

Radiological and Electrophysiological Abnormalities in children presenting with afebrile seizures in a tertiary care centre'



Paediatrics

KEYWORDS: Neuroimaging, EEG, Cerebral palsy, Neurocysticercosis.

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ABSTRACT

BACKGROUND: The present study aims at determining the frequency of radiological (Neuroimaging) and electrophysiological (EEG) abnormalities in children admitted with afebrile seizures and also to determine the most common cause of these abnormalities. **METHODOLOGY:** The present study included 96 children presenting with afebrile seizures between the age groups of 2 months to 10 years admitted to PICU, Pediatric department of Alluri Sitarama Raju Academy of Medical Sciences Hospital, Eluru, during the period of two years from Dec 2014 to Sep 2016. Seizures were classified based on latest terminology laid by ILAE (Berg et al.) 2010. All the children were subjected to EEG and either CT/MRI (with or without contrast) or both. The subsequent findings helped in determining the cause of afebrile seizures. **RESULTS:** Afebrile seizures were more commonly found in males when compared to females. Higher percentage of children in the present study group hailed from rural areas which were resource limited. 42.7% of the study group belonged to the age group of 6 months- 4 years. In the age groups 6 months- 4 yrs and 4-6 yrs GTCS was most common. whereas between 6-8 yrs, and 8-10 yrs Focal seizures were more common. The frequency of radiological (Neuroimaging) abnormalities was determined to be 76%, which indicates that Neuroimaging is necessary in afebrile seizures. Most common cause of radiological (Neuroimaging) abnormalities was determined as Cerebral Palsy 59.4%, followed by Neurocysticercosis 11.4%. Cortical Atrophy was the most common radiological abnormality observed in children with Cerebral Palsy. In Neurocysticercosis single lesions (91%) were most commonly observed. The Frequency of EEG abnormalities in the present study was 53.2%. In cases presenting with GTCS, EEG abnormalities were observed in 73.4% followed by Focal seizure with impairment of consciousness 37.9%. Different patterns of EEG observed were: Generalized epileptiform discharge (68.6%), Focal epileptiform discharge (25.4%), Multifocal (4%), Others (Burst Suppression) (2%). Cerebral palsy and Neurocysticercosis were determined to be one of the common causes of acquired epilepsy. Most common Cause of Radiological (Neuroimaging) and Electrophysiological Abnormalities was Cerebral Palsy (84.3%) and the 2nd most common was Neurocysticercosis (2.6%). **CONCLUSION:** Radiological (Neuroimaging) And Electrophysiological (EEG) abnormalities are common in afebrile Seizures. Etiology of afebrile seizure are (Neuroinfections, Neurocysticercosis, Metabolic causes, Neurotrauma following Adverse perinatal events (Birth Asphyxia) etc) Most of these are treatable (like Neuroinfections, Neurocysticercosis.) and are easily picked up in Neuroimaging. Future epilepsy can be predicted by EEG as it proved to be a sensitive modality in picking up abnormalities and treatment can be accordingly given.

INTRODUCTION: Acute symptomatic seizures occur secondary to an acute problem affecting brain excitability such as electrolyte imbalance. Most children with these types of seizures do well. However, sometimes these seizures signify major structural, inflammatory, or metabolic disorders of the brain, such as meningitis, encephalitis, acute stroke, or brain tumour. Consequently, the prognosis depends on the underlying disorder, including its reversibility and the likelihood of developing epilepsy from it¹. Approximately 4-10% of children experience at least 1 seizure (febrile or afebrile) in the 1st 16 yrs of life. The cumulative incidence of epilepsy is 3%, and more than half of the cases start in childhood². The overall prevalence (3.0-11.9 per 1,000 population) and incidence (0.2-0.6 per 1,000 population per year) data from recent studies in India on general population are comparable to the rates of high-income countries, despite marked variations in population characteristics and study methodologies. In these cases abnormal Neuroimaging / EEG can be expected in up to 50% of cases³. This study aims to determine the frequency of abnormal Neuroimaging and EEG in afebrile seizures and also to determine the most common cause these abnormalities.

METHODOLOGY: In a hospital based prospective study, 96 children presenting with afebrile seizures between the age groups of 2 months to 10 years admitted to PICU, Pediatric department of Alluri Sitarama Raju Academy of Medical Sciences Hospital, Eluru, during the period of two years from Dec 2014 to Sep 2016 were included. Seizures were classified based on latest terminology laid by ILAE Berg et al¹ 2010. All the children were subjected to meticulous neurological, medical assessment, EEG and either CT/MRI (with or without contrast) or both. The subsequent findings helped in determining the cause of afebrile seizures. Data was compiled using SPSS software.

INCLUSION CRITERIA:

Children aged 2 months to 10 years admitted with afebrile seizures

EXCLUSION CRITERIA:

1. Febrile seizures
2. Seizures with fever (Meningitis, encephalitis)
3. Known cases of Seizures who were previously subjected to radiological (Neuroimaging) and electrophysiological (EEG) tests

RESULTS:

TABLE 1: GENDER DISTRIBUTION OF STUDY GROUP

Sex	No. of cases	Percentage
Males	50	52%
Females	46	48%
Total	96	100%

Gender distribution in the present study showed higher percentage of afebrile seizures in males (52%) than in females (48%)

TABLE 2: DISTRIBUTION OF CASES BASED ON PLACE OF LIVING:

Rural/Urban	No. of cases	Percentage
Rural	69	72%
Urban	27	28%
Total	96	100%

Most of the children hailed from rural areas (72%) which were resource limited (Lack of Investigative Modalities)

TABLE 3: AGE WISE DISTRIBUTION OF STUDY GROUP

Age	No. Of Cases	Percentage
2months-6months	2	2.1%
6months -4yrs	41	42.7%
4yrs-6yrs	26	27.1%
6yrs-8yrs	15	15.6%
8yrs-10yrs	12	12.5%
Total	96	100%

Children between the age groups 6months - 4 yrs showed higher incidence of afebrile seizures 42.7%

TABLE 4: DISTRIBUTION OF DIFFERENT TYPES OF SEIZURES AMONG VARIOUS AGE GROUPS

Age	GTCS	Focal without impairment of consciousness (SPS)	Focal with impairment of consciousness (CPS)	Focal seizure with secondary generalization	Total cases=96 Percentage (100%)
2months-6months	1	1			2 2.1%
6months -4yrs	28	1	9	3	41 42.7%
4yrs-6yrs	11	4	7	4	26 27.1%
6yrs-8yrs	5	2	7	1	15 15.6%
8yrs-10yrs	4	2	6		12 12.5%

Distribution of different types seizure based on age in the present study showed higher incidence of GTCS in the age groups 6months-4yrs and 4-6yrs. whereas between 6-8yrs, and 8-10yrs Focal seizures were more common

TABLE 5: FREQUENCY OF RADIOLOGICAL ABNORMALITIES (NEUROIMAGING: CT/MRI)

Neuroimaging	No Of Cases	Percentage
Abnormal	73	76%
Normal	23	24%
Total	96	100%

The Frequency Of Radiological (Neuroimaging) Abnormalities was determined to be 76%.

TABLE 6: CAUSES OF RADIOLOGICAL ABNORMALITIES (NEUROIMAGING: CT/MRI)

Cause	No of cases	Percentage
Cerebral Palsy	57	59.4%
Neurocysticercosis	11	11.4%
Tuberculoma	2	2.1%
Neurodegenerative disorders	2	2.1%
Porencephaly	1	1.1%
Normal imaging	23	23.9%
Total	96	100%

Most common cause of Radiological (Neuroimaging) Abnormalities in the present study was determined as Cerebral Palsy 59.4%, which was followed by Neurocysticercosis 11.4%

TABLE 7: RADIOLOGICAL ABNORMALITIES (NEUROIMAGING) IN CEREBRAL PALSY

Abnormality	No. of Cases	Percentage
Cortical Atrophy	28	49.2%
Periventricular Leukomalacia	15	26.3%
Malformations	3	5.3%
Others*	11	19.2%
Total	57	100%

*(Basal ganglia involvement, nonspecific grey and white matter changes)

Cortical Atrophy was the most common Radiological abnormality observed in children with Cerebral Palsy 49.2%, which was followed by Periventricular Leukomalacia 26.3%.

TABLE 8: RADIOLOGICAL ABNORMALITIES (NEUROIMAGING) IN NEUROCYSTICERCOSIS:

Lesions	No Of Cases	Percentage
Single	10	91%
Multiple	1	9%
Total	11	100%

Neurocysticercosis Radiological (Neuroimaging) Abnormalities revealed higher incidence of single lesions (91%).

TABLE 9: FREQUENCY OF ELECTROPHYSIOLOGICAL (EEG) ABNORMALITIES

EEG	No. Of cases	Percentage
Abnormal	51	53.2%
Normal	45	46.8%
Total	96	100%

The Frequency of EEG abnormalities in the present study was observed to be 53.2%.

TABLE 10: ELECTROPHYSIOLOGICAL ABNORMALITIES (EEG) AMONG CHILDREN WITH DIFFERENT TYPES OF SEIZURES

Type Of seizure and total no of cases=96	Abnormal EEG/%	Normal EEG/%
GTCS - 49	36 - 73%	13 - 27%
Focal without impairment of consciousness(SPS) - 10	3 - 30%	7 - 70%
Focal with impairment of Consciousness(CPS) - 29	11 - 38%	18 - 62%
Focal with secondary Generalization - 8	1 - 12.5%	7 - 87.5%
X ² =18.3, p<0.001(S)		

EEG abnormalities was observed in 73.4% of the cases presented with GTCS showed followed by Focal seizure with impairment of consciousness 37.9% Here p<0.001 (S) indicating it to be sensitive modality in picking abnormality in seizures.

TABLE 11: TYPES OF EEG ABNORMALITIES IN THE PRESENT STUDYGROUP

Abnormality	No of Cases	Percentage
Generalized Epileptiform Discharge	35	68.6%
Focal Epileptiform Discharge	13	25.4%
Multifocal Epileptiform Discharge	2	4%

Others*	1	2%
Total	51	100%

*Burst Suppression Pattern

In the present study, Generalized epileptiform discharge was most commonly observed in EEG.

TABLE 12: CAUSES OF EEG ABNORMALITIES IN THE PRESENT STUDY GROUP

Etiology	No. of Cases	Percentage
Cerebral Palsy	32	62.7%
Neurocysticercosis	4	7.8%
Seizure Disorder	Focal Seizure Disorder-5 Generalized Seizure Disorder-8	25.5%
Tuberculoma	1	2%
Porencephaly	1	2%
Total	51	100%

X² =15.8 p<0.01(s)

Causes of EEG abnormalities in the present study were determined as Cerebral Palsy 62.7%, which was followed by Seizure Disorders (Both focal and generalized together) 25.5% Neurocysticercosis 7.8%.

TABLE 13: FREQUENCY OF EEG ABNORMALITIES IN CEREBRAL PALSY AND NEUROCYSTICERCOSIS

In children with cerebral palsy, 56.1% had EEG abnormalities. In children with Neurocysticercosis, 36.3% had EEG abnormalities.

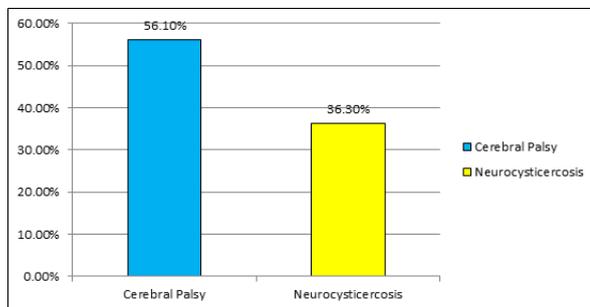
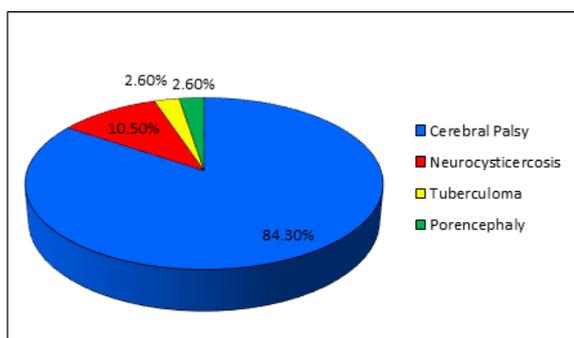


TABLE 14: CAUSES OF BOTH RADIOLOGICAL (NEUROIMAGING CT/MRI) AND ELECTROPHYSIOLOGICAL (EEG) ABNORMALITIES

Etiology	No. of Cases	Percentage
Cerebral Palsy	32	84.3%
Neurocysticercosis	4	10.5%
Tuberculoma	1	2.6%
Porencephaly	1	2.6%
Total	38	100%



Most common Cause of Radiological (Neuroimaging) and Electrophysiological Abnormalities was Cerebral Palsy (84.3%) and the 2nd most common was Neurocysticercosis (2.6%).

DISCUSSION: Afebrile seizures were found more commonly in males than in females. Akther Rasool et al.⁴ conducted a similar study in Kashmir and the observations were similar 58.7% in males and 41.3% in females. In studies conducted by Sudhir Adhikari et al.⁵ and Arpita Gogoi et al.⁶ also similar findings were observed. There is no specific reason attributed to this entity and the possible explanation would be the relative negligence of female child when compared to male child in low socioeconomic groups. Most of the cases hailed from rural areas. It was observed that children between the age group of 6months- 4 yrs (42.7%) were found to have higher incidence of afebrile seizures which is similar to the findings of Akther Rasool et al.⁴. GTCS was the most commonest type of seizure followed by Focal seizures similar to the observations of Poudel et al.⁷ In the present study the frequency of radiological abnormalities found to be 76% of the total cases similar to the findings of Dr. Narendra saini et al.⁸ It indicates that there is definite need for Neuroimaging in afebrile seizures due to higher incidence of abnormalities. Most common cause of radiological (Neuroimaging) abnormalities was found to be Cerebral Palsy (59.4%) followed by Neurocysticercosis (11.4%) ,followed by others (Tuberculoma 2.1%, Neurodegenerative disorders 2.1%, Porencephaly 1.1%). Dr. Narendra Saini et al.⁸ in their study found NCC and Tuberculoma in Neuroimaging. In the present study most common cause of radiological abnormalities was Cerebral palsy which accounted to 59.4% of the cases. Cortical atrophy was more commonly observed in Neuroimaging in CP cases similar to the findings of Gedam et al.⁹ Anju Aggarwal et al.¹⁰ Robinson MN et al.¹¹ Ashwal S et al.¹² . Children with cerebral palsy presenting with afebrile seizures were more commonly found to be between the age groups of 6months-4yrs compared to other age groups. Gedam DS et al.⁹ made similar observations in their study (1-5yrs - 68%). Reason behind this could be that usually in early childhood i.e. between 1-5yrs of age, physical disability becomes more and more obvious and parents bring their children with seizures for evaluation. But in older children with CP (age groups above 6yrs), parents understand the nature of the disease well and in spite of seizures or any other complications they become reluctant to come to the hospital for evaluation. In NCC cases Single lesions were found in 91% of the cases which was similar to the studies conducted by Ravi Singh Chauhan et al.¹³ Singhi P et al.¹⁴ Shakya Bhattacharjee et al.¹⁵ by Rajashekar et al.¹⁶ and Tushar B Patil et al.¹⁷ . In the present study the frequency of EEG abnormality was found to be 53.1% cases which is similar to the observations made by Akther Rasool et al.⁴ (56.2%), Shinnar et al.¹⁸ Baheti et al.¹⁹, Jasons et al.²⁰ and King et al.²¹ In the present study in children presenting with GTCS 73.4% had abnormal EEG, Focal without impairment of consciousness (SPS) 30%, Focal with impairment of Consciousness (CPS) 37.9% , Focal with secondary Generalization 12.5%. Chi square was found to be 18.3 and p<0.001 which is significant. It indicates the sensitivity of EEG as a modality in picking up abnormalities in seizures. EEG patterns observed were Focal epileptiform discharge in 25.4% Generalized epileptiform discharge in 68.6% Multifocal epileptiform discharge in 4% and others (Burst suppression) in 2% which were similar to those observed in study by Al- Sulaiman AA et al.²² In the present study causes of Abnormal EEG were found to be Cerebral Palsy 63.7%, Neurocysticercosis 7.8%, Seizure Disorders 25.5%, Porencephaly 2% and Tuberculoma 2%. EEG abnormalities in Neurocysticercosis were found in 36.3% of the total NCC cases which was similar to the observations of Rajnish Kumar et al.²³ It can be inferred that Neurocysticercosis is one of the commonest cause for acquired epilepsy in India. Causes of both radiological and electrophysiological abnormalities observed were Cerebral palsy (72.2%), followed by Neurocysticercosis (22.2%), Tuberculoma 1 case (2.8%), Porencephaly 1 case (2.8%). Poudel et al.⁶ Arpita Gogoi et al.⁶ , S.Adhikari et al.⁵ made similar observations with reference to NCC and Tuberculoma. . As CP is essentially a clinical diagnosis Neuroimaging and EEG are routinely not done for etiological diagnosis. But in a child with CP presenting with seizures

Neuroimaging and EEG are essential in order to determine the focus as well as to establish epilepsy if any features are suggestive. This will help to prognosticate the child and also in treatment levels and duration.

CONCLUSION: Seizures are common in children with a differential distribution among various socioeconomic and demographic groups with higher rates reported for the male gender, rural population and low socioeconomic status. Radiological (Neuroimaging) And Electrophysiological (EEG) abnormalities are common in afebrile seizures. Initially it was not clearly defined as to what would be the indications for investigating children with afebrile seizures. After much debate and research the importance of detailed investigation in terms of Neuroimaging and EEG has been emphasised. This importance is attributed to the varied etiology of afebrile seizure (Neuroinfections, Neurocysticercosis, Metabolic causes, Neurotrauma following Adverse perinatal events (Birth Asphyxia) etc) Most of these are treatable (like Neuroinfections, Neurocysticercosis.) and are easily picked up in Neuroimaging. In a nutshell Radiological and Electrophysiological assessment is an integral part of evaluating afebrile seizures

IMAGES



IMAGE 1: Porencephaly



IMAGE 2: Neurocysticercosis Lesion with Perilesional Edema



IMAGE 3: A case of Cerebral Palsy showing Periventricular Leukomalacia in MRI

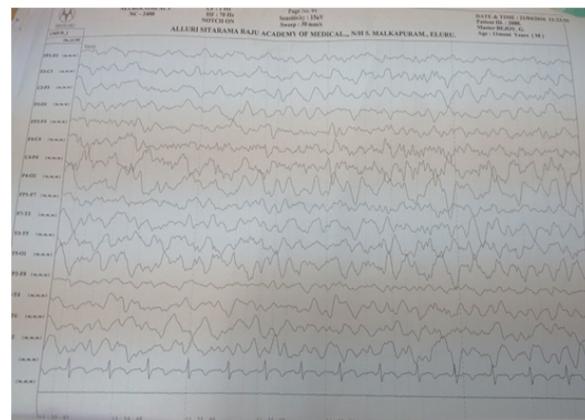


IMAGE 4: EEG showing Focal Epileptiform Discharge

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