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Original Research Article

Study Computed Tomography Evaluation of Patients with First Onset Seizure: A Cross-sectional Analysis

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Abstract

Background: A crucial part of diagnosing, treating, and managing seizures with a first onset is structural neuroimaging. Imaging is done to determine the cause, help with prognosis, and identify individuals who would benefit from a change in medication or surgical treatment. MRI is regarded as the preferred imaging technique. Where MRI is less practicable, CT is the preferred diagnostic imaging test for patients with first-onset seizures and seizures in resource-constrained areas. Aim of this study to the spectrum of Computed Tomography findings in patients with first onset seizure.

Methods: Cranial CT scans were performed on a cross-section of patients with first-onset seizures who visited the radiology department of Nalanda Medical College and Hospital in Patna, Bihar, between May 2025 and November 2025. Chart review was used to gather the data, and SPSS version 25 and Microsoft Excel 2022 were used for analysis.

Results: Seventy-three patients with first onset seizures, 44 males and 29 females with a mean age of 30.1 years, had CT done during the specified period. Thirty-one patients (42.5 %) had normal CT results and forty-two patients (57.5 %) had abnormal results. Neurocysticercosis (NCC) (23.81%), calcified granuloma (21.43 %) and cerebral atrophy (11.9 %) were the most common abnormality. Generalized seizures were seen in 46 patients (63.0%) patients and remaining 27 patients (37 %) had partial seizures. In total 46 cases of generalized seizures, normal CT findings were found in 26 (83.9%) cases and abnormal CT findings were found in 20 (47.6%) of cases. In contrast, among 27 cases of partial seizures, abnormal CT findings were found in 22 (52.4%) of cases.

Conclusion: Abnormal CT scans were More Commonly seen in patients with Partial Seizures.

Keywords: First Onset Seizure, Computed Tomography (CT).

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Introduction

Any clinical occurrence brought on by an aberrant electrical discharge in the brain is referred to as a seizure.[1] The phrase "seizure" and epilepsy must be properly differentiated from one another. A chronic underlying mechanism causes repeated seizures in people with epilepsy. [2]

The total prevalence rate of epilepsy in India is 5.59 per 1,000 people, according to a meta-analysis of published and unpublished studies. There are no statistically significant differences in rates between men and women or between urban and rural areas. [3] In addition to being the initial sign of epilepsy, seizures can also be a sign of a brain tumor, infection, stroke, or congenital condition that needs particular care.[4] When evaluating patients with epilepsy, neuroimaging is crucial. Because it can identify tiny lesions like mesial temporal sclerosis, cortical dysplasias, small tumors, etc. that are missed by traditional MR or CT scans of the brain, magnetic resonance imaging, particularly the 3 Tesla MRI, is the preferred imaging modality.

Finding these lesions frequently aids in more successful treatment of refractory epilepsies. But because MR is expensive and unavailable in many areas of the nation, CT must be used as a backup that is both helpful for initial research and for

emergency scenarios.[5] CT can accurately detect hemorrhage, infarctions, gross malformations, ventricular system pathologies and lesions with underlying calcifications. In older children and adults, CT is technique of choice in the perioperative state because it can rapidly detect hemorrhage, hydrocephalus and major structural changes.[6]

In the Emergency department, computed tomography (CT) is often easily available and therefore preferred over magnetic resonance imaging (MRI). MRI is the preferred imaging method because it has greater sensitivity for detecting abnormalities than CT. However, patients with acute seizures initially should undergo CT because it more accurately detects acute bleeding and is reasonably sensitive in detecting other abnormalities.[7] Previous studies suggest that emergency brain CT leads to an acute change in management in 1.8-17% of cases.[8]

Material and Methods

From May 2025 to November 2025, the Department of Radiology at Nalanda Medical College and Hospital in Patna, Bihar, carried out this cross-sectional descriptive study. Cochran's formula was used to determine the sample size, which included 73 patients with first-onset seizures who had brain CT scans. We reviewed axial, coronal, and sagittal reformats. Seizures were classified as either generalized or partial, and patients were grouped by age: ≤20, 21–40, 41–60, and >60 years. Informed consent was obtained prior to scanning.

Data were edited, coded, and entered into Microsoft Excel and SPSS (v25/26). Descriptive statistics (frequency, percentage) were used, and chi-square test assessed associations between seizure type and CT abnormalities, with significance set at $p \leq 0.05$.

Results

Of the 73 patients, 29 (39.72%) were female and 44 (60.28%) were male. They ranged in age from one year to seventy-eight years. The average age was 30.1 years (SD±20.2). Patients aged ≥60 years had the lowest percentage of patients (10.9%), while those aged ≤20 years had the highest rate (42.5%). There were 42 (57.53%) abnormal CT scans and 31 (42.47%) normal CT scans overall.

Table 1: Spectrum of Abnormal CT Findings

CT Findings	No. of cases	Percentage
NCC	10	23.81%
Calcified granuloma	9	21.43%
Corticalatrophy	5	11.90%
TB	3	7.14%
CVA	3	7.14%
Malignancy	3	7.14%
Arachnoid cyst	2	4.76%
Arteriovenous malformation	1	2.38%
Gliotic changes	1	2.38%
Cerebral Abscess	1	2.38%
Cerebral venous sinus thrombosis	1	2.38%
Fahr's Disease	1	2.38%
Hydrocephalus	1	2.38%
Schizencephaly	1	2.38%
TOTAL	42	100%

Table 2: Relation between CT Findings and Type of Seizure

CT Findings	Seizure Patterns	
	Generalized N (% within CT Finding)	Partial N (% within CT finding)
Normal	26 (83.9%)	5(16.1%)
NCC	4(40.0%)	6(60%)
Calcified granuloma	4(44.4%)	5(55.6%)
TB	1(33.3%)	2(66.7%)
CVA	1(33.3%)	2(66.7%)
Cortical Atrophy	3(60%)	2(40.0%)
Malignancy	1(33.3%)	2(66.7%)
Arachnoid cyst	1(50.0%)	1(50.0%)
Schizencephaly	0(0.0)	1(100%)
Hydrocephalus	0(0.0)	1(100%)

Gliotic change	1(100%)	0(0)
Fahr's disease	1(100%)	0(0.0)
Cerebral venous sinus thrombosis	1(100%)	0(0.0)
Cerebral Abscess	1(100%)	0(0.0)
Arteriovenous malformation	1(100%)	0(0.0)
TOTAL	46	27

Table 3: Relation Between Various CT Findings and there Distribution Percentage in Various Age Group

CT Findings	Age groups				
	≤20 years N(%)	21-40 years N (%)	41-60 years N(%)	>60 Years N(%)	Total N(%)
Normal	15(48.4%)	13 (61.9%)	3(23.1%)	0(0.0)	31(42.5%)
NCC	6(19.4%)	2(9.5%)	2(15.4%)	0(0.0)	10 (13.7%)
Calcified granuloma	2(6.5%)	5(23.8%)	2(15.4%)	0(0.0)	9(12.3%)
TB	1(3.2%)	1(4.8%)	1(7.7%)	0(0.0)	3(4.1%)
Cortical Atrophy	1(3.2%)	0(0.0)	1(7.7%)	3(37.5%)	5(6.8%)
CVA	0(0.0)	0(0.0)	0(0.0)	3(37.5%)	3(4.1%)
Malignancy	0(0.0)	0(0.0)	2(15.4%)	1(12.5%)	3(4.1%)
Arachnoid cyst	2(6.5%)	0(0.0)	0(0.0)	0(0.0)	2(2.7%)
Schizencephaly	1(3.2%)	0(0.0)	0(0.0)	0(0.0)	1(1.4%)
Hydrocephalus	1(3.2%)	0(0.0)	0(0.0)	0(0.0)	1(1.4%)
Glioticchange	0(0.0)	0(0.0)	0(0.0)	1(12.5%)	1(1.4%)
Fahr's disease	0(0.0)	0(0.0)	1(7.7%)	0(0.0)	1(1.4%)
Cerebral venous sinus thrombosis	1(3.2%)	0(0.0)	0(0.0)	0(0.0)	1(1.4%)
Cerebral Abscess	0(0.0)	0(0.0)	1(7.7%)	0(0.0)	1(1.4%)
Arteriovenous malformation	1(3.2%)	0(0.0)	0(0.0)	0(0.0)	1(1.4%)
Total	31	21	13	8	73

Table 4: Relation between Seizure Type and the Rate of Abnormal/Normal CT Findings

Seizure Type	Normal CT N(%)	Abnormal CTN(%)	TotalN(%)	P value
Generalized Seizure	26 (83.9%)	20 (47.6%)	46 (63.0%)	0.002
Partial Seizure	5(16.1%)	22 (52.4%)	27(37%)	
Total	31(100%)	42(100%)	73(100%)	

Table 4 shows the resulting p value of <0.005 suggest that the rate of abnormality is significantly higher for partial seizure 52.4 % as compared to only 16.1 % for generalized seizure. Likewise, the normal rate is significantly higher for generalized seizure (83.9 %) as compared to only 26.47 % for partial seizure.

Discussion

In our study, most seizures occurred in patients ≤20 years (31 cases, 42.5%), followed by 21–40 years (21 cases, 28.8%), 41–60 years (13 cases, 17.8%), and >60 years (8 cases, 10.9%). Thus, the majority were below 20 years, similar to Lavados J et al., who also reported that first seizures commonly occur before 15 years of age. [9]

In our study, CT scans were abnormal in 42 patients (57.5%) and normal in 31 (42.5%). Similar findings were reported by Smith et al. (56.8%)[10] and Arruda et al. (44.3%).[11] Lower rates were observed by Yang et al. (33%)[12] Pathan S et al. (33.3%)[13], Kotisaaari et al. (12%)[14,] and Zarmehri B et al. (27%).[15]These variations in CT scan abnormalities may be explained by differences in patient selection, sample size, geographic location, and scanning techniques. In our study, 47.5% of patients with generalized seizures had abnormal CT findings, comparable to Schoenenberger et al., who reported 34%.[16]

In our study, CT abnormalities were more frequent in partial seizures, while 83.9% of generalized seizures had normal scans. Similarly, Ashraf M et al. reported normal CTs in 77.4% of generalized seizures and abnormalities in 52.4% of partial seizures.[17] McAbee GN et al. found 95.1% normal CT among generalized seizures.[18]

In our study, the most common abnormalities were neurocysticercosis (23.8% of abnormal, 13.6% of all CT findings), calcified granuloma, and tuberculoma. Among patients <20 years, NCC was most frequent (19.4%), consistent with Garvey et al.[19], Nair et al.[20], Poudel. et al.[21], Ojha, et al.[22] and Gauchan et al.[23] which was 1.0%,10.10%,12.1%,2.4% and16% respectively.

In our study, calcified granuloma was the most common CT finding in ages 21–40 and the second most common overall (12.3%), similar to Acharya

et al.[24] As calcified granuloma is sequalae of neurocysticercosis and neurocysticercosis is already high in this region so number of calcified granulomata might be also high. In our study, 3 patients (4.1%) with known tuberculosis presented with first-onset seizures, and CT showed tuberculomas with rim enhancement and edema. Similar findings were reported by Weisberg et al.[25], Acharya S et al. (4.1%)[24], and Wadia et al., who also found tuberculoma as a cause of seizures in endemic regions.[26]

In our study, 3 patients >60 years with seizures had CVA. Similarly, Forsgren et al.[27] and Myint PK et al. [28] reported stroke as a common cause of first-onset seizures in the elderly.

Likewise, hydrocephalus was seen in 1.3 % of abnormal CT result which is similar to other studies done by Ashraf M et al. [17] and Poudel. P et al.[21]

In our study, one first-seizure case had gliotic changes post-hemorrhagic stroke, consistent with Myint PK et al., who linked seizures to gliotic scarring and altered neuronal excitability.[28]

In our study, 3 patients with first seizures had primary brain malignancies, consistent with Maschio M et al., who noted seizures as a presenting symptom of brain tumors.[29]

In our study, one case of congenital schizencephaly presented with seizure, aligning with Denis D. et al., who reported seizures in over one-third of 30 cases.[30]

Two patients in our study with first seizures had arachnoid cysts, consistent with Arroyo S et al., who reported similar findings.[31]

In our study, one patient with cerebral venous sinus thrombosis presented with a first seizure, supporting findings by Kalita J et al. [32], who reported seizures in a significant proportion of such cases. In our study, one patient with a cerebral abscess presented with first-onset seizure, consistent with Kilpatrick C, who reported seizures as a presenting feature.[33]

In our study, one patient with Fahr's disease presented with a first seizure, consistent with Acharya S. et al., who also reported seizures in Fahr's disease.[24]

Conclusion

CT scans were abnormal in 57.5 % of the total cases. Generalized seizures were the most common. Abnormal scan was reported significantly high in the patients with partial seizure.

The highest incidence of seizure was found in ≤20 years age group. The most common CT scan finding in ≤20 years age group, 21-40 years age group, 41-60 years age group was found to be normal CT scan study. Most common abnormal CT finding in below 20 years age group was NCC followed by Calcified granuloma and tuberculoma. Most common abnormal CT finding in 21-40 years age group was found to be NCC followed by calcified granuloma. Most common abnormal finding in 41-60 years age group were NCC, Calcified granuloma and malignancy. Most common abnormal CT finding in >60 years was CVA.

With this information the study hopes to empower neurophysians and neurosurgeons alike, to make prompt decision regarding diagnosis and treatment of the seizure. This information is also essential to guide them to determine which type of seizure requires CT scans and may produce positive CT scan findings. Therefore, unnecessary exposure to patient could be lowered.

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