

## Case Report

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# ADHD and Epilepsy in Children – a case report and the clinical issues arising therein

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### ABSTRACT

Epilepsy is seen in 20-40% children with attention deficit hyperactivity disorder (ADHD). Neurobiological studies point towards neuronal hyperexcitability as a putative mechanism in the pathogenesis of both ADHD and epilepsy. The management of ADHD in the presence of epilepsy needs wise clinical acumen. There is an increased risk of breakthrough seizures when methylphenidate may be used in children with epilepsy and stimulants as it is predispose children to the risk of seizures even in the absence of epilepsy. The following cases discussed here highlight the clinical complexities and treatment decisions that need to be made when ADHD and epilepsy are present in the same child.

**Key words:** ADHD, epilepsy, methylphenidate, seizures.

(Paper received – 28<sup>th</sup> April 2016, Accepted after peer review – 7<sup>th</sup> June 2016)

### CASE REPORT

A 12 year old male child, studying in standard 7 and a known case of seizure disorder (generalized tonic clonic type), was referred to our child guidance clinic from the pediatric department in view of the child being diagnosed as having ADHD comorbid with seizure disorder. The child had seizure disorder since the age of 3 years. Since then he was well maintained on syrup Valproate 5ml thrice a day. The patient would have a recurrence of seizures whenever Valproate would be stopped or tapered and hence the parents ensured compliance to treatment. However there were no breakthrough seizures while on treatment.

On taking detailed history the parents mentioned that when the child was 8 years old, the school teacher complained that the child was not able to sit in class even for a span of 10 minutes. The parents too noticed that the child could not sit in one place not only while studying but also while eating and watching television. Even if he did sit, it was due to the fear of being reprimanded by his teacher or parent. He would easily get distracted and would distract others in class as well. His schoolwork and homework would remain incomplete. He would frequently lose his belongings and interject conversations when others were speaking. His exam papers would remain incomplete and his grades showed a progressive decline. However no treatment was ever sought for the same and the patient was given grace marks and promoted each year in school.

By the time the child was 12 years old and in standard 7, his hyperactivity decreased, however he was still fidgety, not able to pay attention while studying, was distractible and hence failed in his terminal examinations. This was the reason the parents sought help for the ADHD. The child was diagnosed as having ADHD mixed type and was started on Atomoxetine 10mg in the morning which was weekly increased in 3 weeks to 25mg in the morning. Valproate was continued at the same dosage. After about 3

weeks, there was a 50% improvement in the patient's attention span, however the patient had an episode of a breakthrough seizure (GTC type), despite compliance to valproate. The pediatrician increased the dose of Valproate from 1000mg to 1200mg per day. The patient however continued to have breakthrough seizures and his valproate was further increased to 1400mg/day. As the seizures did not abate, his serum valproate levels were done and was 80mg/L. The patient would get seizures at the frequency of once in 7 to 10 days. Thus the patient was referred to our hospital, which is a tertiary referral centre. He was seen in the pediatric department, wherein the patient's mother complained not only of seizures, but also inattention and absent mindedness. Hence the patient was referred to our child guidance clinic.

Because of the propensity of Atomoxetine to cause or worsen seizures, we stopped Atomoxetine gradually over 2 weeks and advised a trial of Clonidine (0.1mg twice a day) along with occupational therapy, which the patient underwent for 3 months, without improvement and the complaints from school continued. We then started the patient on Methylphenidate 10mg in the morning and kept the patient under close follow up. After 2 weeks, the case was reviewed and the patient had no fresh seizure episode. His attention improved by a 20%. The patient's weight was 32mg and so the dose of methylphenidate was increased to 20mg per day. The patient was seen after 15 days, without any breakthrough seizures and a 50% decrease in inattention. On long term follow up, the patient had no breakthrough seizures and his grades improved with almost 80% improvement in attention span and methylphenidate at 20mg per day. He continued with occupational therapy.

## **DISCUSSION AND CLINICAL ISSUES**

### **ADHD AND EPILEPSY**

Many medical hypotheses have been put forth in an attempt to explain the co-existence of ADHD and epilepsy. ADHD and epilepsy may exist within a common syndrome complex; both may have a genetic predisposition; and finally, antiepileptic drugs (AEDs) may contribute to both attention difficulties and increased levels of activity, including irritability in a number of children. Many clinicians believe that the two are in fact disorders of neuronal hyperexcitability but vary in severity and lie on the same continuum [1-2].

It is well known that difficult-to-treat epilepsies and attention-deficit-hyperactivity disorder (ADHD) often co-occur. This is a difficult group as sometimes one may have to treat ADHD while breakthrough seizures may continue in the child. This also confounds the clinical picture as it is rather difficult to ascertain whether the breakthrough seizure is ADHD medication induced or part of the epilepsy itself [3].

Around 5-10% of children with ADHD show distinct EEG abnormalities. Further, where an EEG is undertaken without a clinical diagnosis of epilepsy, any abnormalities identified on the EEG must be interpreted appropriately and should not influence the treatment of ADHD. Many children with ADHD show spikes and sharp wave patterns on the EEG and hence that may serve as indicator of increased seizure risk in these cases and thus one may have to be watchful for medication induced seizures in these cases [4-5].

The type of epilepsy may also be important, although the evidence is conflicting. Children with complex partial seizures are reported to have significant difficulty with aspects of sustained attention, irrespective of whether there is a preceding or concurrent diagnosis of ADHD. Although children with ADHD and those with complex partial seizures have similar problems with attention, the mechanism responsible may be different. Clinically there is no specific type of epilepsy that has been linked to ADHD [6].

### **METHYLPHENIDATE, EPILEPSY AND ADHD**

There is little or no literature to support the notion that methylphenidate may contribute to the development of epilepsy or exacerbate seizures in children with a diagnosis of epilepsy [7]. There are many clinical considerations that must be borne in mind. First, a new seizure or an exacerbation of pre-existing seizures and the initiation of methylphenidate may be entirely coincidental, reflecting the natural history of the epilepsy in any child [8]. Second, methylphenidate may cause disruptions in sleep and reduce sleep quality and thus lower the threshold for epileptic seizures resulting in deterioration of seizure control [9]. Third, methylphenidate could be pro-convulsant and therefore lower seizure threshold. The drug primarily

acts on the presynaptic reuptake of the neurotransmitters noradrenaline and dopamine rather than the neurotransmitters commonly associated with the pathophysiology of seizures (GABA and glutamate) [10]. It is not known to affect calcium or sodium channels, which are also implicated in the pathophysiology of many of the epilepsies [11]. There is considerable anecdotal evidence to suggest that methylphenidate is safe in children whose seizures are well controlled with antiepileptic drugs [12].

Most studies have shown that methylphenidate improves symptoms of ADHD and enhances the performance in children with both ADHD and epilepsy. It does not appear to exacerbate seizures in children with either well controlled or active epilepsy.

### **ATOMOXETINE, ADHD AND EPILEPSY**

Several studies have shown that treatment of ADHD symptoms with atomoxetine does not appear to elevate seizure risk further [13]. In contrast to this, many case studies have demonstrated worsening/breakthrough seizures due to atomoxetine [14].

ADHD and epilepsy reflect a similar underlying neurobiological diathesis; both illnesses may share dysregulation in the noradrenergic system [15]. Although ADHD is multifaceted in etiology, the catecholamine hypothesis implicates dysregulation in the norepinephrine systems within the frontosubcortical brain areas [16]. Similarly, subclinical epileptiform discharges are associated with transient cognitive impairment, including deficits in attention and recall. Supporting the shared vulnerability hypothesis is the observation that problems with attention are commonly present at the onset of seizures in children [17].

Regardless of the underlying possible etiology, there is accumulating evidence that children with ADHD are likely to be at greater risk for seizures. A treatment intervention that effectively alleviates ADHD symptoms but does not lower the seizure threshold would be ideal. Although seizures have been reported among patients taking atomoxetine, research data suggests that atomoxetine does not increase seizure risk in children with ADHD and can be used safely in this population [18].

### **CLINICAL IMPLICATIONS**

Thus our case goes on to highlight the scholastic problems that arise due to ADHD and how it can adversely affect a child's academic performance. Thus there is no doubt that ADHD, even in a child with co morbid seizure disorder warrants treatment.

The difficulty/dilemma arises in children having seizure disorder co morbid with ADHD. Treatment options excluding both atomoxetine and methylphenidate in these patients do not show good results; at least as far as academic performance is concerned [19].

The safety of methylphenidate is amply clear and thus evens a child co morbid with ADHD and seizure disorder should not be outrightly denied effective treatment due to unfounded concerns about treatment precipitating seizures. Instead, due importance should be given to emphasizing the need for compliance to anti epileptic medications [20].

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Acknowledgements – Nil

Source of Funding – Nil

Conflict of Interest – Nil