



Degeneration of the Splenium of the Corpus Callosum in an Attention Deficit Hyperactivity Disorder (ADHD) Patient: A Case Report

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DOI: 10.31080/ASNE.2022.05.0490

Received: March 09, 2022

Published: March 25, 2022

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Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is a common clinical and neurobehavioral disorder that has a serious impact on the patient and his/her loved ones. Structural deformities associated with ADHD have been described, of which the corpus callosum is one of the most parts studied.

Deformities involving the splenium of corpus callosum have a robust association with ADHD. In this manuscript, we present a case of degeneration of a hypoplastic splenium of corpus callosum in an ADHD patient detected on MRI 2 years after initial detection of hypoplasia of corpus callosum.

To our knowledge, and after searching the published scientific data, this case may be the first case to report degeneration of a hypoplastic splenium of corpus callosum in an ADHD patient. It highlights a few important points: sample age matching in studies focusing on neuroanatomy of ADHD, it provides possible evidence that neuroanatomy can change with time in ADHD, and its association to worsening ADHD symptoms.

Keywords: ADHD; Degeneration; Splenium; Corpus Callosum; Case Report

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is one of the several common neurobehavioral disorders found in children and adults, and the most presenting for treatment in children [1]. ADHD is often associated with high rates of anxiety and mood disorders [2] along with substance use disorders [3]. Diagnosis of ADHD is based on criteria that have been set in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) [4]. However,

its biggest limitation is that it was derived from children aged 17 and under, so it is not tailored for adults [5].

Clinical diagnosis for ADHD is based on the combination of Family history, psychosocial stressors, comorbidity, impairment level, and the patient symptoms. Some studies have associated ADHD with abnormalities of the brain structure and function. Among those was highlighted by Ivanov and his colleagues in 2010. It found

a reduction in the pulvinar volumes of the thalamus in youths with ADHD, and that area was found to be enlarged in patients that have been treated [6]. Another study found that ADHD can cause working memory impairment that affects learning and causes a decrease in intellectual ability⁷. However, to our knowledge, there is no case showing connection between a deformity in the splenium of the corpus callosum in ADHD patients through time.

This case report presents degeneration of a hypoplastic splenium of the corpus callosum in an ADHD patient detected on MRI 2 years after initial detection of hypoplasia of corpus callosum.

Case Presentation

A 9-year-old male patient was brought to the clinic by his family with chief complaints of distractibility, hyperactivity, and language disabilities for the past 3 years.

After a long interview with the patient and the family, brain injuries and insults were ruled out. Patient showed moderate language impairment. He had issues remembering daily activities, was not able to focus while doing tasks and chores which he didn't complete. He also was unable to listen when spoken to and keeps running and jumping at home. He had a lot of complaints from his teachers regarding his behavior in the classroom. His teachers reported that he was impulsive, was distracting his peers, and gets out of his seat during the class. Similar complaints to the above, were also reported by the family.

These behaviors have affected his performance at school, got him suspended multiple times, and caused his parents to worry. The patient was otherwise well, and his physical examination was normal. Electroencephalogram showed no specific findings, and a Brain Magnetic Resonance Image (MRI) was ordered to exclude any anatomical causes.

The MRI showed hypoplasia of the splenium of the Corpus Callosum with otherwise normal structures. Figure 1. The patient was born prematurely (34 weeks) and showed language delays in developmental milestones assessment. After excluding other psychiatric disorders explaining behavioral findings, and a negative family history, specialist diagnosed him with attention deficit hyperactivity disorder (ADHD).

Treatment options were discussed, and family chose non-stimulant medication atomoxetine, in addition to cognitive behavioral therapy. He was also referred to a speech specialist.

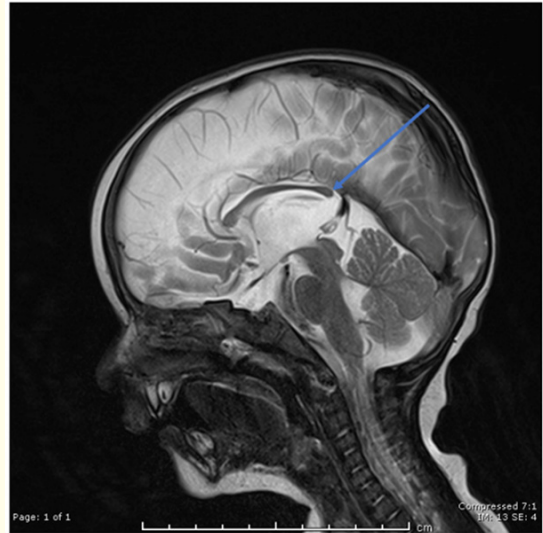


Figure 1: Hypoplasia of the splenium of the Corpus Callosum.

From our follow up, the patient has been doing well, and the symptoms have improved.

After approximately 1.5 year, he presented with worsening of his symptoms despite complete adherence to the drug. Atomoxetine dose was increased to the maximum allowed dose and symptoms didn't improve. The patient was then started on methylphenidate and atomoxetine was discontinued.

Brain MRI demonstrated a normal brain anatomy other than complete absence of the splenium of corpus callosum figure 2.

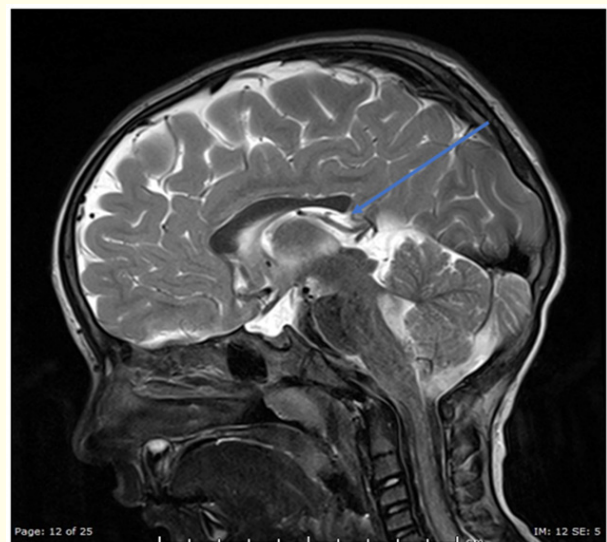


Figure 2: Complete absence of the splenium of corpus callosum.

Discussion

Attention deficit hyperactivity disorder (ADHD) is a prevalent neurobehavioral disorder that affects children and adults and carries a significant impact on the patient, the family, and society. ADHD is a clinical diagnosis met by the presence of 6 or more symptoms in each of two categories; inattentive, hyperactive, and impulsive or both as described by DSM-5 [8]. The mentioned in this case report met criteria of ADHD according to DSM-5.

Plentiful studies have shown structural deformities at an anatomical level, involving cortical, subcortical regions, and others. Corpus callosum is one of the most studied parts for alterations in ADHD patients [9]. Corpus callosum is the main supratentorial white matter tract connecting the two cerebral hemispheres [10].

It is subdivided into Rostrum anteriorly, Genu, Isthmus, and the splenium posteriorly [11]. Corpus callosum abnormalities prevalence is 2-3% in people who are developmentally challenged, of which 30% have agenesis of the posterior part of the corpus callosum [12].

The association between ADHD and alterations in the splenium of corpus Callosum have been studied multiple times with variable results. Some studies have shown that it was intact in ADHD patients, other studies showed remarkable decrease in size [11]. The splenium of corpus callosum links the posterior parietal areas, both temporal lobes, and both occipital lobes, which affects the speed of information distribution between these lobes. The insufficiency in this pathway may be linked with the distractibility, inattention, and visual dysfunctions seen with ADHD patients [13]. Magnetic resonance imaging (MRI) grants a high-quality image of the brain, differentiates between white and gray matters, and illustrates other structures [14]. In our case report, the corpus callosum was hypoplastic at first, and the splenium of corpus callosum was completely absent on MRI 2 years later.

The patient was first started on behavioral therapy and Atomoxetine which helped him for about 18 months. After that, symptoms have worsened despite adherence to the treatment. The dose was increased to the maximum allowed dose. When symptoms didn't improve on dose increment, atomoxetine was replaced with methylphenidate.

Conclusion

ADHD is a prevalent psychiatric disorder which has a high impact on patients and their families. The diagnosis is achieved by certain criteria. The treatment is typically with medical management, in addition to cognitive behavioral therapy.

There are studies showing structural abnormalities in the brain including the white matter. Structural abnormality of the splenium of corpus callosum is known to be associated with ADHD, in which agenesis and hypoplasia have been described. In our case, degeneration of the splenium shed a light on the structural neurological changes through time. Early detection and treatment are associated with better outcomes.

Conflict of Interest

Researchers declared no conflict of interest.

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