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To study clinical profile and correlation of EEG and CT findings in diagnosis of focal seizures in children at medical institution in mid – Karnataka region

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Abstract

Focal-onset seizures account for approximately 40% of seizures in children. Focal seizures are most commonly associated with underlying brain pathology in extreme age groups. Clinical correlation and localizing the site of the lesion play an important role in the early diagnosis and proper management of focal seizures in children. Objectives: To study the clinical profile and correlation of EEG and CT findings in children admitted to the paediatric ward of Medical College.A prospective study on the correlation of focal seizures, CT brain, and EEG studies was carried out in children in the age group of 1 month–14 years admitted to the Department of Pediatrics at Medical College & Hospital, Karnataka. Among the (n=50) study subjects, the majority of the children with focal seizures were in the age group of 6–10 years, with a slight male preponderance.(n=22) (44% of the children) presented with focal-aware seizures. The most common brain lesions detected were calcified disc lesions and cysticercosis ring lesions (52%).45% of children with focal seizures had epileptiform discharges. We also observed that complementary to CT brain scans in correlating with the clinical history. It was noted that44% of children with focal seizures had normal CT brain scans and normal EEG studies. A good clinical history is crucial in the diagnosis of focal seizures. Most focal seizures are associated with underlying organic brain lesions. A CT brain scan plays an important role in the detection of brain lesions in children with focal seizures. The EEG study complements history and CT scan of the brain in defining and correlating the lesions precisely.

Keywords: Focal seizures; Focal impaired awareness seizure; CT scan; EEG; Partial seizures; Tuberculoma; NCC

1. Introduction

A seizure (from the Latin sac ire to take possession of) is a transient occurrence of signs and/or symptoms resulting from abnormal, excessive, or synchronous neuronal activity in the brain. Altered consciousness is due to abnormal, excessive, and hypersynchronous discharges from an aggregate of central nervous system neurons [1]. Epilepsy describes a condition in which an individual has recurrent seizures due to a chronic, underlying process. According to the International League Against Epilepsy (ILAE), epilepsy is defined by any of the following conditions: (1) at least 2 unprovoked seizures occurring >24 h apart; (2) one unprovoked seizure and a probability of further seizures similar to the general recurrence risk (at least 60%) after 2 unprovoked seizures occurring subsequent to 10 years; and (3) diagnosis of an epilepsy syndrome. [3] Epilepsy accounts for 0.5% of the worldwide burden of disease. Affecting around 50 million people worldwide. The incidence of epilepsy is 0.3 to 0.5% in different populations throughout the world. In India, the prevalence of epilepsy has been estimated at4–10 people per 1000. [2] A fundamental principle is that the seizures may be either focal, generalized, or unclassified. The incidence of focal seizures accounts for approximately 40% of seizures in children and can be divided into focal aware seizures (simple partial seizures), in which

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consciousness is not impaired, and focal impaired awareness seizures (complex partial seizures), in which consciousness is affected. The predominant seizures were focal (53.6%), generalized (40.3%), and unclassifiable (6%). In epilepsies and epileptic syndromes, 55.3% were focal, 27% were generalized, 13.5% were undetermined, and 4.1% were special syndromes. In the majority of cases, the causative factors are not evident by history and clinical examination alone. [3,7] Focal seizures indicate the site of seizure activity. Most focal seizures are associated with underlying organic brain lesions. Accurate detection of the type of lesion is critical to the management of the case. Focal-aware seizures were short, consisted primarily of motor symptoms, and were not associated with postictal impairment.[4] Focal impaired awareness seizures were longer and could be categorized into four subgroups based on the initial clinical manifestations: staring, automatisms, motor phenomena, and drop attacks. [1]All children with new-onset seizures should have a brain imaging study to determine whether there is an underlying structural abnormality that is responsible for the seizure. A CT scan helps identify treatable lesions and ring- enhancing lesions like tuberculomas, neurocysticercosis, intracranial space-occupying lesions, AV malformations, cortical dysplasia, and hydrocephalus.[5,6] EEG is used for functional or electrical mapping of the brain. It helps in classifying seizure disorders and aiding in the selection of anticonvulsant medication, the withdrawal of antiepileptic drugs, assessing the prognosis of seizure disorders, and planning for surgery. However, in 50% of epileptics, the interictal EEG may be normal. EEG is not useful in predicting which patients with predisposing conditions will go on to develop epilepsy. [7] All patients with new-onset seizures should have a brain imaging study to determine whether there is an underlying structural abnormality that is responsible for the seizure. [8] EEG aids in the diagnosis of focal seizures. A CT scan complements the clinical history and EEG. CT brain and EEG help in the structural and functional evaluation of epilepsy, yielding more information than can be used in early intervention. An MRI brain study can be done for the evaluation of focal seizures. [9] Here, we have undertaken a study to correlate the CT scan findings and EEG with the clinical profile of the patient and to come up with a better method for the initial evaluation of patients with focal seizures in our setup.

Objectives

- To study the clinical profile of children with focal seizures
- To correlate CT and EEG findings in focal seizures.

2. Material and methods

2.1. Source of data

The data is collected from children (1 month to 14 years old) admitted to the Department of Pediatrics, Medical College. Data were collected by direct interview of both mother and child with clinical examination, which was carried out after taking informed consent from the mother or guardians. The following data sets were collected: Socio- demographic data: age, gender, clinical profile of children Symptomatology. EEG study, computed tomography

2.2. Sample size

Total (n = 50) children admitted with new-onset focal seizures in pediatric wards of Medical College. A prospective study design was adopted for the study with an accrual duration of one year at the pediatric ward, Department of Pediatrics. The following inclusion criteria: new-onset focal seizures in children between 1 month and 14 years; exclusion criteria: those children on antiepileptic treatment with seizure mimic and pseudo seizures; CT scans were taken within 3 days of admission.

3. Results

A prospective study on the correlation of focal seizures, CT brain, and EEG studies was carried out in children in the age group of 1 month–14 years at Medical College, Karnataka. In our study, the majority of the children with focal seizures were in the age group of 6–10 years (40%), followed by 1–5 years (36%), and 10–14 years (24%). Boys (56%) were more affected than girls (44%). Out of 50 cases, 22 (44%) of the children presented with focal aware seizures, followed by 12 (24%) cases with focally aware bilateral tonic-clonic seizures and 10 (20%) cases with focally impaired awareness seizures. CT findings were abnormal in 72% of the patients. The most common brain lesions detected were calcified disc lesions and cysticercosis ring lesions (52%), followed by tuberculoma (22%). 36% of children with focal-aware seizures had normal CT brain findings. The EEG study was complementary to the clinical history and CT brain lesions in determining the focal seizure type. 45% of children with focal seizures had epileptiform discharges. In our study, a CT brain scan was crucial in correlating with the clinical history and defining the brain lesions causing focal seizures. We also observed that EEG was complementary to CT brain scans in correlating with the clinical history. It was noted that 44% of children with focal seizures had normal CT brain scans and normal EEG studies.

Table 1 EEG results in focal seizures

Sl. No.	Type of EEG	No. of patients	Percentage of patients
1	Normal awake pattern	24	48
2	Hemispheric discharges	09	18
3	Focal discharges	09	18
4	Focal discharges with intermittent generalized discharge	08	16
	Total	50	100%

Table 2 EEG results in various focal seizure types

Sl. No.	Seizure types	No. of patients	Normal EEG		Epileptiform discharges	
			No. of patients	% of patients	No. of patients	% of patients
1	Focal aware seizures	22	12	55	10	45
2	Focal impaired awareness seizure	10	03	30	07	70
3	Focal aware to bilateral tonic-clonic seizures	12	06	50	06	50
4	Focal impaired awareness to bilateral tonic-clonic seizures	05	03	60	02	40
5	Focal epileptic spams	01	00	00	01	100

Figure 1 NCC Ring lesion

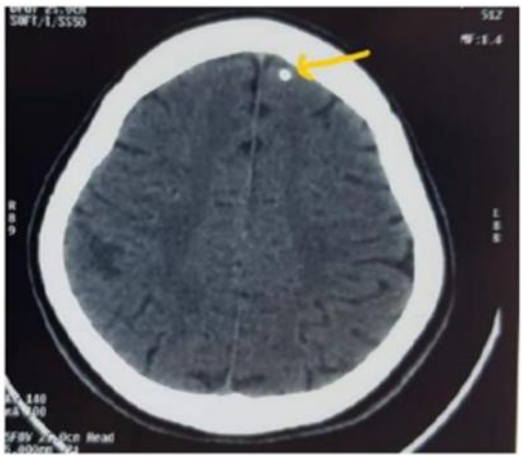

Figure 2 Calcified disc lesion

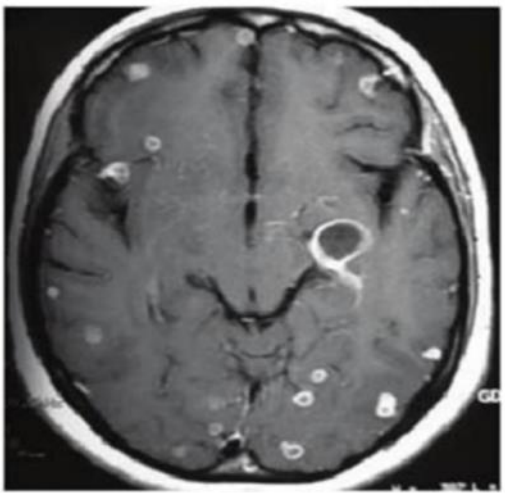

Figure 3 Neurotuberculoma

Figure 4 Brain tumor

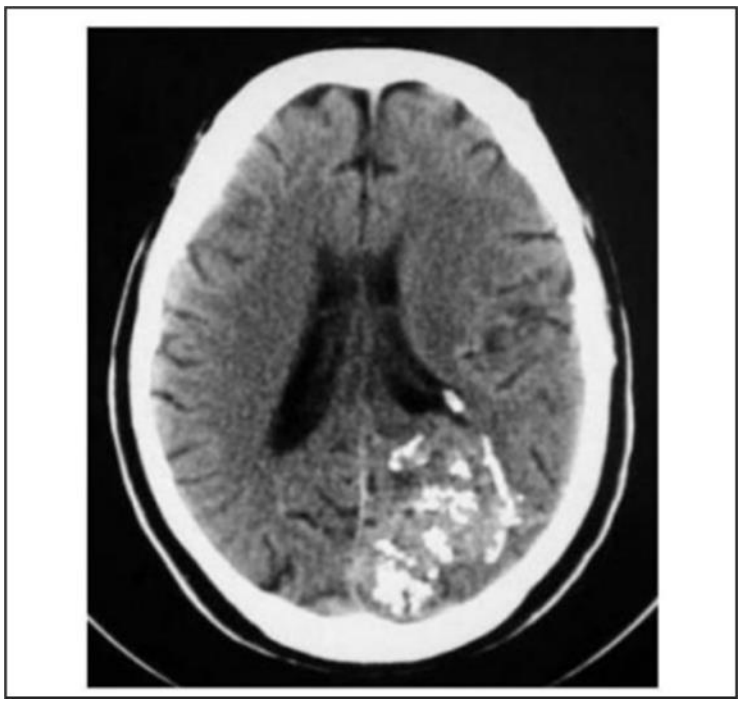

Figure 5 Brain vascular malformation

4. Discussion

A total (n=50) cases of children admitted with focal onset seizures were studied for clinical profile and evaluated with EEG and CT scan brain. Out of the 50 children presented with focal onset seizures, 28 (56%) were male and 22 (44%) were females. 18 (36%) cases were between 1m -5 yrs., 20(40%) were between 6-10 yrs., and 12(24%) were between 10-14 yrs. of age. This demographic distribution is similar to studies by Rho JM et al. [16] Focal aware seizures are present in 22 (54%) patients, Focal impaired awareness seizure in 10 (20%) patients, Focal aware to bilateral tonic-clonic seizures in 12 (24%) patients, Focal impaired awareness to bilateral tonic-clonic in 5(10%) patients, Focal epileptic spams in 1(2%) patient. Neurological findings are abnormal in 24(48%) patients. Observation in our study was quite similar to that observed by Kast S et al., where they found abnormal neurological examination findings in65% of cases of focal seizures.[9,10] Neurological examination was normal in 26 (52%) patients. findings are normal in 14 (28%) patients in our study, but Mani KS et al., found normal CT scan findings in about 28% of cases in their study on

focal seizures. [22] Magiorkinis et al observed normal CT scan findings in about 22% of cases in their study on focal seizures and Berg et al in 38% cases. This difference could be due to determining factors like different age groups in their study. [11, 12] CT scans w found abnormal in 36 (72%) patients, Wilden JA in 62.6% of Cases. The abnormalities detected were in the form of focal lesions like Calcified disc lesions (26%), cysticercosis ring-enhancing lesions in 41% of cases. 60 % of cases have abnormal scans in the study conducted by Wilden JA et al. [19] This has also been seen by studies conducted by BramhanandTripathi. CT studies of focal onset seizures in children are very helpful in detecting small intracranial lesions [12,13] In our study, we found 42.10% of cases are having Cystecercosis ring lesions in the CT scan these findings are consistent with Rajshekhar et al where they found cysticercosis ring lesions in 50% of cases[13],Chaudhary et al. in 30% of cases respectively[14,15]. All single ring-enhancing lesions were considered as cysticercus, granuloma by Magiorkinis et al., Tuberculous granulomas were found in 21% of patients.[10,18,19]. Radhakrishnan et al found tuberculomas in 12% of patients[20,21, 22,23], but Bansal Be et al found in 39.5% of cases in their study of epilepsy[18]. This difference could be since all ring-enhancing lesions were thought to be tuberculomas previously because tuberculosis was considered the commonest disease in India. [16] Cerebral infarcts were found in 2.2% of patients, tumors were found in 2.2% of patients. The percentage of tumors in a study by Reinkainen et al is 17% and 15% by Khan et al. The percentage of focal CT lesions were almost similar in all age subgroups. [22,23] Ladurner et al showed similar findings in their study conducted at the University of Graz, Austria, which found similar CT abnormalities in 68% of the cases with simple focal seizures.[24,25]. In this study, the correlation was made between the CT scan and clinical examination. 42% of patients have focal lesions on CT scan and abnormal neurological findings, that is in comparison to 35% by Kimberlin et al. [6], EEG showed normal awake patterns in 24 (48%) patients and abnormal patterns in 26 (52%) patients, Brechet R et al in 65% of cases. There was a similar percentage of patients with normal EEG results in all age groups. Similarly, the percentage of EEG showing epileptic foci did not significantly vary across age subgroups.[26,27,28] When an analysis was made between the neurological findings and EEG, both abnormalities of the neurological examination and epileptiform discharges were found in 24% of patients in the present study. Schumacher et al have demonstrated similar features in 52% of patients.[15] When an analysis was made between epileptiform discharges on EEG and CT findings, the present study has shown that both focal lesions on CT and epileptiform discharges were found in 32% of patients. 20% of patients have shown epileptiform discharges alone without any abnormalities on CT scan. CT scan alone was abnormal in 40% of patients. Sorel et al have shown that 38.6% of patients with focal seizures had abnormal CT findings along with epileptiform discharges on EEG.[29,30,31] This shows EEG abnormalities can occur independently of CT scan findings in cases of focal seizures and they act complementary to each other in the evaluation of focal seizures. In addition to clinical history and CT scan brain, EEG was an important complementary investigation in defining the lesions more precisely and will also play an important role in identifying seizure types [32]. Thus, focal onset seizures are the most common neurological disease of childhood, which have a greater impact on the social as well as economic aspect of the developing countries. Numerous relatively benign, episodic spells often are wrongly diagnosed and are even treated as seizures. Therefore, appropriate diagnosis and timely management are crucial.

5. Conclusion

A good clinical history is crucial in the diagnosis of focal seizures. 2. Most focal seizures are associated with underlying organic brain lesions 3. CT brain scan plays an important role in the detection of brain lesions in children with focal seizures. 4. EEG study complements the clinical history and CT scan brain in defining and correlating the lesions precisely. 5. 04% of children with focal seizures had a normal CT scan brain and EEG study.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest between Institution and any other funding agency.

Statement of ethical approval

Institutional ethical clearance was obtained as per the ethical standard.

Statement of informed consent

Informed consent has obtained from each participants before inception of the study

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