



STUDY OF CORRELATION OF CT BRAIN AND EEG IN NEWLY DIAGNOSED EPILEPSY: A MONOCENTRIC PROSPECTIVE STUDY FROM A TERTIARY CARE HOSPITAL OF EASTERN INDIA

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ABSTRACT **Introduction:** Newly diagnosed epilepsy are those cases of Epilepsy, who are presented, diagnosed first time during study period & had ≥ 2 episodes of seizure.

Aim: Aim of study was to find out clinical profile, radiologic characteristics & co-relation between them.

Materials & Methods: In this prospective & Descriptive study of 3year duration conducted at S.C.B. Medical College & Hospital, Odisha, 300 newly diagnosed epilepsy patients more than 5yrs age were included and all were subjected to clinical, Electroencephalographic(EEG) & radiological evaluation(CT Scan).

Results: Abnormal EEG was found in 64.7% & 21% patients with partial and generalised seizures respectively, while abnormal CT scan was found in 70.6% & 24.2% patients with Focal seizures and generalised seizures. Granulomatous lesions (Neurocysticercosis, Tuberculoma) were predominated neuro - imaging findings. It was also observed that with increasing abnormalities in EEG, the chance of finding CT abnormality increases in Focal seizure while this is reverse in Generalised seizure.

Summary and conclusion : It is recommended that every case of Newly Diagnosed Epilepsy must be evaluated with EEG as well as CT scan.

KEYWORDS : Epilepsy, Computerized tomography, Electroencephalogram, Tonic-clonic seizures

Introduction

Epilepsies are important cause of morbidity and mortality accounting for 0.6% of hospital admissions [1]. Epileptic Seizure is transient occurrence of signs & symptoms due to abnormal excessive or synchronous Neuronal activity in brain. Thurman DJ et al states new onset epilepsy (NOE) as those cases of epilepsy where numerator includes people identified at their second unprovoked seizure[2]. In contrast the numerator for newly diagnosed epilepsy(NDE) Includes both new onset epilepsy and people with more than 2 unprovoked seizures who are first diagnosed as epilepsy during study period[2]. The aetiology of Epilepsy is different in India and other developing countries as compared to the developed world. In majority of cases aetiology is not evident in history and clinical examination for which serum biochemistry, EEG, CT brain are employed. EEG is used for functional or electrical mapping of brain and not used for diagnosis and confirmation of epilepsy because in as many as 50% epileptics' single interictal recording may be normal[1]. EEG if abnormal helps in classifying seizures, selecting appropriate antiepileptic drugs, withdrawing antiepileptic drugs and planning for surgery. CT brain widely available, economical than MRI, though normal in majority of the cases is an important investigation to detect and to identify the treatable structural lesions of the brain, like tuberculomas, cysticercosis, intracranial space occupying lesions, arterio-venous malformations, cortical dysplasia, hydrocephalus, tuberculous meningitis. CT and EEG thus provide us with a powerful combination of structural and functional methods in the evaluation of epilepsy, yielding more valuable information than can be provided with either method alone.

Material & Methods

Study design: Prospective study conducted in a tertiary care hospital (i.e. S.C.B Medical college & Hospital, Cuttack) of Eastern India, during period AUG 2014 to AUG.2017. Total 300 Newly diagnosed epilepsy patients were classified as per ILAE (international league against epilepsy) and evaluated Radiologically (CT brain) as well as electroencephalographically. Statistical analysis was done by SPSS Software version 21. P Value is considered significant when < 0.05 .

Aim & Objective:

1. To classify Epilepsy and study Computed Tomographic, supplemented by, Electroencephalographic characteristics in 300

cases of Newly Diagnosed Epilepsy.

- To find out correlation between Electroencephalographic and, Computed Tomography characteristics.

Patients attending neurology clinic of S.C.B. Medical College & Hospital, Cuttack.

Inclusion Criteria:

- Newly diagnosed Epilepsy cases more than 5 years age.
- Eligible subjects should meet clinical criteria for an epileptic seizure (ILAE-2014)

Exclusion Criteria:

- Patients with Seizures on treatment or head injuries.
- Patients with systemic illness, metabolic abnormalities or seizure provoked by external factors like alcohol withdrawal.
- Eclampsia with seizure.

Observation

In our study 300 cases of Newly Diagnosed Epilepsy were evaluated clinically, Radiologically & Electrophysiologically. Out of 300 cases 198(66%) were Generalised Seizures & 102(34%) were Focal seizures. Among Generalised Seizures Tonic-Clonic type 132 (66.7%) was most common and among Focal seizure focal seizure with secondary generalisation 72 (70.5%) was most common (Table- I, II). Nearly 66(64.8%) of patients with Focal seizures and 42(21.2%) of generalised seizures were having abnormal EEG (Table-III). Sharp wave and spikes or slow waves were the most common findings observed in both the seizure groups (Table-IV); either of them was present in most of the patients of Focal seizures & Generalised seizures with abnormal EEG. CT scan was found to be abnormal in 72(70.6%) of patients with Focal Seizures & 48(24.2%) patients of Generalised respectively. (Table V). Most common abnormalities observed in Focal seizures group were ring/ disc lesions (33.3%), calcifications(15.6%), tumors(8.8%), Mesial temporal sclerosis (5.9%), followed by Gliosis(4.9%). Hydrocephalus (3.9%), cerebral infarction (2.9%), Cerebral atrophy (1%) plays a minor role in our study (Table- V). Whereas among patients with generalised seizures, the Commonest finding was cerebral atrophy (6%) and followed by calcification(4%), ring or disc lesions(3%), porencephaly (3%), enlarged cistern magna(3%), tumour(1.5%), cerebral infarctions

(1.5%) (Table V). Among patients with normal EEG, 11.7% patients with Focal seizure, and 60.6% patients with Generalised seizure were having normal CT scan, while among patients with abnormal EEG, 41% of patients with Focal seizure and 12% patients of generalised seizure were having abnormal CT scan (Table VI).

Discussion

The study was conducted to assess the role of EEG and CT scan in patients with Focal or Generalized seizures and to make out any correlation between these two investigations, if possible. Overall, 66 (64.7%) of patients with focal seizures and 42 (21%) of patients with generalised seizures were having first interictal abnormal EEG. Ramesh Baheti, B D Gupta et al (2003) in their "Study of CT and EEG findings in patients with Generalized or Partial Seizures in Western Rajasthan" shown abnormal EEG records in 73% and 79.9% patients with Generalized or Partial Seizures respectively [3] which is discordant with our study. Observation in our study was also not similar to that observed by Al-Sulaiman et al [4] and Doose et al [5]; they reported abnormal EEG in 81% of patients with partial seizures and 78% of patients with generalised seizures respectively in different studies. Low incidence of EEG abnormalities in our study can be explained as in majority of patients EEG were done with only 30 minutes record and after 24 hrs of seizure. Also in some of the patients in our study, EEG was performed at various times after seizure (even not within a week of seizure).

On analysing individual abnormalities in EEG, it was observed that sharp wave and spikes or slow waves were the common abnormality observed in both the seizure groups (Table-IV) which is similar to study by Ramesh Baheti, BD Gupta et al [3]. Doose et al [5] also observed sharp wave and spikes as common findings. However, Homes et al [6] observed most common EEG abnormality to be a focal slowing.

CT Scan is a useful tool to determine etiologic diagnosis of seizure and was abnormal in 120 patients (40%) in our study which is comparable to other Indian studies showing CT abnormalities ranging from 25-70% [7,8]. A Study by Achille Edem Tchalla et al (2011) [9] and Daras et al [10] shown CT brain abnormality in 71.5% & 62.6% respectively. Present study revealed more CT abnormalities in focal seizures 70 (70.6%) than generalised seizures 48 (24.2%). Previous Indian study by Ramesh Baheti, BD Gupta et al has shown proportion of CT abnormality in Generalized & Partial seizure as 13 (50%), 9 (34.6%) respectively [3]. This variation in incidence of CT scan abnormalities may be due to influence of clinical presentation. Wadia et al. [11] studied 150 cases of focal seizures and observed ring or disc enhancement in 26% where as it is 35% in our series. In our study of 300 cases of Newly diagnosed epilepsy Ring/Disc lesions were present in 34 (33.3%) cases of Focal seizure group (Tuberculoma-14.7% & Neurocysticercosis-18.6%) & 6 (3%) of Generalised seizure group (Tuberculoma -1% & Neurocysticercosis-2%) (Table-V, fig:1), which is discordant to study by Washimkar et al [12] who reported tuberculoma in and neurocysticercosis in 65.9% , 3.4% respectively with partial seizure disorder. Study by Ramesh Baheti, BD Gupta et al, (2003) also shown Tuberculoma (1%) & NCC (1%) plays minor contribution. 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 merits appropriate treatment [3].

The focal calcification (fig:2) of unknown etiology was observed in 16 (15.68%) cases of focal seizure in our series where as it is reported as 3.3% by wadia et al [11] & 11.5% by Ramesh Baheti et al [3]. It concludes calcification is one of the common causes of focal seizure and Our report of higher calcification is due to more number of Ring/Disc lesions. Hydrocephalus was present in focal seizure in 4 (3.9%) only where as McGhan et al [7] reported hydrocephalus in 2% patients of generalised seizures. We observed cerebral oedema in 3 (1.5%) cases with generalised seizures & 3 (2.9%) cases of Focal seizure. Other studies did not report cerebral oedema as commonly observed finding in seizure disorder and it is possible that cerebral oedema may be a postictal sequelae as some performed CT scan soon after the ictal event.

Ramesh Baheti et al have reported cerebral Atrophy in 6 (23%) of Generalized seizure & 4 (15.3%) of partial seizure where as our study has shown atrophy in 12 (6.1%) generalized seizure & 1 (1%) focal

seizures. Young et al and Wadia et al also reported atrophy in 7.2% & 6.6% respectively. Tumors were found in 9 (8.8%) patients of focal seizure & almost similar figures were found in a study by Wadia et al 9.5% [11]. In our study it was observed that in patients with focal seizures when EEG was abnormal, the chances of finding an abnormal CT scan was higher, i.e., 42 out of 60 patients who had abnormal EEG had abnormality on CT scan (41%), whereas only 30 out of 42 (29.4%) patients with a normal EEG were having abnormal CT scan (Table-VI). However, in cases of generalised seizures, when there was an abnormal EEG, CT scan was abnormal in only 12 out of 42 (6%) and when EEG was normal, 36 out of 156 (18%) 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.

Summary and conclusion

The use of CT brain though decreased greatly with availability of Magnetic Resonance Imaging, still it is the reliable investigation for determining underlying structural abnormalities & helpful in establishing etiology in majority of cases. In country like India infective etiologies (Tuberculoma, NCC) are still important causes hence CT scan plays a important role. EEG though not very useful in evaluation of seizure but presence of abnormal EEG helps to confirm diagnosis. Though EEG, CT correlation is poor in present study but abnormal EEG associated with focal abnormality gives a clue to underlying structural abnormality. Hence any patient of Newly diagnosed epilepsy must be evaluated with EEG as well as Neuro imaging (CT scan) to establish the cause & to decide therapy and to prognosticate seizure disorder.

TABLES-I

Table – I : Types of generalized seizure

Clinical Seizure type	No.	Percentage
Tonic – clonic	132	66.67%
Tonic	12	6.06%
Clonic	6	3.03%
Atonic	12	6.06%
Myoclonic	6	3.03%
Absence	12	6.06%
Atypical absence	6	3.03%
Myoclonic + GTCS	12	6.06%
Total	198	100%

TABLES-II

Table – II : Types in partial seizures

Types of partial seizures	No.	Percentage
Focal seizure with retained consciousness (Simple partial seizures)	12	11.8%
Focal seizure with impaired consciousness (Complex partial seizures)	18	17.7%
Focal Seizures with secondary generalized	72	70.5%
Total	102	100%

TABLES-III

Seizure type (clinical)	No. of Patients	Normal	EEG findings	
			Abnormal	
			Generalized	Focal
Generalized seizure	198 (100%)	156 (76.7%)	42 (21.2%)	-
Focal seizure	102 (100%)	36 (35.2%)	-	66 (64.8%)
• Focal without impaired consciousness	12	-	-	12 (11.76%)
• Focal seizure with impaired consciousness	18	6	-	12 (11.76%)
• Secondary generalized	72	30	-	42 (41.18%)

Type of EEG abnormality in Focal And Generalised seizure groups Table-IV

EEG changes	Focal seizure	Generalised seizure
Normal EEG	36 (35.3%)	156 (78.8%)
Abnormal EEG	66 (64.7%)	42 (21.2%)

Lateralized EEG Abnormalities		
Spikes end or Sharp waves	24(23.6%)	
Slow waves	24(24.6%)	
Focal Abnormality with Secondary Generalisation	18(17.6%)	
Generalised EEG Abnormalities		
Generalised Spikes and or Sharp waves		12(6%)
Generalised Slow waves		6(3%)
Generalised Spikes,Sharp waves and slow waves		24(12%)
TOTAL	102(100%)	198(100%)
A total of 65% of focal seizures and 21% of Generalised Seizures are having abnormal EEG.		

TABLES:V
CT SCAN Abnormality in Focal and Generalised seizure Table-V

CT SCAN Changes	Focal Seizure	Generalised Seizure
Normal CT SCAN Brain(180)	30(29.4%)	150(75.5%)
Abnormal CT SCAN Brain(120)	72(70.6%)	48(24%)
Ring/Disc Lesions(40)	34(33.3%) [NCC19(18.6%),Tuberculoma 15(14.7%)]	6(3%)[NCC 4(2%),Tuberculoma 2(1)]
Gliosis	5(4.9%)	1(.5%)
Calcification	16(15.7%)	8(4%)
Brain Atrophy	1(1%)	12(6%)
Vesicular(cerebral infarction)	3(2.9%)	3(1.5%)
Tumour	9(8.8%)	3(1.5%)
Abscess		
Generalised Oedema	3(2.9%)	3(1.5%)
Porencephaly/Congenital lesions		6(3%)
Mesial Temporal Sclerosis	5(4.9%)	
Enlarged cisterna magna		6(3%)
Hydro cephalus	4(3.9%)	
Total 300(100%)	102(100%)	198(100%)
Figures are overlapping because cases of ring/Disc lesions also having hydrocephalus, generalised edema.One Patient of Calcification is also having brain atrophy		

TABLES:VI **CT SCAN and EEG corelation in patients of Focal and Generalised Seizure disorder Table-VI**

	Normal EEG		Abnormal EEG	
	Focal seizure	Generalised seizure	Focal seizure	Generalised seizure
Normal CT SCAN Brain	12(11.7%)	120(60.6%)	24(23.5%)	30(71.4%)
Abnormal CT SCAN Brain	30(29.4%)	36(18%)	42(41%)	12(28.5%)
Total	42(100%)	156(100%)	60(100%)	42(100%)

Fig:1

Fig. :MRI(T1W Sagittal image) showing Ring enhancing lesions(NCC)

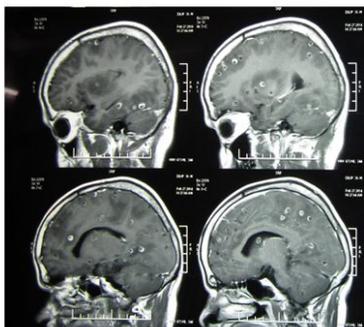


Fig:2

Fig.: CT brain(plain) showing multiple calcifications.



References:

- Deme S. A study of correlation of CT scan brain and EEG in epilepsy. IAIM, 2016; 3(10): 55-61.Thurman DJ, Beghi Ettore et al .ILAE commission on Epidemiology. Epilepsia2011;52 (suppl. 7):2-26.
- Ramesh Baheti, BD Gupta, Rajesh Baheti. A Study of CT and EEG findings in patients with Generalised or Partial Seizures in Western Rajstan.JIACM2003;4(1):25-9.
- Al-Sulamann AA, Ismail HM. Clinical pattern of newly diagnosed seizures in Saudi Arabia : A prospective study of 262 children. Childr. Nerv Sys 1998; 15 (9): 968-71.
- Doose H, Lunale H, Waltz S, Castiglione E. Severe idiopathic generalised epilepsy of infancy. Neuropediatrics 1998; 29 (5): 229-38.
- Homes S, Ni XS, Dutt N, et al. EEG, CT and neurosonographic findings in patients with post-ischaemic seizures. J Neurol Sci 1995; 132 (1): 57-60.
- McGahan JP, Dubin AB, Hill RP. The evaluation of seizure disorders by computerised tomography. J. Neurosurg. 1979; 50: 328-32.
- Yang, PJ, Poul EB, Michael EC, Patncia KD. Computed tomography and childhood seizure disorders. Neurology 1979; 29: 108-88.
- Achille Edem Tchalla,Benoit Marin et al,Newly Diagnosed epileptic seizure: Focus on an elderly population on the French island of Reunion in the Southern Indian Ocean. Epilepsia, 2011, 52(12):2203-2208.
- Daras M, Tuchman AJ, Strosbos RJ. Computed tomography in adult-onset epileptic seizures in a city hospital population. Clin Exp Neurol., 1987; 24: 159-67.
- Wadia RS, Makhale CN, Kalkas AV, Grant KB. Focal epilepsy in India with special reference to lesion showing ring or disc like enhancement on contrast computed tomography. J. Neural Neurasurg Psychiatry 1987; 50: 1298-1301.
- Washimkar SN, Holay MP, Fusey SM. Evaluation of focal seizures by computerized tomography. JAPI 1996, 44: 959-60.