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Psychopharmacologic intervention after hemorrhagic basal ganglia damage

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ABSTRACT

Traumatic brain injury (TBI) can result in cognitive and behavioral impairments such as poor attention, learning, memory and planning ability and uncontrolled crying that can be more persistent problems than the physical disabilities. Cognitive enhancers have been shown to improve cognitive and behavioral impairments in patients with hemorrhagic basal ganglia lesions as well as other forms of TBI. There is little research about the use of cognitive enhancers after hemorrhagic basal ganglia damage. We present a case of a 38 year old male who made significant recovery with the use of cognitive enhancers.

1. Introduction

Cognitive and behavioral impairments are the most common chronic sequel of traumatic brain injury (TBI), and these impairments can result in more persistent disability than the physical disabilities. Cognitive and behavioral impairments such attention, learning, memory and planning ability can be treated with cognitive enhancers [1]. For example, sustained attention and learning deficits as well as reduced gray-matter density and changes in the hippocampus and neo-cortex implicate impaired cholinergic function in TBI patients as a cause of the dysfunction [2–4]. Thus, using cholinesterase inhibitors (ChEIs) to increase cholinergic function may benefit TBI patients [5]. Methylphenidate (Ritalin) has been found to improve working memory, cognitive flexibility, attention and response inhibition in both children and adults with attention-deficit/hyperactivity disorder (ADHD) [6,7]. Citalopram, a selective serotonin reuptake inhibitor (SSRI) has been used to treat pathological crying in stroke patients [8,9].

Hemorrhagic basal ganglia lesions, depending on exactly where the damage lies can result in problems like abulia, loss of executive control, and problems with attention and memory [10]. While there are cognitive and functional treatment programs which attempt to ameliorate some of the problems associated with TBI [11], there are no medications with an approved indication for treating brain injury related cognitive impairments and behavioral dysfunction. Furthermore, the authors were unable to find any studies which look at the use of pharmacological cognitive enhancers for the treatment of behavioral and cognitive impairments related to hemorrhagic basal ganglia damage in adults and only one study with a single child [8]. We present a case study of a patient who sustained a severe hemorrhagic brain injury, and who subsequently experienced cognitive recovery to an unexpected degree due in large part to psychopharmacological intervention using Galantamine (Reminyl) and Ritalin.

2. Patient

Dr A. is a 38-year-old gentleman who worked as dentist. The patient had an unremarkable medical history except for longstanding hypertension. He suffered a severe left basal ganglia hemorrhage 4 months prior to admission to our facility for rehabilitation. Initially, his Glasgow Coma Score was 7/15. He stayed 6 weeks in a coma. A CT scan showed a large basal ganglia hemorrhage with a major intraventricular component, a moderate midline shift and generalized brain edema. The patient needed two external ventricular drains with intracranial pressure monitoring.

3. Neuropsychological evaluation

Upon admission it was obvious from the initial neuropsychological evaluation that the patient suffered a severe cognitive decline from his pre-morbid level of general abilities in addition to meningeal signs, dysarthria and right side hemiplegia. The patient had very poor comprehension and could not follow simple verbal commands. He was disoriented to time, place and person. He had poor attention and concentration. He had poor reading skills and could not read to follow commands. His expressive skills were limited, and he displayed severe echolalia. He had significant global aphasia but was able to repeat some sentences or well-rehearsed phrases or information spontaneously but not voluntarily.

He had poor basic visual–perceptual and simple spatial skills and severe memory impairment. He had impaired right–left orientation. His nonverbal reasoning was very poor, matched to that of a child.

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He demonstrated poor performance in tasks that required good executive function such as switching behavior, mental flexibility, error correction behavior, and ability to plan in novel tasks and situations.

He showed indications of stress in new or novel tasks which could be attributed to poor adaptation to changing situations. He displayed poor switching behavior and mental flexibility as evidenced by deficit performance on the Trail Making Test as he failed to complete both trails (A, B) correctly. He had very poor results in all neuropsychological tests performed. On theTONI-3 (Test of Nonverbal Intelligence-Third Edition) he scored 67 which is in the very poor range; on the WAIS-III's (Wechsler Adult Intelligence Scale-Third Edition) picture completion subtest his scaled score was 3 (very poor) and on the matrices subtest his scaled score was 4 (very poor).

4. Patient behavior

After the patient's neuropsychological evaluation, a psychiatry consultation was requested for possible psychopharmacological intervention for irritability and cognitive enhancement. The patient was started on Escitalopram 10 mg QD which helped reduce impulsivity but failed to improve apathy and motivation (associated with depression) in therapy sessions. Galantamine 4 mg BID was added, and the dose was increased gradually in 4 weeks to 8 mg BID, then to 12 mg BID after 6 weeks. After 2 months the patient showed some improvement in attention, memory and comprehension; however he still had poor motivation in therapy and low frustration tolerance. Twelve weeks after starting his rehabilitation program, Ritalin 10 mg bid was added.

The rehabilitation program consisted of computer-based tasks for cognitive stimulation, physiotherapy and occupational therapy. The patient's progress was measured by improvement in performance in standardized tests and computer-based tasks. After one year of rehabilitation, the patient's functioning significantly improved as measured by psychological tests and computer-based tasks as well as the evaluation of the patient's quality of life. The observations of his performance in daily life situations showed better orientation, attention, concentration, comprehension of verbal stimuli and processing speed.

The comparison between the scores of neuropsychological tests demonstrated improvement on the WAIS-III picture completion subtest (SS = 3/SS = 6) and matrix reasoning subtest (SS = 4/SS = 7) which inferred improvements in perceptual, visual–spatial, and constructive abilities. This improvement was also evident by the comparison of the scores of computerized cognitive training tasks; he showed extended visual capacity and ability to recall 4 correct pictures out of 4. At another level of remarkable progress, his performance suggested improvement on the maze test and trial making test. The results indicated improvement in his planning skills and searching behavior.

Despite these improvements there was no significant improvement on a number of executive functions such as abstract reasoning, and he had low cognitive tolerance for dealing with novel situations and challenges.

5. Discussion

Based on all criteria, this patient's prognosis was extremely poor. Initially, he had a GCS of 7/15. Upon admission to our facility for rehabilitation, 4 months after injury, he had Rancho Los Amigos score of II, meaning that he had nonspecific non-purposeful reactions to stimuli. Despite this, he survived his brain injury in far more than a minimally responsive state and today can reasonably be assigned the highest Rancho Los Amigos score of VIII meaning that he is able to learn new things and compensate for his problems. He exhibits more flexibility in thinking and realizes that he has a problem in his thinking and memory.

Studies into the pharmacological neuromodulators of the cognitive disorders secondary to TBI are currently in the early stages. There are three small positive prospective studies using an acetyl cholinesterase inhibitor for *cognitive* rehabilitation. Memory and attention were the most consistently improved cognitive domains [12–15].

Seven double blind, randomized, placebo-controlled trials which used cognitive measures as a primary outcome, as well as two other non-randomized trials reported that methylphenidate had positive effects on multiple cognitive domains including attention, memory, executive function, sensory–perceptual–motor skills, and global cognition. Attention was the most studied domain amenable to methylphenidate treatment [16–20].

Our patient's observed significant cognitive and physical recovery must not be attributed solely to medications. Cognitive enhancers most likely accelerated and facilitated his recovery in addition to the use of psychosocial rehabilitation by enhancing cognitive function, so that maximum function could be restored.

Conflict of interest

The authors declare no conflicting interests, and the study was not supported/funded by any drug company.

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