Epileptiform activities in the EEG of Children with Attention Deficit Hyperactivity Disorder

Thesis

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

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Rama Ahmed Mahmoud Mansour

Dedication

I would like to dedicate this work to my mother, the soul of my father, to my husband, my children , my brother and to all my family for supporting me all through my way to finish this work.

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LIST OF ABBREVIATIONS

ACTeRs	**:**	comprehensive teacher rating scale and parent form
ADHD	**:**	attention deficient hyperactivity disorder
ADHD-RS	**:**	attention deficient hyperactivity disorder rating scale
AED	**:**	antiepileptic drugs
ATX	**:**	atomoxetine
BECTS	**:**	benign epilepsy with centrotemporal spikes
COMT	**:**	catechol- o- methyl- transferase
CPs	**:**	cycle per second
CRS-R	**:**	Conner's revised
DAT1	**:**	dopamine transporter 1
DBH	**:**	dopamine B-receptor
DR	**:**	dopamine receptor
DSMV	**:**	Diagnostic and Statistical Manual of Mental Disorders, 5th edition.
DTD	**:**	dopamine transporter deficit
EA	**:**	epileptiform activity
ED	**:**	epileptiform discharge
EEG	**:**	electroencephalography
GAF	**:**	global assessesmnt of function
IED	**:**	interictial epileptiform discharges

IQ	**:**	intelligent quotient
LEV	**:**	levetiracetam
MPH	**:**	methyl phenidate
NET	**:**	norepinephrine transporter
NIMH	**:**	national institute of mental health
OCD	**:**	obsessive compulsive disorder
PA	**:**	paroxysmal abnormality
RDOC	**:**	research dopamine criteria
SNAP	**:**	synaptosomal - associated protein
SNC	**:**	substancia nigra
VNTR	**:**	variable number tandom repeats
VPA	**:**	valproic acid
VTA	**:**	ventral tegmental area

Abstract

Introduction: Attention deficit hyperactivity disorder (ADHD) is characterized by heightened impulsivity, inattention, and hyperactivity.

One of changes in EEG of ADHD children is epileptiform activity (EA), characterized by recording of excessive neuronal discharge.

Objectives: identifying encephalographic epileptiform activity in (ADHD) children and its relation to types of ADHD.

Methodology: All ADHD cases from the Centre of special need children within the year of 2015 were examined (4 days / week), 50 cases were enrolled and EEG epileptiform abnormalities were recorded.

Results:

A total of 4 cases (8%) presented with generalized epileptiform activities and 23 (46%) presented with focal epileptiform activities.

There was a statistical significant correlation between type of epileptiform activity and ADHD severity (r=-0.467) (p=0.014).

There was a statistical significant difference between age groups and background abnormalities where (75.9% of >7group) compared to (28.6% of < or = 7 group) had abnormal background (χ^2=12.052, p=0.002), ADHD severity and generalized epileptiform activity (χ^2 = 8.269, p=0.016), where 40% of mild, compared to (10% moderate and 2.9% of the marked) type of ADHD cases had generalized activity. And a highly statistical significant difference between speech problems and ADHD severity (χ^2 = 19.179, p=0.004), where all reversal group was of moderate, and (75%) of delayed group was of the marked type.

Conclusion: Epileptiform activities were detected in ADHD children with the focal (46%) and generalized (8%) type with the marked combined type mostly presented in the focal group.

Keywords: Attention Deficit Hyperactivity Disorder (ADHD), Electroencephalography (EEG), Epileptiform activity (EA).

Introduction

Introduction:

Attention deficit hyperactivity disorder (ADHD) in children is defined to be characterized by heightened impulsivity, inattention, and hyperactivity ***(DSM V, 2013).***

Moreover increased public awareness and escalation of risk factors has been accompanied by an increased rate of ADHD diagnosis among children, along with a rise in medication use ***(CDC, 2014).***

Furthermore the American Psychiatric Association's Diagnostic and Statistical Manual, Fifth edition (DSM-5), is used by mental health professionals to help diagnose ADHD. It was released in May 2013 and replaces the previous version, the text revision of the fourth edition (DSM-IV-TR). There were some changes in the DSM-five for the diagnosis of ADHD: where symptoms can now occur by age 12 rather than by age 6; several symptoms now need to be present in more than one setting rather than just some impairment in more than one setting; new descriptions were added to show what symptoms might look like at older ages; and for adults and adolescents age 17 or older, only 5 symptoms are needed instead of the 6 needed for younger children ***(DSM V, 2013).***

For these reasons it is crucial that children with ADHD are treated appropriately as they can develop significant psychosocial, educational, and neuropsychological impairment. They are also at risk of not achieving their highest potential in education and employment as adults. Where Behavioral therapy in addition to medications are central to the management of ADHD, resulting in greater improvements in academic performance, reduction of behavioral problems, and higher parental satisfaction ***(Sibley et al., 2014).***

Many authors had reported that the prevalence of ADHD in childhood epilepsy is higher than in the general population and as is the rate of epilepsy in ADHD. Both attention deficit hyperactivity disorder (ADHD) and epilepsy are common disorders in childhood. ADHD and epilepsy can be detrimental to the behavior, learning and social relations of affected children. Children with epilepsy and ADHD together tend to be at a higher risk of school difficulties compared with children who suffer from epilepsy only ***(Idiazabal and Alecha, 2012).***

As mentioned by authors Attention-deficit hyperactivity disorder (ADHD) and epilepsy are major reasons for referral of children to pediatric neurologists. The presence of both these disorders in a single patient poses a particular therapeutic challenge. That's why many Concerns have been raised that antiepileptic drugs may exacerbate already malfunctional social

and academic behaviors in ADHD children, and that exposure to stimulants can aggravate epilepsy in those children ***(Kaufmann et al., 2009).***

Moreover many previous researches on children with unprovoked seizures shows that behavioral disturbance are more common before the onset of the first seizure attack compared to controls ***(Austin et al., 2001).***

Also EEG studies in children with ADHD are searching for data with respect to various brain function aspects. Where one of the alterations that can occur in an EEG of ADHD children is that of epileptiform activity (EA), characterized by electrographic elements that correspond to the recording of excessive neuronal discharge and abnormal components of the basic epilepsy mechanism. EA can occur with less frequency in non-epileptic individuals. A greater recording of EA has been described in ADHD children than in normal children ***(Richer et al., 2002).***

Moreover it was stated that a high incidence of pathological encephalography (EEG) findings had been reported in school aged children with ADHD, but the range was wide from 6.1% of 476 to 30.1% of 176 children possibly indicating methodological differences ***(Richer et al., 2002).***

For that reason some researchers recommended that all children suspected to have ADHD undergo encephalography

examination for their brain regardless of the presence of seizures ***(Becker et al., 2004).***

On the other hand behavioral symptoms of inattention, impulsivity, and hyperactivity serve as a foundation for the diagnosis of attention-deficit/ hyperactivity disorder (ADHD). Where various states of alertness, behavioral inhibition, and information processing have been associated with the electrical currents (alternating and direct) produced by the brain and the variation in alertness and behavioral control reflects the activity of specific thalamocortical generator mechanisms and the arousal of the prefrontal cortex which are noted on surface EEG recordings ***(Monastra, 2008).***

Aim of the study

To identify the encephalographic epileptiform activity in the electroencephalography of children with attention deficit hyperactivity disorder and its relation to different types of attention deficit hyperactivity disorder, after diagnosing and classifying the attention deficit hyperactivity disorder cases according to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition, and Conner's parent rating scale .