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Original Research Article

MRI Brain Findings in Pediatric Patients Presenting With Fits

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Abstract: ***Objective:*** To determine the frequency of MRI brain findings in pediatric patients presenting with fits. Study design: Cross Sectional Study Place: Radiology department, Lady Reading Hospital (LRH) Peshawar. Duration: July 2025 to September 2025. ***Methodology***: Total 86 children between the ages of one and sixteen years who had fits were included. Children having a history of head trauma, metallic implants, or non-epileptic seizures were excluded. Every research participant had an MRI of their brain. Siemens 1.5 Tesla MRI was used for all imaging. The following scanning was part of the protocol: Repeated sagittal T1weighted spin echo (SE). Fast spin echo weighted by axial T2 (FSE). FLAIR stands for axial rapid fluid attenuated inversion recovery. weighted echo planar with axial diffusion. PD that is axial. GRE axial. The results of the MRI were assessed as follows: Widening of the cerebral sulci, ventriculomegaly, increased subarachnoid spaces, and localized atrophy are all signs of cerebral atrophy. ***Results***: With a range of 1 to 16 years, the study's mean age was 7.25 ± 4.56 years. Of the 86 patients, 29 (33.72%) were female and 57 (66.28%) were male, resulting in a male to female ratio of 1.9:1. The average weight was 28.09 ± 9.53 kg. MRI of pediatric patients who presented with fits revealed that 10.47% had cerebral atrophy, 5.81% had encephalomalacia, 4.65% had ventricular enlargement, 3.49% had mesial temporal sclerosis, and 2.33% had Strug Weber syndrome. ***Conclusion:*** Our research emphasizes how important MRI is for diagnosing pediatric epilepsy. Common findings were mesial temporal sclerosis, encephalomalacia, and cerebral atrophy.

Keywords: Seizure, MRI, Cerebral atrophy.

INTRODUCTION

An aberrant, spontaneous, and excessive neuronal discharge is the cause of seizures, a disorder of the cerebral cortex. Seizures fall into two categories: generalized and focal.[1] There are other forms of seizures. It is a significant public health issue and a long-term, severe neurological issue.[2] Children who have been diagnosed with seizures face many difficulties.[3] Before diagnosing epilepsy, it's crucial to rule out other possible causes of a patient's seizures, such as tumors, traumatic brain damage, bleeding, infection, and genetic disorders.[4]

Since they can determine the origin of seizure events, electroencephalography and neuroimaging are crucial in the initial evaluation of patients with seizures. The fact that these methods are noninvasive and spare patients from ionizing radiation makes them beneficial.[5] FS can be accurately diagnosed using a number of medical procedures and methods. A powerful magnetic field, radio waves, and a computer are used in magnetic resonance imaging (MRI) of the brain to provide anatomical features of the brain that are significantly more valuable and provide more sufficient information than other imaging technologies. The traditional textbook regimen recommended a single first-line antiepileptic medication as the optimum way of treatment for complicated febrile seizures. Patients with complicated febrile seizures frequently require both the first and second lines of antiepileptic medications (AEDs) to manage their seizures.[6] Additionally, it has been noted that most children with CFS need numerous AEDs to control their seizures, even though they occasionally require ICU care to manage their fever.[7] Therefore, early diagnosis of complicated febrile seizures is necessary for the best possible care. Because of its versatility, absence of radiation, anatomic resolution, and ability to characterize pathologic processes, MRI is better than other methods.[8]

Because of its great sensitivity and capacity to represent neuroanatomy, magnetic resonance imaging (MRI) is the preferred supplementary modality to electroencephalograms (EEG). It is essential for illustrating the location, morphology, and degree of cortical involvement.[9] A thorough clinical and radiological assessment is necessary to identify the underlying structural abnormalities producing seizures. In addition to making a diagnosis, MRI can be used to assess children who have seizures, help with treatment planning, and determine the patient's prognosis.[9] For children with epilepsy to be evaluated and managed effectively, neuroimaging—particularly MRI—is essential. In addition to determining whether surgical resection is necessary, it aids in the localization and characterization of structural abnormalities such as tumors, cortical malformations, neurocutaneous disorders, and hippocampus sclerosis.[8] According to one study, MRI results showed that cerebral atrophy was found in 11.56% of pediatric patients who presented with fits, encephalomalacia in 6.94%, ventricular enlargement in 6.34%, mesial temporal sclerosis in 5.7%, and Strug Weber syndrome in 4.5%.[10]

Seizures in children are a serious emergency and a frequent reason for hospitalization, with high rates of morbidity and fatality. There aren't many research specifically focused on neuroimaging in seizures from developing nations like India and Pakistan. The results of this study will help us better understand the MRI brain findings in juvenile patients with seizures, enabling us to diagnose them accurately, treat them effectively, and enhance their quality of life. The purpose of this study is to evaluate different structural neurological abnormalities found by MRI in children who have seizures. This could result in the creation of individualized treatment programs that guarantee that interventions are customized to the particular neurological abnormalities, improving the overall management of pediatric epilepsy.

METHODOLOGY

With approval from the ethical review committee, this descriptive cross-sectional study was carried out in the Radiology department of Lady Reading Hospital (LRH) Peshawar from July 2025 to September 2025. Using the WHO sample size calculator and the following presumptions, the sample size was calculated to be 86. MRI results in children who have fits, such as Strug Weber syndrome in 4.5% of cases.[10] The confidence level is 95%, while the margin of error is 4.4%. Children between the ages of 1-16 years who had fits (defined as patients exhibiting all of the following visible symptoms, such as convulsions, altered consciousness, or aberrant movements). A clinical evaluation that met any one of the following criteria at least two unprovoked seizures that occurred more than 24 hours apart, one unprovoked seizure, and a high risk (≥60%) of recurrence and epilepsy syndrome diagnosis was used to make the diagnosis. Children having a history of head trauma, metallic implants, or non-epileptic seizures were excluded.

Every participant in the study gave their informed consent. Data was collected at baseline. Every research participant had an MRI of their brain. Siemens 1.5 Tesla MRI was used for all imaging. The following scanning was part of the protocol: Repeated sagittal T1weighted spin echo (SE). Fast spin echo weighted by axial T2 (FSE). FLAIR stands for axial rapid fluid attenuated inversion recovery. weighted echo planar with axial diffusion. PD that is axial. GRE axial. White matter diseases, neurocutaneous disorders, tumors and metastases, and presumed inflammation are all treated with gadolinium enhancement. In order to prevent motion artifacts and to lessen anxiety, sedation was administered as needed. The lowest dose of hypnotics or sedatives was preferred. Children who needed long-duration scans or who had a history of unsuccessful sedation were the ones who were selected for general anesthesia (GA). The results of the MRI were assessed as follows: Widening of the cerebral sulci, ventriculomegaly, increased subarachnoid spaces, and localized atrophy are all signs of cerebral atrophy. Symptoms of encephalomalacia include well-defined cystic/gliotic alterations, CSF-like signal intensity, and focal or multifocal areas of volume loss. Periventricular T2/flair hyperintensity, ballooning of the third ventricle, and ventricles enlarged proportionally to the cortical sulci are all signs of ventricular enlargement. Mesial temporal sclerosis is characterized by the following symptoms: blurring of normal internal hippocampal structure, hyperintensity in the hippocampus on T2-weighted images, and volume loss or shrinkage of the afflicted hippocampus. Gyriform enhancement (post-contrast T1) over the cerebral cortex is one of the symptoms of Strug Weber syndrome.

Every patient's information was recorded using a pre-made structured proforma. Under the supervision of a radiologist with at least five years of post-fellowship experience, the researcher personally gathered all patient data. The Statistical Package for the Social Sciences (SPSS) version 20 (IBM SPSS Statistics, Armonk, NY, USA) was used for data entry and statistical analysis. For numerical data such as age, weight, and symptom duration, the mean + SD or median (IQR) were computed. For categorical information such as gender, MRI results, presenting symptoms, and family history, frequencies and percentages were computed.

RESULTS

With a range of 1 to 16 years, the study's mean age was 7.25 ± 4.56 years. Of the 86 patients, 29 (33.72%) were female and 57 (66.28%) were male, resulting in a male to female ratio of 1.9:1 (Figure I). The distribution of patients with additional confounding variables is shown in Table I. The average weight was 28.09 ± 9.53 kg. Table II displays descriptive statistics.

According to Table III, an MRI of pediatric patients who presented with fits revealed that 10.47% had cerebral atrophy, 5.81% had encephalomalacia, 4.65% had ventricular enlargement, 3.49% had mesial temporal sclerosis, and 2.33% had Strug Weber syndrome.

Table I: Distribution of different variables (n=86)

		Frequency	%age
Age (years)	1-8	46	53.49
	9-16	40	46.51
Weight (kg)	≤20	39	45.35
	>20	47	54.65
Presenting symptoms	Convulsions	51	59.30
	Altered Consciousness	19	22.09
	Abnormal Movements	17	19.77
Family history	Yes	23	26.74
	No	63	73.26

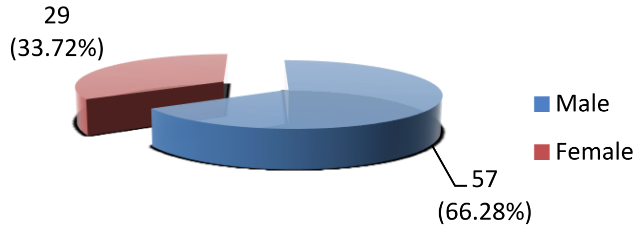

Figure I: Gender distribution (n=86).

Table II: Descriptive statistics

	Mean ± SD
Age	7.25 ± 4.56
Weight (kg)	28.09 ± 9.53
Duration of symptoms (min)	32.96 ± 19.43

Table-III: MRI brain findings in pediatric patients presenting with fits (n=86).

MRI brain findings	No. of Patients	%age
Cerebral atrophy	09	10.47
Encephalomalacia	05	5.81
Ventricular enlargement	04	4.65
Mesial temporal sclerosis	03	3.49
Strug weber syndrome	02	2.33

DISCUSSION

The mean age of the patients in this study was 7.25 ± 4.56 years, which is similar to the mean age of 6.2 years reported by Mundhe AS et al.11 The age range of 9–12 years old had the lowest frequency. According to numerous additional research, such as Ramya et al., the prevalence of seizures is high in the 1–5 age group and low in the 9–12 age group.4. Our findings were consistent with a study by Chen CY et al12, which found that seizures start between the ages of one and six. According to a study by Metsarnata P et al., the average age at which seizures began was 4.5 3.10 years. Overall incidences for all ages in the SIRE study were lower than the 51–74/100,000 reported in earlier European and US studies, with the elderly group being particularly affected. Infants less than one year had a slightly greater age-specific incidence, according to the SIRE study. The age-specific prevalence of seizures in developing nations was in line with our findings.13,14

Fits are more likely in men than in women, according to the current study, which supports findings from other research.12-14 According to one study15, of the 26 patients assessed, 11 (48.7%) were men and 15 (51.3%) were women. There were more female patients than male patients, indicating that seizure disorders were more common in women than in men (female: male = 1.36: 1). Our findings conflicted with studies by Sidenvall et al16, where the male to female ratio was 1.1:4, and Metsarnata P et al17, where the female to male ratio was 1.08:1. Although the exact cause of this is unknown, it is impossible to rule out the potential of some hereditary involvement; this calls for more investigation. Convulsions, altered consciousness, and changed movements were the most frequent manifestations of generalized seizures in our patients. According to an Engel textbook, these are rather typical observations in generalized tonic-clonic seizures.18

There aren't many local research on neuroimaging results in Pakistani children with epilepsy. Compared to studies by Gul P et al.19 (55%), Ali A et al.20 (55.7%), and Khandediya OB et al.21 (62%), the current study's 41.86% of patients exhibited aberrant MRI findings. The most common anomaly seen in 10.47% of patients was cerebral atrophy, which was greater than the findings of Dirik et al et al.22 (4.55%) but closer to the findings of the studies conducted by Amirsalari et al.23 (10%) and Ali A et al.20 (9.91%). The time gaps between the MRI scan and the epilepsy diagnosis could be the cause of these discrepancies.

Encephalomalacia, which affected 5.81% of individuals, was the second most frequent finding. The literature has reported outcomes that are nearly identical.10,13 The percentage of patients with ventricular enlargement was 4.65%, which was less than the percentage reported in research by Dura T et al24 and Kalnin AJ et al.25 Although Jackson DC et al.26 discovered significant lateral ventricular enlargement in children with new-onset idiopathic generalized epilepsy as compared to healthy controls, no substantial research was done on the relationship between ventricular size and epilepsy.

3.49% of patients had mesial temporal sclerosis, which was higher than that documented in other studies27,28 but significantly lower than Kalnin AJ et al.25 This could be because of stringent study selection criteria or MRI obtained later in the condition. Due to disparate demographic data, the additional MRI abnormalities revealed in this study were in different proportions and cannot be compared to those found in other investigations. Although the majority of studies also found high ratios of meningitis, encephalitis, and tuberculoma, the current study only looked at structural abnormalities that might or might not be corrected by surgery or medication, and did not take into account seizures resulting from infectious etiology.

Arachnoid cysts, choroid plexus cysts, septum pellucidum, and magna cisterna cysts were among the few neuroimaging findings in the current investigation that were non-specific with regard to their etiological link with epilepsy, as established by Samia P et al.27 Xuan NM et al28 came to the conclusion that arachnoid cysts are frequently an unintentional finding in epileptic patients and do not indicate the site of seizure focus. Although corpus callosum dysgenesis was observed in 1.73% of patients, research has shown that while corpus callosum abnormalities do not directly cause seizure initiation, 23 epileptic patients have additional maldevelopmental abnormalities. However, callosotomy helped reduce seizures in some drug-resistant/refractory individuals, most likely because it reduced the propagation of seizures through the corpus callosum.28

The fact that MRI imaging was completed within 72 hours of the seizure episode, that comprehensive data was collected, and that bias was reduced by consulting two radiologists are only a few of the features of our study that provide the article a distinct advantage. Additionally, we looked at focal seizures (FS), a frequent juvenile illness, in our study because no systematic radiological evaluation has been done before. Focused and persistent febrile seizures are associated with MRI abnormalities, according to the study that examined the brain structure in the initial FS. People with severe febrile convulsions have a higher risk of developing epilepsy than those with uncomplicated convulsions. Nevertheless, no case follow-up investigation has been carried out in this study.

It should be linked to all pediatric epileptic patients in this study since aberrant MRI findings were found in up to 41.86% of the children with epilepsy. Despite having a good sample size, this study has certain limitations because it is limited to a single tertiary center and one area of Pakistan. Therefore, more research on a broad population and multicenter should be conducted to determine the generalizability of these abnormalities.

CONCLUSION:

Our research emphasizes how important MRI is for diagnosing pediatric epilepsy. Common findings were mesial temporal sclerosis, encephalomalacia, and cerebral atrophy. Notwithstanding its limitations, including its single-center focus, the study highlights the necessity of incorporating MRI into routine procedures for early intervention and better patient outcomes. All things considered, this study highlights how important customized imaging procedures are in directing successful treatment plans for pediatric epilepsy.

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