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Original Research Article

Assessment of CT scans findings in patients with seizures: An Imaging perspective

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Abstract: Epilepsy is a chronic disease characterized by recurrent seizures that affect 2% of the population. The present 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 and to establish usefulness of CT in defining the aetiology of seizures. The study was retrospectively carried out on the records of patients who underwent CT scan for seizures in Radio- diagnosis Department of the tertiary care hospital in New Delhi. Cases with history of seizure disorder in which EEG was also available were included in the study. EEG and CT scan findings were correlated. Obtained data was arranged accordingly and was expressed as a number and percentage of respondents and were analyzed using the SPSS Version 17 software. Out of 116 total patients, 65were males and 51were females. Out of total 57 patients with partial seizures, 30 showed abnormal CT findings while 27 showed normal CT findings. Out of 59 patients with generalized seizures, 19 showed abnormal CT findings while showed 40 had normal CT findings. Maximum patients showing abnormal CT findings belonged to the age group of 11 to 20 years. Tuberculoma was the most common abnormal CT finding in the present study**.** 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.
Keywords: Epilepsy, Seizures, CT scan

INTRODUCTION

Approximately 10 percent of the world population is affected by seizures while approximately 2 percent of the population is affected by epilepsy which is characterized by recurrent seizures. Although primarily defined by EEG abnormalities, it is presently recognized that epilepsy is often associated with gross or subtle structural or metabolic lesions of the brain. Modern neuroimaging is useful in the diagnosis of the abnormalities underlying the epilepsies, but the information provided by imaging techniques can also contribute to the proper classification of certain epileptic disorders and can delineate the genetics underlying some syndromes. Neuroimaging is even more important for those patients who have medically intractable seizures [1]. Advances in technology to localize focal epileptogenic substrates especially that of high-resolution structural imaging with magnetic resonance imaging (MRI) [2], have substantially improved the success of surgical treatment [3]. Excellent hard tissue imaging contrast with moderately good soft tissue resolution is generated by Computed tomography (CT). Although the use of CT for patients with epilepsy has been greatly diminished by MRI, CT is still the technique of choice for the investigation of patients with seizures and epilepsy under certain conditions. In the neonate and young infant, CT is often of secondary or adjunctive importance, but it serves as a significant backup role to ultrasound. CT can accurately detect hemorrhage, infarctions, gross malformations, ventricular system pathologies and lesions with underlying calcification [4]. EEG plays a very important role in diagnosis as well as in the classification of seizures. It also provides substantial evidence of localisation when surgical treatment is planned. In case of paediatric patient presenting with partial seizure, CT scan is indicated as there are significant chances of finding some structural cerebral lesion in such cases [5]. In older children and adults, CT is the technique of choice in the perioperative state because it can rapidly detect recent hemorrhage, hydrocephalus, and major structural changes [6]. The present 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 and to establish usefulness of CT in defining the aetiology of seizures.

MATERIALS & METHODS

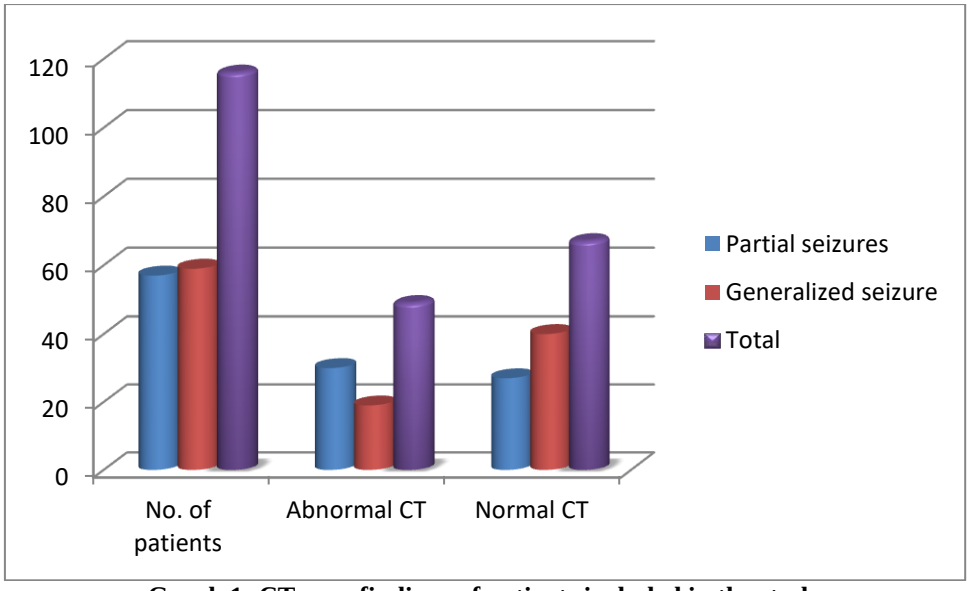
This was a retrospective hospital-based study carried out on the records of patients who underwent CT scan for seizures in Radio- diagnosis Department of the tertiary care hospital in New Delhi over a period of one year i.e. from December 2013 to March 2015. Cases with history of seizure disorder in whom EEG was also available were included in the study. EEG and CT scan findings were correlated. The findings of EEG were correlated with the diagnosis. The presence of seizures was not excluded by the normal EEG. EEG if abnormal helped in classifying seizures, selecting appropriate antiepileptic drugs, withdrawing antiepileptic drugs and planning for surgery. The various abnormalities observed in EEG include abnormalities of background activity like diffuse or localized reduction in amplitude seen in terminal stages of cerebral degenerative process and occlusion of a major cerebral artery. 12 channel EEG recorders were used for performing EEG. After the settlement of vitals and other parameters, patients were referred to the Department of Radio-diagnosis for CT scan Brain/Skull with appropriate history. The present study excluded cases of traumatic skull or brain injuries. CT scan was done using Siemens Spiral CT scanner Somatom Emotion 16 and regular CT protocols were followed. CT protocols included supine position with head first and axial section of head. Plain CT scan with 8 mm slice thickness was taken and thin sections up to 2 to 5 mm were also done in particular aspects. CECT was also carried out whenever required. The CT patterns were then assessed. After the CT scan the diagnosis were confirmed with co-relation with clinical history and by various pathological, microbiological and biochemical investigations. Tuberculoma was confirmed with clinical history, Mantoux test and ADA titer of CSF. Neuro cysticercosis was confirmed by ELISA test. CT scan was performed as the diagnostic investigation for cerebral edema, cerebral infarct, cortical atrophy, calcification, hydrocephalus intracerebral hemorrhage and hypoxic ischemic encephalopathy. Some of the interesting cases are shown in figures 1 to 5. Few cases were also referred for MRI to confirm the diagnosis. Obtained data was arranged accordingly and was expressed as a number and percentage of respondents and were analyzed using the SPSS Version 17 software.

RESULTS

A significant amount of abnormal findings are observed while evaluating the results. Age distribution also highlights that maximum number of patients with seizures whether partial or generalized belonged to second and third decade of life. Table 1 shows the demographic details of the patients. Among patients with partial seizures, more than 50 percent of the patients were males. Out of total of 116 patients included in both the groups, 65 were males. Graph 1 shows the CT scan findings of the patients included in the present study. Out of total 57 patients with partial seizures, 30 showed abnormal CT findings while 27 showed normal CT findings. Out of 59 patients with generalized seizures, 19 showed abnormal CT findings while 40 showed normal CT findings. 49 patients out of total 116 patients with seizures showed abnormal CT findings. Table 2 shows the distribution of patients according to different age groups. 11 to 20 years age group of patients contained maximum patients having partial seizures followed by patients in age group of 21 to 30 years. Also in patients with generalized seizures, maximum number of patients occurred in age group of 11 to 30 years. Graph 2 shows the abnormal CT findings in partial and generalized seizure patients. Most of the abnormal CT findings in patients with partial seizures was interpreted as Tuberculoma (table 3) while in case of generalized seizures, diffuse cerebral edema was the most common abnormal finding (table 3).

Table 1: Demographic details of patients

Sex	Partial seizure	Generalized seizure	Total
Male	32	33	65
Female	25	26	51
Total	57	59	116



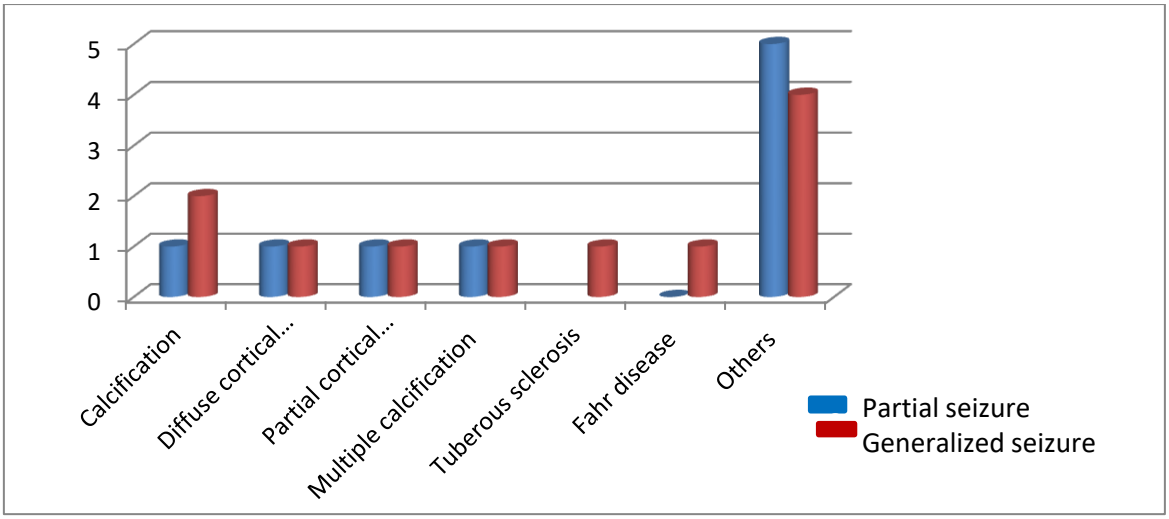
Graph 1: CT scan findings of patients included in the study

Table 2: Distribution of patients according to different age groups

Age group (years)	No. of patients	Partial seizure	Generalized seizure	Abnormal CT findings
1-10	19	10	10	9
11-20	35	17	19	14
21-30	25	11	13	11
31-40	14	7	8	4
41-50	12	6	6	6
51-60	5	2	3	2
61-70	3	2	1	2
71-80	1	1	-	1
81-90	1	-	1	-

Table 3: Abnormal CT findings in seizure patients

CT Scan findings	Partial seizures	Generalized seizures
Tuberculoma	11	-
Cerebral infarct	3	4
Focal cerebral edema	7	-
Diffuse cerebral edema	-	6
Brain tumour	4	-
Calcification	1	2
Diffuse cortical atrophy	1	1
Partial cortical atrophy	1	1
Multiple calcification	1	1
Tuberous sclerosis		1
Fahr disease	-	1
Others	5	4



Graph 2: Abnormal CT findings in partial and generalized seizure patients

Fig 1: Contrast enhanced axial CT shows a small ring enhancing lesion with mildly irregular walls in the left frontal lobe with surrounding perilesional edema.

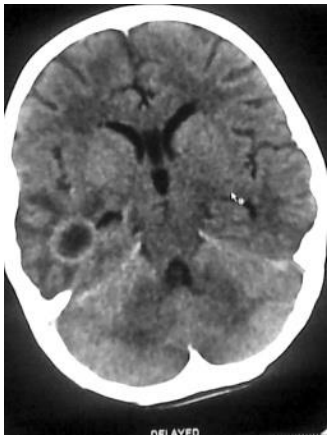


Fig 2: Contrast enhanced axial CT scan in a child with chronic right ear discharge and recent presentation with complex partial seizures shows a thin walled ring enhancing lesion in keeping with otogenic abscess in the right temporal lobe with surrounding perilesional edema.

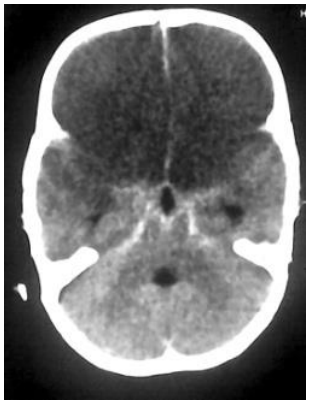


Figure 3: Contrast enhanced CT scan in a chronically sick patient now presented with GTCS and low GCS shows bilateral diffuse front temporal cerebral edema with basal exudates in keeping with complicated TBM.

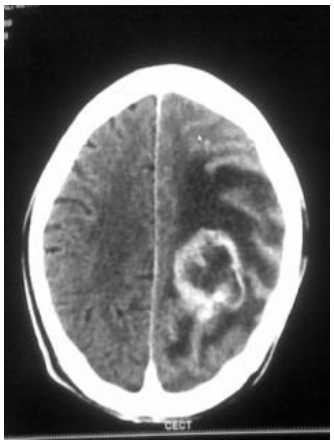


Fig 4: Contrast enhanced axial CT scan in an adult presentated with headache and generalized seizures shows an irregular, heterogeneously enhancing mass lesion with central necrosis in left parietal lobe with surrounding perilesional edema. It was later confirmed as Glioblastoma multiforme.

Fig 5: Unenhanced CT scan in a child with a long history of GTCS failure to thrive shows large front temporal encaphalomacic change with focal areas of calcification, as a sequelae of previous vascular insult.

DISCUSSION

Seizures are an important cause of morbidity and mortality. It is therefore important to establish accurate diagnosis of seizures and its aetiologies to appropriately manage such patients. The aetiology of seizures differs in developing countries as compared to the developed world. Tuberculoma and neuro cysticercosis have relatively high frequency in India [7]. Localization of abnormalities in cases of partial seizures varies from 28% to 80% as observed in various studies [8, 9]. Serial CT or other diagnostic scans are required to differentiate between post-treatment inflammation and residual tumor, delaying appropriate therapy in glioblastoma multiforme. Birth asphyxia, anoxic

episodes, head trauma, or neoplasm (usually slowly growing gliomas) are the commonest causes of seizures identified in western studies [7]. But in India, Washimkar SN *et al.;* [10] observed that tuberculoma (65.9%), infections (15%), and neuro cysticercosis (3.4%) are the major causes of partial seizures. Studies conducted on patients with generalised seizures also reveal similar abnormalities. Murthy JM *et al.;* [11] carried out a study on 591 patients with generalized seizures and observed that 53% of them had an identifiable aetiological factor. In addition to its value as a diagnostic aid, EEG may be helpful in classifying the seizure, to find an underlying aetiology, guides clinical management as well as provides evidence of localisation when surgery is planned [12]. Because of a significant chance of finding some structural cerebral lesion, an imaging procedure such as CT scan is indicated essentially for paediatric patients with partial seizure [13].

The present 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. Overall, 73% of patients with partial seizures and 76.9% of patients with generalised seizures were having an abnormal EEG. Observation in our study was quite similar to that observed by Holmer S *et al.;* [14] who reported abnormal EEG in 81% of patients with partial seizures and 78% of patients with generalised seizures. 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 which was also reported by Yang PJ *et al.;* [15] However, Homer S *et al.;* [14] reported focal slowing as most common EEG abnormality. CT scan is a useful tool to determine the aetiological diagnosis of seizure. It has been reported as abnormal in 28% to 92% of patients with seizure disorders in various studies [15-17].

Washimkar SN *et al.;* [10] reported tuberculoma in 65.9% and neuro cysticercosis in 3.4% of patients with partial seizure disorder. Majority of studies [18-20] conducted in developed countries have not reported any case of tuberculoma or neuro cysticercosis as aetiological factors in cases of seizure disorders. Baheti R *et al.;* [21] compared EEG and CT findings and reported that abnormal EEG 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. Koome M *et al.;* [22] assessed the CT perfusion (CTP) in the detection of cortical ischemia and its association with post-stroke seizures and concluded that both sensitivity and specificity of the cortical involvement might occur with non-contrast CT. Lalchan S *et al.;* [23] evaluated the role of routine CT scan of the brain in adult patients presenting with first episode of seizure and reported that neuro cysticercosis was the commonest abnormality detected in younger population. However, more studies are required to comment on this correlation.

CONCLUSION

From the above results, the authors conclude that evaluation of every patient with idiopathic partial seizures should be done by EEG and CT scan. However, future studies in the field of radio-diagnosis are required for improving the diagnostic rates of especially cerebral lesions.

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