optimal patient hand over between health care providers, emphasize on essential components and differences if any between level of health care provider (e.g. nursing vs. physician)

2) What questions would you ask in this particular case before taking over?

In about 30 minutes while you are inducing in another room the resident sends a “waking up” page. You finish the induction as efficiently as possible and go to the craniotomy OR. The resident informs that he has just turned off the Sevoflurane and Remifentanyl. You wait a couple of minutes but since they are paging you from the other room you leave for about 5 minutes just to come back and see the same situation.

3) Discuss the average emergence time expected in this scenario and medications mentioned.

The resident’s response to your query is that “Maybe it’s the propofol”. You now find out that as the head holder was being removed she had received “few CCs” of propofol since the pressure had gone up and the patient moved. You are convinced now that there is more to it than a regular emergence and start investigating.

4) Compare the effect of the propofol bolus now with an awake patient and infer if this could be a reason for a delayed emergence.

You start looking at the chart to find what other medications could contribute to this situation.

5) List medications used in a general anesthesia case that can contribute to delayed emergence the reversible medications and describe other medications that could be the cause in a craniotomy.

The patient had received 1 gram of fosphenytoin, 2 grams of magnesium. He was not reversed since “He had good twitches”

6) Describe the effect of antiseizure medications in these patients in both scenarios of preoperative maintenance as well as intraoperative initiation of these medications.

- 7) Address the issue of muscle relaxation in the context of ancillary medications
- 8) What other monitoring information can help you in the diagnosis of the delayed emergence
- 9) Name any laboratory tests that can help you at this time

You notice that the portion of closing that the resident refers to as “the patient moved” had a significant change in the hemodynamics including the heart rate and blood pressure

10) Explain if this could have been the result of a seizure and discuss the diagnostic evaluation to know if this is a post ictal situation or even a status epilepticus.

You notice that the surgical resident is not as interactive since he is a very junior one and you want him to call his faculty for a report. In the mean while you notice he has not performed any neurologic examination yet.

11) Name any neurologic examinations that could be done in this patient who has not yet emerged from anesthesia? What are the diagnoses that could be recognized with a simple examination?

12) What is your response to your resident if he suggested going to the Recovery room intubated and sedated until the patient wakes up?

13) List and discuss any preoperative medical conditions that can contribute to the delayed awakening including medications taken by the patient preoperatively

The surgeon calls and tells his resident to call the CT suite for a stat CT as he is making his way back to the operating room

14) Name and explain the diagnoses that could and could not be reached at with the CT scan at this point.

15) What are the next steps if the CT is “negative”? How would you hand off this patient in the ICU?

Model Discussion Content

Delayed emergence although not specific to neurosurgical anesthesia, it does raise concern in this group of patients since the organ under question as the cause of the delayed emergence, the brain, is in fact what was under the surgeon’s knife. Delayed emergence is usually described as failure to regain consciousness 20-30 minutes after surgical procedure. Intracranial hemorrhage is a feared complication after a craniotomy⁽¹⁾, however the etiology underneath the delayed awakening is not limited to this complication. Delayed emergence in itself regardless of the surgical procedure needs a systematic review of all possible reasons that can influence the timely return of the neurologic function after discontinuation of anesthetic agents. One possible differentiation of the etiology is the categorization of causes to pre-operative, intraoperative and immediate postoperative periods.

A well-reviewed pre-operative evaluation is an important part of any efficient anesthetic plan and can be key in identifying some baseline conditions that can affect speed of recovery from anesthesia. Age is an important determinant and can show its effect not only through the MAC but also the pharmacokinetic of all medications used. Alcohol intake is also a determinant of MAC of anesthetic agents hence having an effect on emergence. Pre-operative medications can also affect by not only their role in metabolism of anesthetics, but also directly by their effect. In patients with diabetes a careful review of dosage and timing of medication is important for a diagnosis of hypo (or hyper) glycemia. A patient with Parkinson’s disorder is also prone to have a very slow emergence after prolonged procedure since these patients need frequent dosing of their medication. Parkinson’s by itself can affect the neurological examination at the end of a

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procedure. Use of over the counter medications, herbal medications and recreational drugs can also affect emergence. A detailed history of pre-operative mental status is essential since many patients with intracranial pathology may already have an impaired mental state. This is a good opportunity to stress on a good hand over of a care especially during an ongoing procedure⁽²⁾. There are many guidelines for an effective hand off of patients and some medical centers have developed guidelines and prepared hand off sheets especially for nurses. The Joint Commission on Accreditation of Healthcare Organizations has recommended a standardized approach to hands-off communication and designed workshops in that regard⁽³⁾. A print out of anesthetic record can be a relatively good guide for the pre-operative history, medications as well as intraoperative course if filled correctly, however nothing can replace a face to face conversation with the anesthesiologist who can highlight his/her concerns about the ongoing case and relay his/her plan for the completion of anesthesia course as well as emergence and final destination of the patient. In this problem based learning discussion scenario there has been inadequate information relayed to the second anesthesiologist regarding what the immediate base line medical situation and mental status has been. Currently there are multiple studies underway to investigate the effect of the anesthetics on Post-Operative delirium which is out of the scope of this discussion, however one should be aware that specifically in the older age group patients may have a slower emergence with mental status changes.

The intraoperative course of a general anesthesia case should be reviewed in detail to examine all possible causes of delayed emergence. A well-defined algorithmic approach can help in ruling out important and life threatening issues rapidly. Ensuring adequate oxygenation and ventilation and optimized hemodynamics is a good place to start. Reviewing the ventilatory goals throughout the case and comparing the PaCO₂ during the case and at emergence can show if there has been a change in the pH (relative respiratory acidosis or alkalosis). An arterial blood gas can give vital information about the acid base status, as well as hematocrit level and electrolytes. Medications used during the general anesthesia for craniotomies are also important. Some medications used can increase the sedation level; antiseizure medications may be in this category if administered during the procedure. Long acting opioids and other sedatives such as benzodiazepines can also be a cause of delayed emergence. Use of intravenous anesthetics such as propofol infusion or dexmedetomidine may also cause a slower emergence. Intravenous magnesium can be a cause of weakness if used in high doses. In some case intravenous agents are administered for a short period of burst suppression or decreasing the cerebral metabolic rate (CMRO₂). These medications can also cause a slower emergence depending on the amount used and the pharmacokinetics of these drugs. Medications injected directly by the surgeon such as local anesthetics injected intradurally may also cause a delayed emergence⁽⁴⁾. Needless to say monitoring the adequacy of muscle relaxant reversal is also important part of this root cause analysis. Patient temperature is also important and a cold patient may have a much delayed emergence.

Although there seems to be a long list of the anesthetic causes of delayed emergence, one should not assume that these are the only possible causes. There are also important surgical causes⁽⁵⁾ and complications that need to be addressed in a timely manner to decrease the chance of further complications and irreversible damage. There may be an intracranial hemorrhage as a result of inadequate hemostasis during the closure. A neurological examination does not necessarily need an awake and alert patient. Examining the pupil size, equality and reaction to light may help in diagnosing an intracranial hemorrhage. Although after anesthetic medications especially after reversal drugs or narcotics the sensitivity and specificity

are greatly diminished it could still be a good guide. Patients with large intracranial tumor have a slower awakening⁽⁶⁾. In situations that there is a large intracranial gap from an excision of a space occupying lesion, pneumoencephalos can be a reason for delayed emergence. In these cases specifically using nitrous oxide can worsen the situation expanding the intracranial pocket of air and increasing the intracranial pressure.

At this point communication with the surgeon is important to give the surgical team to prepare for a diagnostic method and return to the operating room if necessary. The communication should not be in the line of blaming but more towards getting ready to act if necessary. The anesthesiologist can mention that although there could still be an anesthetic cause of delayed emergence, it is advisable to think of surgical complications as well. Usually the imaging method of choice is a head CT scan. IN many instances the ischemic changes may not be apparent if it is in an acute phase, however it can be used for diagnosing intracranial air or hemorrhage. Transporting the patient with a less than expected mental status regardless of them being intubated or not requires vigilance to treat complications instantly. The operating room should be kept ready in case there is a need for immediate return for a redo craniotomy. Emergency medications as well as equipment for airway management are essential and it is always preferable to transport the patient under monitoring. Even if the patient does not return to the operating room, communication should be made with the final destination of the patient specifically the physician to explain the concerns.

In conclusion, delayed emergence after craniotomy is a situation with many possible anesthetic and surgical causes which need a systematic review to identify and rapid action to decrease chance of irreversible damage and needs ample communication between the anesthesiologist, surgeon and Intensivist.

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