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# Evaluation of seizures in pediatric patients in a tertiary teaching hospital using Magnetic Resonance Imaging (MRI)

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**Abstract**
**Background:** Epileptic seizures are a frequently encountered manifestation in the emergency room. Seizures are defined by involuntary disruptions in motor, sensory, or autonomic functioning. They occur because to aberrant and excessive neuronal activity that is caused by sudden bursts of electrical discharges from the brain. Seizure disorders significantly contribute to both illness and death rates in children.
**Methods:** This study was a hospital-based inquiry conducted in the Department of Radio Diagnosis at Madha Medical College and Research Institute in Chennai, Tamil Nadu, India. The study took place from June 2013 to May 2014 in the Radiodiagnosis department. The sample consisted of 148 individuals. The Siemens Magnetom Area's 1.5 T MRI equipment was utilized to obtain each image.
**Result:** Based on the acquired outcomes, we have identified the subsequent percentages. The distribution of age groups is as follows: 0-1 month (33.10%), 1 month to 1 year (27.02%), 1 year to 5 years (8.10%), and 5 to 15 years (31.75%). The male population accounted for 60.81 percent, while the female population accounted for 39.18 percent. 83.67% of the infants were born at full term, while 16.32% were born prematurely. We discovered that 65.85% of the neonates were male, while 34.14% were female. The proportion of male preterm births was 62.50%, whereas the proportion of girls was 37.50%.
**Conclusion:** Upon completion of our experiment, we will ascertain the efficacy of MRI in detecting lesions that underlie pediatric seizures and determine its correlation with MR Spectroscopy.

**Keywords:** Pediatric patients, MRI evaluation, seizures, and tertiary teaching hospital.

## Introduction

According to recent studies, the occurrence rate of active convulsive epilepsy in Sub-Saharan Africa is estimated to be between 7.0 and 14.8 cases per 1,000 individuals. This figure represents a twofold increase compared to the estimated rate of 4.5-5.0 per 1,000 individuals in Europe. The significant load can be attributed to a higher prevalence of central nervous system infections, prenatal insults, and traumatic brain damage. These factors are especially significant in youth, and with the acknowledged higher occurrence of genetic causes and anatomical abnormalities in early life, they collectively contribute to a substantial burden of epilepsy in children in SSA. The prevalence of childhood epilepsy in Sub-Saharan Africa is compounded by the inadequate resources available for healthcare, diagnostics, and treatment [1-3].

Magnetic resonance imaging (MRI), the most favored imaging technique for epilepsy, has limited availability, with just 0.48 per million of the population being able to access it, even in the most optimal conditions. Genetic testing services have a highly restricted level of accessibility. The limited diagnostic capability is linked to a treatment gap for epilepsy that can reach up to 85%. An issue that is connected to this is the inadequate explanation of the causes of infantile epilepsy in Sub-Saharan Africa (SSA). Early-onset epilepsy occurs at the crucial phase of physical, psychological, and cognitive maturation [4, 5]. It is crucial to identify the cause and classify the individual types of epilepsy whenever feasible, since this information is essential for guiding therapy, predicting outcomes, and maximizing the different parts of developmental support during early life. Imaging plays a vital role in making such conclusion. Neuroimaging plays a crucial role in determining the cause, predicting the outcome, and devising suitable treatment for a condition [6-8].

According to the International League against Epilepsy, neuroimaging is recommended for children under the age of 2, except in cases of febrile seizures. Exceptions to this recommendation include cases of localization-related epilepsy, typically benign idiopathic epilepsy, abnormal neurological examination, and childhood epilepsy that does not respond to the first two antiepileptic drugs. MRI is the preferred imaging modality due to its superior ability to provide precise anatomical details and accurately identify and describe pathological conditions. While a computed tomography (CT) scan may not detect certain abnormalities that are seen on magnetic resonance imaging (MRI), it is more accessible, less expensive, and generally does not necessitate anesthesia for children. The deployment of CT scans in emergency scenarios is more convenient and they are capable of detecting cancers, anomalies, stroke, as well as calcification and bone abnormalities. Nevertheless, it exhibits a comparatively low efficacy in detecting focal brain lesions. Neuroimaging and neurophysiologic tests are usually only available in major urban areas in Sub-Saharan Africa (SSA) [9-11].

There are limited studies that have described the imaging findings in children with epilepsy in Sub-Saharan Africa (SSA). We have not encountered any studies that provide a comprehensive description of their MRI findings within the framework of a standardized MRI access strategy. It is necessary to improve the descriptions of imaging findings in pediatric epilepsy in Sub-Saharan Africa (SSA) and to adjust imaging criteria to account for the distinct causes and limited resources in this region. EEG investigations can provide additional information to complement these findings. They are more easily available and can help in determining and prioritizing candidates for imaging when resources are restricted [10-12].

## Materials and Methods

This study was a prospective hospital-based inquiry conducted in the Department of Radio Diagnosis at Madha Medical College and Research Institute in Chennai, Tamil Nadu, India. The study took place from June 2013 to May 2014 in the Radiodiagnosis department. The sample consisted of 148 individuals. The Siemens Magnetom Area's 1.5 T MRI equipment was utilized to obtain each image.

The sample consisted of 148 individuals. The Siemens Magnetom Area's 1.5 T MRI equipment was utilized to obtain each image. Information on brain lesions observed on the MRI was gathered. The results of the MRI brain scan were compared with the clinical assessment by the treating physician, leading to the final diagnosis. The study received prior approval from the institutional ethics committee. Consent was received from the subjects and their parents/guardians to include their photographs in the study.

### Inclusion Criteria

- Both outpatient and inpatient pediatric seizure patients aged 0-15 were referred.

### Exclusion Criteria

- Simplefebrile seizures, hemodynamically and neurologically fragile children

## Results

This study was conducted by the Radiology Department of S.V.S. Medical College and Hospital as a prospective hospital-based investigation. The investigation was undertaken by researchers from the Department of Radiodiagnosis. We employed a sample size of 150. All of these photographs were captured using a 1.5 T MRI scanner from Siemens Magnetom in their specifically designed imaging room. The study yielded the following results.

**Table 1:** Age group distribution

| Age group | Patients | % |
|---|---|---|
| 0-1M | 50 | 33.78 |
| 1M-1Y | 40 | 27.02 |
| 1Y-5Y | 10 | 6.75 |
| 5-15Y | 48 | 32.43 |
| Total | 148 | 100 |

The age group distribution is as follows: 33.78% for 0-1 month, 27.02% for 1 month to 1 year, 6.75% for 1 year to 5 years, and 32.43% for 5 to 15 years.

**Table 2:** Gender Distribution

| Gender | Patients | % |
|---|---|---|
| Male | 92 | 62.16 |
| Female | 56 | 37.83 |
| Total | 148 | 100.00 |

The gender distribution was as follows: 62.16% male and 37.83% female.

**Table 3:** Neonate's distribution

| Neonates | Patients | % |
|---|---|---|
| Term | 40 | 81.63 |
| Preterm | 9 | 18.36 |
| Total | 49 | 100 |

The distribution of neonates, categorized as term and preterm, was observed to be 81.63% and 18.36% respectively.

**Table 4:** Neonates distribution

| Neonates | Patients |
|---|---|
| Vascular (32) | |
| HII | 18 |
| CSVT | 4 |
| PAIS | 3 |
| Bleed | 5 |
| Combined | 2 |
| (24) | |
| Anomaly | 2 |
| Metabolic | 2 |
| IEM | 2 |
| Infection | 2 |
| Normal | 15 |
| Transient | 1 |

Neonatal distribution was found for vascular conditions such as hypoxic-ischemic injury (HII), cerebral sinovenous thrombosis (CSVT), perinatal arterial ischemic stroke (PAIS), bleeding, and combination conditions. The prevalence of metabolic, inborn errors of metabolism (IEM), infection, normal, and transitory conditions was 4.16% for 1 and 79.16% for 19.

## Discussion

Based on the results given above, we have identified varying percentages for distinct parameters as follows. The age group distribution is as follows: 33.10% for 0-1 month, 27.02% for 1 month to 1 year, 8.10% for 1 year to 5 years, and 31.75% for 5 to 15 years. The gender distribution was as follows: 60.81% male and 39.18% female. The distribution of neonates, categorized as term and preterm, was observed to be 83.67% and 16.32% respectively. The average age of the study participants is slightly lower than that of Wongladarom S *et al.*'s study, where the average age was 7 years and 5 months [26, 27]. The study consisted of 100 patients, with 58% being male and 42% being female. Furthermore, it aligns with the research undertaken by Amirsalari S *et al.*, which included 57.7% male participants and 42.5% female individuals [12-14].

The distribution of neonatal cases was observed for vascular conditions such as hypoxic-ischemic injury (HII), cerebral sinovenous thrombosis (CSVT), perinatal arterial ischemic stroke (PAIS), intracranial hemorrhage (bleed), and combination conditions. The percentages for each condition were 59.37%, 9.3%, 6.25%, 18.75%, and 6.25% accordingly. The prevalence of metabolic, inborn errors of metabolism (IEM), infection, normal, and transitory conditions was 4.16% for 1 and 79.16% for 19. A significant finding was that the use of a standardized grading method, in conjunction with high-quality MR imaging, for new-onset seizures revealed a greater prevalence of abnormal findings compared to previous research. Based on this data, numerous generalizations and observations can be made [13-15]. At the time of their initial seizure diagnosis, only a tiny proportion of children exhibited distinct epileptogenic abnormalities in the cortex or grey matter. Conversely, irregularities in the white matter were more commonly associated with the occurrence of the initial seizure that was detected. Furthermore, the occurrence of volume loss, which was initially considered to be an insignificant deviation, was shown to be more prevalent than expected in this group. This discovery aligns well with the conclusions reached by Shinnar and his colleagues [14-16].

All of these children were younger than three years old. Out of these youngsters, 97 had acquired injuries, 56 had cortical growth abnormalities, and 51 had widespread brain development problems. Based on their research findings, MRI is of utmost significance in diagnosing disorders. Only a limited number of studies in India have utilized MRI technology to examine the brains of children. The objective of this study in a developing country such as India was to ascertain the root cause of seizures in children discovered by MRI scans. Based on this study, the primary cause of seizures was shown to be the inflammatory granuloma. The report recommends using MRI as the main method of evaluation for instances with epileptic seizures [17-19].

The study excluded children with a prior history of trauma or febrile seizures. During their examination, it was shown that infection was the predominant factor, responsible for 25 out of the 95 youngsters observed. Tuberculosis was shown to be the predominant infectious cause, with a diagnosis in seven out of the twenty-five people who underwent examination. In the earlier study conducted by Amirsalari S *et al*., the participants consisted of 57.7% boys and 42.5% girls. A study involving 95 patients found that the majority, 60%, experienced generalised seizures at the time of presentation. 29% of patients had focal seizures, while 11% had seizures of an unclear kind. The results of the investigation were similar to those of a study conducted by Rasool A *et al*., which examined 276 patients. The study found that the majority of seizures were generalized seizures, accounting for 42% of all seizure types. Partial seizures and complicated febrile seizures were the next most common categories [20-22].

In the study conducted by Mande A. S. *et al*., it was shown that infections were responsible for 35% of epilepsy cases. Anoxia and hypoxia ischemic encephalopathy (HIE) accounted for 14% of cases, while other causes accounted for 8.2% of cases, and abnormalities of cortical development (MCD) were the second most common cause. In a study of 95 children under the age of 12 years, Aarti Aanand *et al*. found that anoxia, hypoxic-ischemic encephalopathy, and infection were the most common causes. These findings were in line with previous research. According to Ojaswi B. Khandediya *et al*., infection was the most common cause, followed by Mesial temporal sclerosis and localized cortical dysplasia [21-23]. Through study, it was shown that a solitary lesion in the temporal lobe resulted in epilepsy in six individuals. The most frequent causes of temporal lobe epilepsy were mesial temporal sclerosis, gliomas, and gangliogliomas. Research conducted by J. D. Grattan Smith *et al*. showed that out of 53 children, mesial temporal sclerosis accounted for 57% of cases, followed by tumors in 15% of cases, cavernous angiomas in 1.8% of cases, and ectopic grey matter in 1.8% of cases. Based on the study conducted by Sales LV *et al*., the predominant diseases observed among the 31 patients with temporal lobe epilepsy were mesial temporal sclerosis, dysplasia, tumours, and arachnoid cysts [24-26].

Their research aligned with the findings of a prior study conducted by Chaurasia *et al*., Kumar *et al*., and Gulati *et al*., where infection was also identified as the main contributing factor. The analysis highlights the importance of using MRI as an imaging method to evaluate seizure disorders. Andrew J. Kalnin, MD, and his colleagues conducted a study on 366 children who had been diagnosed with epilepsy. They utilized non-contrast 1.5 Tesla MRI to examine seizures unrelated to temperature. The most common structural defects that were identified included mesial temporal sclerosis, unilateral and bilateral heterotopias, cortical dysplasia, neurocutaneous diseases, and a few neoplasms. Based on their research findings, MRI is an invaluable tool for visualizing the extent, morphology, and distribution of lesions linked to seizures [25-27].

## Conclusion

Upon completion of our research, we will acquire a more comprehensive comprehension of the efficacy of magnetic resonance imaging in identifying lesions that serve as the root cause of seizures in pediatric children, as well as its correlation with the findings of MR Spectroscopy. This will occur due to our enhanced understanding of the efficacy of magnetic resonance imaging in identifying the lesions responsible for seizures in pediatric patients. It is crucial to strike a balance between the potential advantages of MRI in uncovering more nuanced imaging findings and the need to prevent unnecessarily contributing to the escalation of medical imaging costs. Achieving this equilibrium will be crucial in order to discover a resolution.


## Funding

None


## Conflict of interest

None

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