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# CLINICAL AND INVESTIGATIVE FEATURES OF SEIZURE IN CHILDREN ADMITTED IN TERTIARY CARE HOSPITAL OF NORTHERN INDIA

**Pediatrics**

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## ABSTRACT

**Introduction:** Convulsions are one of the most common paediatric neurological disorders worldwide, with its incidence being highest among children younger than 3 years of age. It is also one of the most frequent causes for visit to the pediatric emergency department and could either be idiopathic or secondary to disease process of brain. **Aims and objectives:** Seizures lead to alterations in the laboratory values and reflect changes in different organ systems. This study was done to evaluate the clinical, laboratory, EEG and CT findings in cases of seizure among children between 1month to15years of age. **Materials and methods:** It was a descriptive study conducted in patients admitted in emergency and indoor of department of paediatrics, Patna Medical College and Hospital, over a period of 2 years from October 2014 to September 2016. Children from 1 month to 15 years of age with seizures were studied to know the proportion of idiopathic or secondary seizures and to evaluate various laboratory, EEG and CT findings in these cases. **Results:** During study period, 200 children between ages 1 month to 15 years, with convulsion, were enrolled. Seizures were found to be more common in males (67.5%). Secondary seizures were present in 90% cases and idiopathic epilepsy accounted only for 10%. GTCS was the commonest type of seizure both in idiopathic epilepsy (100%) as well as in secondary seizure group (87.77%). Family history of seizure disorders was present in 13% of cases. Developmental delay was found in 11.5% cases, whereas 88.5% children were developmentally normal. Commonest symptoms associated with secondary seizures were fever (86.11%), altered sensorium (77.22%), and cough (38.89%). Headache, vomiting, ear discharge, rashes were other symptoms. Altered sensorium (69.5%), neck stiffness (33%), cranial nerve involvement (16%) were commonest signs. Hypocalcemia, hyponatremia and hypoglycaemia were found in 4.5%, 1.67% and 1.11% cases respectively, in cases of secondary seizures. CSF analysis was done in all 200 cases and was found to be normal in all cases (100%) of idiopathic epilepsy, whereas it was abnormal in 81% cases of secondary seizures. Abnormal CSF findings included low CSF glucose (24.69% cases), high CSF proteins (100%) and CSF pleocytosis in 82.71% cases. EEG was also done in all cases, and was found to be abnormal in 85% cases of idiopathic epilepsy, whereas 43.89% cases of secondary seizures had abnormal recordings. Abnormal EEG recordings were abnormal background activity in 60.41%, generalised interictal discharges (IED) in 77.08% and focal IED in 21.87%. Abnormal CT scan findings were seen in 60(45.8%) cases. Out of these 60 cases, commonest CT scan abnormalities seen were cerebral oedema (45%), cerebral atrophy (20%), and hydrocephalus (16.7%). Other CT findings were ring enhancing lesions, basal exudates, infarcts etc.

## KEYWORDS

Idiopathic epilepsy, altered sensorium, hypocalcemia, IED, cerebral oedema.

## I. INTRODUCTION

Convulsions are the most common pediatric neurological disorder worldwide. They are also one of the most frequent causes for visit to the pediatric emergency department. Around 4%- 10% children suffer at least 1 seizure (febrile or afebrile) in the 1st 16 years of life. The incidence is highest in children younger than 3 yrs of age with decreased frequency in older children [1]. A seizure or convulsion is defined as transient involuntary alteration of consciousness, behaviour, motor activity, sensation or autonomic function which is caused by excessive rate and hyper synchrony of discharges from a group of cerebral neurons. A postictal period of decreased responsiveness usually occurs in most seizure episodes. A seizure or convulsion can also be defined as transient occurrence of signs and symptoms resulting from abnormal, excessive or synchronous neuronal activities in brain [2]. The international classification of Epileptic seizures divides epileptic seizures into two large categories- A: FOCAL (partial) in which first clinical and EEG changes suggest activation of neurons limited to parts of one cerebral hemisphere. The term simple partial refers to focal seizure with no alteration of consciousness whereas complex partial also called focal dyscognitive seizure denote focal seizure with altered awareness of surroundings. B: GENERALISED seizure in which the first clinical and EEG changes indicate synchronous involvement of all of both hemispheres Epilepsy is a disorder of brain which is characterised by enduring predisposition to generate seizures and by neurobiological, cognitive, psychological and social consequences of this condition. "The clinical diagnosis requires the occurrence of at least 1 unprovoked epileptic seizure with either a second such seizure or enough EEG and clinical information to convincingly demonstrate an enduring predisposition to develop recurrences." For epidemiological purposes epilepsy is considered to be present when 2 or more unprovoked seizures occur in a time frame of >24 hours [2]. SEIZURE DISORDER is a general term that is usually used to include any 1 of several disorders, including epilepsy, febrile seizures, and possibly single seizure and symptomatic seizures secondary to metabolic, infectious, or other aetiologies like hypocalcemia, meningitis etc [2].

Clinical manifestation of seizure depends on the threshold of brain to manifest it. Age, neuro-developmental maturity status, family history, developmental history determines the clinical manifestations and type of seizure disorder. Thorough evaluation, including careful history, physical examination, laboratory work up, EEG and neuroimaging studies, as indicated by clinical suspicion are required to identify the underlying pathology causing seizures. A lumbar puncture is firmly recommended in all patients under 1 year of age that presents with temperature and seizures [3]. Also LP is required in immunocompromised patients, those having clinical signs of meningitis, persisting seizures and recent CNS infections [4].

Status epileptics refer to continuous or recurrent seizure activity without regaining of consciousness lasting for more than 5 minutes as part of an operational definition. In past cut-off time was 30 minutes. These children require aggressive stabilization, resuscitation and concurrent implementation of diagnostic testing, monitoring and pharmacological interventions.

## II. AIMS AND OBJECTIVES

Convulsion is a common problem which can be idiopathic or secondary to a disease process of the brain. The clinical presentation of convulsion in these two broad groups may be quiet similar. Investigation modalities like laboratory parameters including blood glucose, serum electrolytes, CT scan and/or MRI are available which can detect disease process or structural abnormalities of the brain presenting as seizure and for which treatment can be offered. Hence it is important to separate cases of idiopathic seizures or epilepsy from secondary seizures.

**Objectives of this study:**

1) To study the proportion of idiopathic epilepsy and secondary seizures.
2) To evaluate the clinical, laboratory, EEG and CT findings in cases of convulsion.

## III. MATERIALS AND METHODS

**STUDY AREA-** Paediatric emergency and indoor of Department of Paediatrics, Patna Medical College and Hospital, Patna, Bihar.

- **STUDY POPULATION-** Children between age group 1month and 15 years
- **STUDY PERIOD-**2 years (from Oct2014 to Sept2016)

**INCLUSION CRITERIA:** All children between 1month-15years presenting with seizure during study period.

**EXCLUSION CRITARIA:** Children less than 1month or more than 15 yrs of age.

**STUDY DESIGN-**Descriptive study

**TOOLS AND PARAMETERS:** After obtaining consent from parents/caregivers, patients were enrolled in this study. Detailed history was taken and clinical examination done. Relevant data were recorded in predesigned proforma. Investigations in form of CBC, serum electrolytes, serum calcium, and serum glucose were done. Lumber puncture and CSF Analysis were done in all cases. EEG was also done in all cases. Ophthalmoscopy, CT SCAN and/or MRI were done as and when required.

### STATISTICAL ANALYSIS

The primary goal of this study was to provide descriptive statistics of the patient population. Data so collected was entered in Microsoft excel. SPSS version 22.0 for Microsoft windows was used to analyze the data. Descriptive statistics were presented as number of observations and percentage (%).The clinical and laboratory parameters of the study population were expressed in terms of mean and ± standard deviation (SD). Nonparametric categorical data were compared with Chi-square test and parametric continuous data were compared with Student's t test. P values less than 0.05 were considered statistically significant. Appropriate statistical uncertainty was expressed by the 95% confidence levels.

## IV. OBSERVATIONS AND RESULTS

Total of 200 children with seizures were enrolled in this study. Only 10% (n=20) of children had idiopathic epilepsy where as in 90% (n=180) secondary seizures were present (Fig. 1).

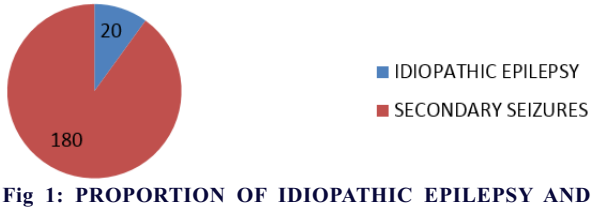


**Fig 1: PROPORTION OF IDIOPATHIC EPILEPSY AND SECONDARY SEIZURES; (N=200)**

20% (n=40) children had age between age 1 month to <1 year, 44% (n= 88) children had age from 1 year to <5 years and 36% (n=72) had age between 5 years to 15 years (Fig. 2)

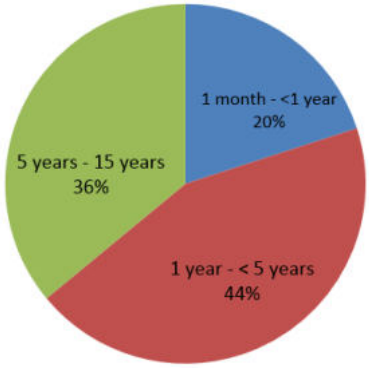


**Fig 2: AGE-WISE DISTRIBUTION OF CASES**

Out of these 200 children, males were 67.5% (135) and females were 32.5% (65). Family histories of seizure disorders were present in only 26 (13%) cases. 88.5% cases were found to be developmentally normal, whereas 11.5% cases having developmental delay. All of the idiopathic epilepsy cases (n=20), had GTCS type of seizures whereas in secondary seizure groups, GTCS was the most common seizure types being present in 87.77% cases, followed by left focal in 6.67%, right focal in 5% and myoclonic seizures in only 0.56% (Table1).

**TABLE 1: DISTRIBUTION AND TYPES OF SEIZURE (N=200)**

| CHARACTERISTICS | | TOTAL NO. | PERCENTAGE |
|---|---|---|---|
| SEX | MALE | 135 | 67.5% |
| | FEMALE | 65 | 32.5% |
| AGE | 1 MONTH -- < 1YEAR | 40 | 20% |
| | 1 YEAR -- <5 YEAR | 88 | 44% |
| | 5 YEAR – 15 YEAR | 72 | 36% |
| Family history of seizure disorders | PRESENT | 26 | 13% |
| | ABSENT | 174 | 87% |
| Developmental history | DEVELOPMENTAL DELAY | 23 | 11.5% |
| | NORMAL | 177 | 88.5% |
| Seizure types in idiopathic epilepsy (N=20) | GTCS | 20 | 100% |
| | FOCAL | 0 | 0% |
| Seizure types in secondary seizure (N=180) | GTCS | 158 | 87.77% |
| | LEFT FOCAL | 12 | 6.67% |
| | RIGHT FOCAL | 9 | 5% |
| | MYOCLONIC | 1 | 0.56% |

Fever (86.11%) was the most common symptom associated with secondary seizure followed by altered sensorium, cough, vomiting, headache etc. Altered sensorium was the most common sign present in maximum number of patients. Neck stiffness, cranial nerve involvement (mainly 6th, 7th, 3rd), other neurological deficits were the neurological signs present in seizure disorders in our study (Table 2).

**TABLE-2: INCIDENCE OF VARIOUS SIGNS AND SYMPTOMS IN SEIZURE. (N=200)**

| CHARACTERISTICS | TOTAL NO. | PERCENTAGE | |
|---|---|---|---|
| SYMPTOMS IN SECONDARY SEIZURES (n=180) | FEVER | 155 | 86.11% |
| | ALTERED SENSORIUM | 139 | 77.22% |
| | COUGH | 70 | 38.89% |
| | VOMITING | 67 | 37.22% |
| | HEADACHE | 42 | 23.33% |
| | EAR DISCHARGE | 29 | 16.11% |
| | RASH | 13 | 7.22% |
| SIGNS (N=200) | ALTERED SENSORIUM | 139 | 69.5% |
| | NECK STIFFNESS | 66 | 33% |
| | CRANIAL NERVE INVOLVEMENT | 32 | 16% |
| | OTHER NEUROLOGICAL SIGNS | 42 | 21% |

In our study we found that in cases of secondary seizures, hypocalcaemia, hyponatremia and hypoglycemia were present in 8 (4.5%), 3(1.67%) and 2(1.11%) cases respectively. CSF findings were normal in 19% of cases. In idiopathic epilepsy CSF findings were normal in all 20 (100%) cases, whereas in secondary seizures normal CSF findings were normal in only 10% cases. In 162 cases of abnormal CSF, CSF proteins were raised in all (100%) cases. CSF pleocytosis was present in 82.71% of cases and CSF sugar was decreased in 24.69% of cases. Abnormal EEG findings were seen in 85% of idiopathic epilepsy cases and in 43.89% cases of secondary seizures (Table 3).

**Table 3: LABAROTARY PARAMETERS IN SEIZURE (N=200)**

| LAB PARAMETERS | IDIOPATHIC EPILEPSY (N=20) | | SECONDARY SEIZURE (N=180) | | TOTAL (N=200) |
|---|---|---|---|---|---|
| | TOTAL NO. | % | TOTAL NO. | % | % |

| | | | | | | |
|---|---|---|---|---|---|---|
| BLOOD GLUCOSE | NORMAL | 20 | 100% | 178 | 98.9% | 99% |
| | HYPOGLYCEMIA | 0 | 0% | 2 | 1.1% | 1% |
| SERUM SODIUM | NORMAL | 20 | 100% | 177 | 98.3% | 88.5% |
| | HYPONATREMIA | 0 | 0% | 3 | 1.67% | 1.5% |
| SERUM CALCIUM | NORMAL | 20 | 100% | 172 | 95.5% | 96% |
| | HYPOCALCEMIA | 0 | 0% | 8 | 4.5% | 4% |
| CSF | NORMAL | 20 | 100% | 18 | 10% | 19% |
| | ABNORMAL | 0 | 0% | 162 | 90% | 81% |
| EEG | NORMAL | 3 | 15% | 101 | 56% | 52% |
| | ABNORMAL | 17 | 85% | 79 | 44% | 48% |

Common abnormalities seen in EEG in our cases were Generalised interictal epileptiform discharges (IED) in 77.08%. Abnormal background was seen in 60.41% cases and focal IED in 21.87% of cases (Table 4).

**Table 4: EEG FINDINGS IN SEIZURE CASES**

| EEG FINDING | TOTAL NO. | PERCENTAGE |
|---|---|---|
| ABNORMAL BACKGROUND | 58 | 60.41% |
| GENERALIZED IED | 74 | 77.08% |
| FOCAL IED | 21 | 21.87% |

CT scan was done in 131 cases. It was normal in 71 (54.2%) and abnormal in 60 (45.8%) cases. CT scan was normal in all cases of idiopathic epilepsy. Among abnormal findings, cerebral edema was the most common finding followed by cerebral atrophy, hydrocephalus, ring enhancing lesion, basal exudates and infarcts. Other findings were bilateral hypodensities seen in thalamus and basal ganglia, cystic encephalomalacia and blood in cortical sulci and cistern (Table 5).

**Table 5: CT FINDINGS IN SECONDARY SEIZURE CASES (N=131)**

| FINDINGS | | TOTAL NO. | PERCENTAGE |
|---|---|---|---|
| NORMAL | | 71 | 54.2% |
| ABNORMAL | CEREBRAL EDEMA | 27 | 20.6% |
| | CEREBRAL ATROPHY | 12 | 9.1% |
| | HYDROCEPHALUS | 10 | 7.6% |
| | RING ENHANCING LESION | 9 | 6.9% |
| | BASAL EXUDATES | 6 | 4.6% |
| | INFARCTS | 6 | 4.6% |
| | OTHERS | 6 | 4.6% |

## V. DISCUSSION

Seizures are one of the most common paediatric neurological emergencies, occurring in 10% of children [5]. Most of the seizures in children are provoked by some somatic disorders originating outside the brain, like high fever, infection, syncope, head trauma, hypoxia etc. Epilepsy comprises less than one third of seizure cases in children. The cumulative lifetime incidence of epilepsy is 3%, out of which more than half starts in childhood [2].

Age is one of the important determinants of seizure disorders that should be studied. Approximately 4- 10% of children suffer at least one seizure in 1st 16 years of life. In this study we found the highest incidence of seizures was in the age group of 1year to<5 years i.e. 88 (44%), which is followed by 72 (36%) in the age group of 5 years to 15 years and least between 1 month to <1 year i.e. 40 (20%). Our findings correlates with the findings of study done by Dr Shilpa Dugar et al [6] who found age group 1year- 5 years had maximum cases of seizures.

In our study seizures were present more in males, accounting to 135 (67.5%) cases while females were 65 (32.5%), and male: female ratio being (2.07:1). The study done by Yelandur et,al found that male preponderance (72%) was there in cases with active epilepsy [7].

In this present study, idiopathic epilepsy was found in 20 (10%) cases and secondary seizures in 180 (90%). Our findings correlate with the findings of Johnston MV et al [8] study who found that less than one third of seizures in children were caused by idiopathic epilepsy. GTCS was the commonest seizure types in our study. In idiopathic epilepsy group, all 20 (100%) cases were of GTCS type whereas in secondary seizure group GTCS was present in158 (87.77%), left focal 12(6.67%), right focal 9(5%) and there was 1 (0.56%) case of myoclonic seizures. Arzimanoglou A et al [9] study noted that (GTCS) seizures are the most common type of childhood seizures, occurring in almost 61% of cases. Sudhir Adhikari et al [10] study also found GTCS as the commonest type (69.9%) of seizure in pediatric population. These findings correlate with the findings of our study. Family history of seizure disorders were present in 26 (13%) of total cases. Chevrie and Aicardi et al [11] study found, a positive family history of seizures in 28% of infants with uncharacteristic seizure. Normal developmental history was found in 88.5% children and developmental delay was present in 11.5% cases. These findings were lower than findings of Fenichel GM [12] study who found approximately 25% of children who had recurrent seizures during the first year excluding neonatal and infantile spasm were developmentally and neurologically abnormal at the time of first seizure. Seizure disorders can be associated with various symptoms depending upon the aetiologies. In our study majority of the patients presented with fever 155 (86.11%), altered sensorium 139 (77.22%), cough 70(38.89%) and vomiting 67(37.22%). Other symptoms were headache 42 (23.33%), ear discharge 29(16.11%) and rash 13 (7.22%).

According to the study done by Dr Shilpa Dugar etal [13], fever was most prominent clinical association. Fever, altered sensorium, refusal to feed, convulsions and vomiting were the common presenting symptoms in children with pyogenic meningitis in a study by Arzimanoglou A, et al [14]. In our study, most common neurological sign was altered sensorium 139 (68.5%) followed by neck stiffness 66(33%), cranial nerve involvement 32 (16%) and other neurological deficits 42 (21%) in seizure disorders. Kamarkar SA etal [15] found that focal neurological signs in viral encephalitis may be stationary, progressive or fluctuating. Various signs could include meningeal signs, raised ICT, abnormal involuntary movements, ataxia, focal deficit and cranial nerve palsies. According to Charles G.Prober et al [16], overall 10-20% of children with bacterial meningitis had focal neurological signs. In our study we got similar findings of 16% cases that had neurological deficit in the form of cranial nerve involvement.

Serum sodium, calcium and blood glucose levels were done. Hyponatremia, hypocalcemia and hypoglycaemia were found in 1.67%, 4.5% and 1.11% cases of secondary seizures. In a study done by Cetinkaya F et al [17] hypocalcemia due to rickets was the leading cause in (25.6%) of afebrile seizures. These findings do not match with our findings, perhaps because majority of the cases they studied were of rickets.

Lumber puncture was done in all 200 cases. 38 (19%) cases had normal CSF findings. In all 20 idiopathic epilepsy cases CSF findings were normal and 18 cases out of 180 cases of secondary seizures had normal CSF findings. Abnormal CSF findings were seen in 162 (81%) cases. According to Haslam RHA [18] an elevated PMN suggests bacterial meningitis or early phase of aseptic meningitis. CSF lymphocytosis indicates aseptic, tuberculous or fungal meningitis [18]. CSF proteins may be elevated in many processes, including infectious, immunologic, vascular and degenerative diseases as well as tumours of brain and spinal cord[18].

EEG was done in all 200 cases. Abnormal recordings (in the form of sharp waves, spikes /polyspikes, generalised slowing, abnormal background, high voltage slow waves interspersed with a normal background, focal IEDS) were found in 96(48%) cases. 17 (85%) cases of idiopathic epilepsy had abnormal findings. Dr. S.J.M [19] found that 50% patients with epilepsy show IED (inter ictal epileptiform discharge) in the first EEG test. In a study done by Bharati Mehta et al [20] they found that, EEG was abnormal in 47.9% children (45 out of 94) with no significant gender difference. Epileptiform EEG was seen in 73.6% of children with history of seizures and 41.3% of children without history of seizures ($p<0.05$). The EEG abnormities included: abnormal background (64.5%), presence of generalized interictal epileptiform discharges (57.8%), focal epileptiform discharges (20%) exclusively from left hemisphere and multifocal interictal epileptiform discharges (33.3%), each occurring in isolation or associated with other abnormities. In our study generalised IED were seen in 77.08% cases, abnormal background in 60.41% and focal IED in 21.87% cases. Among focal IED 12 (57.14%) were originated from left hemisphere and 9(42.85%) from right hemisphere. EEG may be of great help in difficult cases or for a more precise classification of seizures, but one cannot emphasise too strongly that, in no case, should a diagnosis of epilepsy rest only on EEG grounds [21].

CT scan was done in 131 cases. Scan findings were normal in 71(54.2%) of cases and abnormal in 60(45.8%) cases. Out of these 60 abnormal findings, Cerebral oedema was the most common abnormality, and was present in 27 (45%) of cases. Cerebral atrophy was present in 12 (20%), hydrocephalus in 10 (16.7%), ring enhancing lesion in 9 (15%), basal exudates in 6 (10%), infarcts in 6 (10%) and other findings in 6 (10%) cases. Other findings included bilateral hypodensities in basal ganglia and thalamus in 4 cases, cystic encephalomalacia in 1 case and blood in cortical sulci and cistern in 1 case. Sudhir adhikari etal [22], in their study found, abnormal brain images were noted in 111 (45.9%) of 242 patients and most common abnormality was neurocysticercosis 66 (59.5%) In a one year retrospective study done by Maytal J etal [23] in 66 patients who presented with new onset of seizures to the emergency department, 52 (78.8%) had normal CT results and14 (21.2%) had abnormal CT results.

## VI. CONCLUSION

We concluded that secondary seizures (structural or metabolic) were more common than epilepsy. Seizure disorders were mostly seen in 1 year to 5 years of age group. Males were affected more than females, male: female ratio being 2.07:1. GTCS was the commonest type of seizure. Family history and developmental history was also important in cases of seizures. Commonest symptoms associated with convulsions in cases of secondary seizures were fever followed by altered sensorium, cough, vomiting. Other symptoms were headache, ear discharge and rashes. Various neurological signs associated were lethargy, meningeal irritation, cranial nerve involvement and other neurological deficits. Metabolic abnormalities like hypocalcemia, hyponatremia and hypoglycemia were seen. Normal CSF findings were present in 19% cases only. Abnormal CSF findings included low CSF glucose, elevated CSF proteins and CSF pleocytosis. 48% had abnormal EEG recordings in the form of abnormal background, generalised and focal IED. CT scan was done and most common CT abnormalities found was cerebral oedema, followed by cerebral atrophy, hydrocephalus, ring enhancing lesion, basal exudates, infarcts etc.

## VII. LIMITATIONS

This was a single centric study with moderate sample size. There's need for larger multi-centric study for any generalized recommendations to be made.

## VIII. CONFLICT OF INTEREST

None

## IX. FINANCIAL DISCLOSURE

The authors declare that this study has not received any financial grant.

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