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A PROSPECTIVE STUDY USING MRI IN THE EVALUATION OF PAEDIATRIC EPILEPSY IN A TERTIARY HEALTH CARE CENTRE

Radio-Diagnosis

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KEYWORDS

INTRODUCTION

A seizure is defined as a sudden, paroxysmal electrical discharge from the central nervous system (CNS) resulting in involuntary motor, sensory or autonomic disturbances with or without alteration in sensorium. The age and neurodevelopmental maturity status determine the clinical manifestation and type of seizure disorder. About 5% children are at risk of experiencing a seizure and half of them encounter the first seizure in infancy. Prevalence is greater in the neonatal period (almost 1% in term and 20% in preterm). In infancy, febrile convulsions are the most frequent form.[1] Epilepsy is a condition in which seizures are triggered recurrently from within. It is considered to be present when two or more unprovoked seizures occur at an interval >24 h apart. The cumulative lifetime incidence of epilepsy is 3%, and more than half the cases begin in childhood. The annual prevalence of epilepsy is lower (0.5–0.8%) because many children outgrow epilepsy.[2] Children with epilepsy should undergo neuroimaging if one or more of the following indications are present:

a.) If there is any evidence to suggest that epilepsy is localization-related (e.g. focal), with the exception of typical benign idiopathic partial epilepsy. The basis for establishing localization-related seizures includes the characteristics of the seizure, abnormalities on an electroence phalograph (EEG), focal examination (including Todd's paralysis), and history or examination to suggest remote symptomatic cause (such as extreme prematurity, meningitis, encephalitis, complicated febrile convulsion, or significant head injury).

b.) Abnormal neurologic examination including focal deficits, stigmata of neurocutaneous, cerebral malformation syndrome, or a history of significant developmental delay, arrest, or regression.

c.) Children younger than 2 years, excluding those with simple febrile seizures.

d). Children with characteristics of a symptomatic generalized epilepsy syndrome, including infantile spasms or early Lennox-Gastaut syndrome.

e.) Failure to control seizures, worsening seizures, changes in seizure manifestations, or developmental regressions also merit neuroimaging if not previously performed.

f.) Finally, new-onset seizures/epilepsy presenting with evidence for a medical emergency such as increased intracranial pressure or status epilepticus always merit emergency imaging.

OBJECTIVES:

The aim of study was to detect and characterize various lesions causing epilepsy in pediatric age group (0–14 years) in tertiary health care centre .

To detect frequency with which they occurred using MRI as the imaging modality of study

MATERIALS AND METHODS:

The study was performed on 281 children under the age of 14 years over a period of 1 year during September 2021 to October 2022 referred from outpatient and inpatient paediatric department presented with epilepsy to GGH,RMC ,Kakinada.

Patients with metallic implants, claustrophobia, trauma, and febrile seizure disorders were excluded. All patients were subjected to MRI using GE 1.5 Tesla machine.

- Conventional MRI was performed by taking T1W (TE 8.0 ms, TR 480 ms), T2W (TE 102.9 ms, TR 4780 ms), and fluid-attenuated inversion recovery (FLAIR) (TE 92.2 ms, TR 8002 ms) sequences.
- Post-gadolinium (dose 0.1 mmol/kg) enhanced MRI was performed in axial and sagittal planes in selected cases depending on findings on non-contrast study or clinical suspicion.
- Diffusion-weighted imaging (TE 83 ms, TR 5025 ms) and gradient recalled echo axial performed in all cases.
- When required, MR spectroscopy, venous 3-dimensional phase contrast angiography and MR angiography including time of flight were done.

MRI was assessed for any possible neurological causative lesion of seizures.

- Lesions were characterized in location, signal intensity and other features seen on different MRI sequences.
- Statistical analysis - data were collected and entered into MS Excel. Statistical calculations were made, and results of this study were analyzed

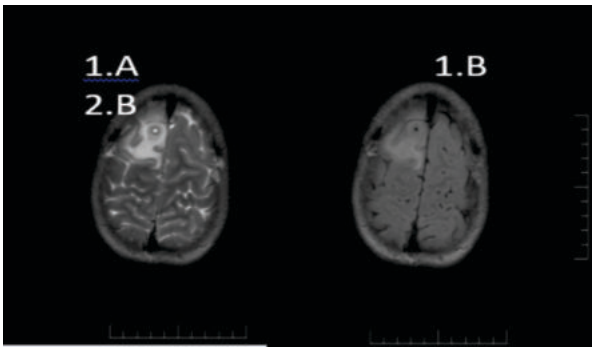
RESULTS:

- Out of 281 patients, 194 patients (69.3%) presented with generalized seizures, 62 patients (22.1%) presented with focal seizures while 24 patients (8.6%) had an unknown onset.
- 239 patients (85.1%) had positive findings on MRI while 42 patients (14.9%) had normal MRI with no detectable lesions.
- Most of the patients in the study were in the age group of 0–3 years followed by 10–12 years. There was a male preponderance with male:female ratio of 2.2:1.
- Our study shows hypoxic-ischemic encephalopathy and its sequelae (36.8%) as the most common etiology followed by infection(22.4%).
- Tuberculomas/ TB meningitis (37.0%) (figures 1A and 1B)was the most common infectious etiology.
- Neurocystiscercosis (25.0%)(figures 1A and 1B), Meningitis (7.4%), Meningoencephalitis and encephalitis constituted 3.7% and 18.5% of infectious causes.

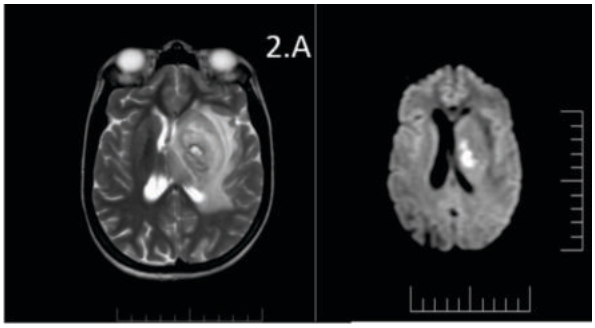
Vascular causes and malformations of cortical development constituted 10.0% and 6.2% respectively. Of 10.0% of vascular causes, arterial infarcts (70.0%) were most common.

Hypoplastic left transverse sinus(14.0%), Venous sinus thrombosis (12.5%), Arteriovenous malformations (4.0%), cavernous angioma(4.0%), Fetal origin of PCA(4.0%) constituted remaining cases.

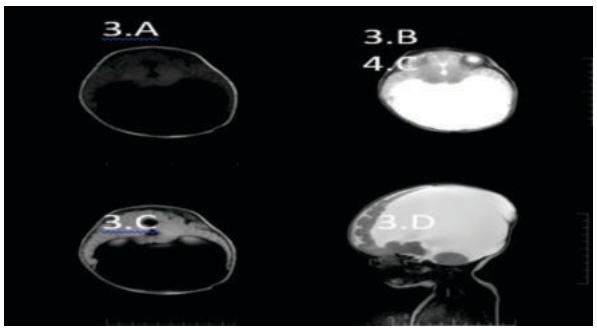
- Lissencephaly spectrum (46.67%) was the most common malformation of cortical development.
- Heterotopias(20.0%),Holoprosencephaly (13.33%)-alobar(6.67%) figures 3A,3B, 3C and 3D) and lobar(6.67%), Dykedavidoff Mason syndrome(13.33%), open-lip schizencephaly(6.67%) constituted rest of the cases



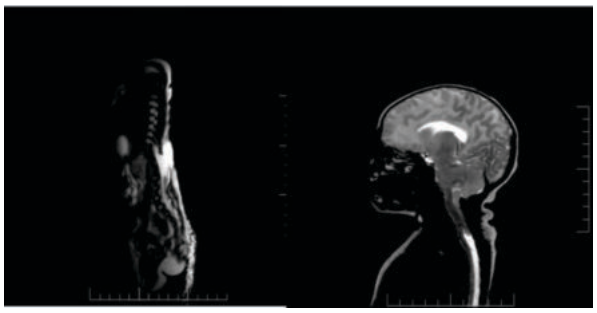
Neurocysticercosis:Axial MRI T2WI and FLAIR show hyperintense lesions with central hypointense dot with peripheral edema in right frontal lobe



Tuberuloma:Axial MRI T2WI and DWI images show heterogenously hyperintense lesion with foci of restiction in left basal ganglia



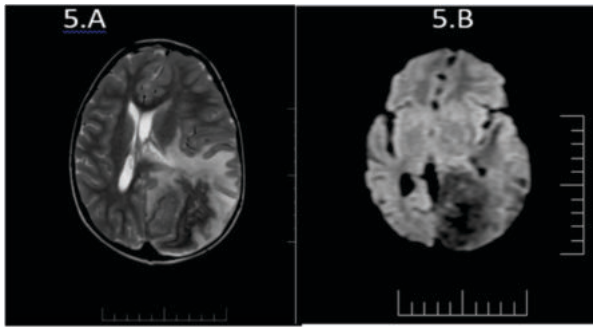
Alobar holoprosencephaly:Axial MRI T1WI, T2WI ,FLAIR and Sagittal T2W1 images fused basal ganglia with large dorsal cyst



Arnold Chiari 2.0 : Sagittal T2WI images show myelomeningocele and small posterior fossa

Congenital cystic lesions and neoplasms constituted 2.9% and 2.5% of cases respectively.

- Arachnoid cysts(42.86%), choroid plexus cysts(28.5%), colloid cysts(14.2%) and Neuroglial cyst(14.2%) comprised the congenital cystic lesions.
- Of 6 patients who had neoplastic etiology , 2 patients had Medulloblastomas(33.33%)(figure 6), Glioma, Ganglioglioma (Figures 5A and 5B), Atypical Teratoid/Rhabdoid Tumor , Germinoma repreesented 1 case each.
- Posterior fossa anomalies and inherited metabolic diseases represent 2.1% each. Of 5 patients who had posterior fossa anamolies, 2 patients had Arnold Chiari 2.0. Remaining 3 patients had Arnold Chiari1.5 and 1.0, and Dandy Walker Malformation.
- Out of 5 patients with inherited metabolic diseases, Leigh's syndrome (figures 9A and 9B)constituted 40.0% (2 patients)of cases, while MELAS, Metachromatic Leukodystrophy and Alexander's disease constituted 1 case each

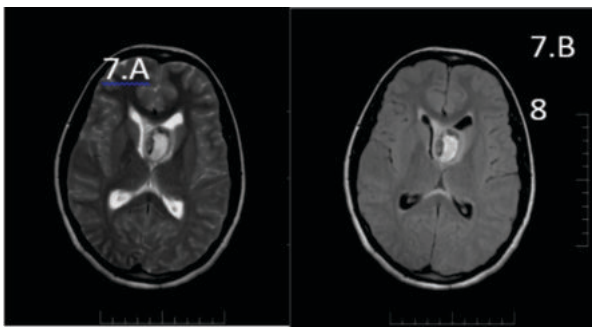


Ganglioglioma:MRI Axial T2WI and DWI images show heterogenously hypointense lesion with peripheral edema and no restriction proved to be ganglioglioma

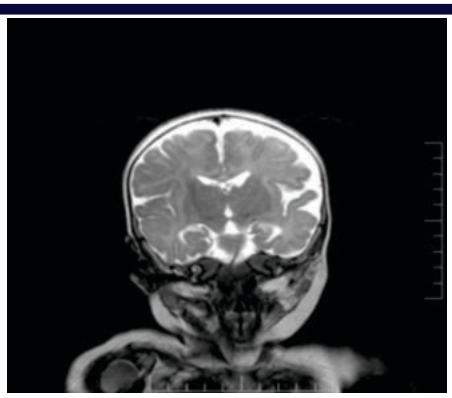
Medulloblastoma: MRI Axial T2WI show heterogenously hyoerintense lesion in fourth ventricle with obstructive hydrocephalus

A rather miscellaneous group constituted 9.6% of cases(23 patients) with post-ictal edema(34.7%), left cerebellar atrophy (17.4%), Aqueductal stenosis(13.0%),Transient splenial lesion (13.0%), terminal zones of myelination (8.69%) as common causes. 2 patients had Tuberous sclerosis(8.69%)(Figures 7A and 7B) while only one patient had Mesial Temporal Sclerosis(4.3%)(Figure 8)

Partial complex seizures originating from temporal lobe represented 3.3% of cases with tuberculous infection (37.5%) being the most common etiology here while there was only one documented case of mesial temporal sclerosis (12.5%).



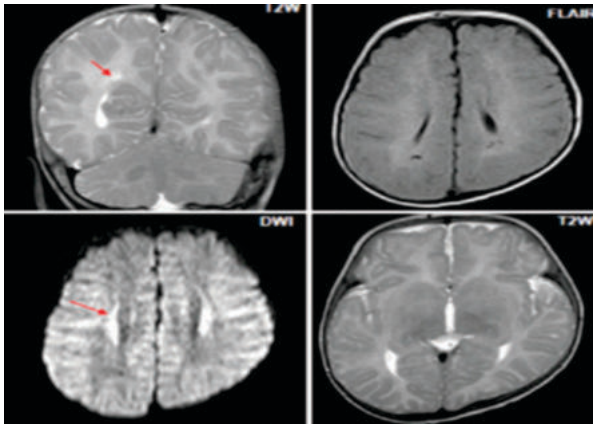
Tuberous sclerosis: MRI Axial T2W1 and FLAIR images show heterogenously hyperintense lesion near left foramen of monroe suggestive of SEGA.



Mesial temporal sclerosis: MRI coronal T2WI image atrophy of left hippocampus with dilated temporal horn

HIE and its sequelae (36.8%)were the most common etiology in our study with 88 cases.

- Out of them 6o(68.2%) were perinatal and remaining 28 cases(31.8%) were of varying ages from 1 to 14 years.Of these 28 cases ,19 patients (67.8%) had cystic encephalomalacia and rest (32.2%) had gliotic changes.
- Of 60 perinatal cases, 32 (53.33%) were preterm and 28(46.67%) were at term babies.
- In perinatal age group, Periventricular leukomalacia-PVL(52%) (figures 10)was most common finding with cystic changes (26.67%), White Matter volume loss (8.33%), hemorrhage (13.33%) were seen in remaining cases. Of 8 babies with hemorrhage , 5 patients (62.5%) had Germinal Matrix hemorrhage while 3 cases(37.5%) had Intraventricular Bleed



Hypoxic-ischemic encephalopathy in a preterm.:T2W images show periventricular cerebrospinal fluid attenuation lesions which are suppressed on fluid-attenuated inversion recovery images. Diffusion-weighted imaging reveals restricted diffusion in these lesions

DISCUSSION :

In our study of total 281 patients, maximum (57.9%) were in the age group of 0–3 years. The mean age group of the study population was 3years 3 months.

Our study is in discordance with the study conducted by Gulati et al. in which maximum patients were in the age group 6–12 years.[6]

It is also in discordance with the study conducted by Wongladarom et al. in which mean age group of the study population was 7 years and 5 months.[7]

Male:female ratio in our study was 2.2:1 and correlates with the study conducted by Sanghvi et al. in which 60.5% were males and 31.7% were females.[8]

Studies conducted by Gulati et al., Amirsalari et al., and Zajac et al. also showed similar findings in which males outnumber females.[6,9,10] Generalized seizures constituted the major seizure group being present in as many as 69.3% in our study and correlate with the study conducted by Chaurasia et al. in which it was seen in 76.7% patients.[11]

239 patients(85.1%) had abnormal MRI findings in our study. Kuzniecky et al. found MRI abnormalities in 84% of patients.

- Our study is in discordance with the studies of Chaurasia et al., Gulati et al., Kumar et al. and shows infection as the most common etiology in pediatric epilepsy.[11,13,14]
- This may be due to a higher prevalence of maternal anemia and poor maternal health care and delivery practises in our area.
- However, the results are discordance with previous studies regarding age distribution, neuroimaging findings in MTS, anoxia and HIE, distribution according to pathologies in MCD, phakomatoses, and vascular cause.
- We could not find any comparable data mentioning the most frequent pathology in inherited metabolic disorders, demyelination and among miscellaneous causes.

CONCLUSION:

MRI is the imaging modality of choice in the evaluation of pediatric patients presenting with epilepsy.

- Proper MRI seizure protocol helps to establish the correct diagnosis, plan the management according to diagnosis as well as helps in prognosis.

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