



THE DIAGNOSTIC ABILITY OF COMPUTED TOMOGRAPHY (CT) SCAN TO DETERMINE THE CAUSE OF SEIZURE IN PEDIATRIC AGE GROUP

Sana Ibad Khan

Manish Agrawal*

Saraswathi Institute Of Medical Sciences, Anwarpur, Hapur *Corresponding Author

ABSTRACT

OBJECTIVES: 1) To study the clinical profile of children's presented with first episode of seizures.
2) To study the correlation between the clinical profile, type of seizures and lesions detected on CT scan.

SETTINGS: Children with first episode of seizures presented in SIMS OPD and IPD with abnormal body movements.

DURATION: 1 year (September 2018- august 2019)

DESIGN: Longitudinal observational study

PARTICIPANTS: A total 100 patients being presented to Department of Pediatrics in OPD and IPD with first episode of seizures of age group 1 month- 16yrs.

RESULTS: Out of 100 cases of seizures majority of cases belongs to age group 1-5 years (36%), there was male predominance (63%) noted. Most common presentation of seizures was GTCS. The associated symptoms noted with seizures were fever (32%) followed by breathing difficulty (16%), altered sensorium (3%). Febrile seizures were most common followed by hypocalcemic seizure, CNS infections.

CONCLUSION: Seizures are common neurological problems with maximum number of cases in younger age group. Febrile seizures are most common cause. CT scan have 27% sensitivity in diagnosing etiological cause of seizures

KEYWORDS : Seizure, Febrile Seizure, Ct Scan

INTRODUCTION

In India prevalence rate of seizures is 5.59/1000 per year according to IAP textbook of pediatrics 6th edition¹. Seizures are quite frequently encountered in pediatric practice. Incidence of seizures among pediatric age group is 50 / 100,000 per year². About 70% of children of <1 year experiencing seizures developed status epilepticus².

The incidence is highest in children younger than 3 years of age, with a decreasing frequency in older children². Epidemiologic studies reveal that approximately 150,000 children will sustain a single episode, unprovoked seizure each year, and of those, approx 1/5th (30,000) will develop epilepsy. A seizure is a result of excessive nerve-cell discharges in the brain. It is seen as a sudden abnormal function of the body, often with loss of or alteration in consciousness, an excess or loss of muscular activity, abnormal autonomic or an abnormal sensation or autonomic behaviour. The excessive nerve-cell discharges or excitation may remain in a small area of the brain giving rise to focal seizures, or spread to the whole brain and spinal cord giving rise to generalized seizures. As we compared the data from developed and developing world the incidence and prevalence is almost similar.

A number of conditions causes seizures and in such a case, a clinician, often have to get several investigations done to determine the cause of seizures. Cranial computed tomography (CT) is one of the common investigations in an attempt to arrive at an etiological diagnosis in such a case.

The present study is aimed to study the clinical profile of the children coming with various types of seizures. Besides this our endeavor is to find a correlation between various types of lesions detected on cranial CT and childhood seizures in western Uttar Pradesh.

METHODS:

This longitudinal observational study was conducted in the department of Pediatrics, Saraswathi Institute of Medical Sciences, Hapur (U.P) between September 2018- August 2019. After taking permission from ethical committee of institution.

All children of age group 1 month – 16 years with first episode of seizure were included in study after taken written informed consent from parents and guardians.

INCLUSION CRITERIA

- Children presented with first episode in outpatient and inpatient department of hospital within age group 1 month to 16 years irrespective of sex.

EXCLUSION CRITERIA

- Known epileptics

- Those who are already on antiepileptic drug prophylaxis
- Patients < 1 month old and > 16 yrs old.

CLINICAL EVALUATION

The patients were evaluated as follows:

HISTORY:

A detailed history of the patient was taken with emphasis on seizures related events. Details of the seizures with regard to the type, frequency, duration, evolution & sequence were noted along with any visual, auditory, other focal deficits and behavioral abnormalities preceding and following the seizures.

PHYSICAL EXAMINATION:

A detailed general & systemic examination including complete neurological examination was performed on subjects.

INVESTIGATIONS:

Following investigations were done mainly to screen cases to rule out any preexisting disease

- Blood Examination:
 - Complete blood counts
 - Peripheral smear
- Urine routine and microscopic examination
- Tuberculosis screen
- Stool R/M
- Serum electrolytes
- Lumbar puncture (if needed)
- CECT/NCCT Head

OBSERVATION AND RESULTS

TABLE 1: incidence of convulsions in different age group

Age(yrs)	NO	%
<1 yrs	30	30
1-5 yrs	36	36
5-10 yrs	22	22
10-16 yrs	12	12
Total	100	100

Table 1 showing the age distribution of study subjects. Maximum 36% study subjects belong to age group 1-5 yrs, 30% subjects were below 1 yr, 22% between 5-10 yrs and 12% were aged more than 10 yrs. With mean age 4 year 0.5 month, SD- 3 yr 11 month, and Range – 1 month to 16 year

Table 2: Associated complaints with seizures

Associated Complaints	No (N=100)	%
Fever	32	32
Altered sensorium	26	26

Breathing difficulty	6	6
Headache	19	19
Vomiting	4	4

Table 2 is showing distribution of study subjects as per the associated complaints. Maximum 32% study subjects had fever, 26% had altered sensorium, 19% had headache, whereas only 6 % study subjects had Breathing difficulty, 4% subjects had vomiting.

Table 3: CECT/NCCT findings

CECT/NCCT findings	No(N=100)	%
Normal	73	73
Cerebral edema	9	9
Ring enhancing lesion with eccentric edema	5	5
Hydrocephalus	16	16
Hemorrhage	4	4
Others	10	10

Table 3 shows CECT/NCCT findings of study subjects. 73% study subjects had normal finding on CT Scan, 27 % study subjects had some Ct findings. 16% showed findings of hydrocephalus, 9% study subjects showed finding of cerebral edema, 5% had ring enhancement lesion, 4% subjects had findings of hemorrhage, whereas 10% study subjects had other findings such as infarction, atrophic changes, etc. The sensitivity of CECT/NCCT finding is 27%.

Table 4: Etiology of seizures

Etiology	No of cases	Percentage
Febrile seizures	34	34%
Idiopathic	29	29%
Pyogenic meningitis	5	5%
Tubercular meningitis	3	3%
hypoglycemia	1	1%
Tuberculoma	2	2%
Viral encephalitis	1	1%
Microcephaly	4	4%
Trauma	2	2%
Hydrocephalus	1	1%
Cerebral palsy	3	3%
Malformations	2	2%
Hypocalcemia	9	9%
Neurocytotoxicosis	4	4%

Table 4 shows distribution of subjects as per etiology, most common cause of seizure is febrile seizure (34%), followed by idiopathic (29%), hypocalcaemia (9%), pyogenic meningitis (5%), NCC and microcephaly (4%), TBM and CP (3%), tuberculoma, trauma and malformations (2%) and hydrocephalus and hypoglycemia (1%).

Table 5: Types of seizures

Diagnosis	No	%
Generalized tonic clonic	71	71
Focal aware tonic clonic	9	9
Focal to bilateral tonic-clonic	6	6
Generalized tonic	12	12
Myoclonic seizure	2	2
Total	100	100

Table 5 shows Distribution of study subjects as per types of seizures. Maximum 71% study subjects were having generalized tonic clonic seizure, 12% had generalized tonic, 9% had focal aware tonic clonic, 6% had focal to bilateral tonic clonic, 2% had myoclonic

TABLE 6:

CECT/NCCT	EEG		Total
	Positive	Negative	
Positive	27	0	27
Negative	63	10	73
Total	90	10	100

Table 6 shows Comparison of CECT/NCCT and EEG as diagnostic tool for seizure activity. When we use Cohen's kappa for finding agreement between two diagnostic test, we found that, % of agreement: 24.03%, Cohen's k: -0.31, No agreement between two diagnostic test for the diagnosis of seizure. However when we calculate sensitivity, EEG had better sensitivity than CECT/NCCT in diagnosing seizure.

DISCUSSION:

The present study focused mainly on two aspects, viz. To study the clinical profile of children with seizures including the type of seizures and To detect the cases showing lesions on cranial CT Scan to find out its diagnostic ability.

AGE DISTRIBUTION

Majority of the children in our study with seizures irrespective of the type of seizure were between 1 and 5 years of age (36%). In Rochester, Minnesota in 1945-54, the incidence for children aged 1-9 years was 50-62/100,000 and decreased further to 39/100,000 in children aged 10-14 years (Hauser et al., 1993)³⁴. In Nova Scotia, the incidence for each year of age between 1 and 10 years was very constant (mean: 46±7/100,000) (Camfield et al., 1996)⁴. Between age 11 and 15, the incidence plateau at about 21/100,000, which is very similar to most published rates in adults in, developed countries. Again, in Rochester, Minnesota in 1980- 2004, data showed the incidence for ages 13-17 to be 24.8/100,000 (Wirrell et al., 2011)⁵. In Chen CY et al. 2010 94% children were younger than 6 years of age⁶.

In Ernestina Ernest Mwipopo et al. 2016⁷, 96.5% children were aged 1 month to 5 years. Also Maximum number of cases was below 5 years in Shweta Singh et al. 2017⁸. This shows that the age distribution in our study was not much different from the other studies on this subject.

SEX DISTRIBUTION

Majority of the patients in our study were males (63%) rest were females (37%). As studied by Jain et al¹, of the 172 of the northern Indian children with seizures, 65.11% were male and 34.88% were female. Another study by Adhikari et al¹⁰ was done in 94 patients, in which 61.3% were male and 38.7% were female. As studied by Shretha et al¹¹ there was a slight male predominance in the study with male: female ratio being 1.2:1 in children's with seizures. As studied by Shweta Singh et al⁸ there was also slight male preponderance. Therefore, our study finds that like most of other previous studies seizures were more commonly seen in male sex as compared to females.

RELIGION DISTRIBUTION

Our study showed that majority of the patients was Hindu though the Muslims were in sizable number. A study done in north India by Kumar et al¹², also stated that most of the patients belonged to Hindu religion.

DIETARY HABITS

Majority of the patients in our study were vegetarian. They constituted 64% of the total patients with 36% patients being non-vegetarian. Among vegetarians group 2 infants were on exclusive breastfeed, 10 were on breastfeed and cows milk both, 3 were on only cow's milk, 6 were taking formula feed and 5 were taking buffalo's milk. In our study, 1 patient had a history of pork consumption. Since many younger children's were on cows and buffalo milk this may be the reason that most of them had hypocalcaemic seizures. In a study by Kumar et al¹², out of 79 children with seizures, vegetarians were 73.4% and non-vegetarian 26.6%

ASSOCIATED COMPLAINTS

In our study with abnormal body movements, 32% study subjects had fever and most of them were in age group 1-5yr, whereas only 6 % study subjects had breathing difficulty, 3% subjects had altered sensorium. In Ernestina Ernest Mwipopo et al. 2016¹³, History of fever during seizure illness was present in 91.0% children and 92.7% were in the age group 1 month to 5 years. Also in Chen CY et al. 2010¹⁴ febrile seizures 62.1% were the main etiology of the first seizure. The most common presenting symptom associated with abnormal body movements was fever (76%) followed by altered sensorium (58%), lethargy (48%), headache (40%), cough (38%), vomiting (23%), loose motions (15%), rash (8%), pain abdomen (3%), ear discharge, focal deficit in Shweta et al 2018⁸.

SEIZURES CHARACTERISTICS

The literature tells generalized tonic clonic, (GTC) seizures are the most common type of childhood seizures, occurring in almost 61% cases of seizures^{15,16,17}. According to Shetty K.S et al. 2017¹⁸, 87.14% seizures were generalized tonic clonic and rests were focal. Also according to Chen CY et al. 2010. Generalized tonic-clonic seizures were the most common type (71.2%). In our study Maximum (71%) study subjects had generalized tonic clonic seizure, 12% had

generalized tonic seizures, 9% had focal aware tonic clonic seizures, 6% had focal to bilateral tonic clonic seizures, 2% had myoclonic seizures.

GENERALEXAMINATION

Most common finding associated with seizure was pallor (38%) followed by delayed milestones (11%), microcephaly (6%), lymphadenopathy (4%), dysmorphic facies (3%), macrocephaly (1%). 48% study subjects had hemoglobin value 10-13 gm/L. Our finding also correlates with Shweta Singh et al.2017⁸.

CSF Findings

We did lumbar puncture in 20 cases. Most common abnormality detected in CSF findings was raised counts on cytology (13 subjects had raised cell counts). CSF proteins were raised in 10 subjects and decreased in 5 subjects.

CSF sugar was raised in 4 subjects and decrease in 6 subjects. CSF pressure was normal in 19 cases and low in one case.

SERUM ELECTROLYTES:

Most common electrolyte imbalance detected in cases was hypocalcaemia followed by hypoglycemia. As studied by Shweta et al.2017⁸ hypocalcaemia and hypoglycemia were present in 2.4% and 1.5% cases of seizures.

Hypocalcaemic seizures have been found as high as 13% to 25.6% of cases in the age group of 1 month to 1 year¹⁹.

CECT/NCCT FINDINGS OF STUDY SUBJECTS.

73% study subjects had normal finding on CT Scan, 27 % study subjects had some CT findings. 16% showed findings of hydrocephalus, 9% study subjects showed finding of cerebral edema, 5% had ring enhancement lesion, among ring enhancing lesion neurocysticercosis was most common followed by tuberculoma, 4% subjects had findings of hemorrhage, whereas 10% study subjects had other findings such as infarction, atrophic changes, etc. According to an Indian study by Jain et al⁹, intracranial lesions were detected in 62.20% patients. The most commonly observed lesion on CT scan head in our study was a ring-enhancing lesion. Bhaskar et al²⁰, 82% children had single ring enhancing lesion on the CT scan brain with NCC in 63.41%, tuberculoma in 9.75% of cases. But in all these studies most of study subjects doesn't presented with first episode of seizure. The sensitivity of CECT/NCCT finding is 27%.

EEG FINDINGS.

51% study subjects had generalized seizure activity, 39 % subjects had focal seizure activity, where as 10 % study subjects were normal at EEG. Sensitivity of EEG is 90%.

COMPARISON OF CECT/NCCT AND EEG AS DIAGNOSTIC TOOL FOR SEIZURE ACTIVITY.

When we use Cohen's kappa for finding agreement between two diagnostic test, we found that, % of agreement: 24.03%, Cohen's k: -0.31, No agreement between two diagnostic test for the diagnosis of seizure. However when we calculate sensitivity, EEG had better sensitivity than CECT/NCCT in diagnosing seizure.

SUMMARY AND CONCLUSION

1. In present study majority of patients belongs to age group 1-5yr (36%) followed by 1 month to 1 year (30%), 5-10yr (22%), 10-16yr (12%). This shows with increase in age incidence of seizures decreases.
2. Male percentage (63%) was more than female (37%).
3. Hindu patients outnumbered Muslim patients.
4. While considering the dietary habits vegetarians (64%) were more in number than non-vegetarians (36%).
5. Most common presenting symptom associated with seizure was fever (32%).
6. 38% subjects had anemia associated with seizure, most of them had HB level range between 7-10gm/dl. 11% had delayed milestones, 6% had microcephaly, 4% had lymphadenopathy, and 3% had dysmorphic facies.
7. Most common electrolyte disturbance noticed was hypocalcaemia followed by hypoglycemia.
8. Most common type of seizure was tonic-clonic (85%) followed by tonic (14%), myoclonic (1%).
9. Most common seizure was generalized tonic-clonic (71%) followed by focal aware tonic clonic (12%), focal to bilateral

tonic-clonic (9%), generalized tonic (6%), myoclonic (2%).

10. CSF was normal in 59 cases and 41 had abnormal CSF findings.
11. EEG was normal in 10% cases while showed generalized seizure activity in 51% cases and focal seizure activity in 39% cases.
12. CT scan was normal in 73 cases and showed abnormality in 27 cases, most common finding was hydrocephalus (16%), followed by cerebral edema (9%), ring enhancing lesion (5%), others viz, infarction, calcification, atrophic changes etc (10%), and hemorrhage (4%).
13. We found that CT scan has sensitivity of 27% in finding abnormality in new cases of seizures.

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