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Original Article

Etiological Evaluation of Partial Seizure by Computed Tomography

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Abstract

Introduction: Seizure occurs in up to 10% of the population whereas epilepsy is a chronic disease characterized by recurrent seizures that may affect up to 2% of the population. Modern neuroimaging is useful in diagnosis of abnormalities underlying the epilepsies, but the information provided by imaging techniques can also contribute to proper classification of certain epileptic disorders and can delineate the genetics of some underlying syndromes.

Aim: To study the incidence of structural lesion in partial seizures, to identify the cause for partial seizures in different age groups, electroencephalogram (EEG) changes predicting computed tomography (CT) lesions and to identify clinical clues which predict a structural lesion in partial seizure.

Methods: Prospective observational study was conducted. Detailed history and clinical examination is carried out to ensure the organic nature of epilepsy. EEG and CT were done; results are critically analyzed for the presence of focal, localized, or generalized changes by montage-wise analysis.

Conclusion: Seizures are an important cause of morbidity in adults. It is therefore important to establish accurate diagnosis of seizures and its etiologies to manage appropriately such patients.

Key words: Clinical features, Computed tomography, Partial seizure

INTRODUCTION

Partial seizures are those, in which, in general the first clinical and electroencephalographies (EEGs) changes indicate initial activation of a system of neurons limited to part of one cerebral hemisphere.[1] Many Investigations have suggested that people with partial seizures are more likely to have recurrence than generalized seizures. In the evaluation of partial seizure - we the physician utilize various tools.[2] First and foremost is the history of illness and then, EEG and neuroimaging. The incidence of structural abnormality in partial seizure is relatively high when compared to generalized seizure, and it is about 78% in a study by Misra *et al.*, done at Banarus Hindu University, Varanasi. EEG helps us to identify the functional site of epileptogenesis even though the yield is low and also helps us to identify the mirror focus.[3] In the era of epilepsy surgery, a clinical approach which mixes the skillful history elicitation, EEG, neuroimaging together helps us to localize the site of origin of seizure and thereby helps us to have a better cure rate. In our present study, we are intended to identify the correlation between the clinical history, EEG, and neuroimaging in the identification of the site of lesion and also to study the incidence of structural lesion in partial seizures and also to identify clues in the clinical history and examination which points toward structural lesion.

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Aim

To study the incidence of structural lesion in partial seizures, to identify the cause for partial seizures in different age groups, EEG changes predicting computed tomography (CT) lesions and to identify clinical clues which predict a structural lesion in partial seizure.

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MATERIALS AND METHODS

Prospective observational study was conducted in a tertiary care hospital. Detailed history and clinical examination is carried out to ensure the organic nature of epilepsy. Results are critically analyzed for the presence of focal, localized, or generalized changes by montage-wise analysis. Individual abnormalities are recorded in the pro forma. CT scan brain plain and contrast axial section with routine slice thickness performed in all cases. Radiologist's opinion obtained, abnormalities noted. Finally, the data were analyzed combining the clinical, EEG and CT scan brain findings and conclusion arrived.

RESULTS

In 76 patients of which three did not turn up for CT brain and EEG, so a drop out of three cases. Finally, the study included 73 cases, in them detailed history, clinical examination, and investigations were completed. In our study population, children under 13 years were 28 in number. Adults under 45 years were 38 in number. Adults more than 45 years were seven in number. In study group, youngest patient was 9 months old baby. The eldest person was 70 years old. Among the total 73 cases, 29 patients had simple partial seizures, 42 patients had complex partial seizure, and two patients had both simple and complex partial attacks. Duration of illness before reporting for medical advice, <1 week - 18, <1 month - 33, and more than 1 month - 22. The right focal seizure was noted as 43 patients and the left focal seizure is 30 patients. When we analyzed the symptomatology of our patients' headache was the most frequent symptom, and it was reported in 25 cases. 31 patients out of the 73 cases had clinical signs of deficit (42.5%). Among the clinical signs, hemiparesis was seen in 14 patients (19.2%) among these patients CT scan brain was abnormal in 12 patients (85.87%). Five patients had papilledema (6.8%). CT brain was abnormal in all the five patients (100%). Three patients had hemisensory deficit (4.1%) and CT brain was abnormal in two patients (67%). Three had facial weakness of upper motor neuron type (4.1%). CT brain was abnormal in three (100%). Three had extensor plantar (4.1%) - CT was abnormal in all the three patients (100%). Two patients had homonymous hemianopia (2.7%) in this CT brain was abnormal in both (100%). One patient had paraparesis 1.4% in whom CT was abnormal showing a suprasellar mass lesion. Among the 73 patients who were examined 31 patients had deficit which amounts to 42.5%. 28/31 patients with signs of neurological deficits postictal had structural lesions in their CT brain.

In our study, CT brain was abnormal in 47 patients (64.4%). 28 patients among these 47 patients had deficits on clinical examinations (59.6%). 19 patients with CT brain abnormality did not show any deficit (Table 1). Hemiparesis was the most frequent deficit noted. Hemisensory, upper motor neuron (UMN) facial weakness, homonymous hemianopia, papilledema, extensor plantar response alone, and paraparesis were also noted (Table 2). In the etiological aspect, contrast-enhancing granuloma was the most frequent lesion. We have encountered contrast-enhancing granuloma in 55.3% of our study populations (Table 3). EEG was abnormal in 40 cases (56.2%). Lateralizing EEG changes were noted in 26 cases; among the patients CT brain was abnormal in 20 cases (76.92%). Bilateral changes were noted in 14 cases; among these CT was abnormal in four cases (35.7%) (Table 4). Among 47 cases with CT lesions, 31 cases lesions were seen in parietal lobe (Table 5). One

Table 1: Postictal neurological deficits in predicting CT brain lesions

Clinical signs of deficits	Present	Absent	Total	*P* value
Present	28	3	31	<0.0001
Absent	19	23	42	

CT: Computed tomography

Table 2: Clinical deficits seen in study patients

Clinical deficit	Number of patients (%)
Hemiparesis	14 (45.16)
Papilledema	5 (16.13)
Hemisensory impairment	3 (9.68)
UMN facial weakness	3 (9.68)
Extensor plantar response	3 (9.68)
Homonymous hemianopia	2 (6.45)
Paraparesis	1 (3.22)

UMN: Upper motor neuron

Table 3: CT lesion seen in study patients

CT lesion	Number of patients (%)
Contrast-enhancing granuloma	26 (55.31)
Infarct	10 (21.27)
Mass	4 (8.51)
Postictal edema	2 (4.25)
Calcification	1 (2.12)
AVM	1 (2.12)
Tubers	1 (2.12)
Gliosis	1 (2.12)
Diffuse gyral enhancement	1 (2.12)
Total	47 (100)

CT: Computed tomography, AVM: Arteriovenous malformation

Table 4: EEG abnormalities

Phase reversal	11
Bilateral spike, sharp waves	14
Focal or unilateral sharp waves	8
Focal slow waves	7

EEG: Electroencephalogram

patient had paraparesis 1.4% in whom CT was abnormal showing a suprasellar mass lesion (Table 6).

Among the patients with granuloma EEG was positive in 16 cases. Totally, among 26 cases of ring-enhancing granulomas as evidenced in CT brain. 16 patients had EEG abnormality (61.5%). Interestingly, 15 patients had shown lateralizing EEG abnormalities (93.75%). Predominantly, granulomas were seen in younger population. Among the 26 cases, 23 cases were at or under 18 years of age, three were in their 20-35 years of age group. Infarct was seen in 10 cases here to parietal lobe was the most common site (Figure 1). 8/10 cases shown die infarct in the parietal lobe. EEG was abnormal in four cases (40%) of which three had lateralizing EEG changes, and one showed generalized changes. Among the four cases with mass lesion, EEG was abnormal in two cases both of them showed generalized changes. Patient with tuberous sclerosis also showed generalized EEG changes. Patient with AVM showed lateralizing EEG changes. Patient with calcification and gliosis did not show any EEG abnormality. Hence, totally among the 47 patients with CT abnormality 25 had shown abnormal EEG (53%). Post-ictal edema is reported in two cases. Both in young-age group, one confirmed by repeat CT brain and other with MRI scan. Both did not show any EEG abnormality.

Table 5: Distribution of infracts in CT brain

Parietal	8
Temporal	1
Occipital	1

CT: Computed tomography

Table 6: Distribution of mass lesion

Suprasellar	1
Frontal	1
Parieto-occipital	1
Frontotemporal	1

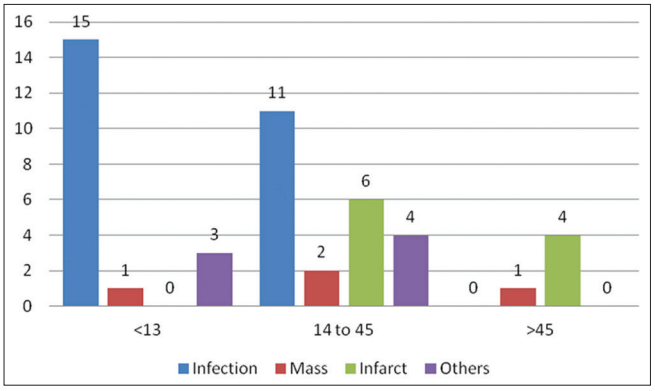

Figure 1: Etiologies of partial seizure in various age groups

DISCUSSION

Overall, we have studied 73 cases. The incidence of partial seizures is almost equally distributed among male and female population. Complex partial motor seizure was the most common entity. Incidence of partial seizure is more common in younger population than in older. More frequent in young adults and children. When compared to generalized seizures, partial seizures are known to produce more clinical signs when evaluated postictal.[4] In our study, 31 cases out of the 73 (42.46%) had positive clinical signs. Hemiparesis was the most frequent deficit noted. Hemisensory, UMN facial weakness, homonymous hemianopia, papilledema, extensor plantar response alone, and paraparesis were also noted.[5] We have statistically analyzed whether people who have a deficit or sign on clinical examinations have a higher chance of harboring a structural lesion in their brain when compared to those who do not have any deficit. Furthermore, it was proved that those who have a deficit have more incidence of structural lesion than those who do not. Among the patients with clinical signs or deficit postictal, 28/31 had structural lesion on CT brain. Headache was the most common symptom reported by our patients. This history was given in 25 cases. Among the 73 cases studied EEG was abnormal in 40 cases (56.2%). 25 out of 40 patients with EEG abnormality had CT brain lesions (62.5%). This is almost comparable to an Indian Study done in 2003 by Baheti *et al.* In their study, 57.9% of cases with EEG abnormality had abnormal CT brain.[6] Generalized EEG changes were noticed in 14 cases and lateralizing EEG changes in 26 cases. We have analyzed the statistical significance of both these changes independently in predicting structural lesion in the CT brain. Analysis showed that EEG showing lateralizing changes is more specific in picking up structural lesion than EEG with generalized changes. Patients with EEG showing lateralized changes have a sensitivity of about 42.5% and specificity of 76.9% in predicting CT brain abnormality. With a very significant *P* value ($P = 0.0032$) (Table 7). Patients with generalized EEG changes have a sensitivity of 10.6% and specificity of 65.3% in predicting a structural lesion (Table 8). Hence, in general patient with EEG changes in partial seizure are more likely to have structural lesion than those who do not. However, in specific patient with lateralizing changes have more chance of having structural lesion than generalized changes. Among the localized EEG changes, phase reversal is more predictive of structural lesion (81%) followed by focal spike, sharp, and slow waves accounting for about 70%. In the etiological aspect, contrast-enhancing granuloma was the most frequent lesion. We have encountered contrast-enhancing granuloma in 55.3% of our study populations. In our study, CT brain was abnormal in 64.4%. When

Table 7: Lateralizing EEG changes in predicting CT brain lesions

Lateralizing EEG changes	CT brain lesions		Total
	Present	Absent	
Present	20	6	26
Absent	27	20	47

EEG: Electroencephalogram, CT: Computed tomography

Table 8: Generalized EEG changes in predicting CT brain lesions

Generalized EEG changes	CT brain lesions		Total
	Present	Absent	
Present	5	9	14
Absent	42	17	59

EEG: Electroencephalogram, CT: Computed tomography

Table 9: Comparison of CT observation in Misra *et al.* study in the year 1994 to our study[3]

CT Observation	Misra *et al.* 1994%	Our study 2004-2005%
Enhancing granuloma	63.3	55.3
Infarct	4.0	21.3
Mass	4.6	8.5
Calcification	11.8	2.1
Cerebral atrophy	5.9	Nil
Edema	1.9	4.3
Hemorrhage	0.8	Nil
Vascular malformation	0.8	2.1
Gliosis	0.5	2.1
Tubers	Nil	2.1

compared to a study by Misra *et al.* in the year 1994, this is a bit low. In their study, structural lesions were noted in 79.3% (Table 9).[3]

Similar study in children was done in the year 2004 by Hussain *et al.*[7] In their study, the incidence of structural lesion was 68% which is almost close to our study. In their study also contrast-enhancing granuloma was the most common lesion. We have observed that patients with granulomatous contrast-enhancing lesions have more chance of their EEG being abnormal when compared to other patients with structural lesions. Incidence of lateralizing EEG abnormality was also more in patients with granulomatous lesions. Distribution of granuloma was most commonly noted in parietal lobe 21/26 (81%) of which left side was > more common than right with 30% more on the left compared to the right side. Overall 34 cases, of the 47 cases with structural lesion had their lesion in the parietal lobe (72.3%). Hence, it shows that parietal lobe lesions are the most common cause of partial motor seizure.

CONCLUSION

Seizures are an important cause of morbidity in adults. It is therefore important to establish accurate diagnosis of seizures and its etiologies to manage appropriately such patients. Those patients who have a post-ictal neurological deficit has higher incidence of CT lesions. Among all granulomas - NCC is the most common cause of focal seizures. Among the structural lesions, EEG changes are more common in those with granulomas. Parietal lobe is the most common site for structural lesions in epileptics with partial seizure.

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