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Original Research Paper Radiology

Radiological Abnormalities in Children with First Afebrile Seizure

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ABSTRACT

OBJECTIVE-*To determine the incidence and type of radiological abnormalities in children presenting with a first afebrile seizure.*

METHODS:- *In a prospective observational study 50 children who were admitted with first afebrile seizure in department of pediatric N.S.C.B . M.C.H Jabalpur were underwent brain CT scan between Aug.2015 to July2061.Neuroimaging was performed (90/100)of these children within 48hours of their arrival to the Emergency Department.*

RESULT:-*Neuro-imaging abnormality were found in 66.7% cases.There was a significant relationship between abnormal neuro-imaging and focal seizure (P<.001).42% cases of GTCS and 81.8% cases of partial seizure have abnormal neuro-imaging .Most common abnormality observed in our study was Neurocysticercosis27.7%)followed byTuberculoma16).*

CONCLUSION:-*Incidence of neuro-imaging abnormality in children presenting with first afebrile seizure is high in developing countries like india due to high prevalence of NCC and tuberculosis so neuro-imaging should be considered in any child with first afebrile seizure.*

KEYWORDS : Afebrile seizure, ,Neurocysticercosis,Tuberculome.

I. Introduction

A *seizure* (from the Latin *sacire*, "to take possession of") is a paroxysmal event due to abnormal, excessive, hypersynchronous discharges from an aggregate of central nervous system (CNS) neurons.

Classification of seizure-

1. Partial seizures
a. Simple partial seizures (with motor, sensory, autonomic, or psychic signs)
b. Complex partial seizures
c. Partial seizures with secondary generalization

2. Primarily generalized seizures
a. Absence (petit mal)
b. Tonic-clonic (grand mal)
c. Tonic
d. Atonic
e. Myoclonic

3. Unclassified seizures
a. Neonatal seizures
b. Infantile spasms[12]

Partial Seizures

Partial seizures occur within discrete regions of the brain. If consciousness is fully preserved during the seizure, the clinical manifestations are considered relatively simple and the seizure is termed a *simple partial seizure*. If consciousness is impaired, the symptomatology is more complex and the seizure is termed a *complex partial seizure*.

Generalized Seizures

By definition, generalized seizures arise from both cerebral hemispheres simultaneously.

Absence Seizures (Petit Mal)

Absence seizures are characterized by sudden, brief lapses of consciousness without loss of postural control.

Atypical Absence Seizures

Atypical absence seizures have features that deviate both clinically and electrophysiologically from typical absence seizures.

Generalized, Tonic-Clonic Seizures (Grand Mal)

Primary generalized, tonic-clonic seizures are the main seizure type in ~10% of all persons with epilepsy. They are also the most common seizure type resulting from metabolic derangements and are therefore frequently encountered in many different clinical settings.

Atonic Seizures

Atonic seizures are characterized by sudden loss of postural muscle tone lasting 1–2 s. Consciousness is briefly impaired, but there is usually no postictal confusion.

Myoclonic Seizures

Myoclonus is a sudden and brief muscle contraction that may involve one part of the body or the entire body.

Common cause of afebrile seizure-

Tuberculoma , Neurocysticercosis, calcified lesion Tumar ,Infract, Structural malformation of brain hypoglycemia ,hypocalcemia.
Most common cause of afebrile seizure in India is NCC

Inflammatory granulomas-

Inflammatory granulomas are an important cause of raised intracranial pressure and partial seizure in childhood.
These may be –tubercular, parasitic, fungal or bacterial in origin.
NCC and Tuberculoma are commonest of granuloma.

Neurocysticercosis (NCC)- It is cause by larva stage of Teania solium.
NCC can be classified as-
Parenchymal, Intraventricular, Meningeal, Spinalcord, Ocular

Clinical feature-Parenchymal NCC –seizure are commonest manifestation(80%) followed by raised intracranial pressure ,focal deficits. seizure may be generalized or partial[13]

Tuberculoma-

Intracranial tuberculoma is an important cause of space occupying lesion in both the developing and developed nations. In the paediatric population, tuberculomas account for 41 percent of intracranial lesions.

Most frequent site of location in children was considered to be the cerebellum (in adults tuberculomas are supratentorial). Tuberculomas may be single or multiple.

CT SCAN IN TUBERCULOMA

Predictive value of computed tomography based diagnosis of intracranial tuberculomas. Studies have shown the sensitivity of CT in the diagnosis of intracranial tuberculoma as 100 percent and its specificity as 85.7%, the positive predictive value was only 33 percent (confidence limits 24 to 42%). The negative predictive value was 100%. The low positive predictive value for diagnosis of intracranial tuberculoma on CT alone indicates the need for a confirming histological diagnosis.

Parietal lobe was the commonest site of single granuloma seen in 68% cases followed by frontal (20.9%), occipietal (9.4%) and temporal lobe (1.7%).[14]

DIFFERENT DIAGNOSIS

Cysticercus granuloma, Progenic abscess, Metastasis , Fungal granuloma , Glioma

DIFFERENTIATION FROM NEUROCYSTICERCOSIS

Single enhancing CT (NCC and tuberculoma) lesions are the commonest radiological abnormality in Indian patients with new onset partial seizures. Histopathological studies have proved that neurocysticercosis is the most common cause for these lesions. Rajshekhar et al used CT features to differentiate between these two conditions after establishing definite diagnosis by stereotactic brain biopsy.

Brain tumor- WHO calcification of tumours of CNS and meninges 5 categories constitute 86% of all paediatrics brain tumours – Juvenile pilocystic astrocytoma ,medulloblastoma/ PNET, diffuse astrocytoma, ependymoma and craniopharyngioma child hood brain tumour reported a slight predominance of infratentoria tumour location 43.2% followed by supratentorial tumour location 40.9%, spinal cord 4.9%, age related difference in primary location of tumour with in first year of life – supratentorial tumour predominant. Form 1-10 year age infratentorial tumour predominate (Juvenile pilocystic astrocytoma, medulloblastoma)

HEMORRHAGE:

Intracranial hemorrhage may occur in the sub arachnoid space or the bleeding may be primarily located in the parenchyma of the brain. Which is characterized by focal neurological signs and seizure.[15]

A-V malformation result from failure of normal capillary bed development between arteries and vein during embryogenesis. Children with A-V malformation frequently have a history of seizure and migraine like headache.[15]

Vascular causes – Arterial thrombosis/ embolism may involve major cerebral arteries (internal carotid A, anterior, middle, posterior cerebral arteries) or smaller cerebral arteries.[15]

Disorders of neuronal migration- These may result in minor abnormality or devastating abnormalities of the CNS like mental retardation ,seizure , lissencephaly ,schizencephaly.

Brain Imaging

Almost all patients with new-onset seizures should have a brain imaging study to determine whether there is an underlying structural abnormality that is responsible. MRI has been shown to be superior to CT for the detection of cerebral lesions associated with epilepsy. .The purpose of performing an neuroimaging study in a child with first afebrile seizure is to detect a serious condition that may require immediate intervention. Guidelines for obtaining emergent neuroimaging in adult patients presenting with seizures have recently been published.It is recommended that emergent brain computed tomography (CT) scan should be performed for most adults with a new-onset seizure. The prevalence of abnormal neuroimaging in an adult with a new-onset seizure is 34% to 45%. However, the role of emergentneuroimaging in children presenting with first afebrile seizure is still not well-defined. Based on several studies, the prevalence of abnormal neuroimagings in pediatric patients with a newonset afebrile seizure is estimated to be 0% to 21% **[1]** . Nevertheless, the American Academy of Neurology7 states that these evidences are not sufficient to make a recommendation at the level of guideline for the use of routine neuroimaging in children with a new-onset seizure.

AIMS AND OBSECTIVES

- To determine the prevalence of Neuro Imaging abnormality in Children (1 month to 14 years) with afebrile seizure.
- To collect evidence sufficient to make a recommendation for the use of routine neuro-imaging in children with first episode of afebrile seizure.

II. Material & Methods

METHODS:- In this study 100childrens aged between one month and 14 years with a new-onset afebrile seizure, admitted to the Paediatric Ward N.S.C.B M.C.H Jabalpur(M.P) were prospectively enrolled from August 2015 to July 2016.We defined the first seizure using the International League against Epilepsy (ILAE) criteria to include multiple seizures within 24 hours, with recovery of consciousness between seizures. Patients with their afebrile seizure and absence of any laboratory abnormalities were entered into the study.

Historical and clinical data :-included patient's age, sex, and the presence of any predisposing conditions, generalized or focal type of seizure, temperature, focal neurologic signs, Glasgow coma scale and any other abnormal findings in the neurologic examination.

Laboratory data;- included serum electrolytes, calcium, magnesium (if performed), and blood sugar,mantoux test.

Neuroimaging data:- CT scans were performed within 48hours of arrival to hospital. All the emergent neuroimaging studies were conducted with and without the injection of contrast medium. Statistical analyses were conducted using SPSS software. Variables were reported as mean ± SD. χ^2 analysis was performed to determine the correlation. *P* value of <0.05 was considered statistically significant.

III. Result

There were 110 patients admitted with the diagnosis of seizure over this one-year period. 90 of these underwent neuroimaging formed our study group. There were 54 (57%) males and 36 (40%) females. The mean ± SD age of male patients was79.62 ± 52 months and female patients was 89.89±52.9months. (range: one month – 14years) Neuroimagings were obtained in 90(92.6%) patients. Emergent CT scan, as an initial study,was performed in 82(91%) and MRI in 8(8.8%) patients. Neuroimaging results were normal in 30(33.3%) patients. Clinically-significant neuroimaging results were reported in 60 (66.7%) patients(Table 1)

Table 1
Neuroimaging abnormalities of studied cases.

Neuroimaging	No. of Cases	95% CI
Normal	30(33.3%)	22.72-46.34
Abnormal	60(66.7%)	51.91-85.09

Table 2
Neuroimaging Abnormalities

Neuroimaging Report	Frequency	Percent
Normal	30	33.3
NCC	25	27.7
Tuberculoma	15	16.6
Infract	4	4.4
Tumor	6	6.6
Misc.	10	11.1
Total	90	100

55 patients presented with focal and 35 with generalized seizures. Out of 55 patients with focal seizures, 45 (81.8%) and out of 35 with generalized seizures 15 (42.8%) had abnormal neuroimaging results . A significant relationship was also found between the facility of seizure and abnormal findings in neuroimaging (Chi-square test, $P < 0.001$) (Table 3). **Table-3 Correlation between type of seizure and abnormal neuroimaging.**

Table 3
Correlation between type of seizure and abnormal neuroimaging

	Seizure		
Neuroimaging	Focal	General	Total
Abnormal	45 (81.8%)	15 (42.8%)	60 (66.6%)
Normal	10 (18.1%)	20 (57.1%)	30 (33.3%)
Total	55	35	90 (100%)

χ^2=0.291,P>0.05(Not significant) Our study shows no significant association between neuroimaging abnormalities and abnormal neurological examination(low GCS<9). Our study shows that mantoux positivity in CNS tuberculoma was 30.7% and history of contact was found in 38.4%cases.statistical significance observed between mantoux positivity and tuberculoma(P<.05).

Table 4
Correlation between neurological examination (GCS) and neuro-imaging report.

Neuro-imaging	GCS (< 9)	GCS (> 9)	Total No. of cases
Normal	6 (20%)	24 (80%)	30
Abnormal	10 (20%)	50 (80%)	60

c^2 = 0.291, p > 0.05 (Not significant)

IV. Discussion
Approximately 4 – 6% of children are expected to have a seizure by the age of 16 years. About70% of these children are admitted and undergo different investigations. The role of emergent neuroimaging for children with a new-onset afebrile seizure is not well-understood. This is because the prevalence of neuroimaging abnormalities in this group has yet not been determined. However, regarding the results reported in the literature for adults, there has been a relatively high prevalence (between 34 – 45%) of CT scan abnormalities in adults with a new seizure. As a result, a recommendation has been published to perform emergent neuroimaging in large population of adults having their first seizure.2 So far, several studies have reported the prevalence of abnormal neuroimaging in children with new-onset seizures. The prevalence of abnormal neuroimaging in these studies ranged between 0 – 21%3 . The proportion of children with febrile seizures ranged between 17% and 71. It is important to note that children with febrile seizures, either simple or complex, are at low risk of neuroimaging abnormalities.7 Recently, **Sharma et al4** reviewed a large number (n = 500) of patients presented with new-onset afebrile seizures. They excluded patients with febrile seizure (simple or complex) and those with recurrent seizures. Neuroimaging was performed in 475 patients and they reported the prevalence of 8%, as clinicallysignificant abnormal neuroimaging. Their study was reliable because of the selected exclusion criteria. Our study enrolled 81patients with their first afebrile seizure. All patients with simple or complex febrile seizures, as well as those with recurrent seizures were excluded. Neuroimaging was performed in 90 patients and abnormalities were found in 66.7% of cases. The results showed that there was a significant relationship (P < 0.001) between focality of the seizure and abnormal neuroimaging.

Table – 5
Comparative Studies

Studies	Total no. cases	Normal	Abnormal
Our study	90	25 (33.3%)	50 (66.7%)
Sujit Sharma et al (2003)[30]	475	437 (92%)	38 (8%)
Sinome CV et al (2006)[12]	387	273 (80.4%)	114 (19.6%)
Hussain I et al (2008)[1]	100	90 (90%)	10 (10%)
Shlomo S et al (2001)[13]	218	172 (79%)	45 (21%)
Shipra Mathur et al (2007)[18]		68%	32%
Azita T et al (2011)[29]	140	112 (80%)	28 (20%)

Result of our study shows a considerably higher proportion of neuroimaging abnormalities which includes various finding such as NCC, Tuberculoma, infract, tumor, misc. **Shipra Mathur et al5** conduct study in north India shows prevalence of abnormal neuroimaging was 32% although our result are higher than stated prevalence **Shipra Mathur et al5** but our neuroimaging finding correlates with their finding .Study conducted elsewhere reported of 8-20% but these studies were conducted in developed countries where the prevalence of tuberculosis and NCC is low. Thus our results shows a higher prevalence of neuroimaging abnormalities . Most common neuroimaging abnormality observed was NCC (40%) followed by tuberculoma(26%) that is similar to Shipra Mathur et al**5** (2007). In our study various confounding factors may have direct correlation with abnormal neuroimaging finding which includes low socioeconomic status, lower literacy rate ,poor hygiene and poor nutritional status and higher prevalence of tuberculosis and NCC. There for our result are not comparable to other reported studies(**Simone CV et al6 , Hussein I et al1, Sujit Sharma et al7**) conducted in developed countries.who observed various neuroimaging findings such as haemorrhage, brain tumor, volume reduction of cerebral hemisphere and vascular lesion . In our study 50% cases of generalized seizure and 83.8%cases of partial seizure have abnormal neuroimaging.partial seizure abnormality were similar to those of **George et al8 (2006).** Our study shows no significant association between neuroimaging abnormalities and abnormal neurological examination(low GCS<9).But **Hussein et al1** shows significant association .our result was not comparable due to higher proportion of NCC and tuberculoma cases presenting with normal neurological examination at the time of admission. Our study shows that mantoux positivity in CNS tuberculoma was 30.7% and history of contact was found in 38.4%cases.statistical significance observed between mantoux positivity and tuberculoma(P<.05).**D. Vijaya Shekaran et al9 (2006)** showed that 21.2%mantoux test and 30.4%contact positivity were found in CNS tuberculoma and the results were comparable with our study. In our study Parietal lobe was commonest site for inflammatory granuloma followed by frontal lobe. Based on our findings, we recommend that neuroimaging should be performed in children with their first afebrile seizure in area having high prevalence of NCC, tuberculosis.

V. Conclusion:-
Incidence of neuro-imaging abnormality in children presenting with first afebrile seizure is high in developing countries like india due to high prevalence of NCC and tuberculosis so neuro-imaging should be considered in any child with first afebrile seizure.

IMAGES

Tumor

Fig-1Meduloblastoma

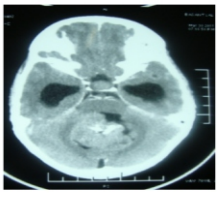
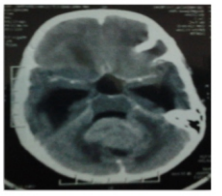


Fig-2Mass lesion in post fossa with hydrocephalous-meduloblastoma



NCC-

Fig-3 MRI -Vesicular stage NCC in cerebellam

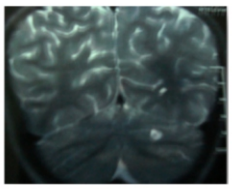


Fig-4 Right frontal inflammatory granuloma with edenuloma-NCC

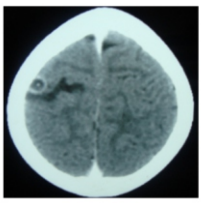
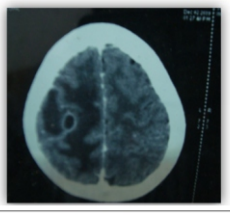
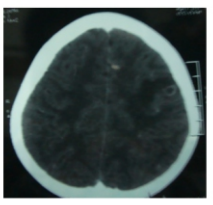


Fig- 5 Tuberculoma



Fig—6 Lt parietal inflammatory granuloma with edema-Tuberculoma



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