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Original Research Article

Role of EEG in Children with Developmental Delay without Overt Seizure or any Paroxysmal Behavioral Events- a Clinico-Neurophysiologial Evaluation

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Abstract: ***Background:*** Sometimes children are referred to the EEG lab without overt seizures but with wide array of features of delayed developmental domains like motor delay, cognitive delay, speech and communication delay, visual impairment, hearing impairment. A detailed history and physical examination are most important for the diagnosis. EEG is done to identify the background dysfunction and the cases of Epilepsy. ***Aim of the study:*** To see the background function and the cases of Epilepsy through EEGs children presenting with delayed developmental domains. ***Method:*** Retrospective analysis was done from the EEG records during a 1year period (ie, 2015). 537 cases were identified with developmental delay but not having overt seizure. Their EEG findings were compared with history and clinical presentation. ***Results:*** In this study, 41.7% presented with speech communication problems, 32.4% with cognitive delay, 10.6% with hearing impairment, 8.8% came with motor delay and 6.5% with visual impairment. EEG of 29.5% showed abnormal features. These included 15% with features of focal discharges, 7% with generalized epileptiform discharges, 0.5% with multifocal epileptic form discharges, 2% with features of epileptic encephalopathy, 3% with features of generalized encephalopathy, 2 children with diffuse encephalopathy, and 5 children with non-specific dysfunction, 4 children with generalized low amplitude activities. ***Conclusion:*** EEG abnormalities were found in over one-third of the referred children based upon which important decisions could be taken for appropriate diagnosis and management.

Keywords: EEG, Developmental Delay, Non-Epilepsy or Non-Paroxysmal Behavioral Events.

INTRODUCTION

EEG or Electroencephalogramis a method to measure the electrical activity of large, synchronously firing, populations of neurons in the brain with electrodes placed on the scalp [1]. EEG is most often used to diagnose epilepsy, which causes abnormalities in EEG readings [2]. EEG offers non-destructive, painless, side effects less and accurate interpretations for some brain disease such as epilepsy, memory loss, Alzheimer and autism [3-6]. EEG is also used for evaluation of one or more of the following domains: speech and language gross and fine motor skills, social and personal skills, activities of daily living and cognition [3-4, 7, 8]. Developmental delay may be caused by a variety of factors, including heredity factors, complications during pregnancy or childbirth, and premature birth [9]. Sometimes the exact cause is difficult to pinpoint. There are two main reasons to obtain EEG in the child with developmental delay. These are: the evaluation of a concomitant seizure disorder and as part of the diagnostic evaluation of delay. In the latter situation, the EEG may provide information allowing the diagnosis of a specific electroclinical syndrome. Electroclinical syndromes are a constellation of clinical features associated with a characteristic EEG [10]. Children with Developmental Delay may not have Epilepsy or Paroxysmal Behavioral Events. Children with sustained developmental delay are at higher risk of learning difficulties, behavioral problems and functional impairments later in life [2-5, 8, 11]. It is challenging to establish the presence of developmental delay as the wide normal variation among children can make it difficult to find the real findings. Many factors are associated with increased risk of developmental delay, including poor

maternal health during pregnancy, birth complications, infections, genetic characteristics, exposure to toxins, trauma, maltreatment and possibly low socioeconomic status [7, 11-15]. Low frequency, high-morbidity developmental disabilities such as cerebral palsy, mental retardation, and sensory impairments are more likely to be identified in the preschool years, whereas low-morbidity, high-frequency disorders including learning disabilities and attention-deficit hyperactivity disorder (ADHD) are more likely to be identified in school-aged children [16]. There is considerable interest in the possibility that early identification and intervention may improve health outcomes among children with developmental delay. Through EEG functional state of brain can be obtained and by which prognostic and staging information of developmental delay of children may be evaluated. Thus it can help for diagnosis and proper treatment. Furthermore, as delay must be monitored with in fine and gross motor, language, cognitive, and psychosocial development, it is not unusual for one of these areas to be overlooked [17]. There are very few studies regarding the role of EEG in children with developmental delay but not having epilepsy or paroxysmal behavioral events in Bangladesh. Thus, this study was conducted to assess the role of EEG in children with developmental delay but not having epilepsy or paroxysmal behavioral events.

OBJECTIVES

To assess the role of EEG in children with developmental delay but not having epilepsy or paroxysmal behavioral events

METHODOLOGY & MATERIALS

This Retrospective analysis was done from the EEG records during a 1 year period (ie, 2015). Total 537 cases were identified with developmental delay but not having overt seizure. Their EEG findings were compared with history and clinical presentation. Provisional diagnosis was made by referring physicians. EEG is done by a 32 channel digital EEG machine (EB Neuro-made in Italy) with video monitoring for every child. EEG diagnosis was obtained from the records. Each recording of EEG was obtained through digital equipment's with minimal duration of 30 minutes and electrode positioned on scalp according to international 10~20 system. Recording was done in both awake and sleep state, except very few cases, which didn't sleep following all measures, only awakened state recording was taken. Findings of observation and interview with the patient and attendants were recorded on prescribed data collection sheet that were fulfilled by the investigator. After collection of data, all data were compiled in a master table first. Data were expressed as percentage. Unpaired z-test was used as a test of significance; with p value <0.05 was taken to be significant. Standard formulae were used and statistical analysis of the result was obtained by using window-based computer software devised with Statistical package for Social Science (SPSS-22) and Microsoft Office Excel 2007.

Inclusion criteria

- Age less than 18 years.
- Children with Developmental Delay

Exclusion criteria

- Age greater than 18 years.
- Transferred to other hospital
- Having Epilepsy or Paroxysmal Behavioral Events

RESULT

Total 537 children with developmental delay were included in this study. Table-1 shows the demographical features of the children with developmental delays. In this study, most of the children (39.1%) were in the age group of 0-5 years followed by 31.1% in the age group of 6-10 years, 20.9% in the age group of 11-15 years and 8.9% in the age group of >15 years. Most of the children (59%) were male. Most of the children (78%) reside in urban area. Table-2 shows the symptoms of the children where 41.7 % presented with speech communication problems, 32.4% with cognitive delay, 10.6% with hearing impairment, and 8.8% came with motor delay, and 6.5% with visual impairment. All the symptoms were statistically significant. Table-3 shows the EEG abnormalities. EEG of 29.5% showed abnormal features. These included 15% with features of focal discharges, 7% with generalized epileptiform discharges, 0.5% with multifocal epileptiform discharges, 2% with features of epileptic encephalopathy, 3% with features of generalized encephalopathy, 2 children with diffuse encephalopathy, and 5 children with non-specific dysfunction, 4 children with generalized low amplitude activities. All of these abnormalities in EEG tracing were statistically significant.

Table-1: Demographic characteristics of the children. (n=537)

Characteristics		n	%
Age	0-5 years	210	39.1
	6-10 years	167	31.1
	11-15 years	112	20.9
	>15 years	48	8.9
Sex	Male	317	59.0
	Female	220	41.0
Residence	Urban area	419	78.0
	Rural area	118	22.0

Table-2: Symptoms of the children (n=537)

Symptoms	n	%	P-value
speech communication problems	224	41.4	< 0.0001
cognitive delay	174	32.4	< 0.0001
hearing impairment	57	10.6	< 0.0001
motor delay	47	8.8	< 0.0001
visual impairment	35	6.5	< 0.0001

Table-3: Types of abnormalities in EEG tracing. (n=537)

Types of abnormalities in EEG tracing	n	%	P-value
Focal discharges	81	15	< 0.0001
Generalized Epileptiform discharges	38	7	< 0.0001
Multifocal epileptiform discharges	3	0.5	< 0.0001
Epileptic Encephalopathy	11	2	< 0.0001
Generalized encephalopathy	16	3	0.0001
Diffuse encephalopathy	2	0.4	0.0008
Non-specific dysfunction	5	0.9	0.003
generalized low amplitude activities	4	0.7	< 0.0001

DISCUSSION

In this study, most of the children (39.1%) were in the age group of 0-5 years followed by 31.1% in the age group of 6-10 years, 20.9% in the age group of 11-15 years and 8.9% in the age group of >15 years. Most of the children (59%) were male. Most of the children (78%) reside in urban area. In this study, 41.7 % presented with speech communication problems, 32.4% with cognitive delay, 10.6% with hearing impairment, 8.8% came with motor delay and 6.5% with visual impairment. In the study of Yeargin-Allsopp M. *et al*. [18], in per 1000 children, mental retardation was 10.3%; cerebral palsy was 2.0; hearing impairment was 1.0%; and visual impairment was 0.6.EEG of 29.5% showed abnormal features. These included 15% with features of focal discharges, 7% with generalized epileptiform discharges, 0.5% with multifocal epileptiform discharges, 2% with features of epileptic encephalopathy, 3% with features of generalized encephalopathy, 2 children with diffuse encephalopathy, and 5 children with non-specific dysfunction, 4 children with generalized low amplitude activities. Children with developmental delay but not having epilepsy or paroxysmal behavioral events should be diagnosed properly. In astudy in Denmark, it was found that 39% of children who were diagnosed as having epilepsy were misdiagnosed, and approximately 47% of these diagnoses consisted of NEPEs. A misdiagnosis affects the patient's family life, education, and many economic factors [19].

Limitations of the study

Sample size was not sufficiently enough to make a firm conclusion. It was a single center study. So, the findings of this study may not reflect the exact scenario of the whole country. Duration and follow up period were short. Further study is required to have better understanding.

CONCLUSION AND RECOMMENDATIONS

EEG abnormalities were found in over one-third of the referred children based upon which important decisions could be taken for appropriate diagnosis and management. Appropriate diagnosis should be done for the children with developmental delays asnon-paroxysmal non-epileptic events can cause diagnostic confusion performing EEG.

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Conflict of interest

There is no financial conflict of interest relevant to this paper to disclose.

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