Original Research Article

Etiological features of seizures in paediatric patients: A hospital based magnetic resonance imaging study

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Abstract

Background: Children with epilepsy differ from adults not only in the clinical manifestations of their seizures, but also in etiologies. Primary generalized epilepsy is considered to be genetic in etiology, whereas most localization-related epilepsy occurred as a result of a cerebral insult. Recent developments in brain imaging has led to identification of the cause of seizures in more children. **Aim:** To study the etiological features of seizures in paediatric patients based on MRI findings. **Material and Methods**: In this hospital based study, 75 paediatric patients of age under 12 years presented with generalized or partial seizure disorder or absent seizures were evaluated. Patients were subjected to MRI scanning. Final diagnosis was made on radiological features and in inconclusive cases; diagnosis was made by followup MRI and treatment response. **Results:** The most common etiology was found to beanoxia and hypoxic ischemic encephalopathy in 23 patients (41.8%) followed by malformations of cortical development in 11 patients (20%), miscellaneous causes in 7 patients (12.7%), infection in 4 patients (7.4%). Phakomatoses constituted 3 patients (5.5%). Mesial temporal sclerosis and inherited metabolic disorders and neoplasm constituted 2 patients each (3.6%).Vascular causes constituted only one patient (1.8%). **Conclusion:** Identification of cause of seizure is important for management. MRI has emerged as a versatile tool in imaging of paediatric patients with seizures.

Key Word: paediatric patients, seizures, etiology, magnetic resonance imaging

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INTRODUCTION

Seizures arise from an excessively synchronous and sustained discharge of a group of neurons. Children with epilepsy, particularly infants, differ from adults not only in the clinical manifestations of their seizures, but also in etiologies and response to antiseizure drugs. Primary generalized epilepsy is considered to be genetic in etiology, whereas most localization-related epilepsy occurred as a result of a cerebral insult.[1]Localization-related epilepsy is said to be more common in developing countries. Recent developments in brain imaging has led to identification of the cause of seizures in more children.[2]Magnetic resonance imaging (MRI) gives precise localization and histological nature of lesions and subsequently. MRI is the technique of choice to identify underlying cause in partial seizures. It increases the detection rate of certain intracranial lesions especially those of vascular nature and those involving the meninges. The present study was conducted to evaluate the magnetic resonance imaging of brain in evaluation of pediatric seizure disorder. Identification of etiological features are of immense help to both clinicians as well as neurosurgeons in their attempt to achieve more accurate method of discovering the nature of the pathologies.[3]The present study was undertaken to study the etiological features of seizures in paediatric patients based on MRI findings.

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MATERIAL AND METHODS

In this hospital based prospective observational study 75 paediatric patients with seizures, referred for MRI brain in Department of Radiology, Dr. Hedgewar Rugnalaya, Aurangabad were evaluated. Ethical clearance was obtained from the Research Committee and Ethical Committee of the institution for this study.

Inclusion criteria

- All paediatric patients (age under 12 years) presented with generalized or partial seizure disorder or absent seizures.

Exclusion criteria

- Patients unfit for MRI with regards to anaesthesia considered contraindicated for MR imaging.
- Patients not willing for MRI.
- Poor general condition of patient with life support.

Informed written consent was taken from parents/accompanying relatives. Complete clinical history, birth and vaccination history, family history and past history of patient was noted. The points noted were type of seizure, duration of illness and any associated complaints. Physical examination findings as for evidence of any neurocutaneous stigmata and complete CNS examination findings were noted. Routine blood investigations like complete blood profile, liver and renal function tests, blood glucose levels, blood electrolytes levels as advised by physician were noted. Other laboratory parameters like biochemical levels for leukodystrophies, serological studies for infections, CSF examination were done. Findings of EEG and CT scan if done were documented. Few cases had EEG documentation which was correlated with imaging findings. All patients were screened for ferromagnetic objects. Patients were subjected to MRI scanning (Philips Achieva 1.5 tesla, 16channel). When necessary, adequate sedation was given by the anesthetist. Conventional MR imaging was performed by taking T1 weighted (TE 8.0ms, TR 480 ms), T2 weighted (TE 102.9 ms, TR 4780 ms), and FLAIR (TE 92.2 ms, TR 8002 ms) sequences in planes as mentioned below. Post gadolinium(dose0.1mmol/kg) enhanced MRI was performed in axial, coronal and sagittal planes in selected cases depending on findings on non-contrast study or clinical suspicion. DWI and GRE (Gradient recalled echo) axial performed in all cases. When required, MR spectroscopy, MR venography and MR angiography including TOF was done. Final diagnosis was based on radiological features and in inconclusive cases; diagnosis was made by follow up MRI and treatment response. MRI Brain findings were noted and recorded.

RESULTS

Out of total 75 patients included in the study, 29 males and 12 females were in the age group 0-3 years, 12 males and 3 females were in the age group 4-6 years, 7 males and 5 females were in the age group 7-9 years while 3males and 4 females were in the age group 10-12 years. In our study, maximum male and female patients were in the age group of 0-3 years followed by 4-6 years.

Table 1: Age and Sex-wise comparison of patients (N=75)

Age Group	Male	Female	Total
0-3yrs	29	12	41
4-6yrs	12	03	15
7-9yrs	07	05	12
10-12yrs	03	04	07
Total	51	24	75

Outof75patientsstudied,55patients (73.3%) had positive findings on MRIwhile20 patients (26.7%) had normal MRI with no detectable lesions. Different types of seizure disorders were classified according to the recommendations of ILAE. Out of 75 patients, 51 patients (68%) presented with generalized seizures, 18 patients (24%) presented with focal seizures while 6 patients (8%) had an unknown onset. In our study, most common seizure type was generalized seizures. In the study, anoxia and hypoxic ischemic encephalopathy (HIE) comprised 23 patients (41.8%). Malformations of cortical development (MCD) was seen next in 11 patients (20%) followed by miscellaneous causes in 7 patients (12.7%), infection comprising of 4 patients (7.4%). Phakomatoses constituted 3 patients (5.5%). Mesial temporal sclerosis and inherited metabolic disorders and neoplasm constituted 2 patients each (3.6%). Vascular causes constituted only one patient (1.8%). Thus, most common etiology in our study was anoxia and hypoxic ischemic encephalopathy followed by malformations of cortical development.

Table 2: Distribution of various types of etiologies according to age group(N=55)

Type of Etiology	0-3yrs	4-6 yrs	7-9 yrs	10-12 yrs	Total
Mesial temporal sclerosis	2	0	0	0	2
Malformations of cortical development	5	4	1	1	11
Phakomatoses	2	0	0	1	3
Inherited metabolic disorders	2	0	0	0	2
Anoxia and hypoxic ischemic encephalopathy	13	4	5	1	23
Infection	2	1	1	0	4
Neoplasm	1	1	0	0	2
Vascular	0	1	0	0	1
Miscellaneous	4	1	1	1	7
Total	31	12	8	4	55

There was no statistically significant association between lesions andage. In our study, 55 patients with seizures had abnormal MRI. In age group of 0-3 years, the most common etiology was anoxia and HIE seen in 13 patients (41.9%) followed by malformations of cortical development in 5 patients (14.7%). Miscellaneous causes were seen in 4 patients (12.9%). In age group of 4-6 years, anoxia and HIE and malformations of cortical development were seen in 4 patients (33.3%) each. In age group of 7-9 years, the most common etiology was anoxia and HIE seen in 5 patients (62.5%). In age group of 10-12 years, the most common etiology were anoxia and HIE, malformations of cortical development, phakomatoses and miscellaneous causes seen in 1 patients each (25%). Thus, in our study, anoxia and HIE was the most common etiology in infants and young children (0-3 years) and in older children of age group (7-9 years) while in age group of (4-6 years), common causes were anoxia and HIE and malformations of cortical development. In the age group of (10-12 years) no single common cause was identified.

DISCUSSION

Identification of the cause of seizures is crucial for finding an effective treatment. With its high spatial resolution, excellent inherent soft tissue contrast, multiplanar imaging capability, and lack of ionizing radiation, MRI has emerged as a versatile tool in the evaluation of patients with central nervous system disorders.[3] In our study of 75 patients, maximum number of patients, 69.3% presented with generalized seizures. Our study correlates with the study done by Rasool A *et al*in which generalized seizures constituted the major seizure group being present in as many as 42% of patients.[4]Our study also correlates with the study done by Chaurasia R *et al*in which generalized seizures accounted for the major number of patients seen in 76.7%.[5] In this study of total 75 patients, 55 patients (73.3%) had abnormal MRI findings. Our study is comparable with the study done by Kuzniecky R *et al* in which MRI revealed abnormalities in 84% of patients.[6] In our study, MRI abnormality was detected in 88.9% patients having focal seizures, 70.6% patients having generalized seizures and 50% patients having unknown onset. Our study is comparable to Khodapanahandeh *et al* study**,** in which they found a significant relationship between abnormal neuroimaging and focal seizure.[7] Out of total 75 patients included in our study, 55 patients (73.3%) had abnormal MRI. Out of 55 patients, 31 (56.4%) patients were in the age group of 0-3 years, anoxia and HIE was the most common etiology in seen in 13 patients (41.9%). Malformations of cortical development were also common in this age group and were found in 5 patients (13.5%) followed by miscellaneous causes in 4 patients (12.9%). Out of 55, 12 patients (21.8%) were in age group 4-6 years, anoxia and HIE and malformations of cortical development were common causes in this age group and were seen in 4 patients 33.3% each. Out of 55, 8 patients (14.5%) in age group 7-9 years. Anoxia and HIE was the most common etiology in seen in 5 patients (62.5%) in this age group. Out of 55, 4 patients (7.3%) in age group 10-12 years, no single common etiology were seen in this age group. For etiology in age group 0-3 years, our study correlates well with Khreisat WH study, in which children suffering from seizures below the age of 2 years were studied. The most common etiological factor found in this study was perinatal asphyxia seen in 55%, followed by CNS infection in 15%, anomalies of central nervous system in (9%), head injuries in (8%), congenital and here do familial disorders in (8%) and prematurity in (5%).[8]Our study also correlates well with Leth H *et al*, study 31 term neonates (n=31). Seizure etiology was considered to be hypoxic-ischemic in 35%, hemorrhagic in 26%, metabolic disturbances and cerebral dysgenesis in 16% and unknown in 23%. MRI detected a remarkably high incidence of brain lesions in neonatal seizures. Almost half of these were of prenatal origin and pathogenesis may essentially be attributed to hypoxic and/or hemodynamic causes.[9]Our

study correlates with Durá-Travé T *et al*study, in which children inthe age group 1 month to 15 years at the time of diagnosis of epilepsy wererecorded. The most common abnormalities included white-matter lesions (27.6%), volume loss (19.6%), gray-matter lesions (19.6%), and ventricularenlargement (12%).[10] In our study, 41.8% patients had anoxia and hypoxic ischemic encephalopathy followed by malformations of cortical development which were seen in 20% of patients. 12.7% patients had miscellaneous causes. Infection constituted 7.4% patients followed by phakomatoses in 5.5% patients. Mesial temporal sclerosis, inherited metabolic disorders and neoplasms constituted 3.6% patients each and least common etiology was vascular causes which constituted 1.8% patients. In NK Rollins *et al* study, out of 15 patients, five patients had focal ischemic injury of the cerebral hemispheres and/or basal ganglia and brain stem. Six patients had diffuse cerebral edema, of these; five had basal ganglia edema; one had brain stem edema. One patient had superior sagittal sinus thrombosis with venous infarcts. Three patients had normal MRI studies.[10]In Leth H *et al*study, MRI was positive in 68% patients. The study revealed hypoxic-ischemic etiology as the major cause of seizures in 35%, hemorrhagicetiology in 26%, metabolic disturbances and cerebral dysgenesis in 16% and unknown cause in 23%.[9]Our study is comparable with the above mentioned studies and shows hypoxic ischemic encephalopathy as the most common etiology in paediatric seizure disorder.

CONCLUSION

Identification of cause of seizure is important for management. Due to high spatial resolution, excellent inherent soft tissue contrast, multi-planar imaging capability and lack of ionizing radiation; MRI has emerged as a versatile tool in imaging of paediatric patients with seizures.

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