

CASE REPORT

A case of SIADH following uncomplicated mild traumatic brain injury: Did cognitive bias delay treatment?

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Key Clinical Message

To optimize clinical care, it is imperative for providers to recognize their own inherent cognitive biases and the impact that has on their clinical decision making, thereby minimizing complications such as prolonged hospitalization, unnecessary healthcare spending, and impaired patient satisfaction and functional outcomes.

KEYWORDS

cognitive biases, hyponatremia, improved functionality, SIADH

1 | INTRODUCTION

Mild traumatic brain injuries (mTBI) occur in the United States with an incidence of 1.6 million per year.^{1,2} Patients with mTBI frequently experience complications such as pain, which has prevalence rate of up to 95%.³ The etiology of pain post mTBI can vary drastically and difficult to identify. While one of the most common types of chronic pain post-mTBI is post-traumatic in nature, complications such as syndrome of inappropriate antidiuretic hormone secretion (SIADH) can present as headaches similar in picture to post-traumatic headaches.⁴ It can be difficult to differentiate between the various etiologies. Both post-traumatic headache and SIADH can develop within 7 days of sustaining a head injury. Patients with preexisting headaches are at an increased risk of developing post-traumatic headache.³ Current Center for Disease Control (CDC) guidelines suggest that patients with uncomplicated mTBIs be discharged after stable imaging studies.⁵ However, approximately 12% of uncomplicated mTBIs clinically deteriorate.^{1,2} Deterioration can range from mild

pain requiring no further acute medical management to severe debilitating pain or electrolyte disturbances that require intensive care unit (ICU) level care. One type of electrolyte disturbance is severe, symptomatic hyponatremia, occurring in roughly 33% of both mild and moderate TBI cases, typically manifesting 2–7 days after initial injury with the potential for chronic neurologic morbidities.^{6,7} The authors present a case of a patient with known prior headache history who experienced a mTBI resulting in headaches that were diagnosed as post-traumatic headache. We hypothesize underlying clinician cognitive biases delayed medical diagnosis and care of severe hyponatremia, thus resulting in prolonged hospitalization, unnecessary healthcare spending, and most importantly, impaired patient satisfaction and functional outcomes.

2 | CASE HISTORY/EXAMINATION

A 55-year-old Spanish-speaking male, with a history of asthma and chronic migraines presented to the

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emergency department (ED) after an occipital head strike secondary to a falling tree branch. The patient experienced loss of consciousness for 1 min in duration and was amnesic to the event. On ED arrival, the patient's Glasgow Coma Scale (GCS) was 15, vitals were within normal limits, and the physical examination revealed no signs of focal neurological deficit. A complete primary and secondary Advanced Trauma Life Support protocol was performed, including computed tomography (CT) of the head and spine. This revealed no acute abnormalities. Pertinent physical clinical findings included a small left temporal laceration, which was repaired at bedside, as well as mild leukocytosis. The patient was diagnosed with a mTBI without complication, post-traumatic headache, and leukocytosis secondary to a stress response. Given the patient's stable neurological exam throughout the ED stay, no new functional neurologic deficits on repeat examination, normal laboratory workup including complete blood count (except leukocytosis), and comprehensive metabolic panel on presentation, the patient was placed in observation status with a plan to discharge home after 3 days based on CDC guidelines. The Physical Medicine & Rehabilitation (PM&R) service was consulted to aid the functional needs of the patient including coordination of therapy services, durable medical equipment needs, headache management, and establish outpatient TBI resource management within the community.

3 | INVESTIGATIONS AND TREATMENT

During the patient's observation stay, he reported severe, persistent headaches. Given an unchanged repeat neurologic exam and an underlying history of chronic migraines, the primary team deferred additional testing and attributed the severity of post-traumatic headache symptoms due to the underlying migraine diagnosis. On day three of hospital stay, day of discharge, the patient developed worsening headaches accompanied by new-onset nausea and blurry vision. A repeat CT head and venogram was performed and revealed new multifocal hyperdensities in bilateral frontal lobes and anterior left temporal lobe, trace left subdural hematoma, and a new right cerebral venous sinus thrombosis (CVST) involving the right transverse and sigmoid sinuses. New lab work was not obtained at this time. Given new findings of CVST, the patient was admitted for ongoing medical management needs. It was not until the patient was officially admitted to the hospital that repeat laboratory workup was performed. Unfortunately, lab findings demonstrated marked hyponatremia (121 mmol/L), concerning for SIADH. The

patient was urgently upgraded to the ICU for close observation and management of severe hyponatremia.

4 | OUTCOME AND FOLLOW-UP

Despite stabilization of the CVST with anticoagulation therapy by day 13 of the hospital stay, the patient's hyponatremia and headache remained severe and uncontrolled, preventing a safe discharge. For headache management, the patient was trialed on oral, topical, and intravenous medications (IV) without any improvement. Nephrology was ultimately consulted given the progressive nature of the hyponatremia and no resolution after being started on IV hypertonic saline, oral medications including salt tablets, and being placed on a strict fluid restriction. Per Nephrology recommendations, the patient was started on IV furosemide. These changes ultimately corrected not only the severe hyponatremia but also improved headache severity and symptomatology. At this time, it was recognized that headache etiology was secondary to SIADH rather than post-traumatic headache and his prior migraine history. Following stabilization of hyponatremia and headache, the patient was discharged home with outpatient follow-up. One month after initial injury, the patient continued to suffer from cognitive changes and speech difficulty secondary to the TBI, limiting his ability to return to baseline activities of daily living. [Figure 1](#) depicts the timeline of events throughout the patient's hospital stay.

5 | DISCUSSION

Given post-traumatic headache can develop within 7 days post head injury and are more likely to occur in a population with prior headaches, it is no surprise that the medical team anchored on this information and the patient's severe, ongoing headaches were deemed to be secondary to post-traumatic headache alone.³ Clinicians commonly utilize head imaging studies alone to guide ongoing post-traumatic headache treatment needs, which occurred in our patient's situation. Current CDC guidelines indicate that individuals with uncomplicated mTBIs, like our patient, may be safely discharged following initial stable imaging studies.⁵ Unfortunately, this guideline does not account for clinical deterioration, including causes of severe hyponatremia, that commonly manifests within the same timeframe as post-traumatic headache.⁷ To monitor for such symptoms, routine laboratory workup is necessary.

The literature supports that routine serum sodium levels should be monitored in all hospitalized TBI patients.⁸ In fact, the American College of Surgeons Best Practices in

Timeline of Events

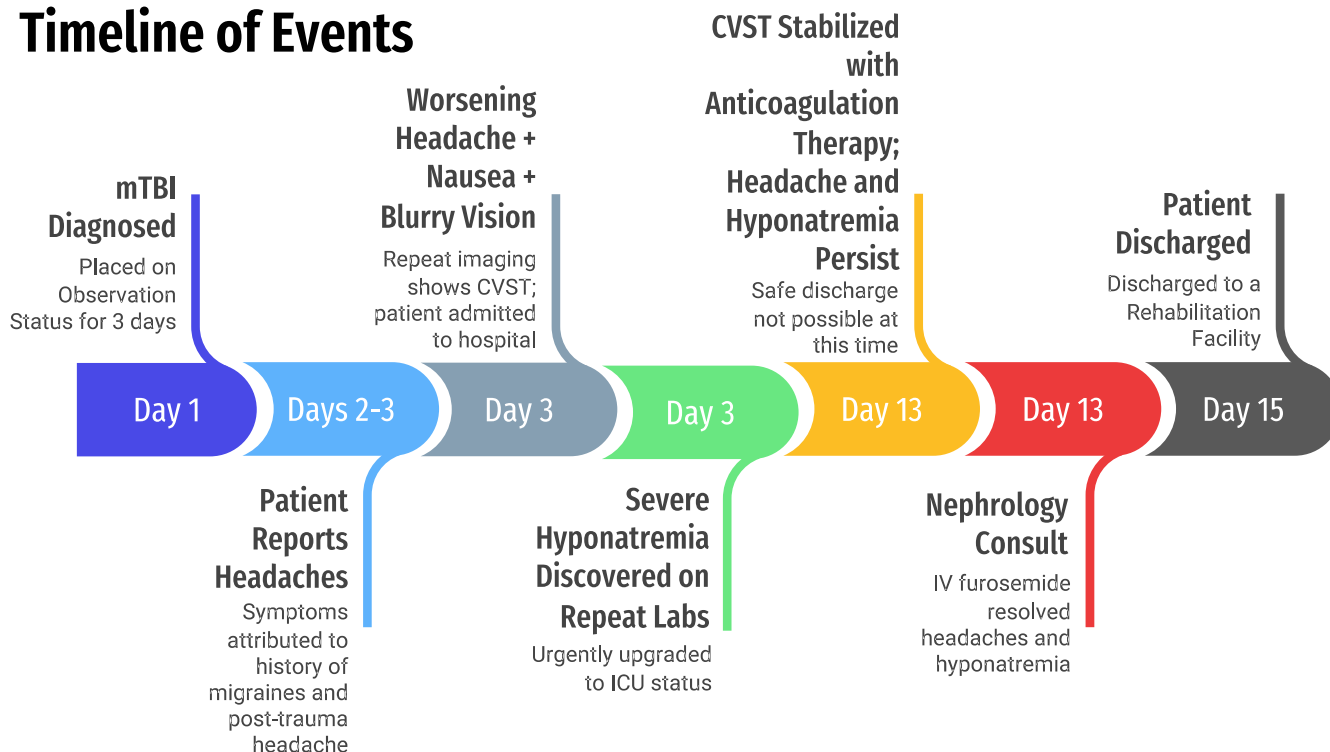


FIGURE 1 Timeline of events. The clinical course of the patient is highlighted from initial mTBI diagnosis through discharge.

the Management of TBI notes: “standard of care for brain injury patients is to monitor for SIADH through frequent laboratory studies.”⁹ Therefore, it is surprising that serum sodium was not routinely monitored in our patient’s case, especially given his ongoing severe headaches. We hypothesize underlying clinician cognitive bias played a role in this issue. Per chart review, the team diagnosed the headaches as post-traumatic headache, and they were not concerned by the severity or lack of improvement given his underlying migraine history. Per documentation, the patient was not pressed to describe his baseline migraines until his ICU stay, where he noted his baseline migraines were different in picture, than what he was experiencing while he was hospitalized. We hypothesize that the clinical team anchored onto the patient’s past medical history of migraines, in conjunction with the language barrier, which impeded communication and prevented in-depth discussions on the patient’s medical history. Unfortunately, this resulted in tunnel vision on a singular diagnosis, migraine variant, which subsequently prevented a thorough differential and appropriate workup. If a more in-depth conversation was held regarding headache symptomatology, we hypothesize the differential for headaches would have included SIADH and prompted laboratory monitoring. By avoiding severe hyponatremia, we hypothesize the patient could have avoided severe headache symptomatology, decreased need for ICU stay, and improved his overall functionality and quality of life.

SIADH is one of the most common causes of hyponatremia in TBI patients.¹⁰ Symptoms range from mild headache, to more severe symptoms including muscle cramps, nausea, vomiting and neurological decline.¹¹ A study from 2017 noted that sodium repletion and early administration of fludrocortisone resolved hyponatremia in SIADH and decreased hospital length of stay.⁷ Reid, et al. noted that patients admitted to a hospital following TBI experienced an average of 2 days longer length of stay over the general population, and accrued 74% higher cost throughout their stay.¹² TBI patients with hyponatremia experience an additional 5 day increase in length of stay, which is similar to our case. Given that complications of TBI, including hemorrhage and hyponatremia, can lead to fatal outcomes if not treated aggressively, early diagnosis and treatment is vital in these patients to optimizing the timeline of recovery and ultimately improving functional outcomes. Additionally, a review of patient outcomes following a mild TBI in 2022 showed that complicated mild TBIs with neuroimaging findings were 22% more likely to require rehabilitation services due to longer lasting functional deficits.¹³

This case of delayed SIADH diagnosis after an uncomplicated mTBI in a Spanish-speaking patient emphasizes the need for clinicians to promptly recognize their own inherent biases and how these cognitive biases can impact patient care and outcomes. Data suggests that cognitive biases affect all healthcare workers.¹⁴ For example, anchoring biases occur when individuals latch onto

information discovered early in the information retrieval process. We hypothesize that clinicians anchored onto the patient's underlying chronic migraine diagnosis to explain not only the fact that the patient had headaches, but to also explain the severity of his headaches. A 2016 systematic review noted that providers tend to “stick” with a diagnosis that they initially anchored to. The review found that this method of thinking was associated with diagnostic inaccuracies in 36.5%–77% of scenarios with a 9.7% increase in medical complications.¹⁴ If the patient had been pressed earlier in his stay regarding his typical migraine pattern, we predict that the differential to explain his ongoing headaches would have broadened to include hyponatremia. Another study showed that an implicit bias towards Hispanic and Black patient populations was a notably decreased perception of patient pain.¹⁵ It is possible that through these inherent lenses, the signs of worsening headache were easier to compartmentalize and assume to be caused by post-traumatic headache alone.

We propose that this patient required prolonged hospital stay and ICU admission, increased costs associated with medical treatment as well as a decline in functional ability requiring rehabilitation services as a result of these biases. Future efforts can be focused on vigilant data acquisition to prevent anchoring biases when establishing a differential diagnosis in order for clinicians to be able to broaden their differential to account for possible complications of a seemingly uncomplicated injury. In turn, we hope clinicians can address their implicit biases to aide in prompt diagnosis which is imperative to prevent delay in treatment and prolonged hospital stays, and to prevent functional decline. By considering the diagnosis of SIADH in those with headache post TBI, clinicians can monitor sodium levels in all TBIs, including mTBI. By doing so, clinicians can minimize the risk of severe neurological and functional decline from severe hyponatremia, and thus avoid the subsequent risk of in-hospital mortality.⁸

6 | CONCLUSION

In conclusion, the case of a Spanish-speaking patient with a delayed diagnosis of SIADH after an uncomplicated mTBI emphasizes the importance of prompt self-recognition of inherent clinical cognitive bias. By acknowledging and reflecting on these biases, providers can prevent this from becoming a barrier to care, thereby minimizing complications such as prolonged hospitalization, unnecessary healthcare spending, and impaired patient satisfaction and functional outcomes. Additionally, further exploration of how language and cultural factors can impact clinical care would enhance the understanding of

inherent clinical cognitive biases and the potential challenges in diverse patient populations.

AUTHOR CONTRIBUTIONS

Andrew Joseph Rothka: Conceptualization; investigation; writing – original draft; writing – review and editing. **Sarahrose Jonik:** Conceptualization; investigation; writing – original draft; writing – review and editing. **Jacob Nelsen:** Conceptualization; investigation; writing – original draft; writing – review and editing. **Shivani Patel:** Conceptualization; investigation; writing – original draft; writing – review and editing. **Neyha Cherin:** Conceptualization; investigation; project administration; supervision; writing – original draft; writing – review and editing.

CONFLICT OF INTEREST STATEMENT

Authors have no conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy. All protected health information was withheld from this piece to ensure patient anonymity. Data sharing not applicable to this article as no datasets were generated or analyzed during the current study. There were no sources of funding for this case report.

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