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Original research article

Diagnostic evaluation of partial seizures in pediatric age group (2 to 12 years) with neuro radiological tools like CT, MRI, EEG

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Abstract

Aims and Objectives: To study neuroimaging in partial seizures in children aged 2 to 12 years. To identify treatable causes of partial seizures.

Methods: All children between 2-12 years of age, who presented to the Emergency Department of Pediatrics, Mallareddy Medical College for Women, Telangana, between January 2022 to March 2023, with partial seizures will undergo neuroimaging, plain and contrast (contrast where indicated).

Results: The study population has fallen into two different age groups (1) 2 to 6 years (2) 6-12 years due to significant difference of incidence of partial seizures in the two age groups 68% belonged to 2-6 years age group, 32% belonged to 6-12 years age group. A total of 158 children were brought to Emergency service Room with partial seizures, among which 100 cases were included in the study, excluding those children falling under the exclusion criteria. Among the 100 children, 13% had simple partial seizures, 21% had partial seizures with secondary generalization, while 66% had complex partial seizures representing the largest group. 63% of the children had abnormal EEG, 75% of the children had abnormal CT brain. Both CT brain and EEG were abnormal in 60% of the cases, which shows that significant number of cases are diagnosed by CT brain and EEG. The lesions detected in CT brain in this study are neurocysticercosis (32%), tuberculoma (26%), infarct (5%), AV malformation (2%), calcifications (4%), Hydrocephalus (3%), subdural effusion (2%), brain tumor (1%). The neuroinfections namely neurotuberculoma and neurocysticercosis itself accounted for 58% of the total cases of partial seizures, 77% of the total abnormal CT brain, the 'P' value is 0.013 which is significant.

Conclusion: In tropical developing countries like India, neuroinfections are the most common cause of partial seizures. ILAE recommends CT brain as diagnostic tool whenever MRI is unavailable or unaffordable as it provides equivalent diagnostic aid. Neuroimaging and EEG are strongly advised. Most partial seizure etiologies are treated medically or surgically in children presenting to the emergency room.

Keywords: Lesions, seizures, neurotuberculoma and neuro cysticercosis, CT brain

Introduction

The commission on classification and nomenclature of the International League against Epilepsy (ILAE 1989) classifies all epilepsy cases into two categories: Partial seizures and Generalized seizures. (1). 40% of childhood seizures are partial. In some series, partial series may be classified as simple or complex partial seizures. Complex partial seizures (CPS) affect consciousness. CPS can have a simple partial beginning followed by loss of consciousness with automatisms or impaired consciousness at onset. The child's age, functional development, seizures, and interictal EEG can identify idiopathic epilepsy. If clinical characteristics and EEG observations are not compatible with established idiopathic condition, MRI scanning is recommended to determine the etiology.

Epilepsy occurs in 0.8-1.1% of people, and 50% of cases begin in childhood (1,2). Primary generalized epilepsy is considered to be genetic in origin. But most localization-related epilepsy is caused by a cerebral insult. In roughly half of all epileptic patients, regardless of age, insult cannot be identified. Imaging technology has lowered this proportion in children and young people with refractory epilepsy, where 25% show cortical development malformations.

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Localization related epilepsy is anticipated to be more common in developing nations. Imaging has made it possible to identify the origin of complex partial seizures in more children, which helps doctors decide whether to treat a particular child with CPS medically or surgically.

Materials and Methods

All children between 2-12 years of age, who presented to the Emergency Department of Pediatrics, Mallareddy Medical College for Women, Telangana, between January 2022 to March 2023, with partial seizures will undergo neuroimaging, plain and contrast (contrast where indicated).

Inclusion criteria

- All children with partial seizures aged 2 years to 12 years with available consent.

Exclusion criteria

- All children with cerebral palsy, mental retardation, and developmental delay.
- All children developing seizures, with neurocutaneous syndromes and following head injuries.

Methodology

A total of 158 young children between the ages of 2 and 12 were brought to the pediatric department of Mallareddy Medical College for Women, throughout the study period with complaints of partial seizures. 100 children were chosen for the group study after the exclusion criteria were applied and they met the inclusion requirements. When these children were admitted to the hospital, a thorough medical history was taken, the child was given initial stabilization care, and the duty resident in charge then performed a physical examination, paying particular attention to the following factors: the child's age, gender, kind of seizure, any secondary generalization, side of the seizure, linked aura and automatisms, post-ictal Todd's palsy, and signs of raised intracranial pressure like headache, vomiting, visual disturbances, abnormal fundus examination. The Complete Blood Picture (CBP), a Random Blood Sugar, Mantoux, Chest X-Ray, Renal function tests, Liver function tests, cerebral spinal fluid analysis, Erythrocyte Sedimentation Rate (ESR), EEG (Electroencephalogram), and Computerized Tomography of the Brain were performed in all the children in collaboration with Biochemistry, Pathology, Microbiology and Radiology. Only a small number of patients had MRI brain done due to unaffordability and their CT brain not indicating an underlying cause.

Results

A total of 158 children with partial seizures were brought to this institution's paediatric department's Emergency Service Room (ESR) during the study period. Only 100 of these cases which met the inclusion criteria were included in the study, which focused on children between the ages of 2 and 12, but left out any children who had developmental delays, cerebral palsy, mental retardation, head injuries, or neurocutaneous syndromes.

EEG & CT brain was done in all the 100 cases, but MRI was done only in 10 cases, due to the unaffordability of most of the patients. MRI brain was reserved only for those cases whose CT brain & EEG did not reveal any etiology.

Age Distribution

All the 100 Children between 2 to 12 years were categorised into 2 age groups due to significant difference between the occurrences of partial seizures in the two groups.

Table 1: Age distribution of partial seizures in the study group

Age	2-6 Years	6-12 Years
No. of children with partial seizures	68	32

This shows 68% of the partial seizures in the age group 2 to 12 years occurred in younger children of 2-6 Years, while only 32% of the seizures occurred in 6-12 years of age group.

Sex distribution

When the sex distribution was considered, there was a male predominance among the children with partial seizures.

Table 2: Sex distribution of partial seizures in the study group

Sex	Female	Male
No. of children with partial seizures	37	63

This shows that 63% of the children with partial seizures were males and 37% were females showing male predominance.

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Type of seizures

Of the 100 children included in the study group, all the three types of seizures were noted namely the simple partial seizures, Complex partial seizures and partial seizures with secondary generalization. Of these, complex partial seizures were the largest group, which were the partial seizures associated with loss of consciousness.

Table 3: Types of seizure

Type of seizure	Simple Partial seizures	Complex Partial seizures	Partial seizure with secondary generalization
No. of children	13	66	21

About 66% of the children with partial seizures presented with impaired consciousness, 21% of the children showed secondary generalization, while only 13% of the children had focal seizures without impaired consciousness.

Side of the Focal Seizure

Of the 100 children with the focal seizures, 54 children were having right sided focal seizures & 46 children were having left sided focal seizures showing no significant difference.

Table 4: Side of the Focal Seizure

Side of the focal seizure	Right side	Left side
No. of children	54	46

Right sided partial seizures-54% Left sided partial seizures-46%.

Abnormal clinical findings

Of the children who presented with partial seizures, abnormal clinical findings were found on examination in few children. They include Todd's paralysis (post ictal paralysis of the involved limbs), Meningeal sings (Kernig's sign, Brudzinski's sign and nuchal rigidity), cranial nerve palsies, and abnormal fundus (papilledema, scolex).

Table 5: Number of children with Abnormal clinical findings

Abnormal clinical findings	No. of children
1. Todd's palsy	13
2. Meningeal signs	4
3. Cranial nerve palsies	1
4. Abnormal fundus	6

Four children presented with meningitis had focal seizures who demonstrated meningeal signs on examination.

- Todd's palsy was observed in 13% of the children.
- Cranial nerve palsies were observed in 1% of the children.
- Abnormal fundus (Scolex was seen in 2 children, papilledema changes in 4 children).

Normal & Abnormal EEG

EEG could detect most of the cases of partial seizures. EEG was abnormal in 63% of the cases.

Table 6: Number of children Normal & abnormal EEG

EEG	No. of Patients
Normal	37
Abnormal	63

CT brain

CT brain could detect the lesions in 75 children of the 100 children with partial seizures showing a high sensitivity.

Table 7: Number of children with normal and abnormal CT brain

CT brain	No. of Patients
Normal	25
Abnormal	75

CT brain could not identify the lesion in only 25% of the patients showing CT brain is the most important diagnostic tool in detecting the lesion of partial seizures.

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EEG abnormalities in relation to age group of the abnormal EEG seen in 63% of patients.
Most of the EEG abnormalities could be seen in the age group of 2-6 years when compared to age group of 6-12 years.

Table 8: Age wise distribution of Abnormal EEG

Age	Abnormal EEG	Percentage
2-6 Years	44	69.8
6-12 Years	19	30.1

44 Children of 63 children with EEG abnormalities were in the age group of 2-6 years that is 69.8%, while 19 children with EEG abnormalities belong to age group 6-12 years i.e., 30.1%
Hence in correlation to the no. of partial seizures seen more in the age group of 2-6 years, the percentage of EEG abnormalities was also more in this age group.

Abnormal CT brain in relation to the age group
Of the 75 children with abnormal CT brain, more no. of children belonged to the age group of 2-6 years.

Table 9: Age wise distribution of Abnormal CT brain

Age	Abnormal CT brain	Percentage
2-6 Years	51	68
6-12 Year	24	32

Of the 75 children with abnormal CT brain, 51 (68%) belonged to age group 2-6 years and 24 (32%) belonged to age group of 6-12 years.

CT and EEG correlations
Of the 75 children with abnormal CT brain, EEG was found to be abnormal in 60 children, while other 3 children with abnormal EEG had normal CT brain.

Table 10: CT and EEG correlations

	Abnormal EEG	Normal EEG
Abnormal CT brain	60 (80%)	15 (20%)
Normal CT brain	3	22

Abnormal EEG was found in 80% of the children with Abnormal CT brain. The remaining 20% of the children with abnormal CT showed normal EEG. Hence EEG should be done whenever possible in the children with abnormal CT brain.

Table 11: CT brain abnormalities detected in the children with partial seizures

Abnormality	Percentage
Neurocysticercosis	32
Tuberculoma	26
Infarct	5
Arterio-venous malformation	2
Brain tumor	1
Calcifications	4
Subdural effusion	2
Hydrocephalus	3

When observed, Neuroinfections i.e., Neurocysticercosis and tuberculoma contributed to 58% of the total cases with partial seizures i.e. 77% of the total abnormal CT brain, hence neuroinfections are the most important causes of partial seizures noticed in our study.

Table 12: Abnormal EEG & CT Brain among neuro infections and other groups

	Both abnormal EEG & abnormal CT brain	Only abnormal CT brain
Neuroinfections	50	8
Others	10	7

Chi Square $x^2 = 6.16$ P = 0.013 (Significant)
P value < 0.05 is significant.

Hence neuroinfections are the most identified cause of partial seizures with abnormal EEG and CT brain in our study contributing to 58% of the cases with statistical significance with ‘p’ value of 0.013.

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Of the 25 children with normal CT brain, MRI was done in 10 children whose parents were affordable. MRI brain was normal in these 10 children.

Discussion

Partial seizures in children make up a significant portion of epilepsy and necessitate an accurate diagnosis for effective care. Cerebro-organic disturbances can be accurately and quickly diagnosed and quantified using a CT brain. Unusual results on a brain CT scan give insight into the level of cerebral involvement. EEG is also helpful for diagnosing seizures, making etiology suggestions, directing therapeutic care, and providing localization data when surgery is intended. Although MRI is the recommended imaging method, accessibility and cost are frequently important factors, with CT scan being the more widely used and less expensive method. A CT scan exposes the patient to radiation, whereas most infants who undergo an MRI run the risk of sedation. If an MRI is not available, the International League against Epilepsy (ILAE) recommendations for neuroimaging investigations advise that a CT can be the best diagnostic imaging for patients with epilepsy.

In number of studies in developing countries, it was shown that in children with localization related epilepsy who were scanned, the prevalence of structural abnormalities was high. More than half of all scans were abnormal. Several series of patients with focal epilepsy studied by CT have been reported in the Western literature. None of these have described the ring (or) disc enhancing hypodense lesion, though the rate of positive findings is similar to ours. In contrast to this observation, most of the studies in India revealed that neuroinfections were the commonest cause.

Hence to attain at a conclusion, this study was conducted to study the etiology of partial seizures and the significant role of radio neuroimaging in identifying these causes. Most of the causes of partial seizures are structural abnormalities which could be corrected either medically (or) surgically which reveals the importance of the study undertaken in the Department of pediatrics, Mallareddy Medical College for Women, Telangana.

During the study Period, a total of 158 children were brought to the Pediatric Department of this institution with partial seizures. Of these children, 100 cases were included in the study, considering the age group between 2 to 12 years and excluding developmental delay, mental retardation, cerebral palsy and head injury. Among them, 75% of the cases revealed an identifiable cause in the CT brain and 63% of the cases showed abnormal EEG. Among the 75% with abnormal CT brain, 58 cases are identified as Neuroinfections, neurocysticercosis in 32 cases, Tuberculoma in 26 cases.

Incidence of overall abnormal neuroimaging (75%) was similar to those of Neeraj Jain & Vibha Mangal study [1] named “Role of EEG and CT Scan in partial seizures in children” (70%), Nehal H. Patel [3] (68%), Ramesh Baheti [4] (50%), RS Wadia [5] (68%), Abnormal EEG in our study is seen in 63% of patients which was similar to those of Neeraj Jain [1] (73%), Doose *et al*., [6] (81%), Ramesh Baheti (73%) [4]

Among the abnormal neuroimaging, ring enhancing lesion were the most common cause. Ring enhancing lesion is defined as peripheral thin rim of enhancement with central hypodensity and disc enhancing lesion is defined as uniform enhancing lesion in entirety. Radiologists’ opinions are obtained in all cases. Vedantham Rajasekhar’s criteria [2] for Neurocysticercosis is utilized.

Table 13: Percentage of abnormal EEG among various studies

Author	Abnormal EEG
1. Neeraj Jain [1]	73%
2. Ramesh Bahati [4]	73%
3. JMK Murthy [7]	73%
4. Kuzniecky [8]	84%
5. RS. Wadia [5]	50%
6. Present Study	63%

Table 14: Percentage of abnormal CT brain among various studies

Author	Abnormal CT brain
1. Neeraj Jain [2]	62%
2. Nehal H. Patel [3]	78%
3. Ramesh Bahati [4]	50%
4. RS. Wadia [5]	68%
5. JMK Murthy [7]	67.5%
6. K.P.S. Nair [9]	59.09%
7. J. Gibbs [10]	26%
8. Present Study	75%

Of the total 100 cases in our study aged between 2 to 12 years, 68 children belonged to the age between 2-6 years, 32 children belonged to the age between 6-12 years, the ratio being 2.1: 1. Among these males

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were 63, females were 37, the ratio being 1.7: 1. Showing a higher male predominance and the significant age group is between 2-6 years (or) less than 6 Years.
This study also sought to identify the underlying causes of partial seizures in all 100 children. Neuroinfections (58%) among the 100 were the most common etiology, they constituted (77%) of the abnormal CT brain. Among these, neurocysticercosis had the highest incidence (32%), followed by Neurotuberculoma (26%). Infarct was seen in (5%), calcifications (4%). Hydrocephalus (3%), Arteriovenous (AV) malformations (2%), subdural effusion (2%), Brain tumor (1%). These observations were compared with those in other studies in Table 6.3.

Table 15: Percentage of neurocysticercosis, neurotuberculomas among neuroinfections in various studies

Author Name	Neurocysticercosis %	Neurotuberculoma %
1. Neeraj Jain (1)	28	21
2. Vedantam Rajasekhar (2)	80	20
3. Nehal H. Patel (3)	9.6	38
4. JMK. Murthy (7)	40	10
5. RS. Wadia (5)	9	16.6
6. Present Study	32	26

The present study showed similar results to that of Neeraj Jain study.
The side of the seizure were considered in the study. Right sided seizures were (54%) when compared to left sided seizures (46%) the ratio being 1.17: 1, which is of no importance, detecting lesions almost equally on both sides.
Of the 100 children with partial seizures, complex partial seizures constituted the largest group (66%) i.e., focal seizures loss associated with loss of consciousness, establishing the most common type of partial seizures. This was followed by partial seizures with secondary generalization (21%) which shows that the high frequency waves from a focal lesion can spread to the cerebral hemispheres in a relatively more children causing secondary generalized seizure. The least common among these is the simple partial seizures (13%) which shows that most of the partial seizures are associated with loss of consciousness. These findings are similar to the study of Neeraj Jain.

Table 16: Comparison of the type of seizures

	Complex partial seizure	Partial seizures with secondary generalization	Simple partial seizures
1. Neeraj Jain (1)	55%	22.67	22
2. Present Study	66%	21	13

Both the studies showed that complex partial seizures are the most common type of partial seizures.
This study compares the incidence of neuroinfections in different parts of the world. When the studies conducted in India are compared with those of the Western countries, India and other developing countries showed more incidence of neuroinfections as the cause of partial seizures. The probable cause for this incidence may be due to the poor economy, poor hygiene, overcrowding, poor education. Hence the management of a case of partial seizures is entirely different in the developing countries, when compared to developed countries.

Table 17: Comparison of incidence of neuroinfections in different countries

	Neuroinfections %	Others %
1. Neeraj Jain (India) (1)	88	12
2. Kramer (Western) (11)	5	95
3. Present Study	77	23

Hence the percentage of neuroinfections as the cause of partial seizures is 70 to 80% in developing countries due to the poor socioeconomic status and high rates of illiteracy with overcrowding as the probable etiology.
When the statistical significance is taken into consideration, neuroinfections which contributed to 77% of the total abnormal CT brains were detected by both EEG and CT brain in 50 cases (83%), only CT brain in 8 cases (13.7%), when the abnormal radio neuroimaging was compared in both the groups that is neuroinfections and others, the X^2 is 6.16 and the 'p' value is 0.013 which is significant. A 'p' value of < 0.05 is considered significant.
Abnormal clinical findings are found in many children after examining the children in the general ward. Those findings in this study were found in 24% of the children, the most common abnormal clinical finding being Todd's palsy, which is weakness of the limbs involved in the seizure activity following the seizure. This finding was seen in 13 children which lasted for few hours to few days. Todd's palsy constituted 54% of the total abnormal clinical findings. The weakness improved spontaneously in all children.

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Meningeal signs namely Kernig's Sign, Brudzinski's sign and nuchal rigidity are seen in 4 children (16.6%) of the total abnormal clinical findings. Meningeal signs are due to irritation of the nerve roots in the cervical spine. Meningeal signs are seen in meningitis which could be viral, bacterial, fungal. Hence meningitis especially in younger children could produce partial seizures. Lumbar puncture was done in all the children with meningeal signs due to suspicion of meningitis. CSF findings revealed leukocytosis in most of the cases with meningitis. The CT brain in these cases showed subdural effusion, infarct, hydrocephalus as the probable etiology for partial seizures. EEG could detect most of the focal seizures.

Abnormal fundus examination was seen in 6 cases constituting (25%) of the total abnormal clinical findings. The abnormal fundus included intrafundal scolex in 2 children with neurocysticercosis. The other 4 children had papilledema probably to Intracranial space occupying lesions such as brain tumor (or) raised Intracranial pressure due to mass effects of Tuberculoma (or) chronic hydrocephalus which occurred due to meningitis or other causes.

Cranial nerve palsies were seen in 1 child (4%) of the children which was a child with meningitis. The observed cranial nerve palsy was 6th nerve (abducens nerve) which is the most common nerve to be involved in raised intracranial tension.

Abnormal clinical examination provides a clue to the etiology of partial seizures, hence every child with partial seizures should be examined for focal deficits, meningeal signs. Those children with abnormal clinical findings had also more incidence of abnormal CT and EEG findings revealing their importance. All the children with abnormal clinical findings had abnormal CT brain (100%).

Neeraj Jain and Vibha Mangal [1] who studied the role of EEG and CT scan in partial seizures in children took 172 children in their study group. In them 112 (65.11%) were male, 60 (34.88%) were females. The age of patients ranged between 6 months and 12 years. 69.8% of children (120/172) had their first episode of seizure before the age of six years when compared to 68% of the children between 2-6 years in the present study group.

In comparison to the present study's 75% detection rate, 107 out of 172 patients (62%) had intracranial abnormalities. Ring enhancing lesions, which were numerous in 6 children and single in 54, were the most often seen lesions on a CT scan of the head. Using radiographic criteria and supporting evidence of tuberculosis elsewhere, 22 of these 60 individuals were identified as having tuberculoma (36.6%) as compared to 26 in our analysis (37.1%). CT findings observed in the study of Neeraj Jain [1] and the present study is as follows:

Table 18: CT scan lesions compared with study of Neeraj Jain [1]

	Neeraj Jain %	**Present Study %**
1. Neuroinfections	55.46	58
2. Cortical infarct	11.21	5
3. Hydrocephalus	9.34	3
4. Calcifications	4	4
5. Brain tumor	1.86	1
6. Subdural effusion	2	1.86

50 children were evaluated by Nehal H. Patel [3], who found that 16 (32%) of them had normal CT brain scans while 34 (68%) had abnormal ones. 20 children (almost 60% of abnormal scans) had potentially treatable lesions, including brain abscesses (n=4), neurocysticercosis (n=3), and tuberculomas (n=13). Five children showed alterations that reflected static pathology and had no bearing on how the patients were managed. In 78% of children, the clinical characteristics and the CT results correlated. Routine investigations like Complete hemogram with Erythrocyte Sedimentation Rate (ESR), basic Renal & Liver function tests, Mantoux test & X-ray chest, were carried out in all patients as in the present study. When clinically necessary, lumbar punctures were used to collect cerebrospinal fluid (CSF) for investigation and/or an EEG test. Each patient had a CT scan of their brain. In 13 (26%) of the youngsters, the Mantoux test was positive (>10mm), and 12 (24%) of the cases had chest X-ray results that suggested tuberculomas. 17 of the 22 children who had clinical suspicions had abnormal CSF results. When compared to research from India (37-76%), it was shown that studies from industrialized nations had a greater incidence of normal CT scans of the brain (50-75%). It was determined that children who have partial seizures are more likely to have aberrant brain CT scan results, particularly if they have neuroinfections that may be curable. Therefore, all children with partial motor seizures, especially those in developing nations, should undergo a CT scan of the brain.

JMK Murthy studied [5] a total 991 cases of partial seizures. The various CT lesions in his study are as follows:

Table 19: CT scan lesions compared with study of JMK Murthy

	JMK Murthy	**Present Study**
1. Neuroinfections	43	58
2. Vascular	25	5

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3. Tumors	4	1

Both the studies reveal that neuroinfections are the most common etiology of CT abnormalities in partial seizures. He stated that infections of the CNS are much more prevalent in the tropical countries and form important risk factor for epilepsy. Neurocysticercosis is a growing problem in tropical countries and increasingly recognized as a leading cause of epilepsy. Histological studies suggest that SCTEL (Single CT enhancing Lesion) represents dying cysticerci that will spontaneously resolve as the result of the host response. Tuberculoma was the pathology of 21% of histologically verified Intracranial space occupying lesions when compared to 26% in our study. More than 60% of patients with intracranial tuberculoma may have seizures. In India tuberculosis of the Central Nervous system is the most common type of chronic infection of CNS. Seizures occur as a late sequalae in 10% of patients with neurotuberculosis and often with signs of focal CNS involvement.

RS wadia [5] who conducted the study in 150 consecutive cases of simple partial epilepsy showed that significant CT abnormalities were seen in 68%. The commonest lesion noted in his study was a hypodense lesion on unenhanced scan with a ring (or) disc enhancement on contrast scan and surrounding hypodensity.

Table 20: CT findings in focal epilepsy in his study and present study are as follows

CT brain abnormalities (%)	RS Wadia	Present Study
Ring enhancing lesions	40.9%	58%
Vascular	4.6%	2%
Calcification	2.3%	4%
Tumor	2.3%	1%

When both the studies are compared, Ring enhancing lesions particularly neuro-infections were the predominant group. He also showed the comparison of no. of cases whose etiology was identified before and after the CT scan era.

Table 21: Showing focal epilepsy, before and after availability of CT

	CT Scan	Prescan
No cause detected	32%	75%
Tumors	9.5%	7%
Vascular	16.5%	6%
Focal calcification	3.3%	0%
Tuberculoma	1.3%	2%
Focal ring (or) Disc	26%	0%

The above comparison showed that CT brain showed a revolution in the diagnosis of etiology of focal epilepsy. The ring enhancing lesions detected in the prescan era was 0% when compared to 26% in the CT scan era. Hence the study of RS Wadia and the present study conclude that CT brain is a must in the diagnosis and also in the management of partial seizures. Tuberculomas in his study, were also subjected to histology. Antituberculous treatment was given in these cases. They were rescanned 1-2 months after the initial scan and seen that the lesions had regressed but not disappeared, implying that the regression of these lesions is a gradual and relatively slow process. The children in the present study were also started on Antituberculous treatment and steroids, but the repeat scan was not done due to short duration of the study.

UC Wieshmann [12] in his study also stated that abnormalities were detected in more than half of all patients with localization related epilepsy but the etiology for the focal lesions differed in his study compared to the present study. In his study which was done in western countries, the primary etiologies were vascular, tumors, compared to neuroinfections. In the present study, showing that etiologies of the focal seizures are different in different parts of the world but underlined the importance of optimal neuroimaging for these patients as most of the cases were treatable and were identified only on neuroimaging. In his study, he stated that MRI was superior to other imaging modalities, but MRI was not done in our study due to a no. of limitations. Moreover, plain CT and contrast enhanced CT were highly sufficient in our study which could identify 75% of the focal seizures and the treatment was initiated.

Therapeutic relevance of computerized tomography (CT) in children with uncomplicated partial seizures is reported to be very low (1-2%) in industrialized countries, while the situation is completely different in underdeveloped nations like India, according to K.P.S. Nair [9] in his study. His objectives were to assess the value of CT in the treatment of SPS in children and to compare the clinical characteristics of children with and without localized brain lesions on a CT scan. When opposed to 75% of children in the current study, only 59.09% of children in his study had focal structural abnormalities.

Neuroinfections (or) their sequalae were responsible for 44.94% of the cases.

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Table 22: Showing the percentage of abnormal neuroimaging in focal seizures in developing countries like India

	KPS Nair	Present study
Total % of abnormal CT	59.09%	75%
Neuro infections	44.94%	58%

He concluded that CT study in children with simple partial seizures in developing countries has significant therapeutic relevance. It is not possible to clinically differentiate children with focal lesions from those without focal lesions in CT.

Ramesh Baheti [4] who conducted his study to assess the role of EEG and CT scan in patients with partial seizures observed that 73% of the children had an abnormal EEG compared to 63% in the present study. Abnormal CT brain was seen in 50% of the patients compared to 75% in the present study. His observation was also similar to that observed by Al-Sulaiman *et al*., [13] and Doose *et al*., [14] who reported abnormal EEG in 81% of patients with partial seizures. He also established a correlation between abnormal EEG and abnormal CT brain. 57.8% of the abnormal CT brain has abnormal EEG in his study, compared to 80% in the present study.

Table 23: Showing the percentage of abnormal EEG among the children with abnormal CT brains

	Ramesh Baheti	Present study
% abnormal EEG among abnormal CT brains	57.8%	80%

The concluded that every case of partial seizures must be evaluated with EEG as well as CT scan as there are nearly 50% chances of finding some structural cerebral lesion, and also because EEG is a useful to screen out patients with seizure disorders and it may have some predictive value in determining co-existing CT abnormalities. He also stated that, CT scan may have both therapeutic and prognostic significance in partial seizures.

David M Treiman [15] in his study showed that most of the complex partial seizures are manageable either by medical treatment (or) by surgery. He stated that the goal of management of refractory complex partial seizures is to make the patient completely seizure free and be achieved by the choice of the optimal antiepileptic drug (AED) (or) a combination of drugs, the use of strategies to maximize the effectiveness of the drug treatment, or by surgical removal of the seizure focus. In refractory partial seizures, surgical intervention has to be a consideration in the management which include resection of the seizure focus, multiple subpial transection, destruction of the seizure focus by gamma knife. From the above discussion, it is shown that there are a number of strategies that can improve control of partial seizures, both AEDs and Surgical, hence detection of the appropriate etiology by EEG and CT brain saves a number of children with partial seizures from significant morbidity and mortality. In the present study, CT brain and EEG were done in all the 100 cases, contrast was used whenever needed.

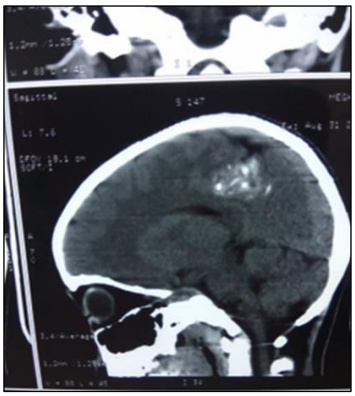

Image 1

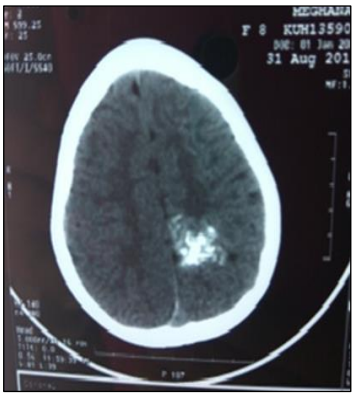

Image 2

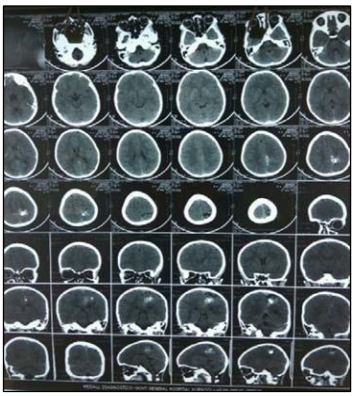

Image 3

Images 1, 2, 3 showing multiple calcified serpentine like lesion left high parietal lobe with focal atrophy-Calcified AVM.

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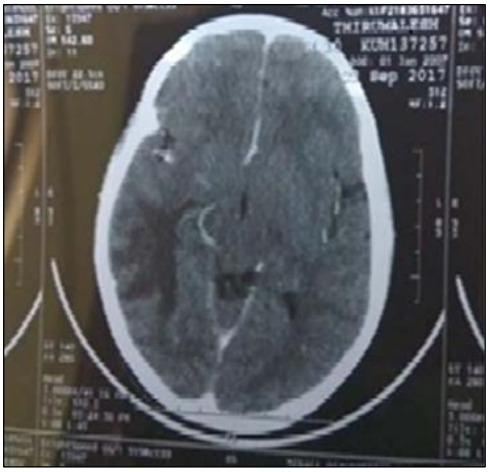

Image 4

Image showing ring enhancing lesion with perifocal edema right temporal lobe-infective granuloma.

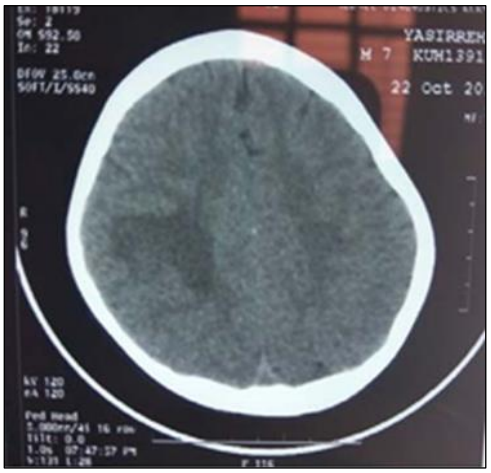

Image 5

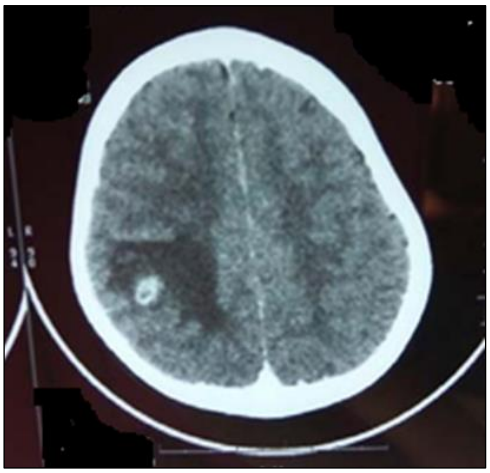

Image 6

Image 5, 6: CT brain of the same patient with ring enhancing lesion with image 5 showing plain CT, Image 6 showing contrast CT.

In the present study, the major limitation is the poor socio-economic status and unaffordability of the patients. Hence MRI bran was limited only to few cases whose CT brain and EEG did not reveal any lesion with partial seizures. The following image shows the MRI of such a patient.

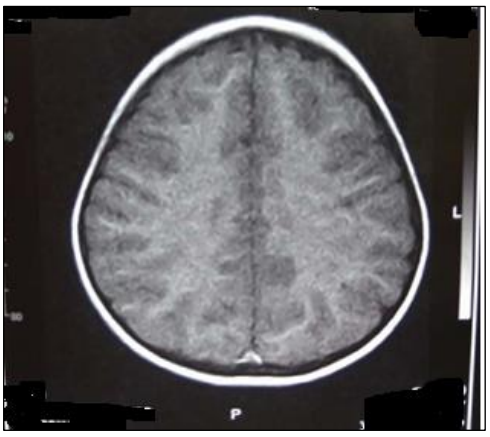

Image 7

MRI of this patient showing normal study whose CT brain and EEG did not identify the lesion.

Diagnosis of the etiology in partial seizures became very important as most of the lesions are treatable. Neurocysticercosis was managed by oral albendazole and steroids. Albendazole should be given for 7 days for single lesion and 28 days for multiple lesions (or) subarachnoid disease. Premedication with

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prednisone (or) dexamethasone before the first dose of antiparasitic drug is necessary.
Tuberculomas were treated medically with corticosteroids and ATT for 9-12 months. Brain abscess was managed with IV antibiotics for 6 weeks. Subdural effusion was treated by aspiration through the open fontanel. Hydrocephalus was treated with acetazolamide and furosemide and surgically by ventriculoperitoneal shunt. Cerebral edema was managed by osmotic diuretics like mannitol and hypertonic saline. Surgical decompression was not necessary. The child with brain tumor was operated and the tumor removed and was kept on chemotherapy.
Vedantham Rajasekhar [2] in his study of 31 patients with histologically proven small solitary cysticercous granulomas and tuberculomas highlighted important distinguishing features in the neuroimaging of the two lesions. Evidence of raised ICP, progressive neurological deficit was seen more in tuberculomas (33%) when compared to (0%) in Neurocysticercosis. The size of lesion was > 2 cms in tuberculomas in (100%) of cases where < 2 cm in neurocysticercosis in (100%) of cases. The lesion shape was irregular in Tuberculomas in (83.3%) whereas most of the cases of neurocysticercosis are regular in shape (80%). As the treatment modalities are entirely different for both the conditions, these differences provide a light for the proper management. These differences were used in the present study for distinguishing neuro tuberculoma from neurocysticercosis.
Hence from the various studies, it is shown that CT brain and EEG play a very important role in the identification and management of partial seizures.
All the children were started on antiepileptics and the specific management for each condition was given.
The present study recommends to also use MRI brain in more no. of cases to study the role of MRI brain in partial seizures as it was not done in most of the cases due to unaffordability. The exact diagnostic importance of MRI could not be established in this study due to these limitations.

Conclusion

In conclusion, it was found that, neuroinfections are the most common cause of partial seizures in developing countries in the tropical areas like India. ILAE recommended the use of CT brain as the diagnostic tool whenever MRI is unavailable (or) unaffordable and provides an equivalent diagnostic aid as of MRI. The conclusion/answer to research question is Neuroimaging and EEG are strongly considered and recommended in any child presenting to the emergency department with partial seizures to know the etiology as most of the causes are treatable either medically (or) surgically.

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Conflict of Interest: None.

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