



## COMPREHENSIVE ANALYSIS OF IMAGING FINDINGS IN PATIENTS PRESENTING WITH SEIZURES

### Radio-Diagnosis

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### ABSTRACT

**Background:** Seizure disorders pose a significant challenge in neurology, impacting patient quality of life through sudden and unpredictable episodes. Accurate diagnosis through imaging is crucial for effective management. This study focuses on analyzing imaging findings in patients presenting with seizures to enhance diagnostic precision and guide treatment. **Aims & Objectives:** The study aimed to identify and analyze the most common imaging abnormalities in seizure patients, differentiating between focal and generalized seizures to improve diagnostic accuracy and patient outcomes. **Methods:** An observational cross-sectional study was conducted over 18 months at the Department of Radiodiagnosis, Heritage Medical College, Varanasi, involving 120 patients with seizures. Data were collected using MRI and CT scans. The imaging findings were analyzed using SPSS version 25, and results were presented as frequencies and percentages. **Results:** The study found that 42.5% of patients were under 10 years old, with a slight male predominance (53.3%). Focal seizures were more common (55%) than generalized seizures (45%). Imaging revealed neurocysticercosis in 21% of focal seizures and normal scans in 30% of generalized seizures. Hypoxic-ischemic encephalopathy (HIE) was the most common finding in generalized seizures (17%). **Conclusions:** The study highlights the importance of imaging in distinguishing between focal and generalized seizures. Neurocysticercosis was the most common abnormality in focal seizures, while normal scans were prevalent in generalized seizures. These findings underscore the need for tailored diagnostic and treatment approaches based on specific imaging results.

### KEYWORDS

Seizure disorders; Diagnostic imaging; Neurocysticercosis; Hypoxic-ischemic encephalopathy; Focal seizures.

### INTRODUCTION

Seizure disorders represent a significant and multifaceted challenge in neurology, often leading to sudden, unpredictable episodes that can drastically affect an individual's quality of life.<sup>1,2</sup> These episodes, resulting from abnormal electrical activity in the brain, can manifest in various forms, from brief moments of altered consciousness to prolonged convulsions.<sup>3</sup> Understanding the underlying causes of seizures is crucial for determining the most effective treatment strategies, and imaging studies play a pivotal role in this process. Among the available imaging modalities, Magnetic Resonance Imaging (MRI) has become a cornerstone in the evaluation of patients presenting with seizures due to its ability to provide detailed images of brain structures and detect subtle abnormalities.<sup>4,5</sup>

In clinical practice, MRI is frequently employed to identify the structural and pathological changes in the brain that might be responsible for seizure activity. These changes can include congenital malformations, brain tumors, vascular anomalies, and evidence of prior brain injuries or infections.<sup>6</sup> Detecting these abnormalities is essential not only for diagnosing the cause of seizures but also for guiding treatment decisions, whether they involve medical management, surgical intervention, or other therapeutic approaches.<sup>7,8</sup> The comprehensive analysis of imaging findings in seizure patients is vital for several reasons. First, it allows clinicians to classify seizures more accurately based on the underlying pathology, which can significantly influence treatment outcomes. For instance, patients with seizures caused by structural abnormalities such as hippocampal sclerosis or focal cortical dysplasia may benefit from surgical interventions, whereas those with normal MRI findings might be managed differently. Second, the identification of specific patterns of brain abnormalities in seizure patients can provide insights into the pathophysiology of seizure disorders, contributing to a broader understanding of these conditions.<sup>5,6,7</sup>

This study aims to conduct a comprehensive analysis of MRI findings in patients presenting with seizures, with the goal of identifying the most common imaging abnormalities associated with seizure activity. By systematically examining the imaging data from a diverse patient population, this research seeks to enhance the diagnostic accuracy and improve the management of seizure disorders. The findings of this study are expected to have significant implications for clinical practice, particularly in the development of more personalized treatment protocols that are tailored to the specific imaging findings of

each patient. Through this analysis, the study hopes to contribute to the ongoing efforts to improve the care and outcomes for individuals affected by seizure disorders.

### MATERIALS & METHODS

This study is an observational cross-sectional study conducted at the Department of Radiodiagnosis, Heritage Medical College, Varanasi, over a period of 18 months from November 2022 to May 2024. The study aims to analyze imaging findings and assess the utility of advanced MRI sequences in patients presenting with seizures. The study population includes patients of any age who presented with complaints of seizures and were referred for MRI, CT, or craniosonogram. The sample size was determined using Fisher's formula, with a calculated sample size of 120 patients.

The inclusion criteria for this study were patients of any age presenting with seizures who were referred for neuroimaging. Exclusion criteria included postoperative patients, individuals with contraindications to MRI (such as those with pacemakers, metallic implants, or severe claustrophobia), contraindications to CT (including pregnancy), and those with contraindications to contrast studies, such as a positive history of contrast reaction or deranged renal profiles. Additionally, patients who denied consent for the study were excluded.

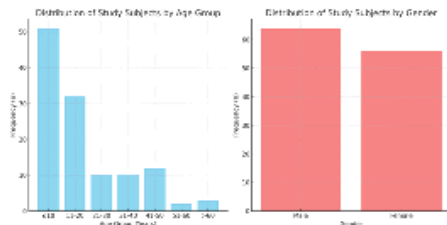
For MRI assessments, all patients were screened for ferromagnetic objects and other contraindications before entering the MRI scanning room. MRI scans were performed using a Philips Achieva dStream 3.0 T machine. Standard MRI sequences, such as T1-weighted and T2-weighted sequences, were acquired alongside advanced sequences like Diffusion Weighted Imaging (DWI), Susceptibility Weighted Imaging (SWI), and Magnetic Resonance Spectroscopy (MRS). Contrast-enhanced MRI was employed in cases where a tumor or vascular abnormality was suspected. CT scans were performed using the Philips MX 16-Slice CT scanner, following standard head protocol.

Data collection was done systematically, with informed consent obtained from all patients in their preferred language. Data was then entered into a Microsoft Excel sheet and analyzed using SPSS version 25. The results were expressed in terms of number and percentage, with appropriate parametric or non-parametric statistical tests applied based on the distribution of variables.

**RESULTS**

**Table 1** Distribution of Study Subjects by Age Group and Gender

DEMOGRAPHIC CHARACTERISTIC	FREQUENCY (N)	PERCENTAGE (%)
AGE GROUP (YEARS)		
≤10	51	42.5%
11-20	32	26.7%
21-30	10	8.3%
31-40	10	8.3%
41-50	12	10.0%
51-60	2	1.7%
>60	3	2.5%
Total	120	100%
GENDER		
Male	64	53.3%
Female	56	46.7%
Total	120	100%



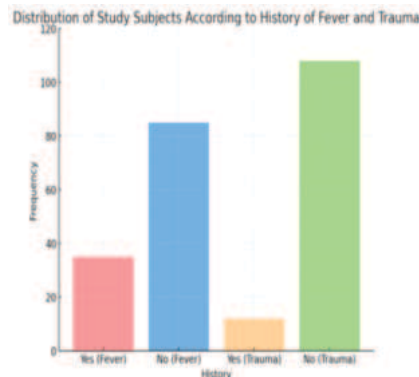
**Table 2** Distribution of Seizure Types Among Study Subjects

TYPE OF SEIZURE	FREQUENCY (N)	PERCENTAGE (%)
Focal	66	55.0%
Generalized	54	45.0%
Total	120	100%



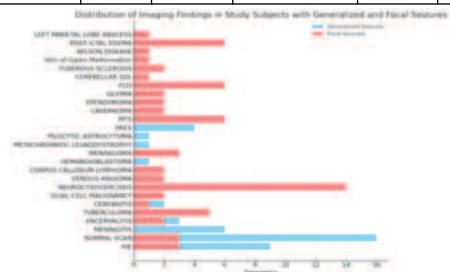
**Table 3** Distribution of Study Subjects According to History of Fever and Trauma

HISTORY OF FEVER	FREQUENCY (N)	PERCENTAGE (%)
Yes	35	29.2%
No	85	70.8%
Total	120	100%
HISTORY OF TRAUMA		
Yes	12	10.0%
No	108	90.0%
Total	120	100%



**Table 4** Distribution of Imaging Findings in Study Subjects with Generalized and Focal Seizures

IMAGING FINDINGS	FREQUENCY (N)	PERCENTAGE (%)	IMAGING FINDINGS	FREQUENCY (N)	PERCENTAGE (%)
GENERALIZED SEIZURES			FOCAL SEIZURES		
HIE	9	17%	Neurocysticercosis	14	21
Normal scan	16	30%	MTS	6	9
Meningitis	6	10%	Meningioma	3	4.5
Encephalitis	3	5%	Glial cell malignancy	2	3
Tuberculoma	3	5%	Cavernoma	2	3
Cerebritis	2	4%	Ependymoma	2	3
Glial cell malignancy	2	4%	Encephalitis	2	3
Neurocysticercosis	2	4%	Corpus callosum lymphoma	2	3
Venous angioma	2	4%	Glioma	2	3
Corpus callosum lymphoma	1	2%	FCD	6	9
Hemangioblastoma	1	2%	HIE	3	5
Meningioma	1	2%	Cerebritis	1	1.5
Metachromatic leukodystrophy	1	2%	Cerebellar sol	1	1
Pilocytic astrocytoma	1	2%	Tuberculoma	5	8
PRES	4	7%	Tuberous sclerosis	2	3
Total	54	100%	Venous angioma	2	3
			Vein of Galen Malformation	1	1
			Wilson disease	1	1
			Post ictal edema	6	9
			Left parietal lobe abscess	1	1
			Normal scan	3	5
			Total	66	100



**DISCUSSION**

In our study, we found that the majority of subjects were children aged 10 years or younger, accounting for 42.5% of the study population. The age group 11-20 years followed, representing 26.7% of the participants. The older age groups (21 years and above) constituted smaller proportions, with only 2.5% of the subjects being over 60 years. Gender distribution showed a slight male predominance, with 53.3% males and 46.7% females. The age distribution and gender ratio observed in our study align closely with the findings of McHugh et al.9 (2008), where a significant proportion of seizure patients were under 20 years of age, with 55% being male. This supports the notion that younger individuals, particularly males, are more prone to seizure disorders. However, the study by Orozco-Hernández et al.10 (2019) in a Colombian population found a slightly higher prevalence of older patients (21-40 years) compared to our study, which may reflect demographic or environmental differences between the study populations.

In our study, we found that focal seizures were more prevalent among the study subjects, accounting for 55% of the cases, while generalized seizures were observed in 45% of the participants. This finding is consistent with the findings of Fordington et al.11 (2020), who reported a similar distribution with focal seizures occurring in 60% of their cohort. On the other hand, the study by Singh et al. (2016) reported a slightly lower prevalence of focal seizures (50%) in their patient population, which may be attributed to differences in diagnostic criteria or the inclusion of specific subtypes of epilepsy in their study.

In our study, we found that 29.2% of the subjects had a history of fever, while 10% had a history of trauma. The majority of the participants did not report any history of fever (70.8%) or trauma (90%). However, Bautovich et al.5 (2012) in their study on pediatric seizures found that fever was a significant contributing factor in a subset of seizure cases, particularly in younger children. This aligns with our findings where a notable proportion (29.2%) had a history of fever. In contrast, the history of trauma was not extensively explored in their study, limiting direct comparison. However, the relevance of trauma as a risk factor for seizures was highlighted by Fordington et al. 11 (2020), who identified trauma as a contributing factor in a smaller percentage of their cohort, consistent with the 10% observed in our study.

Our study revealed that among subjects with generalized seizures, 30% (n=16) had normal scans, while 17% (n=9) had hypoxic-ischemic encephalopathy (HIE). Other notable findings included meningitis (10%, n=6), encephalitis (5%, n=3), and tuberculoma (5%, n=3). For subjects with focal seizures, neurocysticercosis (NCC) was the most common finding, observed in 21% (n=14) of cases. Mesial temporal sclerosis (MTS) was found in 9% (n=6) of cases, while meningitis accounted for 4.5% (n=3). Other findings such as glial cell malignancy and cavernoma were less common, each present in 3% (n=2) of cases. The imaging findings in this study show some differences compared to earlier research. Kushwah et al.12 (2015) observed a higher prevalence of neurocysticercosis (30%, n=45) in patients with focal seizures, compared to 21% (n=14) found in our study. This discrepancy may be due to differences in study populations or diagnostic criteria. Additionally, Singh et al.6 (2016) reported a lower incidence of normal scans in generalized seizures (20%, n=30) compared to 30% (n=16) in our study.

## CONCLUSION

Our study found that the majority of study subjects were children aged 10 years or younger, with a slight male predominance. Focal seizures were more prevalent than generalized seizures, and a significant proportion of patients had no history of fever or trauma. Imaging findings revealed that neurocysticercosis was the most common abnormality in focal seizures, while a normal scan was the most frequent finding in generalized seizures. Hypoxic-ischemic encephalopathy (HIE) was the most common pathological finding in generalized seizures. The study underscores the importance of advanced imaging techniques in accurately diagnosing seizure-related abnormalities, particularly in differentiating between focal and generalized seizures. These findings highlight the need for a tailored approach to the diagnosis and management of seizure disorders, taking into account patient demographics and specific imaging findings to optimize treatment outcomes.

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