The Big Bang Theory: Recurrence of post-concussion-like symptoms in an adolescent following general anesthesia

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Introduction

Altered mental status and transient short-term amnesia are well-known side effects of anesthesia, however, persistence of these symptoms beyond the postoperative phase is uncommon. Transient global amnesia (TGA) is a benign clinical phenomenon caused by a functional cerebral disturbance, characterized by a sudden memory loss of recent and/or remote events and transient inability to acquire new knowledge (1). The occurrence of TGA following general anesthesia in the adolescent population has rarely been reported in the literature (1,2).

Case Report

A previous healthy 14-year-old female injured her right knee while playing soccer, resulting in right anterior cruciate ligament (ACL) tear and was scheduled for operative repair. Intraoperatively she received an uneventful sevoflurane-based general anesthesia which included hydrocortisone, diazepam, and fentanyl & sciotic continuous peripheral nerve blocks for postoperative pain management. Upon emergence, the patient was combative, confused and incoherent state, presenting for surgery. Per the parents’ report, each time the patient fell asleep or experience pain, her memory would “reset” leading her to believe it was approximately 4 months prior with no recall of ACL injury. Her inability to form new memories persisted over the next 24 hours. All postoperative testing including electrolytes, glucose, and brain CT and MRI were normal. The patient experienced anterograde amnesia for approximately one week following surgery. Per the parents’ report, each time the patient fell asleep or experienced pain, her memory would “reset” leading her to believe it was approximately 4 months prior to the date of surgery. It was later discovered during subsequent evaluation that the patient was diagnosed with a concussion 6 weeks prior to surgery. Ultimately the patient returned to baseline with the exception of persistent amnesia specific to the 4-month period preceding surgery.

Characteristics of Mild TBI:

- May be caused either by a direct blow to the head, face, or neck or by a blow elsewhere on the body that results in transmission of an "impulsive" force to the head
- Typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously
- It may result in neuropathologic changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury
- It results in a graded set of clinical symptoms that may or may not involve loss of consciousness
- It is associated with no abnormality on standard structural neuroimaging studies

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Mild traumatic brain injury (mTBI) can cause diffuse neuronal damage and apoptosis impacting neuronal function (6). While it is clear that most patients suffer some acute cognitive difficulties following mTBI, the course of recovery remains variable with many reporting symptoms for months (3).

It remains unknown if anesthesia affects patients with previously diagnosed mTBI. Propofol and sevoflurane induce global central nervous system depression via potentiation of GABA type-A receptors (2,4).

Theta-band oscillations play an active role in memory maintenance, albeit it remains unclear if an increase in theta-band activity correlates with encoding, retention, or recall (5). There is a paucity of literature exploring the cumulative effect of mTBI and general anesthesia.

Discussion (Take 1)

Mild traumatic brain injury (mTBI) can cause diffuse neuronal damage and apoptosis impacting neuronal function (6). While it is clear that most patients suffer some acute cognitive difficulties following mTBI, the course of recovery remains variable with many reporting symptoms for months (3).

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Follow-up completion and release from physical therapy, the patient was cleared to return to soccer. Unfortunately, she suffered a traumatic knee injury and a re-lact of hair growth.

Understandingly, both the patient and her parents expressed concerns about undergoing another anesthetic. Several approaches to anesthesia and analgesia were discussed, including general anesthesia or spinal/epidural with or without minimal sedation. It was acknowledged by both the patient and her parents that undergoing this procedure via spinal/epidural anesthesia and minimal sedation would be psychologically challenging for her given her anxiety. Ultimately, the patient and her parents decided to proceed with general anesthesia.

The patient again received an uneventful sevoflurane-based general anesthetic. In an attempt to quell emergence delirium she was given dexamethasone prior to emergence. Unfortunately, she again awoke in PACU confused, disoriented, and experienced retrograde memory loss to the same distinct point in time, 4 months prior to her initial knee surgery. Of note, she was notably much less agitated than last time per her parents.

Neurology and Psychology were consulted for concerns regarding coping, functional amnesia and for evaluation and treatment recommendations.

The patient and her parents were provided education on the role of cognitive behavioral therapy in the management of and coping with memory loss.

The role of the autonomic nervous system and behavioral strategies (relaxation, diaphragmatic breathing, role of biofeedback), and cognitive strategies (changing thinking about symptoms) to cope with her symptoms were provided.

Discussion (Take 2)

The perplexing presentation of memory loss in this case suggests functional (also known as dissociative or psychogenic) amnesia as the primary consideration. While it is possible that the patient had some confusion after surgery with secondary embellishment, a history of transient organic amnesia (e.g. concussion history) is known to be a risk factor for dissociative amnesia.

Functional amnesia is characterized by block-like memory loss with earlier memories preferentially affected over recent memories in the absence of structural brain abnormality or known neurobiological cause (7).

The diagnosis of functional amnesia can be challenging to discern, especially in the presence of general anesthesia as it is more challenging to rule out contributing organic triggers.

Conclusion

There remains much that is unknown regarding the neurologic impact general anesthesia may have in the presence of concussion. It has been postulated that general anesthesia in patients with a recent mTBI may result in profound mental status changes.

Further research is necessary to better delineate the impact of general anesthesia on adolescents with a recent mTBI presenting for surgery.

In this specific scenario, it would appear that while a recently sustained concussion may have played a role in the patient’s combative, confused, and incoherent state following her initial ACL surgery, it likely was a red herring which made elucidating how to treat her altered neurologic status ever more challenging.

This case report emphasizes the importance of inclusion of psychiatric disorders in the differential diagnosis of patients presenting with unforeseen and inexplicable neurologic sequelae.

References

1. Botvinick, S., et al., Anesthesia & Analgesia, 2005