Original Research Article

A study to know etiology and spectrum of MRI findings in patients with seizures in tertiary care hospital, Karnataka

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Abstract

Background And Objectives: Seizure is a common medical disorder and neuroimaging plays valuable role in evaluation of etiological factors for seizures. The objectives are to identify structural abnormalities in the brain that may be associated with the cause of seizures with MRI and to study the spectrum of findings in patients with seizures. **Materials and Methods:-** All the cases referred to department of radiology, Sapthagiri institute of medical sciences and research Centre College, Bengaluru, Karnataka. All MRI scans were performed on a 1.5 T Philips Achieva. Sequences used , T1WI sagittal, T2WI axial and coronal, FLAIR axial, gradient echo axial, DWI axial and ADC maps, T1W with contrast, MRA and MRS according to MR Imaging protocol of seizures. **Results:** In our study 60 patients with clinical diagnosis of seizures were selected as per the criteria laid down by ILAE 1981.Majority of the subjects 28.3% were in 1-15yrs age group, followed by 20% were in 16-30yrs age group, 16.7% were in <1yrs and 31-45yrs age group. Male 35 (58.33%) and Female 25(41.64%).The MR examination revealed pathological findings in 30 out of 60 patients (50%) which includes, cerebral infarct with gliosis (20%), NCC (6.66%), atrophy (6.66%), gliomas (1.66%), cortical malformations (3.34%),tuberculoma (3.34%),venous thrombosis (3.34%), cavernoma (3.34%), meningioma (1.66%)

Key Words: Seizures, MRI.

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INTRODUCTION

Seizure is a paroxysmal alteration in neurologic function resulting from abnormal excessive neuronal electrical activity.[1]Epilepsy is a chronic condition characterized by recurrent seizures unprovoked by an acute systemic or neurologic insult.[1] An epileptic seizure is a clinical manifestation of abnormal, excessive neuronal activity arising in the grey matter of the cerebral cortex.[2] The incidence of epilepsy is approximately 0.3 to 0.5% and prevalence of epilepsy estimated as 5 to 10 persons per 1000.[3] It is age dependent and higher in children and elderly persons than in young adults. An estimated 2.5% of the population will have at least one non-febrile seizure during their lifetime. Most of the patients suffering from this disease in fact majority of them have good control of this disease with the use of antiepileptic drugs. However up to 20% of patients continue to have seizures despite the best medical treatment. The good news is that most of these patients with intractable epilepsy have seizures that are focal and which can be potentially treated.[3,4] In clinical practice the assessment of patients presenting with seizures is a problem that the physician faces quite regularly. In order to diagnose and find out the etiology of the lesion, there are many neuro radiological investigations that can be utilized. These includes x-ray of skull, pneumocephalography, CSF examination, carotid angiography, EEG, CT and MRI.[5] Although the treatment of an isolated seizure is directed toward the immediate

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underlying metabolic or neurologic derangement, epilepsy usually requires long term pharmacotherapy or in selected cases neurosurgical intervention to eliminate or reduce recurrent seizures. Neurosurgery is most often considered in medically refractory epilepsy when removal or isolation of epileptogenic region is possible without unacceptable neurologic deficit. In this context, the revolutionary introduction of MRI for evaluation of seizures has been a great boon, both for the diagnosis of cerebral lesions as well as clinical management of patients with neurologic disorders. MR imaging has emerged as the more diagnostically valuable and most valuable tool for preoperative localization of epileptogenic focus because of its excellent soft tissue contrast, allowing for detailed depiction of anatomy, freedom from beam – hardening artifact in basal brain that occur with CT and capacity for multiplanar imaging.[1] A number of studies have been reported with MR abnormality 32% to 90% and in temporal lobe epilepsy 75% to 100%.The diagnosis of epilepsy with the help of MRI has made this diagnostic tool beyond compare to other investigations. MR is much more diagnostically valuable and there is the appropriate neuroimaging study of choice. It has been proven beyond doubt that MRI is the most meaningful procedure in the diagnosis, treatment and follow-up of patients with inflammatory and parasitic lesions of the brain such as cysticercosis tuberculoma, brain abscess, and encephalitis. MR gives more precise localization and histological nature of lesions and subsequently, this is of immense help to both clinicians as well as neurosurgeons in their attempt to achieve a faster and more accurate method of discovering the nature of the pathologies. Coregistration of MRI with other functional imaging modalities including PET and SPECT has also been proven valuable in localization of structural and functional alteration.[1] The role of MR in epilepsy surgery in identifying the epileptogenic focus, also lies in its ability to depict topographic relationships between epileptogenic lesion and the eloquent regions of brain.[1] Postoperative MR may detect reasons for failure such as inadequate resection and can monitor tumour recurrence on follow up imaging. MR is especially useful for prognosticating postoperative seizure control.[1]The following study has been undertaken to study the etiology and spectrum of MRI findings in patients with seizures.

MATERIALS AND METHODS

Study setting: - Department of radiology, Sapthagiri institute of medical sciences and research Centre College, Bengaluru, Karnataka

Study design: - Prospective cross sectional study.

Study period: - May 2018 to November 2018

Sample size: - All patients who were referred to Department of Radio-Diagnosis and Imaging sciences with clinical symptoms and signs of seizures

Inclusion criteria:

- Seizure patients selected based on clinical data
- All patients presented with seizures.
- Cases were included irrespective of age / sex.

Exclusion criteria:

- Contraindications to MRI studies, such as patients with pacemakers, metallic implants, aneurysmal clips.
- Claustrophobia or anxiety disorders exacerbated by MRI.
- Inability to provide consent.

Method of data collection:

The patient selected for the study were clinically diagnosed cases of seizures as per the criteria laid down by the ILAE 1981. A detailed history was taken and clinical examination was done. The points noted were duration of illness, type of seizures, any associated illness. Detailed clinical and neurological examination was done to find any neurological deficit. Based on the history and examination, a clinicoetiological diagnosis was made. Biochemical investigations were done as per the proforma and were found to be within normal limits. All the patients underwent MRI scanning on 1.5T PHILIPS ACHIEVA. The procedure was briefly explained to the patient including the risks of contrast examination. Clinical history of each patient was recorded.

Technique of examination:

All patients, screened before entry into the MRI scanning room for ferromagnetic objects, cardiac pacemakers, and aneurysm clips etc. Patients were examined in the supine position on the MRI machine after proper positioning, and immobilization of the head was obtained. The head coil was used for the scan. Initial to pogram of the head was obtained and sequences were planned according to the MRI seizure protocol. MRI protocol at 1.5T includes the entire brain from nasion to inion, conventional routine 5mm slice thickness, T1 and T2 axial sequences, 1.5 mm slice thickness coronal oblique. T1 weighted MPRAGE or SPGR images. 1.5mm slice thickness – are acquired as a 3 dimensional (3D) volume, there by post processing and reformatting images into multiple planes. Protocol also includes coronal and axial FLAIR sequences with 2-3 mm slice thickness 1 mm inter slice gap. A conventional thin slice, T2 weighted axial and coronal sequence is also obtained. Gadobenate dimeglumine paramagnetic contrast agent used in MRI. Contrast agent

was used if a known tumour or vascular malformation identified and also used in neurocutaneous syndromes.Dosage used as 0.1 mg/kg wt. (Adults 5ml, children 2ml).As a precautionary measure, resuscitation apparatus and emergency drugs were kept ready. The scans were studied in detail on monitor and finally films were taken for permanent record. MRI findings were recorded in all patients as per the proforma. Every effort was made to make sure of high quality scans and to avoid artifacts.

Statistical analysis:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.

RESULTS

Table 1: Distribution of subjects according to age and sex

Age in years	Male	Female	Total
< 1yrs	4	6	10(16.7%)
1-15yrs	10	7	17(28.3%)
16-30yrs	7	5	12(20%)
31-45yrs	6	4	10(16.7%)
46-60yrs	4	2	6(10%)
>60yrs	4	1	5(8.3%)
Total	**35(58.33%)**	**25(41.64%)**	**60**

Majority of the subjects 28.3% were in 1-15yrs age group, followed by 20% were in 16-30yrs age group, 16.7% were in <1yrs and 31-45yrs age group. Male 35 (58.33%) and Female 25(41.64%).

TABLE 2: Distribution of subjects s on the basis of clinical diagnosis of seizures

Clinical diagnosis	No. of patients	Percentage
GTCS	43	71.66
Myoclonic seizures	6	10
Absence seizures	1	1.66
Simple partial seizures	3	5
Complex partial seizures	2	3.34
Temporal lobe seizures	2	3.34
Febrile seizures	1	1.66
Motor seizures	1	1.66
Tonic seizures	1	1.66

Majority of subjects 71.66% had GTCS, followed by Myoclonic seizures in 10% subjects, Simple partial seizures in 5% of subjects.

TABLE 3: Distribution of subjects on the basis of duration of seizures

Duration of illness	No. of patients	Percentage
<1 month	04	6.66
1-3 months	36	60
>3months	20	33.34

Majority of subjects 60% had duration of seizures between 1-3months followed by 33.34% of them had duration of seizures more than >3months.

TABLE 4: Distribution of patients on MR diagnosis

MR diagnosis	No. of patients	Percentage
Normal study	30	50
Infarct with gliosis	12	20.00
NCC	4	6.66
Atrophy	4	6.66
Tuberculoma	2	3.34
Venous thrombosis	2	3.34
Developmental malformations	2	3.34
Glioma	1	1.66
Cavernoma	2	3.34
Meningioma	1	1.66

In 30 (50%) patients the study was normal. Cerebrovascular causes, (infarct with gliosis, venous thrombosis) constitute (21.64%) 14 patients the most common MR diagnosis in patients presenting with seizures. The MR examination revealed pathological findings in 30 out of 60 patients (50%) which includes, cerebral infarct with gliosis (20%), NCC (6.66%), atrophy (6.66%), gliomas (1.66%), cortical malformations (3.34%),tuberculoma (3.34%), venous thrombosis (3.34%), cavernoma (3.34%), meningioma (1.66%).

DISCUSSION

Patients presenting with seizures can have wide range of MR imaging abnormalities depending upon the etiology. MRI can reliably identify and localize the intracranial abnormality so that further management can be planned accordingly. In our study 60 patients with clinical diagnosis of seizures were selected as per the criteria laid down by ILAE 1981.The clinical history of each patient was recorded and all underwent routine biochemical investigations as per proforma. MRI scan was carried out with 1.5 T PHILIPS MRI scanner. Patients presented with seizures of varying duration ranging from few days to few months. GTCS was the most common clinical diagnosis constituting (60%) cases. Majority of the subjects 28.3% were in 1-15yrs age group, followed by 20% were in 16-30yrs age group, 16.7% were in <1yrs and 31-45yrs age group. Male 35 (58.33%) and Female 25(41.64%). The MR examination revealed pathological findings in 30 out of 60 patients (50%) which includes, cerebral infarct with gliosis (20%), NCC (6.66%), atrophy (6.66%), gliomas (1.66%), cortical malformations (3.34%),tuberculoma (3.34%), venous thrombosis (3.34%), cavernoma (3.34%), meningioma (1.66%). Cerebral infarcts with gliosis : 12 patients (20%) revealed cerebral infarction on MRI study. Danier C. *et al*, conducted prospective cohort study of early onset of seizures in 661 stroke patients and concluded that infarcts involving cerebral cortex, there was a high risk of early stroke in watershed infarcts(23%) than territorial strokes (5.3%). All patients had parenchymal form of NCC, with multiple ring enhancing lesions in cerebral hemispheres. Lesions shows T1 hypointense and T2 hyper intense contents. Few lesions showed perilesional edema. Most of lesions seen in parietal lobe and some show cystic signals with eccentric speck within the lesion. MRS showed choline peak in all patients .TR Velasco *et al*, evaluated 512 patients of intractable epilepsy and concluded that isolated NCC was found in eight patients (1.56%). Tushar B. Patil, Madhuri M. Paithankar studied 40 patients with probable diagnosis of NCC and concluded that 72% patients showed one lesion, 27% with multiple lesions and common site was parietal lobe (4%). Two patients revealed atrophic changes mainly involving bilateral frontal and temporal lobes with periventricular leukomalacia changes. One patient revealed chronic right frontal infarct with gliosis and diffuse cerebral atrophy and one patient showed cortical, subcortical atrophic changes in bilateral parietal lobes. Rabecca SN Liu *et al*, studied 7 patients with epilepsy underwent MRI scan and revealed that significant atrophy of hippocampus, neocortex in 17% and concluded that the brain volume reduction in epilepsy is the cumulative effect of an initial precipitating injury and age related cerebral atrophy. Significant atrophy developed in individual patients particularly those with temporal lobe epilepsy. Rahiman *et al*, evaluated 198 cases of focal seizures with MRI and found that 0.5% (1 case) showed focal atrophy.

Ghayyur Khan, *et al*, studied 100 patients with MRI associated symptoms of seizures, dementia and diabetes and found that cerebral atrophy in 47% male and 43% female, concluded that cerebral atrophy is a complication of long standing diabetes well recognized by MRI. Naser UAMA, Abdul Ghaffur MRCP, *et al*, studied 925 intracranial space occupying lesions with seizures and found 1.4% intracranial tuberculoma and followed after treatment, 66.6% responded well to medical treatment and 33% failed to respond 2 patients revealed well defined focal non enhancing lesion showing hemorrhagic signal intensities in the sub cortical white matter of left frontal lobe in one patient and parietal lobe in another patient with complete hypointense rim on gradient echo sequence. Hakan Kayali *et al*, studied 37 patients with cavernoma on MR imaging one patients revealed polymicrogyria of frontoparietal lobe. Another one patient revealed inferior vermian agenesis. Jagruti P. Sanghvi, Surekha B. Rajadhyaksha and Meher Ursikar studied 76 children with seizures and CNS malformations based on MRI neuroimaging and concluded that 19 cases revealed corpus callosal dysgenesis, 9 patients lissencephaly and 9 focal cortical dysplasia, 6 pachygyria, 3 polymicrogyria, 15 tuberous sclerosis and 3 Sturgeweber syndrome.one patient revealed low grade glioma on MRI. One patient showed lesion in right frontal region .The MR features: The lesions hypointense on T1WI and hyperintense on both T2WI and FLAIR sequences. Mild perilesional restriction with mild mass effect seen. MRS showed elevated choline peak in both cases and the lesions showed no contrast enhancement. The above features suggestive of low grade glioma and both patient are referred to higher centers. Yamamoto Junich *et al*, studied a patient with medically intractable complex partial seizures and MRI study revealed a tumour with low signal intensity on T1 and increase

signal intensity on T2 with no contrast enhancement in left anterior temporal lesion. And it was histologically proved as astrocytoma and concluded that epileptiform discharges located at the temporal lobe which was identified in MRI could be predictive of epileptic zone. Rishi K. Gupta *et al*, reported a case of superior sagittal sinus (SSS) thrombosis with long history of continuous headache and MRV confirmed the presence of SSS thrombosis with small venous infarct where CT was normal. Vikas Pathak *et al*, studied a case of history of migraine where CT was normal. MRI revealed SSS thrombus and followed after treatment. The subsequent MR scanning showed resolution of thrombus and concluded that suspected clinical diagnosis of cerebral venous thrombosis necessitate MR neuro imaging. One patient revealed the features of meningioma in frontal convexity. Well defined extra axial, enhancing SOL noted in left anterior frontal convexity, measuring 5x4 cm. It was dural based lesion with dural tail at its margin revealed subtle cortical hyperosteosis of the roof of the left orbit. Perilesional edema extending into adjacent white matter compressing the lateral ventricle. The lesion was compressing the underlying cerebral parenchyma and causing midline shift. In our study, the neuroimaging showed features of meningioma with mass effect. Paulshogan *et al*, studied one female patient with MRI and revealed a mass in right atrium of left ventricle isointense to gray matter on T1WI and hypointense compared with the cortex on T2WI with mild surrounding edema. The lesion enhances after gadolinium contrast and diagnosed as meningioma.

CONCLUSION

Assessment of the patient presenting with seizure disorder is a common problem in clinical practice. MR imaging plays a pivotal role in the evaluation of patients with seizures. Accurate diagnosis of the cause of seizure is crucial for finding an effective treatment. MRI has been shown to be highly sensitive and specific in identifying the underlying pathology in seizures. With its high spatial resolution, excellent inherent soft tissue contrast, multipanar imaging capability and lack of ionizing radiation, MR imaging has emerged as a versatile tool in the evaluation of patients with seizures. MR imaging not only identifies specific epileptogenic substrates, but also determines specific treatment and predicts prognosis. Employing appropriate imaging protocols and reviewing the images in a systemic manner helps in the identification of subtle epileptogenic structural abnormalities. MR imaging is superior neuroimaging with no radiation exposure and could be the first investigation of choice in epileptic syndrome, acute cerebrovascular disease with seizure, developmental cortical malformations, and vascular malformations. Its ability in identifying subtle lesions, location, extent of the lesions and amount of findings are excellent. Hence we conclude that MRI plays a significant role in patients presenting with seizures with MRI seizure protocol to confirm or rule out any organic or developmental lesions.

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