Case Report

Methylphenidate for neurological improvement post-TBI

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Abstract

Traumatic brain injuries (TBIs) can have numerous neurologic and cognitive sequelae. The road to recovery can be long and arduous for many patients. Improving cognition can assist in a shorter recovery time as patients may be more in tune with their plan of care. Family physicians may be helpful in assisting with the recovery process post-hospital discharge. This case report seeks to educate family physicians on the use of methylphenidate in the ambulatory setting after TBI. Here, a case of a 51-year-old man on methylphenidate after a traumatic brain injury is presented.

Keywords: Methylphenidate, neurological improvement, traumatic brain injury

Introduction

Traumatic brain injuries (TBIs) often result in a wide range of neurologic and cognitive sequelae, necessitating long and challenging recovery periods for patients. Enhancing cognition is crucial for facilitating a shorter recovery time and enabling patients to actively engage in their care plan. Family physicians play a vital role in supporting the recovery process following hospital discharge. This case report aims to contribute to the knowledge of family physicians by examining the use of methylphenidate in the ambulatory setting for neurological improvement after TBI. In particular, we present a case of a 51-year-old man who experienced significant neurocognitive decline post-TBI and was initiated on methylphenidate therapy. By highlighting this case, our study seeks to shed light on the potential benefits of methylphenidate in the context of TBI and provide insights for family physicians involved in post-TBI management. This study aimed to bridge the gap in the existing literature regarding the use of methylphenidate for cognitive enhancement in the ambulatory setting post-TBI and serve as a reference for future research and clinical decision-making.

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While the case report may not introduce groundbreaking or revolutionary concepts, its uniqueness lies in the specific population studied, the comprehensive treatment approach described, the emphasis on cognitive improvement, and its practical implications for family physicians. These aspects contribute to the case report's innovative and informative nature within the context of TBI management and methylphenidate use.

Case Presentation

History of present illness

A 51-year-old man presented to the office after a treatment period of several months for a motorcycle accident in which he was the unrestrained driver. The patient was not wearing a helmet during the incident. He was subsequently taken to the hospital where he was scanned for injuries. After he was stabilized, he was taken to a tertiary care center for further care.

Physical examination

- Constitutional: Unresponsive, intermittently moving lower extremities. Glasgow Coma Scale 3.
- Head eyes nose throat: Significant nasal bridge and left eyelid swelling. Left intraocular eye pressure of 23 mmHg. Chemosis and hemorrhage present. Right pupil of 4 mm, extremely sluggishly reactive. Large deep laceration over the

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right eyebrow with significant surrounding swelling and active bleeding. Large complicated upper eyelid laceration involving the tear duct. C-collar in place.
- Cardiovascular: Normal pulses.
- Musculoskeletal: Deformity of right wrist present. No step-offs or deformities of the C, T, and L spine.
- Skin: Diffuse road rash over the chest, bilateral lower extremities, and head and upper extremities.

Imaging

A computed tomography scan of the head as seen in Figure 1 revealed areas of subarachnoid hemorrhage involving the right frontoparietal and temporal regions. Acute subarachnoid hemorrhage is also seen in the right Sylvian fissure. Acute extra-axial hemorrhage is seen in the region of the tentorium. Bilateral frontal scalp, large left and small right periorbital preseptal, left premaxillary, and left anterior face hematoma and laceration, blood in the left maxillary sinus, left orbital proptosis, and acute left orbital floor blowout fracture were found.

Interventions

1. Subarachnoid, intraventricular, and corpus callosum hemorrhage—an external ventricular drain was placed and subsequently removed after the intracranial bleed demonstrated stability on serial imaging. Prophylactic antibiotics were administered with the external ventricular drain in place. A seven-day course of Keppra was administered for seizure prophylaxis. The patient was started on amantadine twice daily for neurological stimulation and eventually switched to ritalin.
2. Apneic episodes due to TBI—during this time, the patient had to be intubated. Upon stabilization of his clinical status, extubation was attempted successfully.
3. Dysphagia—a gastrojejunal tube was placed with eventual removal after dysphagia resolved and speech-language pathology took over care.
4. Left orbital fracture—nonsurgical intervention necessitated per facial reconstruction and plastic surgery.
5. Left brow laceration with lower lid laceration of the left eye and hyphema of the left eye—erythromycin ointment and ophthalmology follow-up.
6. 12% body surface area of road rash—bacitracin ointment.
7. Persistent tachycardia—propranolol.
8. Motor deficits—physical therapy and occupational therapy.
9. Neurocognitive decline—methylphenidate 2.5 mg twice daily.

Figure 1: CT scan of the brain showing left orbital blowout fracture and acute subarachnoid hemorrhage

Discussion

Cognitive deficits that are most often seen after TBI include a reduction in short-term memory and abnormal concentration and attention.[1] According to another study, the purported mechanism includes stimulation of dopaminergic and noradrenergic receptors in the prefrontal cortex and subcortical regions.[2] The distribution of these neurotransmitters leaves them susceptible to diffuse axonal injury during a TBI. Other pharmacotherapeutic agents such as amantadine, sertraline, and donepezil have been used for improved cognition after TBI. However, according to one study, randomized controlled trials have supported methylphenidate as the leading therapeutic agent for improving cognitive deficits after TBIs.[3]

As a result, methylphenidate has been used for a myriad of purposes after TBIs. A review article stated that methylphenidate was responsible for increasing mental processing speed.[4] One study showed that methylphenidate was responsible for increasing attention after a TBI.[5] This study also stated that attention deficits were rectified for patients with TBIs and stroke; in addition, methylphenidate has been useful in working memory. One study stated that patients were extubated earlier on methylphenidate likely due to the neuroprotective effects of methylphenidate.[6] Another study showed that the use of stimulants and methylphenidate in particular led to shorter intensive care unit and hospital stays overall.[7] Furthermore, methylphenidate was seen to be useful for combating depression post-TBI depression according to one study conducted in 2020.[8]

The patient in this case report used methylphenidate 2.5 mg twice daily. The patient reported increased attention to detail and ease of following exercises for physical and occupational therapy. The patient stated that the use of methylphenidate allowed them to remember to take their myriad of medications and remember the appointments they needed to attend with multiple specialists during the recovery period. There was a self-reported improvement in the ability to concentrate on speech during physician appointments. The patient has continued to show improvement in cognitive function and physical therapy progress as time has passed.

Overall, the take-home message is that methylphenidate may be a valuable tool in the management of neurocognitive decline post-TBI, providing primary care physicians with an additional option to support cognitive recovery and enhance patient care.

This paper is relevant to the practice of primary care physicians in several ways. By highlighting the relevance of methylphenidate in the management of cognitive deficits post-TBI, this case report provides primary care physicians with valuable insights, expands their treatment options, promotes long-term collaboration with specialists, supports informed decision-making, and enhances the continuity of care for TBI patients in their practice.

However, there are certain limitations to the study. The study is based on a single case report, which limits generalizability and makes it challenging to draw definitive conclusions about the effectiveness of methylphenidate for neurological improvement post-TBI and how factors such as injury severity, individual variations, and comorbidities can significantly impact treatment outcomes, or can be confounding. There is not enough information to determine the optimal duration of treatment or evaluate the sustainability of the observed improvements. The reported improvements in attention, memory, and cognitive function were primarily based on self-reported measures from the patient. The lack of objective assessments or standardized cognitive tests limits the objectivity and reliability of the findings. Lastly, there is a lack of comparison to alternative treatments, including pharmacological agents or non-pharmacological interventions.

Based on the case report, here are some areas that could benefit from future studies. There is a need to determine the optimal duration of methylphenidate treatment for neurocognitive improvement post-TBI. Long-term studies assessing the sustained benefits, tapering strategies, the potential impact on the patient's overall recovery, and quality of life would be valuable in guiding treatment decisions. Conducting comparative studies to compare methylphenidate with other pharmacotherapeutic agents or non-pharmacological interventions commonly used for neurocognitive improvement post-TBI, or even a control group or placebo, would provide valuable insights into the relative efficacy and potential benefits of different treatment approaches. Future studies should aim to include larger sample sizes and diverse populations to enhance the applicability of the findings to a broader TBI population. Incorporating objective outcome measures, such as standardized cognitive assessments, neuropsychological testing, and functional outcomes, would provide more robust and objective data to evaluate the effectiveness of methylphenidate in improving cognition post-TBI.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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