

Original Research Article

Study of intracranial structural lesions diagnosed by computed tomography among children with unprovoked seizure disorder

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ABSTRACT

Background: Seizures are the most common pediatric neurological disorder. The objectives were to know the prevalence and types of intracranial structural lesions diagnosed by Computed Tomography in children with unprovoked seizures.

Methods: It is hospital based cross-sectional study done in Patna Medical College, India from August 2005- July 2007. All patients aged 6 months to 12 years admitted in pediatrics department with at least 2 episodes of unprovoked seizures were undergone Computed Tomography brain.

Results: Out of total 112 patients admitted, 66.1% had abnormal CT scan. Prevalence of abnormal CT scan increased with advancing age and significant, with maximum percentage found in age group 10-12 years (43.2%). Males had more seizures and intracranial lesion than females but this association was statistically non-significant. 65.2% had generalized seizure and 34.8% had partial seizure. Among patients with abnormal CT scan, generalized seizure (70.3%) and partial seizure (29.7%). The commonest probable diagnosis was tuberculoma (47.3%) followed by neurocysticercosis (25.7%) and brain abscess (4%). Other were atrophy, gliosis and hydrocephalus, 2.5% each; arachnoid cyst, extradural hematoma, sturge weber syndrome, tuberous sclerosis, infarct, hemiatrophy, caudate lobe hemorrhage, basal ganglia calcification, corpus callosum agenesis, 1.35% each.

Conclusions: Inflammatory granuloma is the leading cause of unprovoked seizure in this part of the country. Every seizure case should undergo a CT scan examination. Preventive measures can be applied for tuberculoma and NCC so as to lower down the burden of seizure disorder.

Keywords: Children, Computed tomography brain, Intracranial structural lesion, Unprovoked seizure

INTRODUCTION

Seizures are common childhood neurological disorder. Globally, 4 to 10% of children suffer at least one episode of seizure in their first 16 years of life.¹ In the developing countries, seizures are more prevalent in older children due to the higher incidence of trauma and neuro-infections.² Globally, it was estimated that 10.5 million children under 15 years have active seizures representing about

25% of the world seizure population. Of the 3.5 million people who develop seizures annually more than 80% live in developing countries.³ The prevalence rate of childhood epilepsy in Indian subcontinent is 5.59/1000 with no gender and geographic difference.⁴

The intracranial structural lesions (ISLs) associated with structural changes in the brain or cranial cavity are important cause of symptomatic epilepsy. The common

lesion include cerebral atrophy, ring enhancing lesions, dilated ventricles, infarct, porencephaly, calcifications, hydranencephaly, Dandy-walker variant, gyral enhancement, prominent thalami and basal ganglia hypodensity.⁵ On an average 38% of cranial CT scans were abnormal in epileptic children in various studies and abnormal scans were more common in patients with partial seizures, abnormal neurological examination, focal paroxysmal discharges or slowing on EEG.^{1,6,7} Neuroimaging after a first unprovoked seizure in children is currently recommended in situations where it is likely to identify a cause for the seizure that is of clinical significance. Western studies have shown that this is more likely in children who present with focal seizures, have neurological deficits on examination, or have a suggestive history.^{8,9} There are few studies that have looked at neuroimaging in children with unprovoked seizure from developing countries where infections are common which may cause an apparent unprovoked seizure. Thus, the aim of our study is to know the prevalence of neuro-radiological abnormalities in children with unprovoked seizures and to study the intracranial structural lesions diagnosed by Computed Tomography Scan of brain.

METHODS

It was a hospital based cross-sectional study done in Patna Medical College, Patna, Bihar. The study was done for the duration of two years from August 2005- July 2007. All patients admitted in pediatrics department with at least 2 episodes of unprovoked seizures were included for the purpose of study. The patients were in age group of 6 months to 12 years. The patients who had associated clinical evidence of infections and with metabolic causes were excluded from the study.

Inclusion criteria

- Children in age group of 6 months to 12 years.
- Those having at least 2 episodes of unprovoked seizures.

Exclusion criteria

- Patients with associated clinical evidence of infections.
- Children with seizure due to metabolic causes.

Detailed history about mode of onset of seizure, number of episodes of seizures, duration of seizure and sensorium were taken from each patient. Other information from patient included in the study were family history of seizure, contact with tuberculosis patient, dietary history, maternal drug intake history, any past medical and surgical illness, vaccination status and other socio-demographic profile. Seizure was classified according to ILAE Classification 1989 into generalized, partial and unclassified seizures.¹⁰

A detailed physical examination was performed in every patient with respect to state of sensorium, mental status, cranial nerve palsy, sensory or motor deficit, any congenital anomaly, trauma to skull or spine. Ophthalmoscopy was done in every patient in dark room. All cases were subjected to investigation like complete blood count, liver function test, renal function test, mantoux test, chest x-ray, electroencephalogram and computed tomography of brain (CT scan).

Magnetic resonance imaging was not done as the facility was not available during the study period in the medical college. Third generation rotatory CT scan was used for the purpose of study [somatom AR (spiral), SIEMENS machine]. Children under 2 years of age were sedated with Trichlorophos (20 mg/kg) and children above 2 years (if uncooperative) were sedated with IV Midazolam (0.1mg/kg) before performing CT scan. All patient vitals were monitored while undergoing CT scan.

The permission of medical college institutional Ethics Committee was obtained before the commencement of the study. Written informed consent was taken from each participating patient.

Statistical analysis

The data was collected and entered in the MS EXCEL spread sheet and subjected to appropriate statistical tests. Descriptive statistics in terms of percentages and inferential statistics in terms of Chi square was used to find out the association of intracranial structural lesion with other variables at 5% level of significance.

RESULTS

A total of 112 patients were admitted to pediatric department with at least two unprovoked seizure. 38 patients (33.9%) had normal CT scan and 74 (66.1%) had abnormal CT scan.

Table 1: Distribution of patients according to age and gender.

Age group	No. of patients (%)	Abnormal CT scan (%)	Level of significance (p value)
6 months - 1 year	9 (8%)	4 (5.4%)	0.04
1 year - 5 years	22 (19.6%)	11 (14.9%)	
5 years - 10 years	33 (29.5%)	27 (36.5%)	
10 years - 12 years	48 (42.9%)	32 (43.2%)	
Gender			
Male	62 (55.4%)	43 (58.1%)	0.41
Female	50 (44.6%)	31 (41.9%)	

As the age increased the prevalence of abnormal CT scan also increased significantly with maximum percentage found in age group of 10-12 years (43.2%) ($p < 0.05$). Unprovoked seizure with abnormal CT scan was more in males (58.1%) than females but this was statistically non-significant (Table 1).

Table 2 shows the types of seizure in which 65.2% presented with generalized seizure and 34.8% with partial

seizure. For patients with abnormal CT scan, generalized seizure (70.3%) was commoner presentation than the partial seizure (29.7%). Patients with abnormal CT scan having generalized seizure, tonic-clonic seizure (84.6%) was most common presentation followed by tonic seizure (7.7%). Complex partial seizure (54.5%) was the most common type followed by simple partial seizure (40.9%) for patients with abnormal CT scan presenting with partial seizure.

Table 2: Types of seizure in patients with unprovoked seizure and patients with abnormal CT scan.

Type of seizures		Total cases (n = 112)	Abnormal CT scan (n =74)
Generalized seizure	Tonic-clonic seizure	59	44 (84.6%)
	Tonic seizure	5	4 (7.7%)
	Myoclonic seizure	4	3 (5.8%)
	Absence seizure	3	1 (1.9%)
	Atonic seizure	2	-
	Total	73 (65.2%)	52 (70.3%)
Partial seizure	Simple partial seizure	12	9 (40.9%)
	Complex partial	24	12 (54.5%)
	Secondary generalized	3	1 (4.5%)
	Total	39 (34.8%)	22 (29.7%)

Table 3: Differential diagnosis of patients with abnormal CT scan.

Differential diagnosis	Number of cases	Percentage
Tuberculoma	35	47.3%
Neurocysticercosis	19	25.7%
Brain abscess	3	4%
Arachnoid cyst	1	1.35%
Extradural hematoma	1	1.35%
Sturge weber syndrome	1	1.35%
Tuberous sclerosis	1	1.35%
Infarct	1	1.35%
Hemiatrophy	1	1.35%
Generalized atrophy	2	2.7%
Gliososis	2	2.7%
Hydrocephalus	2	2.7%
Caudate lobe hemorrhage	1	1.35%
Basal ganglia calcification	1	1.35%
Corpus callosum agenesis	1	1.35%
Brain tumour	2	2.7%

The most common probable diagnosis for intracranial structural lesion by CT scan was tuberculoma (47.3%) followed by neurocysticercosis (25.7%) and brain abscess (4%) (Table 3).

The most common site for Tuberculoma location was parietal lobe (17 lesions) followed by frontal lobe (10 lesions). For neurocysticercosis most common site was parietal lobe (11 lesions). Tuberous sclerosis was located

in paraventricular area and infarct was located in basal ganglia (Table 4).

Table 5 depicts that the most common age group affected by tuberculoma and neurocysticercosis was 10-12 years followed by 5-10 years age group. The most common presentation of patients with tuberculoma and neurocysticercosis was headache. Other symptoms of different intracranial lesions are shown in table 6.

Table 4: Pattern of location of lesion on CT scan brain.

Differential diagnosis	Frontal	Parietal	Temporal	Occipital	Others
Tuberculoma	10	17	3	5	-
Neurocysticercosis	3	11	2	1	2 Multiple
Brain abscess	-	1	1	-	1 Brain stem
Arachnoid cyst	-	-	-	1	-
Extradural hematoma	-	-	-	-	-
Sturge weber syndrome	-	-	-	1	-
Tuberous sclerosis	-	-	-	-	1 Paraventricular
Infarct	-	-	-	-	1 Basal ganglia
Atrophy	-	1	-	-	2 Generalized
Gliososis	-	2	-	-	-
Hydrocephalus	-	-	-	-	-
Caudate lobe hemorrhage	-	-	-	-	1 Caudate lobe left side
Basal ganglia calcification	-	-	-	-	1 Basal ganglia B/L
Corpus callosum agenesis	-	-	-	-	-
Brain tumour	-	1	-	-	1 Brain stem
Total	13		6	8	10

Table 5: CT scan findings associated with age of patients.

Result of CT scan	6 mnths -1 year	1yr - 5 years	5-10 years	10-12 years
Normal	5	11	6	6
Tuberculoma	-	2	16	17
Neurocysticercosis	-	-	7	12
Brain abscess	-	1	1	1
Arachnoid cyst	-	1	-	-
Extradural hematoma	-	-	-	1
Sturge weber syndrome	-	1	-	-
Tuberous sclerosis	-	1	-	-
Infarct	1	-	-	-
Atrophy	1	2	-	-
Gliososis	-	1	1	-
Hydrocephalus	1	1	-	-
Caudate lobe hemorrhage	-	-	1	-
Basal ganglia calcification	-	-	1	-
Corpus callosum agenesis	1	-	-	-
Brain tumour	-	1	-	1

Table 6: Study of CT scan findings with different associated symptoms.

CT scan results	Headache	Limb paralysis	Trauma	Unconscious	Mental retardation
Tuberculoma	25	3	-	7	-
Neurocysticercosis	14	4	-	-	1
Brain abscess	1	1	-	1	-
Arachnoid cyst	1	-	-	-	-
Extradural hematoma	-	-	1	-	-
Sturge weber syndrome	-	1	-	-	-
Tuberous sclerosis	-	-	-	-	1
Infarct	-	-	-	-	1
Atrophy	-	1	-	-	2
Gliososis	-	-	-	-	2
Hydrocephalus	-	-	-	1	1
Caudate lobe hemorrhage	1	-	-	-	-
Basal ganglia calcification	1	-	-	-	-
Corpus callosum agenesis	-	-	-	-	1
Brain tumour	1	1	-	-	-
Total	44	11	1	9	9

DISCUSSION

Our study reveals that among patients with unprovoked seizure 66.1% had abnormal CT scan. The finding was different in various studies from different regions of India where abnormal CT scan was found to be 75% in study from Andhra Pradesh, 31.9% in study from Kashmir, 32% in study from Jaipur, and 24% in study from New Delhi.^{5,11-13} In Studies from different countries like New York, Nepal, Nigeria and Iran, it was observed that abnormal CT scan was found in 21.2%, 32%, 51.8% and 26% respectively.¹⁴⁻¹⁷ Thus, there is a wide range of regional variation for the abnormal CT scan in patients with seizures. In our study the higher incidence of abnormal CT scan may be due to higher incidence of neuro-infections in Indian subcontinent, lack of good perinatal services and poor environmental sanitation.

In present study, 65.2% presented with generalized seizure and 34.8% with partial seizure. Among children presenting with generalized seizure, tonic-clonic seizure (84.6%) was most common seizure with male predominance. These findings were similar to various other studies done in India.^{11,12} It may be because males are exposed more to environmental risk factors due to more outdoor activity. According to study done by Shipra et al 86% of children with first unprovoked seizures had generalized seizure and among those with abnormal CT scan, 69% had complex partial seizure and 23.5% had generalized seizure.¹³ While in our study among those with abnormal CT scan 70.3% had generalized seizures and 29.7% had partial seizures. Among those with partial seizure 16.2% had complex partial seizure. In study by Kapoor M et al 80% had generalized seizure and 20% had partial seizure.⁵ In those with intracranial space occupying lesions (ISLs) 70% had partial seizures and 12.5% had generalized seizures. Among those with partial seizure, 55% had complex partial seizures. In Nigerian study by Wammanda RD et al 52.6% of children had generalized tonic clonic seizures.¹⁸ Iranian study done by Fallah R et al depicted in his study that 64.7% had generalized seizure while 35.3% had partial seizure.¹⁷

As the age increased unprovoked seizure and abnormal CT scan also increased. Age group affected the most with abnormal CT scan was 10-12 yrs (43.2%) followed by 5-10 yrs (36.5%), 1-5 yrs (14.9%) and 6 months -1 year (5.4%). Children of age group of 5-12 years have more tendencies to play outside independently and consume foods unhygienically especially in this part of country where sanitation and health facilities are poor. Minimum chance of NCC was found in age group of 6 months-5 years which may be because the playing and eating habits of children in this age group are controlled by parents. The findings were not in concordance with the findings of Indian studies where commonest epileptic age group was between 2-5 years, 5-9 yrs, 1-3 years and 1-5 yrs.^{5,11-13}

Here, the most common probable diagnosis for intracranial structural lesion by CT scan was tuberculoma (47.3%) followed by neurocysticercosis (25.7%) and brain abscess (4%) with parietal lobe being the most common site of involvement. However in the study done at Kashmir, India the commonest intracranial structural lesions were cerebral atrophy and dilated ventricle (18.8% each) followed by calcification in 15.5% but none of the patient had ring enhancing lesion in CT scan.¹² Among other studies the most common neuroimaging abnormality observed was NCC followed by tuberculoma.^{11,13,14} The findings of lobar involvement was in concordance to the findings of Bhavani et al where parietal lobe was the most common lobe involved.¹¹ In the study conducted by Patel NH et al, among patients with partial seizures and abnormal CT scan, the most common diagnosis was tuberculoma (38.2%) followed by brain abscess (11.7%) and NCC (8.8%).¹⁹ However, in Nigerian study the most common diagnosis was cerebral infarct (38.5%) followed by cerebral atrophy (30.8%) and ventricular dilatation (15.4%).¹⁸ The findings of one of Iranian study done in year 2012 depicted that brain atrophy was the most common diagnosis (46%) followed by structural dysgenesis (25.6%), structural CNS dysgenesis (15.4%), hydrocephaly (7.8%) and brain tumor (5.2%).¹⁷ According to study done by Poudel et al at Nepal common CT findings were atrophy (13.4%), neurocysticercosis (12.1%), structural abnormalities (4.4%), stroke (3.7%), post-encephalitis changes (3.1%), nonspecific calcification (1.6%), tuberculoma (1.2%), tumor (0.9%), neurocutaneous syndromes (0.9%), hydrocephalus (0.9%) and other findings (2.2%).¹⁵

CONCLUSION

Authors conclude from our study that inflammatory granuloma is the leading cause of seizure disorder in this part of our country. In India, the incidence of seizure disorder is more common due to secondary cause. Computerized tomography scan of brain is a safe, rapid and cost effective in investigation of intracranial structural lesion in children with seizure disorder. Thus, we recommend that every seizure disorder case should undergo a CT scan examination. Preventive measures can be applied for tuberculoma and NCC so as to lower down the burden of seizure disorder.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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