Research Article

Study of partial seizures in children with respect to EEG and CT Scan

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Abstract

Introduction: Incidence of Seizure disorders is more in children compared to adults. Partial seizures are fairly common form of seizures in children. **Methods:** This study was carried to determine the etiology of partial seizures in children with the help of EEG and CT scan. In this study total of 80 children with partial seizures defined as per ILAE, belonging to 1- 12years of age group were studied retrospectively. Data was collected in the form of history, EEG report and CT scan brain report over a period of 2 years, from the hospital records. **Results:** EEG was abnormal in 92.5% and CT scan was abnormal in 85% of children with partial seizures. The most common type of partial seizure was complex partial seizure (58.75%). The most common CT scan abnormality was (75%) ring enhancing lesion. **Conclusion:** EEG and CT scan plays an important role in establishing etiology of partial seizures and thus serves as a tool for appropriate management.

Keywords: CT scan, EEG, Partial seizures.

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Introduction

Seizure disorders are most common neurological disease and important cause of morbidity in children. More than 40% of pediatric seizures are partial. Partial seizures are defined as per ILAE as Focal seizures "originate within networks limited to one hemisphere, which may be discretely localized or more widely distributed. Focal seizures may originate in subcortical structures. For each seizure type, ictal onset is consistent with preferential propagation patterns, which can involve the contralateral hemisphere. In some cases, however, there is more than one epileptogenic network, and more than one seizure type, but each individual seizure type has a consistent site of onset. Focal seizures do not fall into any recognized set of natural classes based on any current understanding of the mechanisms involved" [1,2]. Partial seizures are more often associated with some underlying treatable pathology such as neurocysticercosis, tuberculomas, abscesses, tumors, arterio-venous malformations etc [3]. Thus, identification of some treatable pathology in patients with partial seizures is of paramount importance from management point of view. Etiology of partial seizures is complex and heterogeneous. It is different in developing countries like India as compared to the developed countries. The potential number of etiological factors for epilepsy in developing countries is considerable, and many are preventable. Intracranial infections are of particular importance in this respect [4]. Birth asphyxia, anoxic episodes, head trauma, neoplasm (usually slowly growing gliomas) or neuronal migration disorders (heterotopia) are the commonest causes of seizures identified in western studies [5]. Therefore partial seizures with infective etiology can be controlled with proper antihelminthic and antibiotic treatment along with antiepileptic drugs and that other than infective origin need other treatment like surgery in some structural abnormalities. In addition to its value as a diagnostic aid EEG may be helpful in classifying the seizure types, suggest etiology, guide clinical management and provides localization when surgery is planned [6]. Localization of abnormalities in cases of partial seizures varies from 28% to 80% as observed in different studies [5,7]. Patel NH study shows that partial seizures with predominant motor manifestation have a demonstrable higher incidence of structural cause,

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especially in the form of neurological infections and there is a positive correlation in the clinical findings and CT scan findings. A high diagnostic yield and incremental therapeutic relevance of CT scan findings in children with partial seizure with motor manifestation makes this modality of imaging very essential and should be considered in all such children [8]. The greater yield has prompted many experts to include CT in routine investigation of any seizure disorder especially the partial seizures [9].

However, CT is much more economical than MRI, as our hospital is mainly draining the rural population this is important from the point of affordability of our patients. As mentioned by Baheti R [10] partial seizures must be evaluated with EEG as well as CT scan as there are nearly 50% chances of finding some structural cerebral lesion and also because EEG is a useful tool. As we have substantial number of children with partial seizures, our study was aimed to evaluate the role of EEG and CT scan in those children. With respect to above facts we conducted this study to determine the role of EEG and CT scan in establishing the etiology of partial seizures in our area and to study the incidence of partial seizures with both CT scan and EEG abnormality and incidence of partial seizures with only one parameter abnormality either CT scan or EEG.

Material and Methods

The study was conducted in the department of pediatrics NRI General Hospital, Guntur, Andhra Pradesh. It is a retrospective study. Data collected from the hospital records of those children who were admitted with partial seizures and who underwent EEG and CT scan, during year 2013to 2015 and data was studied retrospectively. We studied the data of 80 children in the age of 1-12 years, with partial seizures as per the ILAE definition. All children below the age of 1 year and above the age of 12 years and children with generalized seizures and febrile seizures were excluded from the study. EEG reports and CT scan reports were studied.

Children were diagnosed as tuberculoma using radiological criteria and supportive evidence of tuberculosis. Some children were diagnosed as Neurocysticercosis using clinical features, neuroimaging, fundus examination and serological methods in some children.

Radiological criteria used for diagnosis of tuberculoma and Neurocysticercosis are as follows, Visualization of scolex by MRI or as eccentric dot on CT is characteristic of NCC. Rajshekhar V [11] described CT criteria for differentiating NCC and tuberculoma. An enhancing ring lesion that is <20 mm in size, regular in outline and not producing a midline shift is likely to be NCC while with tuberculomas the lesion is usually multiple,>20 mm, irregular in outline and may produce midline shift. However the authors themselves believe that these criteria are not absolute and it may be difficult to differentiate a small tuberculoma from NCC by CT [12].

Data so collected is presented in the form of descriptive statistics and analyzed using z-test of proportion wherever applicable.

Results

Out of 80 children with partial seizures 54 (67.5%) were male and 26 (32.5%) were females therefore male: female ratio is 2.07:1. Majority that is 48 (60%) of children with Partial seizures belonged to age group of 6-10 years. The seizure types were Complex partial seizures 58.75%, simple partial seizures 27.5% and partial seizures with secondary generalization 13.75%. EEG was abnormal in 74 children (92.5%) and CT scan was abnormal in 68 children (85%). The most common EEG abnormality was sharp wave and spike (25%). The most common CT scan abnormality was ring enhancing lesion. 51 (75%) children with abnormal CT scan were having ring enhancing lesions followed by cerebral calcification in 9, cerebral infarct in 5, cerebral atrophy 3 children. Single ring enhancing lesions were common finding in this study comprising 37 (72.55%) children and 14 (27.45%) children were with multiple ring enhancing lesions. The most common lobe involved was parietal lobe in 26 followed by frontal lobe in 15 and temporal lobe in 10. We studied correlation between incidence of partial seizures and abnormalities in both parameters CT scan and EEG verses partial seizures and abnormality in only one parameter either CT scan or EEG.

We found that out of 80, 62 (77.5%) children with partial epilepsy had both parameters abnormal and 18 (22.5%) had only one parameter abnormal. So those children with both CT scan and EEG abnormality were having more chances of

getting partial seizures compared to those with only one parameter abnormality, proved to be statistically significant with a p-value 0.0001.

Table 1: Age wise distribution of children with partial seizures.

Age in years	Total number of children with partial seizures	Percentage
1-5	5	6.25%
6-10	48	60.00%
11-12	27	33.75%
	80	100%

Table 2: Age wise distribution of children with partial seizures and abnormal EEG.

Age in years	Total number of children with partial seizures	No. of children with Abnormal EEG	No. of children with Normal EEG
1-5	5	4	1
6-10	48	45	3
11-12	27	25	2
	80	74 (92.5%)	6 (7.5%)

Table 3: Age wise distribution of children with partial seizures and abnormal CT.

Age in years	Total number of children with partial seizures	No. of children with Abnormal CT scan	No. of children with Normal CT scan
1-5	5	3	2
6-10	48	41	7
11-12	27	24	3
	80	68 (85%)	12 (15%)

Table 4: Age wise distribution of partial seizures with abnormal CT scan with details of abnormal neuroimaging.

Age in years	No. of children with Abnormal CT scan	Ring enhancing lesion	Cerebral heterotopia	Cerebral infarct	Calcifictions
1-5	3	2	-	1	-
6-10	41	33	2	1	5
11-12	24	16	1	3	4
	68	51 (75%)	3	5	9

Table 5: Correlation between number of children with partial seizures with both EEG + CT scan abnormality and number of children with partial seizures with only one parameter abnormal either EEG / CT scan.

Age in years	Total number of children with partial seizures	Total number of children with both EEG+ CT scan abnormal	Total number of children with only one parameter abnormal either EEG/CT scan
1-5	5	2	3
6-10	48	38	10
11-12	27	22	5
	80 (100%)	62 (77.5%)	18 (22.5%)

Z-test, P-value = 0.0001

Discussion

The study was conducted to assess the role of EEG and CT scan in patients with partial seizures and to make out any correlation between these two investigations, if possible. Overall, 92.5% of patients with partial seizures were having an abnormal EEG. Observation in our study was quite similar to that observed by Baheti R [10] and Al-Sulaiman AA [13] and Jain N [14]; they reported abnormal EEG in73 % and 81% and 73% of patients with partial seizures respectively. On analyzing individual abnormalities in EEG, it was observed that sharp wave and spikes were the commonest abnormality (25%). Similar observation is seen inBaheti R [10] study with common EEG abnormality as sharp wave and spikes 31.5%. In this study CT scan was found to be abnormal in 85% of patients with partial seizures. Similar observations were reported by Washimkar SN [15] who observed abnormal CT scan in 73% of patients with partial seizures and 79.3% in Misra S [16] study. In contrast to it Baheti R [10] studies observed CT abnormality in 50% of patients with partial seizures and Jain N [14] with CT abnormal in 62% patients of partial seizure disorder. The most common finding on CT scan was ring enhancing lesion in present study with 75% of children being affected. Similar finding observed by Jain N [14] study in 56.6% and Misra S [16] study in 63.3% of children. In our study we observed that single ring enhancing lesions seen in37 (72.55%) children, this finding was more common than multiple ring enhancing lesions which was seen in 14 (27.45%) children. Similar finding with the most commonly observed lesions on CT scan of brainas ring enhancing lesions, was seen in Jain N study [14], which were multiple in 6 children and single in 54 children in Jain N [14] study. Analysis from clinical data and investigations revealed that ring enhancing lesions as neurocyticercosis were the commonest lesion in our study affecting 72.55% of children. Similar finding was observed by Jain N [14] study with neurocysticercosis in 54 (50.46%) children with partial seizures. The CT scan findings from Sahu PS [17] study shows 53 (86.88%) children presented with seizures were suffering from neurocyticercosis, majority that is 38 of the cases presented with a single ring enhancing lesion and 15 cases presented with more than two lesions based on CT scan report. The distribution of lesions in various parts of the brain showed that the majority were in the parietal lobe followed by frontal, occipital lobes in Sahu PS [17] study; this finding is similar with our study. The most common lobe involved in our study was parietal lobe (26) followed by frontal (15) and temporal (10). In our study it was observed that in patients with partial seizures when EEG was abnormal, the chances of finding an abnormal CT scan was higher similar findings were reported by Baheti R [10] study. However, more studies are required to comment on this correlation.

Conclusion

Every Child presenting with partial seizures must undergo EEG and imaging study like CT scan, as both collectively help in establishing the etiology of partial seizure and thus serves as a reliable guide for appropriate management. In India infective etiology is more common so neuroimaging has an important role. Results out of the present study supported the assumption that NCC can be a potential cause of childhood epilepsy particularly in tropical countries and those children with partial seizures chance of having both abnormal EEG and abnormal CT are more. Thus the simultaneous existence of abnormal EEG and abnormal CT scan is more definitive in diagnosing partial seizures.

Abbreviations
EEG- electroencephalography
CT scan – computed tomography
ILAE- International League Against Epilepsy
NCC- Neurocysticercosis

Limitations- follow up CT scan were not done due to economical constraints. Immunological studies for confirmation of NCC are not done for the same reasons.

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