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Multifarious Pediatric Seizures: It's Correlation with EEG & Neuroimaging

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Abstract
Seizures in pediatric age group are generally signaling a potentially serious underlying systemic or central nervous system disorders that require thorough clinical examination, investigation and management. It is therefore important to establish accurate diagnosis of seizures and its etiology to appropriately manage such patients. We carried out this study to evaluate different etiology of seizures and its correlation with abnormal EEG & abnormal neuroimaging in the age group of 1month to 14 years. 144 children presented with seizure to our department from September 2017 to August 2019 were enrolled in this prospective hospital based study. Detailed history, clinical examination, investigation with special emphasis to EEG & neuroimaging was done and different correlation was drawn by using SSPS 18.0 statistical analysis. Among 144 cases, 6 to 10 yr age group constituted maximum (45.14%) number of cases. Male to female ratio is 1.44:1. GTCS is the predominant pattern of seizure (63.89%) in all age groups. EEG abnormality is found in 47.92%, mostly in partial seizure type. Neuroimaging abnormality found in 27.08%. Maximum cases (25%) had infectious etiology. Pediatric seizure needs detailed history taking and careful examination. EEG has a role in specific seizure type; neuroimaging at times helps in diagnosis.
Keywords: *Epilepsy, GTCS, EEG, Neuroimaging.*

Introduction

Seizure occurs due to synchronization of electrical waves in the brain. Convulsion denotes to motor seizure. Fits is a layman terminology where as EPILEPSY means mostly generalized seizure of idiopathic aetiology. As per ILAE 2017 seizures are mainly focal, generalized and unclassified type.

Seizure disorder includes all variety of seizures like febrile seizure, symptomatic seizure due to neuroinfection, metabolic causes like hypoglycemia, hypocalcemia, dyselectromia, different syndromic seizure like LG syndrome, WEST syndrome, LKS, benign rolandic epilepsy of childhood and last but not least primary generalized epilepsy.

EPILEPSY is more common in developing world in comparision to developed world. Till now also among many rural pockets epilepsy is treated as social stigma, thus heading towards naturopathy and non allopathic treatment.

Any child presenting with seizure initial job is to confirm wheather it is seizure or not? Many times seizure mimics like benign paroxysmal vertigo, syncope, hysteria, cyanotic spell, extrapyramidal reaction and different movement disorder do

present like seizure. Once it is confirmed to be seizure immediately after ABC management IV assess is to be made. Our main aim is always to abort seizure following seizure protocol irrespective of causality of seizure.

After control of seizure detail history to be taken regarding family history, number of attack, neurodevelomental status, particular age group , timing of seizure , clinical semiology, provocating factor like fever, sound, photic stimulation or hyperventilation, detail drug history, compliance. All seizure should be managed following syndromic approach.

Neuroinfection like neurocysticercosis and tuberculoma are the important causes of unprovoked seizure in developing country like INDIA where as in developed countries neoplasm, CVA, motor delay and head trauma are common causes.

Neonatal seizure are different category of seizure out of which subtle and multifocal seizure are common. Hypoxic ischemic encephalopathy is the commonest cause of seizure in neonates within first day of life. Besides this hypoglycemia, hypocalcemia. Hyponatremia, hypokalemia, neuronal malformations, meningitis, uremia and inborn error of metabolism are the important causes of neonatal seizure. Phenobarbitone is the drug of choice for seizure management

EEG being an helping tool in diagnosis of syndromic seizure particularly. But always clinical semiology and EEG both along with detail history will pinpoint towards diagnosis. Certain conditions like SSPE, absence sizure, benign rolandic epilepsy of childhood, infantile spasm will have typical characteristic findings in EEG. Some timesbefore stopping of AED EEG are of emmence help.

In 21st century neuroimaging has revolutionized towards diagnosis and management of seizure. Many cases of idiopathic seizure treated before neuroimaging era might be cases of neurogranuloma as more and more number of cases are coming as RING ENHANCING LESION (REL) are coming out to beneurogranuloma. Any new onset focal seizure in a otherwise neurodevelopmentally normal child neuoimaging is a must to rule out pathology in the brain. MRI being the modality of choice in ICSOL, Neurodegenerative conditions where as bone, blood and calcification are being better visualized in CT imaging. MR angiography can lead to diagnosis of vascular malformation.

MRI is superior to CT imaging in assessing refractory seizure and temporal lobe epilepsy. During follow up of ICSOL, post sugical patients MRI score over CT IMAGING.

This study is to evaluate various etiologies of seizures and to study the clinical correlation with EEG and neuroimaging studies. This helps in early intervention and prevention of neurological complications. Early detection and institution of prompt remedial measures so that it results in favorable prognosis.

Our MKCG Medical College, Dept. of pediatrics caters large number of patients from south Odisha and adjoining parts of Andhra Pradesh. Lot cases used to present with seizure due to varied etiology. No study till yet conducted regarding cause of seizure and its correlation with EEG and neuroimaging. So this study will be of immense help to find out the arena of causes of seizure for early intervention, thus reducing morbidity and mortality.

Aim of the Study

To study the various etiologies of seizures in patients of age group of 1 month to 14 years presented to MKCG medical college, Berhampur, to find out frequency of abnormal EEG and abnormal neuroimaging in these cases and various correlations among them.

Materials & Methods

We conducted a hospital based prospective study in the department of pediatrics, MKCG medical college, Berhampur from September 2017 to August 2019. We included all children of age group 1 month to 14 years presented to our department with seizure during the study period.

We took neonatal seizure, pseudo seizure, simple febrile seizure and metabolic seizure as exclusion criteria. According to the inclusion and exclusion criteria 144 numbers of cases were collected. All patients were subjected to detailed history and clinical examination as per case Performa. As per need, appropriate investigation was done with special emphasis on EEG, CT scan Brain, and MRI brain.

The collected data were interpreted and analysed using SPSS software (version 18) and described in terms of frequency and percentage in the form of text, tables and pictorial form. Relevant associations were made using chi-square test and different attributes were made and p value was calculated. P value <0.05 taken as significant.

Results

144 cases of seizure cases of 1 month to 14 years of age were studied, from NOV 2015 to OCT 2017 in the Department of Pediatrics, M.K.C.G. Medical College and Hospital, Berhampur. Detailed history, physical examinations and investigations (including EEG and neuroimaging) were done in all cases to find out the etiology of seizures and correlation of seizure with etiology, EEG and neuroimaging. Among 144 cases, 6-10 year age group constituted the maximum (65 cases, 45.14%) followed by 1month - 5 year age group (49 cases, 34.03%) and 11-14 year age group (30 cases, 20.83%).

Table 1: Generalized vs. Focal seizure among different group

AETIOLOGY	GENERALIZED	FOCAL
INFECTIVE	27(30%)	9(17%)
ATYPICAL FEBRILE	15(16%)	19(36%)
EPILEPSY	16(17%)	10(19%)

(Table 1 indicates that generalized seizure is common in infection & idiopathic epilepsy group, whereas focal seizure is common among atypical febrile seizure group)

The male groups constituted the majority (85 cases, 59.03%) than the female group (59 cases, 40.97%). The male: female ratio is 1.44:1. Regarding seizure pattern, out of 144 cases, 92 cases (63.89%) presented with generalized seizure and 52 cases (36.11%) presented with partial seizure. GTCS (54.17%) is the predominant seizure subtype followed by complex partial seizure (23.61%), simple partial seizure (12.50%), tonic seizure (4.17%), and myoclonic seizure (3.47%). Absence seizure (2.08%) was least common type of seizure in our study. Regarding seizure pattern in different age group, GTCS was the predominant seizure type in all age group. EEG was done in 144 cases out of which EEG abnormality was found in 69 cases (47.92%). Out of 92 cases of generalized seizure, 55 cases (59.78%) had normal EEG and 37 cases (40.22 %) had abnormal EEG. Out of 52 cases of partial seizure, 20 cases (38.46 %) had normal EEG and 32 cases (61.54%) had abnormal EEG. So EEG abnormality was high in partial seizure group than generalized seizure.

Table 2: EEG correlation among different seizure type

SEIZURE TYPE	EEG		TOTAL
	NORMAL	ABNORMAL	
GENERALIZED	55(60%)	37(40%)	92(100%)
FOCAL	20(38%)	32(62%)	52(100%)
TOTAL	75(52%)	69(48%)	144(100%)

(Table 2 shows EEG is abnormal in more number among focal seizure type)

Neuroimaging (CT/ MRI) done in all cases. Out of 144 cases, 105 cases (72.92%) had normal neuroimaging and 39 cases (27.08%) had abnormal neuroimaging. Out of 92 cases of generalized seizure, 71 cases (77.17%) had normal and 21 cases (22.83%) had abnormal neuroimaging. Out of 52 cases of partial seizure, 34 cases (65.38%) had normal neuroimaging

and 18 cases (34.62%) had abnormal neuroimaging.

Out of 39 cases of abnormal neuroimaging, 12 cases (30.77%) had cerebral atrophy, 7 cases (17.95%) had dilated ventricle, 3 cases (7.69%) each had cerebral abscess, infarction, calcification and tumor, 4 cases (10.25%) had tuberculoma, 2 cases (5.13%) had neurocysticercosis, 1 case (2.57%) each had porencephalic cyst and corpus callosal agenesis. So cerebral atrophy and dilated ventricle was most common neurological abnormality.

Table 3: CT/MRI correlation among different seizure type

TEST	CT/MRI BRAIN		TOTAL
	NORMAL	ABNORMAL	
GENERALIZED	71(77%)	21(23%)	92
FOCAL	34(65)	18(35%)	52
TOTAL	105	39	144

(Table 3 shows more neuroimaging abnormality in focal seizure type)

Regarding correlation of neuroimaging (CT/MRI) with EEG, Out of 76 cases of normal EEG, 68 cases (90.67%) had normal neuroimaging and 7 cases (9.33%) had abnormal neuroimaging and out of 69 cases of abnormal EEG, 37 cases (53.62%) had normal and 32 cases (46.38%) had abnormal neuroimaging. Thus neuroimaging abnormality was seen more commonly in those patients who had an abnormal EEG.

Regarding correlation of atypical febrile seizure and EEG, out of 34 cases of atypical febrile seizure, abnormal EEG was detected in 4 cases i.e. in 11.76% of cases of atypical febrile seizure had abnormal EEG. Thus probability of finding abnormal EEG in atypical febrile seizure is very less.

Regarding correlation of atypical febrile seizure and neuroimaging (CT/MRI), no neuroimaging abnormality was found in atypical febrile group.

Out of 13 cases of ring enhancing lesions, 4 cases (30.77%) had tuberculoma, 2 cases (15.38%) had neurocysticercoma and 3 cases (23.08%) each had cerebral abscess and brain tumor and 1 case (7.69%) had toxoplasmosis. Thus tuberculoma was the leading cause of ring enhancing lesion.

Regarding etiology of different seizure, maximum cause of seizure in children is due to infectious etiology (pyogenic meningitis, viral encephalitis and tubercular meningitis) which constituted 36 cases (25%) followed by atypical febrile seizure (34 cases, 23.61%) and epilepsy group (26 cases, 18.06%). Cerebral palsy constituted 8.33% of cases, epileptic syndromes 5.55%, tuberculoma 2.78%, neurocysticrcoma 1.39%, congenital hydrocephalus, brain tumor, stroke, cerebral abscess 2.08% each, porencephalic cyst, tuberous sclerosis, corpus callosal agenesis, toxoplasmosis, SWS in 0.69% of cases and undiagnosed seizure in 3.47% of cases.

Conclusion

Seizure is common neurological problem in pediatric age group. A careful and detailed history, thorough clinical examination, sometimes EEG or more advanced testing is required to differentiate it. Majority of seizures begin in childhood and there is male predominance of seizure. Generalized seizure is the predominant seizure type and GTCS is the major seizure subtype in all age group in our study. Epileptiform abnormalities in the EEG support a clinical diagnosis of seizure, help in the diagnosis of specific syndrome. Many epileptic syndromes are diagnosed by EEG only. A normal EEG may not exclude seizure disorder in children. Computed tomography (CT) scans and magnetic resonance imaging

(MRI) scans are important adjunct to clinical examination and EEG in the evaluation of seizure. CT scan is more useful in detecting calcifications, neurocysticercosis, tuberculoma, metastatic tumors, abscesses and toxoplasmosis. Normal EEG finding may have abnormal CT/MRI finding. In atypical febrile seizure, the probability of

getting abnormal EEG and neuroimaging is very less.

Most common cause of ring enhancing lesion (REL) was tuberculoma. Major etiological factor of seizures in children are CNS infection, epilepsy, febrile seizure and cerebral palsy. Most of the seizures can be prevented by controlling infection, improving health education, controlling tuberculosis, neurocysticercosis, preventing birth asphyxia. Documentation of clinical semiology, syndromic approach, and targeted intervention will give a path for better management and outcome. Seizures should be adequately treated according to the etiology and should be controlled with antiepileptic drugs in order to prevent further brain damage. Parents should be counseled for adequate and regular use of antiepileptic drugs and follow up. In this 21st century seizure is no more a social stigma entity. Proper counseling, patient education and appropriate duration of therapy will lead to better compliance thus giving a quality life to idiopathic epileptic and syndromic epileptic children.

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