

## Necessity of EEG and CT scan For Accurate Diagnosis of Idiopathic (Partial / Generalised) Seizures in Children

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### Abstract

**Objective:** To study the importance of EEG and CT scan as a diagnostic aid for accurate diagnosis in various seizure disorders in children from Bhubaneswar, Orissa, India.

**Design:** Cross-sectional.

**Setting:** Urban tertiary care teaching hospital.

**Method:** A total of 52 children with seizure disorder were included; 26 of them were having partial seizures, while the rest (26) were having generalised seizures. Those patients who were having known aetiological factors were excluded from the study. All the patients were subjected to a detailed clinical history and physical examination. An EEG and CT scan were also performed on every patient.

**Results:** Abnormal EEG was found in 73% and 76.9% of patients with partial and generalised seizures respectively, while abnormal CT scan was found in 50% of patients with partial seizures and 34.6% of patients with generalised seizures. It was also observed that with increasing abnormalities in EEG, the chance of finding some abnormality in CT increases.

**Summary and conclusion:** It is recommended that every case of idiopathic seizures must be evaluated with EEG as well as CT scan.

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### I. Introduction

Seizures are an important cause of morbidity and mortality in childhood. It is therefore important to establish accurate diagnosis of seizures and its aetiologies to appropriately manage such patients. The aetiology of seizures is different in India and other developing countries as compared to the developed world. Tuberculoma and neurocysticercosis have relatively high frequency in India<sup>5</sup>. Birth asphyxia, anoxic episodes, head trauma, or neoplasm (usually slowly growing gliomas) are the commonest causes of seizures identified in western studies<sup>6</sup>. Some major causes of partial seizures are tuberculoma (65.9%), infections (15%) and neurocysticercosis (3.4%), Washimkar et al<sup>4</sup>. Studies done on patients with generalised seizures also show similar abnormalities. In addition as a diagnostic aid, EEG may be helpful in classifying the seizure, suggest an aetiology, guide clinical management as well as provides evidence of localisation when surgery is planned<sup>7</sup>. Because of a significant chance of finding some structural cerebral lesion, an imaging procedure such as CT scan is indicated essentially for every child with a partial seizure<sup>8</sup>. In the light of above facts, we conducted this study to determine various aetiological factors in admitted patients of partial and generalised seizures and also to evaluate the importance of EEG and CT scan as a diagnostic aid for accurate diagnosis in various seizure disorders in children.

### II. Material And Methods

The study is conducted at the Department of paediatrics, HI-TECH MEDICAL COLLEGE AND HOSPITAL, Bhubaneswar, Orissa, India during the period November 2014 to January 2015. All the patients presenting with seizures were enrolled and after excluding patients who were previously diagnosed or had some known aetiological factors, we included 52 children of all age groups and both sexes randomly into the study. Of these 52 patients, 26 were having partial seizures and the rest 26 were having generalised seizures. We defined patients as having partial or generalised seizures according to ILAE classification, according to which partial seizures include a variety of clinical manifestations, including focal motor, somatosensory, or special sensory phenomenon including visual, auditory, olfactory, gustatory hallucinations, and autonomic symptoms. If it is associated with unconsciousness, then it is termed as a complex partial seizure. A generalised seizure may present as tonic-clonic, tonic, myoclonic, atonic movements, or as a sudden attack of absences. It may follow a partial seizure or occur de novo. A detailed clinical examination was done to identify any neurological abnormality, fundus changes, any malformation, and/or associated illness. An EEG was performed using 12 channel EEG recorder in all the patients. The non-cooperative children were sedated with the use of Triclofos sodium for this purpose; while in relatively cooperative children, EEG was done without any sedation and activation procedures were done as and when feasible. CT scan of head with contrast was also performed in all

subjects with the help of new generation 16 slice spiral CT scan machine . Other investigations like Mantoux test, BCG test, X-ray skull, serum electrolytes, blood sugar, etc., were done as and when required. All the findings were recorded in a proforma specially designed for this study, and results were analysed by standard statistical method.

### III. Observation

Mean age and sex ratio of both the groups were comparable (see Table I, II). Nearly 73% of patients with partial seizures and 76.9% of patients with generalised seizures were having abnormal EEG. Sharp wave and spikes were the most common findings observed in both the seizure groups; either of them was present in all the patients of partial seizures with abnormal EEG, and 95% of patients with generalised seizures with abnormal EEG. Asymmetry was noticed in 15.7% patients of partial seizure and 10% of generalised seizure group (see Table III). CT scan was found to be abnormal in 50% of patients with partial seizures while 34.6% of patients with generalised seizures were having abnormal CT scan (see Table IV). In cases of partial seizures, most common abnormality observed was cerebral atrophy (23%) followed by calcification (11.5%), hypodense lesion, hydrocephalus (7.6% each), tuberculosis, neurocysticercosis, hypoplasia of thalamus, and infarction of basal ganglion (3.8% each). Whereas among patients with generalised seizures, the commonest finding was cerebral atrophy (15.3%), followed by cerebral oedema (11.5%), hydrocephalus, and subdural effusion (3.8% each) (see Table IV). Among patients with normal EEG, 71.4% patients with partial seizure, and 50% patients with generalised seizure CT scan was observed to be normal; while among patients with abnormal EEG, 57.8% of patients with partial seizure and 30% patients of generalised seizure were having abnormal CT scan (see Table V).

### IV. Discussion

The study was conducted to assess the role of EEG and CT scan in patients with partial or generalized seizures and to make out any correlation between these two investigations, if possible. Overall, 73% of patients with partial seizures and 76.9% of patients with generalised seizures were having an abnormal EEG. On analysing individual abnormalities in EEG, it was observed that sharp wave and spikes (either alone or both) were the commonest abnormality observed in both the seizure groups.

**Table I : Distribution of patients according to various age groups.**

Age group (in years)	Partial seizure		Generalised seizure	
	n = 26	Mean age(in years)	n = 26	Mean age(in years)
< 1 year	11	0.54 ± 0.31	07	0.60 ± 0.22
1 – 5 year	08	2.36 ± 0.95	13	2.34 ± 0.90
5 – 10 years	06	6.66 ± 0.94	03	9.33 ± 0.94
>10 years	01	12 ± 0	03	13.66 ± 0.47
<b>Total</b>	<b>26</b>	<b>3.02 ± 3.04</b>	<b>26</b>	<b>3.99 ± 4.36</b>

Mean age of patients with partial seizure was 3.02 ± 3.04 and that of generalised seizure was 3.99 ± 4.36. The difference between these two groups was not statistically significant (P > 0.4).

**Table II: Distribution according to sex of the seizure patients Male to female ratio in both groups were**

Sex	Partial seizure (n = 26)	Generalised seizure (n = 26)
Male	18 (69.2 %)	19 (73.0 %)
Female	08 (30.8 %)	07 (27.0 %)
<b>Total</b>	<b>26</b>	<b>26</b>

2.25:1 and 2.7: 1 respectively. The difference was not statistically significant (P>0.7)

**Table III: Type of EEG abnormality in partial and generalised seizure groups**

EEG Changes	Partial seizure	Generalised seizure
Normal EEG	07 (27 %)	06 (23.1%)
Abnormal EEG	19 (73 %)	20 (76.9%)
Asymmetry	-	1 (5%)
Asymmetry with sharp wave	-	1 (5%)
Asymmetry with sharp wave and spike	3 (15.7 %)	-
Abnormal background with sharp wave	-	2 (10%)
Abnormal background with sharp wave	1 (5.2 %)	1 (5%)
Sharp wave alone	5 (26.3 %)	10 (50%)
Spike alone	4 (21 %)	1 (5%)
Sharp wave and spike	6 (31.5 %)	4 (20%)

A total of 73% patients with partial seizures and 76.9% patients with generalised seizures were having abnormal EEG.

CT scan is a useful tool to determine the aetiological diagnosis of seizure. CT scan was also performed on all the patients in our study and was found to be abnormal in 50% of patients with partial seizure and 34.6%

of patients with generalised seizure disorder. Since we had excluded patients with known aetiological factors, it was anticipated that relatively fewer CT scans would reveal a finding in our study. Similarly, McGahan et al<sup>1</sup> reported abnormal CT scan in 40% patients with generalised seizure disorder, a finding quite similar to the one observed by us. We observed that in patients with partial seizure, the most common abnormality found was cerebral atrophy (23%), followed by calcification (7.6%), tuberculoma (3.8%), neurocysticercosis (3.8%), hypoplasia of thalamus (3.8%), and infarction of basal ganglion (3.8%); whereas among patients with generalised seizures, commonest finding was cerebral atrophy (15.3%), followed by cerebral oedema (11.5%), hydrocephalus (3.8%), and subdural effusion (3.8%).

**Table IV : Type of CT scan abnormality in partial and generalised seizure groups.**

CT scan changes	Partial seizure	Generalised seizure
Normal CT scan	13 (50%)	17 (65.4)
Abnormal CT scan	13 (50%)	09 (34.6)
Cerebral oedema	-	3 (11.5%)
Tuberculoma	1 (3.8%)	-
Calcification	3 (11.5%)	-
Cerebral atrophy	6 (23.0%)	4 (15.3%)
Hydrocephalus	2 (7.6%)	1 (3.8%)
Subdural effusion	-	1 (3.8%)
Hypodense lesion	2 (7.6%)	-
Hypoplasia of thalamus	1 (3.8%)	-
Infarction of basal ganglion	1 (3.8%)	-
Neurocysticercosis	1 (3.8%)	-

Figures are overlapping because patient having tuberculoma also had cerebral atrophy and hydrocephalus. While two cases of calcification also had cerebral atrophy

**Table V : CT scan abnormalities in patients with normal and abnormal EEG.**

	Normal EEG		Abnormal EEG	
	Partial seizure	Gen.seizure	Partial seizure	Gen.seizure
Normal CT scan	5 (71.4%)	3 (50%)	8 (42.1%)	14 (70%)
Abnormal CT scan	2 (28.5%)	3 (50%)	11 (57.8%)	6 (30%)
Total	7	6	19	20

Findings in our study were consistent with other studies done by Bogdanoff et al<sup>2</sup> and McGahan et al<sup>1</sup> who observed cortical atrophy as the most common finding in 22% and 38% of patients with partial and generalised seizures respectively. Similarly, Kramer et al<sup>3</sup> observed calcification in 4.2% patients and hydrocephalus in 2.1% patients with partial seizure disorder, whereas McGahan et al<sup>1</sup> reported hydrocephalus in 2% patients of generalised seizures. We observed cerebral oedema in 11.5% cases with generalised seizures. Other studies did not report cerebral oedema as commonly observed finding in seizure disorder and it is possible that cerebral oedema may be a post- ictal sequel as we performed CT scan soon after the ictal event. Tuberculoma and neurocysticercosis both were observed in 3.8% of cases with partial seizure in our study whereas Washimkaret al<sup>4</sup> reported tuberculoma in 65.9% and neurocysticercosis in 3.4% of patients with partial seizure disorder. Majority of studies conducted in developed countries have not reported any case of tuberculoma or neurocysticercosis as aetiological factors in cases of seizure disorders. It is still noteworthy that even when an obvious aetiology was excluded and patients were clinically diagnosed to be having idiopathic epilepsy, 7.6% of cases of partial seizures still had an infective cause which needs appropriate treatment. 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, i.e., 11 out of 19 patients who had abnormal EEG had abnormality on CT scan (57.8%), whereas only 2 out of 7 (28.5%) patients with a normal EEG were having abnormal CT scan (see **Table V**). However, in cases of generalised seizures, when there was an abnormal EEG, CT scan was abnormal in only 6 out of 20 (30%) and when EEG was normal, 3 out of 6 (50%) cases were having abnormal CT scan, apparently indicating no correlation between the two investigations in case of generalised seizures. However, more studies are required to comment on this correlation.

## V. Summary And Conclusion

Thus, in the light of above facts, despite relatively less number of cases in our study (due to logistic and technical problems), we can recommend that every case of idiopathic 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 to screen out patients with seizure disorders and it may have some predictive value in determining co-existing CT abnormalities. Moreover, the study indicates that even the evaluation of generalised seizures is not complete without a CT scan since nearly 35% patients with idiopathic generalised seizures also had an abnormality in CT scan, which may have therapeutic and prognostic significance.

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