

Spectrum of MRI Findings in Pediatric Epilepsy: Medical and Surgical Causes of Epilepsy in Children and its Radiological Correlation

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Abstract

Introduction: Epilepsy is the common condition encountered in both adults and pediatric population. It occurs as a result of various spectrum of etiology ranging from infections to tumors. EEG and Neurosonogram can characterize the type of epilepsy, however, imaging is the only tool to identify the lesion, its location, extent and resection possibility. CT was the only modality before the era of MRI. However, CT was only used to identify the lesion with hemorrhage and calcification. It is having the disadvantage of having poor spatial resolution and using radiation. The era of MRI has changed the imaging due to its higher spatial resolution, gray white matter differentiation, status of myelination and non-utilization of radiation.

Purpose: The aim of study was to detect and characterize various lesions causing epilepsy in pediatric age group (0-12 years) and also to detect frequency with which they occurred using MRI.

Methods: The study was performed on 50 children under the age of 12 years over a period of 1 year who presented with epilepsy. Patients with trauma and febrile seizure disorders were excluded. Conventional and contrast MRI was performed in all cases and lesions were characterized in location, signal intensity, and other features.

Results: The mean age group of the study population was 1-5 years. Generalized seizures constituted the major seizure group. Our study shows infection as the most common etiology followed by Mesial temporal sclerosis and Focal cortical dysplasia. It was followed by neoplastic etiology, phacomatosis and demyelinating diseases.

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.

Introduction

Epilepsy is the major cause of disability in both developing and developed countries [1]. Majority of the epilepsy attacks are idiopathic. However, the differentiation between medically treated and refractory causes helps in management of the case and helps in improvement of quality of life. Majority of the cases are medically responsive, however, the imaging can promptly diagnose the medically refractory cases of epilepsy and aids in the management [2]. The various causes of epilepsy includes infection like tuberculosis, Neurocysticercosis, cytomegalovirus, herpes; inflammation like meningitis, encephalitis, cerebritis; temporal lobe tumors like Desmoplastic infantile Ganglioglioma, dysembryoblastic neuroepithelial tumor, pleomorphic xanthoastrocytoma; congenital conditions like tuberous sclerosis, sturge weber syndrome; other conditions like mesial temporal sclerosis, leukodystrophies, focal cortical dysplasia, etc. The imaging tools identify the epileptogenic foci and helps in early intervention. MRI is the modality of choice for the neuroimaging due to better soft tissue resolution and devoid of radiation [3].

Case Study

This is the retrospective study performed on the 50 cases of pediatric patients visiting the MRI suite of tertiary medical college with complaints of epilepsy. The child with history of at least one episode of seizure was an inclusion criterion. Thorough history in the form of birth history, perinatal history, history of admission stay, family history was noted. The patients were scanned on 1.5 T Toshiba machine with T1W, T2W, FLAIR, DWI, GRE, IR, T1+Contrast sequences with performed in axial, sagittal and coronal planes. The uncooperative patients were sedated in presence of a pediatrician and an anesthetist. The scans were reported by the senior radiologist with experience of 5 years in the department. The surgical cases of epilepsy were followed up in form of repeat MRI and CT scans (Figures 1-5).

Keywords: Epilepsy; MRI; Hydrocephalus; Meningitis; Astroblastoma; Desmoplastic infantile ganglioglioma; Focal cortical dysplasia; Leukodystrophy

Cases

Focal cortical dysplasia

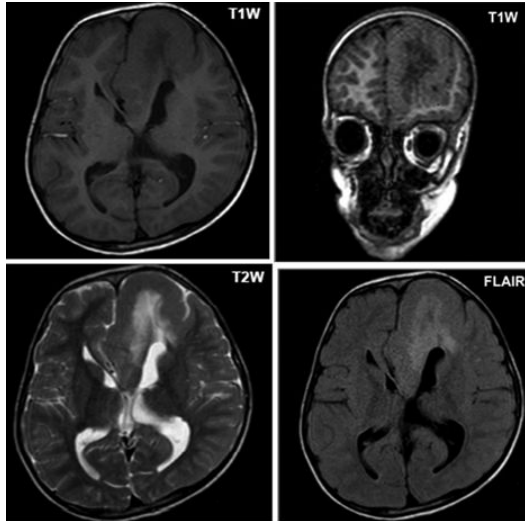


Figure 1: Axial sections showing T1w hypo and T2w and flair hypersignal intensity lesions are noted in subcortical region of parietal lobe radiating from lateral ventricle on left side suggestive of focal cortical defect.

Desmoplastic Infantile Ganglioglioma

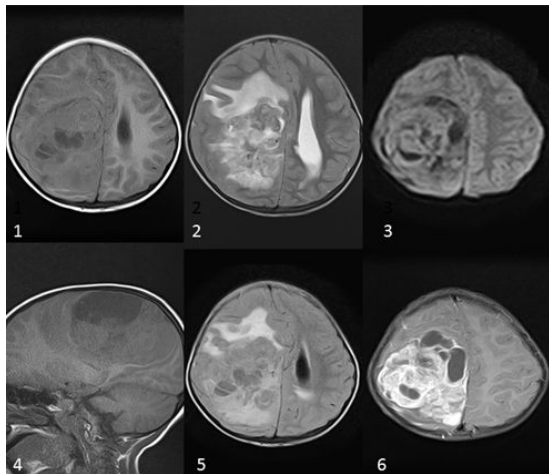


Figure 2: a- T1W axial image showing hypo to isointense signal in Right fronto parietal region. b- T1W sagittal image showing the extent. c-FLAIR sequence showing low signal of cystic areas with evidence of perilesional edema. d-DWI showing no evidence of restriction. e-Postcontrast T1W sequence showing heterogenous enhancement of solid component.

Sturge Weber Syndrome

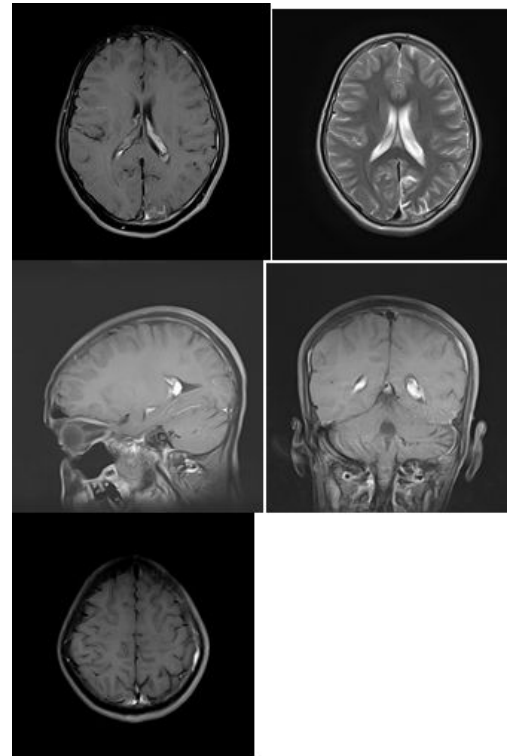


Figure 3: Left cerebral atrophy with pial enhancement in left parieto-occipital region consistent with pial angioma and enlarged left choroid plexuses.

Tuberous sclerosis

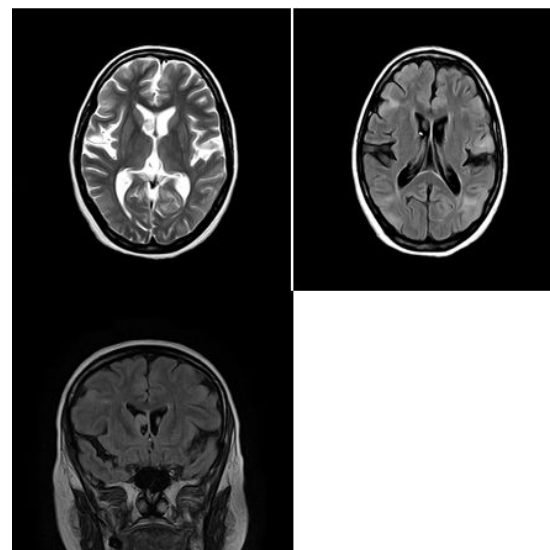


Figure 4: T2W and flair sequence showing cortical and subcortical hypersignal intensity with hyperintense subependymal tubers suggestive of tuberous sclerosis.

Mesial temporal sclerosis

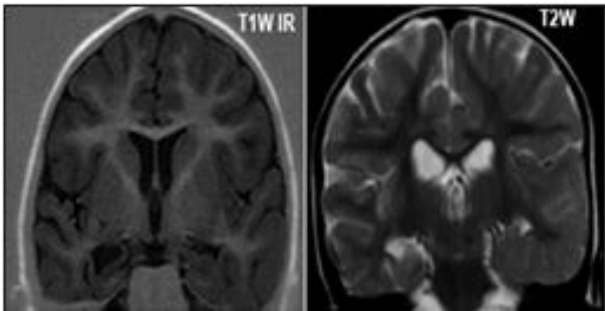


Figure 5: Coronal sections showing loss of hippocampal architecture and loss of hippocampal volume of right side.

Results

The study sample size of 50 patients were taken into the account in which majority of the children belong to the age group of 1-5 years (31/50). There were 29 males and 21 females in the study. The majority of the patients presented with history of fever followed by headache along with the first episode of seizure. Only 15 patients came with history of repetitive episodes of seizures since childhood. 22 out of 50 patients had history of NICU stay after birth, while other had uneventful history. The majority of cases had history of generalized tonic clonic seizure. Out of 50 scans, 9 cases had no evidence of abnormality on MRI imaging. Focal cortical dysplasia was observed in 6 cases, tubercular meningitis and tuberculoma in 7 cases, Neurocysticercosis in 4 cases, mesial temporal sclerosis in 6 case, meningitis, hydrocephalus and ventriculitis in 5 cases, Hypoxic ischemic encephalopathy in 3 cases, tuberous sclerosis in 2 cases, sturge weber syndrome in 2 cases. There was 1 case of vanishing white matter disease. 5 cases of pediatric tumors were observed with 2 cases of Desmoplastic Infantile Ganglioglioma, 1 case of DNET, 1 case of Astroblastoma, 1 case of Ganglioglioma.

Discussion

In our study maximum cases were of age group 1-5 years which corresponds with the study [4]. Our study observed more prevalence of epilepsy in males in comparison to females and similar findings were observed in various studies [5-7]. Generalized tonic clonic seizure compromised the major type of epilepsy in our study and the Chaurasia et al. showed the similar results [8]. The study reported the most common cause of seizure in pediatric age group was due to infective etiology which is similar to results shown by the study [8,9]. The infective etiology included tuberculosis (7 cases) as the most common cause showing MRI spectrum in the form of tubercular meningitis, tuberculoma, tubercular abscess and ventriculitis. It was followed by NCC and pyogenic meningitis and encephalitis. The risk factor involved in the presentation includes the poor hygiene, low socio economic conditions, low nutrition in developing countries. This finding corresponds with the Gulati et al. study conducted on 159 patients [5]. Next common lesion found as epileptogenic foci in our study included focal cortical dysplasia and mesial temporal sclerosis. The 6 cases of MTS

shows the findings ranging from loss of hippocampal architecture, hippocampal atrophy (asymmetric), dilatation of temporal horns and increased T2W and FLAIR signal intensity. This finding correlates with the study conducted by Grattan Smith et al. [10]. Our study observed FCD as the another common etiology of pediatric epilepsy which doesn't correlate with the findings observed by Mittal et al. and Gungor et al. studies [11,12]. This was followed by the neoplastic etiology in pediatric seizures which included temporal lobe tumors resulting in seizures. The findings reported were Desmoplastic Infantile Ganglioglioma, DNET, Astroblastoma and Ganglioglioma as the common tumors involved in pediatric epilepsy. The observations donot correlate with the Zajac et al. study [13]. In our study we reported 2 cases of tuberous sclerosiis and 2 cases of sturge weber syndrome which correlates with Dietrich et al. study [14]. In our study HIE was found in 3 cases and vanishing white matter disease in 1 case which doesn't match with the findings observed in study conducted by Alam and Sahu [15].

Conclusion

The causes of pediatric epilepsy range from medically responsive to medically refractive lesions. Accurate diagnosis can aid in prompt intervention resulting in reduction of morbidity associated with the epilepsy and helps in improving the quality of life of patient. MRI is the investigation of choice for accurate localization of lesion and follow-up due to its better spatial resolution, soft tissue delineation, multiplanar imaging capability and safety due to non-utilization of ionizing radiation. Better planning and protocol can accurately diagnose the lesion and changes the outcome via prompt management.

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