



# THE ROLE OF MAGNETIC RESONANCE IMAGING IN EVALUATION OF PEDIATRIC SEIZURES

**Nishant Raj**

Junior Resident, Department of Radiodiagnosis, Datta Meghe Institute of Medical Sciences, Wardha,  
Maharashtra, India

Email Id: [nishantraj88@gmail.com](mailto:nishantraj88@gmail.com)

**Rajasabala Dhande**

HOD and Professor, Department of Radiodiagnosis, Datta Meghe Institute of Medical Sciences, Wardha,  
Maharashtra, India

Email Id: [dhanderajas@gmail.com](mailto:dhanderajas@gmail.com)

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## Abstract

During clinical practice and in the evaluation of such patients, seizure disorders in youngsters is a regular finding. About 5% of kids seem to be at risk of experiencing a seizure, but the majority of them experience their initial seizure at a very early age. During the newborn stage, frequency is greatest (nearly 1 percent for the term and about 20 percent for the preterm). Febrile convulsions are the most prevalent type of convulsions among children. Whenever two or even more spontaneous convulsions occur during 24 hours, epilepsy is diagnosed. Due to the absence of radiation exposure, Magnetic Resonance Imaging (MRI) being determined to be an optimum and initial imaging choice modality for the disorder of pediatric seizure. This overview seeks to evaluate the function of brain's MRI in the assessment of pediatric neurological condition by conducting literature review from online databases such as Google scholar, PubMed, etc., and concludes that Seizure illness in kids is the most normal condition encountered during the clinical practice, and the analysis of such patients, MRI of brain is a valuable tool. Because of its absence of radiation exposure, high soft-tissue sensitivity, capabilities of multi-planar imaging, and ability to identify modest epileptogenic substrates, MRI is an optimal and preferred imaging modality for pediatric seizure disorders.

**Keywords:** *Seizure disorder; Magnetic resonance imaging (MRI); Epilepsy; and Electroencephalogram (EEG)*

## Search Methods

The goal of this study was to undertake an extensive investigation of important online databases, such as Google Scholar, PubMed, & PMC, for papers written in the English language that have been printed in journal articles from the beginning of publication until June 2020. The search used the terms "Seizures", "Pediatric", "MRI" and "Role" in various combinations. Using the search results, suitable references were found for this analysis.

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## Introduction

A seizure is an abrupt and irregular movement of electrons through the central nervous system (CNS) which causes involuntary disorders of the motor, sensory, and autonomic systems, with or without skin changes (1). Children frequently

experience seizures, which are medical emergencies with significant death and morbidity rates. The term "seizure disorder" covers a wide range of diseases, including epilepsy, possibly isolated episodes, febrile seizures, and also the symptomatic seizures



brought on by viral, metabolic, or some other causes, including hypocalcemia and meningitis. The patient's age and neurological development dictate the clinical manifestation and kind of seizure disease. The complicated as well as simple seizures, focal as well as partial seizures, generalized seizures comprise the clinical spectrum of seizures (2). A seizure could happen to about 5% of kids, and 50% of these kids have their first one when they are still very young. Prevalence is increased during the newborn stage (nearly about 1 percent for the term and 20 percent for the preterm). Febrile convulsions are the most typical convulsion type in kids. Whenever two or even more spontaneous convulsions occur within a period of 24-hour, an epilepsy is reviewed to be present. Epilepsy normally affects about 3% people at a certain point in their life, with much more nearly about 50% instances starting during childhood. The most frequent chronic ailment seen by pediatricians and the most frequent neurological disease treated by neurologists is epilepsy. Epilepsy occurs 1% of the time in children under the age of 18. (1). The electroencephalogram (EEG) is an easy, inexpensive, and non-invasive examination. It can provide significant information concerning seizures when utilized carefully and also in conjunction along the clinical history as well as examination. According to EEG research, between 40 and 50 percent patients with the seizure disorders having normal interictal EEGs, while only approximately 5 percent of those who don't have seizures may have non-specific abnormalities. Numerous seizure disorder causes, such as brain bleeding, ventriculomegaly, calcifications, and significant vascular abnormalities, can be diagnosed with the aid of computed tomography (CT). It has a sensitivity of about 30% when determining the origins of a seizure disease. It is one of the drawbacks of CT, and the expense of exposing

infants and children to radiation is also very significant. Due to these reasons, MRI has taken the position of CT inside the elective workup of the childhood seizure defects (3).

Due to its ability to depict the neuroanatomy, the distinction of great gray-white matter, the level of myelination, as well as the identification of isolated structural brain lesions, MRI is considered to be the recommended imaging technique. MRI is an approved neuroimaging technique for the treatment of children with partial seizures (4). The utilization of MRI has enhanced seizure disorder diagnosis and treatment as well as our comprehension of the underlying sickness process. 12–14% of recently diagnosed epilepsy patients could have the seizure-causing lesion identified utilizing MRI (5).

The International League for Epilepsy have compiled a listing of MRI criteria for epileptic children. Children having focal seizures, focal deficiencies on neurological or cognitive testing, generalized or the unclassified seizures starting within the initial life year or as an adult, difficulty to treat seizures including first antiepileptic drugs, loss of seizure, or any shift in seizure patterns (4). Utilizing the (DTI) diffusion tensor imaging, MR images paired with about 18 fluorodeoxyglucose (FDG), images of positron emission (PET), as well as magnetoencephalography, mapping and substrate detection have indeed been enhanced recently. Neurocysticercosis, tuberculoma, brain abscess, demyelinating diseases, and the encephalitis are examples of inflammatory and infectious lesions of both the brain for which MRI is the optimal test for diagnosis, management, and follow-up. Postoperative MR can monitor tumor recurrence and reveal reasons for failure, such as insufficient resection, on follow-up imaging (6). This study's objective was to examine the variety of MRI results in children with epilepsy.



In India, there are hardly any studies in this area. Researchers also examined the breadth of MRI findings in children who were suffering seizures. The patient then benefits from early intervention and the prevention of problems, which improves the prognosis.

### **MRI and Seizures – In children**

Epilepsy, commonly known as seizure sickness, is indeed the second most prevalent neurological ailment in India, behind headache (7). Lacking is the utilization of radio imaging in the diagnosis of childhood epilepsy, mainly within the coastal region of southern India. MRI is shown to be helpful for the assessment of the structures of brain and screening of probable diseases in an etiology of neurological condition and various irregularities in partial infantile epilepsy. While MRI is a sensitive as well as noninvasive neuroimaging technique, it is costly and not commonly available. MRI is recommended over CT due to its higher resolution, adaptability, and radiation-free nature. Total 100 patients who reported at the hospital with seizures participated in this hospital-based trial. Each patient's clinical history was noted, and all received standard tests in accordance with the proforma. All patients underwent EEGs. As per the pediatric seizure protocol, a 1.5T Siemens Avanto Magnetom MRI scan was performed (8).

Epilepsy is most widespread in the first decade of life in India, as per incidence as well as prevalence surveys (9,10) 59 men as well as 41 women among the 100 patients who participated in the trial were male, with a prevalence of men. The largest number of patients, 82 (82%) experienced tonic-chronic seizures for 74 (74%) of the instances, which manifested as generalized seizures. About 18% of individuals experienced partial seizures. In various investigations to assess neuroimaging results in children seizure disorder, abnormal

MRI findings ranged from 28.5 to 55.86%. (11,12). Doescher et al., (13), EEG and MRI were found to have a positive correlation, meaning that children who experienced EEG abnormalities during seizures also experienced MRI abnormalities. Approximately 58.5% of children with EEG abnormalities also had MRI abnormalities, constant with previous research indicating that MRI problems are commonly linked with EEG abnormalities.

Children with localized encephalomalacia were found to have anomalies in 21% of cases, according to Shinnars et al. (14). When evaluating a young patient's seizure, Rincon et al. (15) examine whether it is beneficial to routinely combine magnetic resonance spectroscopy (MRS) with MRI through retrospective analysis of 216 patients who received both the MRS and MRI as a part of seizures evaluation during a three-year period produced a total of 233 instances. To ascertain the number of patients who had a diagnosis that was pertinent to seizures, the medical records were examined. Two neuroradiologists and an MR physicist/spectroscopist assessed the MRIs and MRSs and came to an agreement on how often MRS results added to those from MRI alone in terms of care, diagnosis, or prognosis. MRS provided the information that was not given by MRI in 100 of 233 cases (43%). In 40 cases, MRS prompted an assessment for an underlying inborn metabolic defect, which added information important to patient care. In 24 out of 100 instances, MRS supplied information crucial to the diagnosis. In 36 cases, MRS provided information important to the prognosis (e.g., hypoxic-ischemic injury). When patients received a seizure-related diagnosis prior to imaging, MRS added new details. Interestingly, MRS was found to be aberrant in 25 cases while the MRI was normal, which prompted testing for a metabolic inborn defect.



These findings indicate that MRS, in addition to MRI, is a valuable evaluation tool for the children having imaging for evaluation of seizures.

In a different study by Nathiya et al. (16), hypoxic-ischemic alterations and periventricular leukomalacia were the most common abnormalities among 42 children having abnormal MRI results, accounting for 21.4% (n=9) of the total. Other white matter lesions made up roughly 19% of the total. The inhabitants of south India, who primarily reside along the coast, was the subject of this study. The most frequent abnormalities were periventricular leukomalacia and gliosis. Therefore, improvements in maternity care, sanitation, and socioeconomic status can help reduce the incidence as well as morbidity of epilepsy in children. Sailakshmi (17) conducted a prospective epidemiological study there at Institute of Child Health and Hospital for Kids over a period of six months. Children between the ages of two months and twelve years who had recently started having seizures were included in the study. In youngsters, normal febrile seizures, severe CNS infections, trauma, poisons, metabolic seizures, and persistent neurological disorders were not considered. Every youngster got a thorough neurological examination, an MRI of the brain, and an EEG. The age range of children who first experienced seizures considered was about 6-12 years, with a mean age of 5.4 years. Generalized tonic-clonic seizures were the most prevalent seizure type. Status epilepticus was the first instance of the new-onset seizure types in 11% of the youngsters. 29% of the children had MRI abnormalities, with Ring enhancing lesions making up the majority of them (65.5%). On neuroimaging, ring boosting lesion was revealed as the most common abnormalities in children diagnosed with unique seizures. 38% of the kids had EEG abnormalities, with generalized spikes

being most prevalent anomaly (63.2%). The most frequent EEG abnormality seen in kids with newly developing seizures is generalized epileptiform activity.

## Conclusion

The most frequent disorder that is observed in clinical practice and in the evaluation of these individuals is seizure disorder in children. Due to its low radiation dose, superior resolution of soft-tissue, ability to detect modest epileptogenic substrates, capabilities of multi-planar imaging, MRI would be the best imaging modality and the first option for children with seizure disorders. MRI is highly sensitive and specific when it comes to identifying the underlying etiological component when the right techniques are used. Finding the origin of the seizure disease is essential not just for a particular treatment and the follow-up, as well as for informing the parents of prognosis. As a result, this review highlights the MRI value in diagnosis of children having pediatric seizure disorders.

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