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ROLE OF MAGNETIC RESONANCE IMAGING IN DIAGNOSTIC EVALUATION OF PEDIATRIC EPILEPSY

Radiodiagnosis

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ABSTRACT

Objective: To study the role of Magnetic Resonance Imaging in diagnostic evaluation of pediatric epilepsy.

Methods: The present study was carried out in the Department of Radiodiagnosis, ESIC Medical College & Hospital, Faridabad. The study included forty five children presented with epilepsy and were referred to our department for brain evaluation.

Results: Abnormal findings on MRI were noted in 39 out of 45 children. The most common abnormality being infectious disease presented in 17 patients which included 10 cases of NCC and 7 patients with intra-cranial tuberculomas. Imaging features of hypoxic ischaemic encephalopathy(HIE) were noted in 6 patients, 6 patients had imaging features of ADEM(acute disseminated encephalomyelitis), 5 patients had focal cortical dysplasias, 4 patients had grey matter heterotropias and 1 patient had Sturge-Weber syndrome.

Conclusion: In children diagnosed with epilepsy, neuro-imaging reveals a significant number of serious abnormalities not previously suspected. MR Imaging plays a significant role in diagnosis, prognostication as well as management of these patients.

KEYWORDS

epilepsy, children, MRI, seizures

INTRODUCTION

A seizure is a paroxysmal alteration in neurologic function resulting from abnormal excessive neuronal electrical activity. The pathophysiologic basis of seizures is loss of normal regulation of neuronal excitation and inhibition, resulting in a state of relative hyperexcitability. Epilepsy is a chronic condition characterized by recurrent seizures unprovoked by an acute systemic or neurologic insult. Seizures are common. About 4 percent of all people will have at least one seizure during their lifetime. In patients with a first ever seizure imaging will mostly show no brain abnormalities, because the seizure is provoked by fever, drugs, dehydration or sleep deprivation. The term epilepsy is used, when there are recurrent unprovoked seizures. About 60 percent of patients with epilepsy can be controlled with antiepileptic drugs. Epilepsy can have both genetic and acquired causes, with interaction of these factors in many cases [1]. Established acquired causes include serious brain trauma, stroke, tumours and problems in the brain as a result of a previous infection [1]. In about 60% of cases the cause is unknown [2]. Epilepsies caused by genetic, congenital, or developmental conditions are more common among younger people, while brain tumors and strokes are more likely in older people [2].

In patients with intractable epilepsy, most reports indicate that a focal abnormality is discovered with CT in approximately one fourth of patients and with MR imaging in one half of patients [3-6]. MR imaging may be able to locate the seizure focus in three fourths of patients with refractory epilepsy, as demonstrated by Kuzniecky et al [7]. MR imaging is unsurpassed for the detection, localization and differentiation of structural epileptogenic lesions.

Thus we have decided to evaluate MRI brain features in epilepsy and determine the frequency of each of them.

AIMS & OBJECTIVES

To describe the MR imaging features and their frequency in pediatric epilepsy.

MATERIALS AND METHODS

1. Study Design: Cross-sectional study

2. Sample Size: 45 patients

3. Inclusion Criteria: All cases presented to our hospital with a history of two or more seizures over a period of 12 months.

4. Exclusion Criteria:

- Presence of fever along with seizures
- Allergy to contrast agents
- Deranged kidney function test (Sr.Creatinine>1.5 mg/dL)
- History of cochlear implants

5. Study Protocol: MR imaging of the patients was performed on a Siemens 1.5 Tesla Scanner - Magnetom Essenza. MRI was performed using a dedicated head coil. After a localizer series, the standard imaging protocol consisted of the following sequences- axial T1, axial T2, axial FLAIR, sagittal T2, axial DWI and axial Gradient (Flash). Contrast (Gadodiamide) MR and MRS where performed whenever required.

RESULTS

In our study all the patients were in the pediatric age group, youngest patient being 5 years and oldest being 12 years with mean age of 7 years.

All the patients in our study presented with epilepsy. Headache was noted in 15 patients (33%). Mental retardation was noted in 13 patients (28%). One patient also had port wine stain on face.

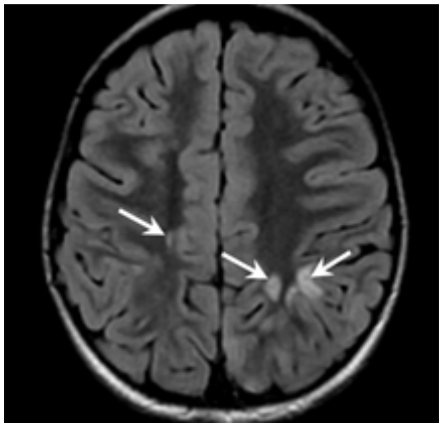
In our study 39 out of 45 children had abnormal findings on MRI (Table 1). The most common abnormality was infectious disease present in 17 patients (37%), 10 (22%) of whom had neurocysticercosis (NCC) and 7 (15%) had intra-cranial tuberculomas. Focal cortical dysplasias was noted in 5 of 45 patients (11%). Peri-ventricular leukomalacia was noted in 6 patients (13%). Imaging features of acute disseminated encephalomyelitis (ADEM) were noted in 6 patients (13%) [Fig 1]. Grey matter heterotropias were noted in 4 patients (9%) and 1 patient (2%) was diagnosed with sturge-weber syndrome [Fig 2].

MR imaging features and their frequency in our study :

Diagnosis	No. of cases	MR Imaging features
Neurocysticercosis (NCC)	10	• Parenchymal or subarachnoid cyst/cysts with or without scolex which is hyperintense on T1 • Surrounding edema +/- depending on pathological stage
Intracranial tuberculous granuloma	7	• Ring enhancing/nodular lesion/lesions with signal intensity depending on type of tuberculoma • Surrounding edema +/- mass effect • Lipid peak on MRS
Hypoxic ischaemic encephalopathy (HIE)	6	• Periventricular leukomalacia • Signal changes in basal ganglia,thalami,white and grey matter.
ADEM	6	• Multifocal T2W + FLAIR hyperintensities in subcortical white matter +/- brainstem +/- thalami • Open ring' enhancement on post contrast T1W

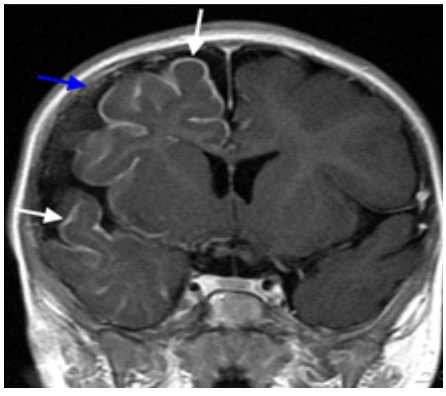
Focal cortical dysplasias	5	• Blurring of grey-white matter junction • Cortical thickening • T2/FLAIR signal hyperintensity in white and/or grey matter • Abnormal gyral/sulcal pattern
Grey matter heterotropias	4	• Nodular heterotropias • Diffuse heterotropias
Sturge-weber syndrome	1	• Unilateral cerebral volume loss • Cortical and subcortical calcification (Tram-track) • Pial angiomatosis • Abnormal cortical veins

Fig 1.



ADEM: Axial FLAIR MR Image showing asymmetric foci of increased signal intensities (arrows) within the subcortical white matter.

Fig 2



Sturge-Weber syndrome: Coronal post contrast T1W MRI showing atrophy of the right cerebrum, pial angiomatosis (white arrows) and abnormal cortical veins (blue arrow)

DISCUSSION

We found an unexpectedly high frequency of imaging abnormalities in our sample (86%). Other studies in similar populations have found a lower incidence of abnormalities [8,9]. One possible explanation for our high number is that we did a very detailed analysis of the neuro-images. Other explanation may be that patients with fever were not included in our study therefore excluding all the patients with febrile seizures. One more reason may be that this study was conducted in a tertiary medical center.

Neurocysticercosis (NCC) is one of the oldest known and perhaps the most common parasitic infections of the human nervous system. It is a major cause of epilepsy and neurological disease in many developing countries [White et al] [10]. Even in our study a large proportion of patients (22%) were diagnosed with NCC as a cause of epilepsy. NCC is common in adults, as well as in children, although it usually manifests after 5 years of age [10].

IN our study 7 patients (16%) were diagnosed with intracranial tuberculous granulomas. Similarly A. Bagga et al used computerized tomography (CT) to screen 83 patients with seizures and found intracranial tuberculoma in 24% of patients [11]. Especially in countries like India where tuberculosis is prevalent, intracranial tuberculosis should always be suspected in a child presenting with seizures.

Imaging features of hypoxic ischaemic encephalopathy (HIE) like peri-ventricular leukomalacia were noted in 6 patients. As some of the children in our study belonged to families of industrial workers and therefore in lower socio-economic strata where child birth at home is still more common than hospital deliveries therefore this may be the cause of increased incidence of HIE in our study.

A S Smith in their study "Association of heterotopic gray matter with seizures: MR imaging" stated that 9 of the 10 patients had seizures therefore grey matter heterotropias is an important cause of epilepsy [12]. Grey matter heterotropias were noted in 4 patients (9%) in our study which included subependymal as well as cortical heterotropias. MRI is the investigation of choice for diagnosing grey matter heterotropias.

Focal cortical dysplasia was noted in 5 patients (11%) in our study. FCD is a common cause of structural abnormality causing seizures. Kuzniecky R et al in their study "Cortical dysplasia in temporal lobe epilepsy: magnetic resonance imaging correlations" evaluated mri brain in patients with cortical dysplasia presenting with epilepsy and made observations that suggested magnetic resonance imaging is sensitive in the detection of cortical dysplastic lesions [13].

We found malformations of cortical development including cortical dysplasias and grey matter heterotropias to be considerably more common than previous imaging reports examining children of all ages with afebrile seizures (20% vs 4%–5%) [14,15].

Features of acute disseminated encephalomyelitis were noted in 6 patients (13%). Seizures are a common clinical manifestation in patients with acute disseminated encephalomyelitis. MRI findings were variable, but lesions were most commonly seen bilaterally and asymmetrically in the frontal and parietal lobes. One patient in our study was diagnosed with Sturge-Weber syndrome. The diagnosis is usually obvious on account of a congenital facial cutaneous haemangioma (also known as port wine stain). The most common clinical manifestation is with childhood seizures, present in 71-89% of cases [16].

CONCLUSION

Epilepsy is a common disorder characterized by recurrent seizures unprovoked by an acute systemic or neurologic insult. MR imaging has dramatically changed the workup of epilepsy, especially for the patient with medically uncontrollable seizures. According to our study infective etiologies like NCC and intracranial tuberculomas, hypoxic ischaemic encephalopathy (HIE), focal cortical dysplasia , grey matter heterotropias and acute disseminated encephalomyelitis (ADEM) are some of the important causes of epilepsy in the pediatric age group with most of these entities requiring MR imaging for their diagnosis. Accurate diagnosis of the cause of seizure in a patient is crucial for finding an effective treatment. MRI plays a pivotal role in every aspect of the diagnosis and management of seizures.

REFERENCES

1. Chugani HT, Shields WD, Shewmon DA, Olson DM, Phelps ME, Peacock WJ. Infantile spasms: I. PET identifies focal cortical dysgenesis in cryptogenic cases for surgical treatment. Ann Neurol 1990;27:406-413
2. Engel JJ. The role of neuroimaging in the surgical treatment of epilepsy. Acta Neurol Scand Suppl 1988;1 17:84-89
3. Jabbari B, Van Nostrand D, Gunderson CH, et al. EEG and neuroimaging localization in partial epilepsy. Electroencephalogr C/in Neurophysiol 1991;79: 108-113
4. Jabbari B, Gunderson CH, Wippold F, et al. Magnetic resonance imaging in partial complex epilepsy. Arch Neurol 1986;43:869-872
5. Latack JT, Abou-Khalil BW, Siegel GJ, Sackellares JC, Gabrielsen TO, Aisen AM. Patients with partial seizures: evaluation by MR. CT, and PET imaging. Radiology 1986;159: 159-163
6. Ormson MJ, Kispert DB, Sharbrough FW, et ai. Cryptic structural lesions in refractory partial epilepsy: MR imaging and CT studies. Radiology 1986;160:215-219
7. Kuzniecky R, de Ia Sayette V, Ethier A, et al. Magnetic resonance imaging in temporal lobe epilepsy: pathological correlations. Ann Neurol 1987;22:341 -347
8. Sharma S, Riviello JJ, Harper MB, Baskin MN. The role of emergent neuroimaging in children with new-onset afebrile seizures. Pediatrics. 2003;111:1–5.
9. Berg AT, Testa FM, Levy SR, Shinnar S. Neuroimaging in children with newly diagnosed epilepsy: A community-based study. Pediatrics. 2000;106:527–532.
10. Neurocysticercosis: a major cause of neurological disease worldwide. White AC Jr Clin

Infect Dis. 1997 Feb; 24(2):101-13
11. A. BaggaV. KalraO.P. Ghai Intracranial Tuberculoma: Evaluation and Treatment;Clinical Pediatrics Vol 27, Issue 10, pp. 487 – 490
12. Smith AS, Weinstein MA, Quencer RM, et al. Association of heterotopic gray matter with seizures: MR imaging. Radiology 1988;1 68:195-198
13. Kuzniecky R, Garcia JH, Faught E, Morawetz RB. Cortical dysplasia in temporal lobe epilepsy: magnetic resonance imaging correlations. Ann Neurol 1991;29:293-298
14. Doescher JS, deGrauw TJ, Musick BS, et al. Magnetic resonance imaging and electroencephalographic findings in a cohort of normal children with newly diagnosed seizures. J Child Neurol 2006;21:491–495
15. Shinnar S, O'Dell C, Mitnick R, Berg AT, Moshe SL. Neuroimaging abnormalities in children with an apparent first unprovoked seizure. Epilepsy Res 2001;43:261–269.
16. Wyllie E, Gupta A, Lachhwani DK. The treatment of epilepsy, principles & practice. Lippincott Williams & Wilkins. (2006):1009–1029