ISSN 2277-7695

MRI Assessment of seizures in pediatric age group patients at a tertiary education institution

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Background: Patients with seizures frequently present to the emergency room. Involuntary deficits in motor, sensory, or autonomic functioning are hallmarks of seizures. Paroxysmal electrical discharges from the brain cause abnormal, excessive neuronal activity, which in turn causes them. Seizures disorders are a major cause of morbidity and mortality in children. Neonates have mortality rates between 21 and 24 percent and morbidity rates between 25 and 35 percent.

Methods: The Radiology Division of the Department of Pediatrics, Annaii Medical College and Hospital, Tamil Nadu, India, conducted the current study, which was a prospective hospital-based inquiry. The department of radiodiagnosis carried out the investigation from December 2010 to November 2011. The sample comprised 148 individuals. Every picture was taken using the 1.5 T MRI scanner at Siemens Magnetom Area.

Results and Discussion: We discovered the following percentages from the results that were collected. 0-1 month (33.10%), 1-1 year (27.02%), 1-5 years (8.10%), and 5-15 years (31.75%) are the ranges. 60% of the population was male and 38.18% was female. Infancy rates were 16.32% preterm and 83.67% term. We discovered 34.14% female and 65.85% male new-borns. Preterm birth rates were 62.50% for men and 37.50% for females.

Conclusion: We will know the extent to which MRI correlates with MR spectroscopy and the degree to which it can identify lesions underlying pediatric seizures after our investigation.

Keyword: MRI Evaluation, seizures, pediatric, patients, tertiary teaching hospital

Introduction

One of the most frequent reasons for visits to the pediatric emergency room is seizures [1]. Seizures are defined as abnormally high levels of neuronal activity caused by paroxysmal electrical discharge from the brain, which might present clinically as involuntary abnormalities of motor, sensory, or autonomic functions [2]. Children are frequently hospitalized due to seizures, which have a substantial death and morbidity rate. Neonates with mortality (21-24%) and morbidity (25-35%) have a notably high rate of this [3]. Around 1% of people worldwide suffer from seizures, which occur at a rate of 68 per 100,000 people annually. It is estimated that approximately 10.5 million children under the age of 15 worldwide suffer with epilepsy [4]. In industrialized countries, the prevalence of epilepsy in children is estimated to be 5 per 1000, whereas in poor countries it ranges from 7.5 to 44.3 per 1000 children [5, 6]. According to research from India, the incidence and prevalence of seizures are, respectively, 0.2-0.6 per 1,000 people annually and 3.0-11.9 per 1,000

populations [7]. Seizures during the neonatal era are rather prevalent among the pediatric age group, occurring in roughly 1.8 to 3.5 per 1000 live births [8]. The new-born phase has a higher prevalence (almost 1% in term and 20% in preterm). Eighty percent of new-born seizures happen during the first two to three days of life. Seizures are more common in children under three years old and become less common as age increases [9, 10].

The prevalence is higher in the new-born phase (almost 1% in term and 20% in preterm), according to research by R. A. Umap *et al.* [11]. Compared to children, the etiology of seizures is more clearly defined in new-borns. However, the cause of 12-15% of neonatal deaths is still unknown [12].

Before five days of life, preterm and extremely low birth weight neonates are more likely to experience neonatal seizures, which are typically caused by prenatal hypoxia and subsequent metabolic abnormalities [13]. Infection is the most common cause of febrile seizures in children in underdeveloped nations. There are regional variations in common causes, albeit [14]. Seizures in children are frequently caused by infections, inflammations, tumors, congenital anomalies, leukodystrophies, and neurometabolic diseases [15]. MRI of the brain has replaced CT or neuro-sonogram as the standard imaging modality for children seizures in developed nations [16]. Due to its great anatomical and vascular overview, superior pathology delineation, and lack of radiation, Magnetic Resonance Imaging (MRI) is the preferred method of neuroimaging for children with seizures [17, 18].

As a result, it aids in determining the cause and organizing the treatment of children experiencing seizures [19]. Understanding the prognosis, which is based on the cause, location, and severity of the underlying brain injury, is also beneficial [20]. The study's objectives were to determine the etiological diagnosis of seizures in children as well as the occurrence and etiology of seizures at different ages.

Materials and Methods

The current investigation was a prospective hospital-based study carried out in the Department of Pediatrics, Annaii Medical College and Hospital, Tamil Nadu, India. The study was conducted in the radiodiagnosis department from December 2010 to November 2011. There were 200 people in the sample. The 1.5 T MRI scanner used in the Siemensmagnetom area produced all of the images. The routine MR sequences that were obtained included gradient-echo (GRE) images (TR/TE/Flip angle = 700/30/30), axial diffusion-weighted images (TR/TE/b factor = 5075/84/1000), axial and Sagital spin echo T1 weighted images (TR/TE = 460/12; 4mm slice thickness / 1 mm gap), and axial fast spin echo T2 weighted images (TR/TE = 5400/117). When there were alterations indicative of vascular events such as bleeding and infarct, MR angiography (MRA) and MR venography (MRV) were performed. The doctor administered procedural sedation in accordance with the institutional standard to lessen anxiety and movement in order to prevent motion artifacts. Information about brain lesions detected by MRI was gathered. The definitive diagnosis was reached after the treating physician clinically correlated the results of the MRI brain scan.

Prior approval for the study was obtained from the institutional ethics committee. The individuals and their parents/guardians gave their informed consent so that their photos may be used in the research.

Inclusion Criteria

Every pediatric patient who appeared with seizures and was referred from the outpatient and inpatient pediatric departments, aged 0 to 15 years.

Exclusion Criteria

Simplefebrile seizures, children with neurological and hemodynamic instability, and parents unwilling to consent to imaging and anesthesia.

Results

The Department of Pediatrics, Annaii Medical College and Hospital, Tamil Nadu, India conducted this prospective hospital-based study. Their investigation was carried out by Department of Radio diagnosis researchers. A 200-person sample size was used. Every single one of these images was captured in its own imaging chamber using a Siemens Magnetom 1.5 T MRI scanner. The following outcomes were attained throughout the investigation.

Table 1: Age group distribution

Age group	N	%
0-1M	64	32.00
1M-1Y	52	26
1Y-5Y	26	13
5-15Y	58	29
Total	200	100

As per the age group distribution 0-1 month 32%, 1month to 1 year is 26%, 1year to 5 years is 13% and 5 to 15 years is 29%

Table 2: Gender distribution

Gender	N	%
Male	116	58
Female	84	42
Total	200	100

In the regards of the gender distribution male was 58% and female was 39.18%.

Table 3: Neonate's distribution

Neonates	N	%
term	66	66
preterm	34	34
Total	100	100

With the regards of the neonates distribution as term and preterm was observed as 66% and 34% respectively.

As per the gender distribution of neonate's term as male and female we found the 65.85 and 34.14% respectively.

Table 4: Gender distribution of Neonates Term

Neonates Term	N	%
Male	37	61.66
Female	23	34.14
Total	60	100

Table 5: Gender distribution of Neonates Preterm

Neonates Preterm	N	%
Male	10	66.6
Female	5	33.4
Total	15	100

Gender wise distribution of neonates preterm patients was reported as male and female, 66.6% and 33.4% respectively.

Table 6: For the period of 5-15Y

5-15Y	50	
Sequelae of Hii	10	25
Sequelae of Infection (Rasmussen's Encephalitis and Anec)	3	7.5
Infection	5	12.5
Bleed	2	5
Infarct	3	7.5
Leukodystrophy	2	5
Neurodegenerative	2	5
Immune-Mediated	3	7.5
Tumour	5	12.5
Anomaly	4	10
Normal	40	100

For the period of 5Y-15Y, for N=10, 3, 5, 2, 3, 2, 2, 3, 5,4 and 40 percentage was 25, 7.5, 12.5, 5, 7.5, 5, 5, 7.5, 12.5, 10 and 100% respectively.

Discussion

From the data above, we were able to determine the various percentages of the various parameters, which are listed below. According to the age group distribution, the following age groups: 0-1 month (33.10%), 1-1 year (27.02%), 1-5 years (8.10%), and 5-15 years (31.75%). In terms of gender distribution, 39.18% of people were female and 60.81% of people were male. Regarding the distribution of new-borns, it was found that 83.67% and 16.32% were born term and preterm, respectively. According to Munde

AS, *et al*., out of 100 patients, the age group with the highest percentage of participants (33%) was 10 to 12 years old, followed by 0 to 3 years old (29%). Gulati P *et al*. observed similar results, with the bulk of their patients falling within the 6-12 age range. The average age was 6.2 years. The mean age of the study is slightly less than the mean age of Wongladarom S, *et al*. (7 years and 5 months) [26, 27]. In our study, out of 100 patients, 58% were men and 42% were women. Male to female ratio of 2:1. Our findings are in line with those of Sanghvi JP, *et al*., who reported that 31.7% of participants were women and 60.5% were men [26, 27]. It also concurs with a research by Amirsalari S, *et al*. that included 42.5% girls and 57.7% boys as subjects.

As per the gender distribution of neonate's term as male and female we found the 65.85 and 34.14% respectively. Gender wise distribution of neonates preterm patients was reported as male and female, 62.50% and 37.50% respectively. Vascular-based measurements of the distribution of new-borns included HII, CSVT, PAIS, and bleeding; the overall values were 59.37, 9.3, 6.25, 18.75, and 6.25, respectively. Additionally, the transitory, normal, metabolic, IEM, and infection rates were 4.16% for 1 and 79.16% for 19.

For the period of 1M-1Y, for N=14, 01, 02, 04, 01, 01, 17 and percentage was 35, 2.5, 05, 10, 2.5 and 42.50% respectively. For the period of 1Y-5Y, for N=05, 01, 01, 01, 01, 02, 01 and percentage was 41, 8.33, 8.33, 8.33, 8.33, 16.66 and 8.33% respectively. For the period of 5Y-15Y, for N=08, 02, 05, 01, 02, 01, 01, 02, 04, 03, and 18 and percentage was 17, 4.25, 10.63, 10.63, 2.12, 4.25, 2.12, 2.25, 4.25, 8.51, 6.38 and 38.29% respectively.

The most significant conclusion was that, in comparison to earlier research, using a standardised grading method in conjunction with high-quality MR imaging for new-onset seizures revealed a greater rate of overall abnormal findings. Numerous generalizations and observations can be made from these data. Only a tiny proportion of children displayed typical epileptogenic abnormalities involving the cortex or grey matter at the time of the first seizure that was recognized. Rather, a higher frequency of correlation was found between the start of the first seizure that was detected and abnormalities in the white matter. Furthermore, it was shown that volume loss, which was previously thought to be a non-significant aberration, occurred more frequently in this cohort than was expected. This result is consistent with that of Shinnar and associates [26, 27].

The brains of children have only been the subject of a small number of MRI studies conducted in India. The aim of this study was to identify the underlying cause of children's MRI-diagnosed seizures in developing countries like India. This study found that the most prevalent cause of seizures was an inflammatory granuloma. The report recommends MRI as the initial examination for epileptic seizures [27].

95 young individuals in all participated in an MRI study conducted by Aarti Anand and colleagues at a tertiary care facility in Nagpur. The authors included children with epilepsy under the age of 12 in their research study [28]. Children with febrile seizures or a history of trauma were excluded from the trial. After conducting an inquiry, they found that, for 25 of the 95 children under study, infection was the most frequent reason. As tuberculosis was detected in seven of the twenty-five people who were investigated, it was found to be the most common infectious cause. 42.5% of the participants in the earlier study by Amirsalari S, *et al*. were females and 57.7% of the participants were boys. Sixty-five percent of the 95 patients in the study had generalized seizures at presentation, 29 percent had focal seizures, and 11 percent had seizures of an unknown type. The results of the study were similar to those of a study that looked at 276 patients and was carried out by Rasool A *et al*. In this study, the majority of seizure types were generalized (42%), followed by partial (31.2%) and complex febrile (23.2%) seizures. Mande AS *et al*., findings and the Chaurasia R *et al*. study, in which generalised seizures were the major sort of seizure in 76.7% of patients, are complementary. 85 patients (85%) in this study's total of 100 participants had abnormal MRI findings. research

was analogous to that of Kuzniecky R *et al.*, in which 84% of patients had abnormalities revealed by MRI. According to Resta *et al.*, 51.3%, Wang *et al.*, 41.7%, and Chang *et al.*, 48.9% of patients had good MRI results. Greater percentage, which is likely the outcome of rigorous exclusion criteria, highlights the relevance of patient selection in MR positive rates. 35% of cases of epilepsy in the analysis of Mande AS, *et al.* were attributed to infections, with anoxia and hypoxia ischemic encephalopathy (HIE), other causes (14%), and anomalies of cortical development (MCD), (8.2%) following in order of prevalence. Aarti Aanand *et al.* reported data that were largely consistent with these findings in a study of 95 children under the age of 12 years, where the most common etiologies were anoxia, hypoxic-ischemic encephalopathy, and infection. Ojaswi B Khandediya *et al.* found that infection was the most common aetiology, followed by mesial temporal sclerosis and localized cortical dysplasia. Six people in the experiment developed epilepsy as a result of a single temporal lobe damage. Additional common causes were gliomas (1 patient each), gangliogliomas (1 patient), and mesial temporal sclerosis (4 individuals). According to J. D. Grattan Smith *et al.* research, mesial temporal sclerosis accounted for 30 out of 53 children (57%), with tumors accounting for 8 (15%), cavernous angiomas accounting for 1 (1.8%), and ectopic grey matter accounting for 1 (1.8%) of the cases. The most common diseases among the 31 patients with temporal lobe epilepsy, according to Sales LV *et al.*, were mesial temporal sclerosis, dysplasia, tumors, and arachnoid cysts [28, 29] of the 345 patients with abnormal MRI results in the Gulati P, Jena A.N. *et al.*, 8 study, 98 (28.1%) had tuberculoma, and 86 (24.9%) had neurocysticercosis. The most common causes of epilepsy, according to a study by Chaurasia R *et al.*, were CNS tuberculosis (30.3%), encephalitis (7.9%), and neurocysticercosis (30.3%). In contrast to our findings, Parihar Ravi Kumar *et al.* reported that the two most common etiologies were tuberculoma (29.91%) and neuro-cysticercosis (55.81%) of the 24 patients with malformations of cortical development in the study by Mittal GK *et al.*, focal cortical dysplasia was the most common pathology seen in 16 patients (29.6%), followed by schizencephalyin8 (14.8%), polymicrogyriain8 (14.8%), and DNETin6 (11.1%). Analogous findings were observed in the Mande AS, *et al.* study. In this study, perinatal asphyxia was shown to be the most common etiological factor for the age group of 0-3 years, accounting for 55% of cases. This was followed by CNS infection (15%), anomalies of the central nervous system (9%), head injuries (8%), congenital, and preterm (5%) instances. Additionally, it aligned with the findings of Parihar Ravi Kumar *et al.*, who looked into the reasons behind partial seizures in kids who were 28 days to 18 years old [28-30]. For 6 patients (66.6%) in the 28-day to 5-year age range, 18 patients (85.7%) in the >5 to 10-year age range, and 12 patients (92.3%) in the >10 to 18-year age range, infection was the most common cause of illness. Infection has a significant role in the development of epilepsy in the increasing age group. The Gulati P *et al.* study, which looked at the aetiology in the older age range and included 170 children with persistent seizures, is also cited in our work. The following age categories were created: 0-1 year, 1-3 year, 3-6 year, and 6-12 year. The etiologies were grouped into four groups: atrophy, vascular, infections (including tuberculomas, neurocysticercosis and meningitis), and other causes [30]. In the age group of 6 to 12 years, infection was the most frequent cause, seen in 51.1% of cases, followed by other in 16.4%. Infection was seen in 4.7%, 4.1%, and 3% of children in the age categories 0-1, 1-3, and 3-6 years, respectively.

Their study was found to be in line with the results of earlier studies conducted by Chaurasia *et al.*, Kumar *et al.*, and Gulati *et al.*, which also revealed that infection was the main causative cause [31, 32]. The analysis heavily emphasises the use of magnetic resonance imaging (MRI) as an imaging modality for the evaluation of seizure disorders. Andrew J. Kalnin, MD, and associates examined 366 youngsters who had received an epilepsy diagnosis. Non-contrast 1.5 Tesla MRI

was the technique they used to investigate seizures that were not caused by fever. The most common structural abnormalities that were discovered were mesial temporal sclerosis, unilateral and bilateral heterotopias, cortical dysplasia, neurocutaneous diseases, and a few neoplasms. Their research's conclusions indicate that MRI is a very useful method for displaying the extent, distribution, and form of lesions linked to seizures [32, 33].

Conclusion

When our study is complete, we will know more about the effectiveness of magnetic resonance imaging in identifying lesions that are the root cause of seizures in young patients and how well it correlates with MR Spectroscopy results. This will be the case because our understanding of the effectiveness of magnetic resonance imaging in identifying lesions that are the root cause of seizures in pediatric patients will improve. Finding a balance between the need to prevent needlessly adding to the growing cost of medical imaging and the potential advantages of MRI in identifying more nuanced imaging data will be crucial. Finding a solution will depend on striking this equilibrium.

Funding: None

Conflict of Interest: None

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