Original Research Article

Role of MRI in evaluation of seizure disorder in Southern Rajasthan, India

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Received: 03 April 2019

Accepted: 04 May 2019

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ABSTRACT

Background: The objectives are to identify and study structural abnormalities in the brain that associated with seizures, spectrum of findings in patients with seizures, classify seizure type and syndrome and to evaluate role of MRI in postoperative seizures.

Methods: A total of 110 patients, those referred from various outdoor/indoor departments with the history of seizure were included after fulfilling the inclusion criteria. Detailed history, appropriate clinical examinations and biochemical investigations were recorded. All MRI scans were performed on a 1.5 T Philips Achieva. Sequences were used according to MR Imaging protocol of seizures. Observation was made and analysed using descriptive tools and scientific methods.

Results: Among 110 patients' majority (41%) were normal, 20% had cerebral infarct with gliosis followed by NCC 7.2%, atrophy 5.45%, tuberculosis 11%, venous thrombosis 3.64%, developmental malformations 3.64%, glioma 1.82%, cavernoma 1.82%, tuberous sclerosis 1.82%, meningioma 0.91%, cerebral abscess 0.91% and Sturge-weber syndrome 0.91%. Most of the patients with cerebrovascular causes and male predominance 61.8%.

Conclusions: The present study was a prospective study. Spectrum of MRI findings related to vascular, developmental, infection and neoplasm was identified. MRI is noninvasive modality with no radiation hazard, excellent gray white matter resolution and multiplanar imaging capability. MRI helps in detection of subtle lesions responsible for seizures. Present study observed that MRI with appropriate imaging protocols add sensitivity and specificity in evaluation of seizures.

Keywords: Imaging protocol, MRI, Seizures

INTRODUCTION

A seizure (from the Latin *sacire*, "to take possession of") is a paroxysmal event due to abnormal excessive or synchronous neuronal activity in the brain. Depending on the distribution of discharges, this abnormal brain activity can have various manifestations, ranging from dramatic convulsive activity to experiential phenomena not readily discernible by an observer.¹ Epilepsy describes a condition in which a person has unprovoked, recurrent seizures due to a chronic, underlying process. The

prevalence of epilepsy has been estimated at 5–30 persons per 1000.² Most of the patients suffering from this disease have good control on seizures with the use of antiepileptic drugs, however most of the patients with intractable epilepsy have seizures that are focal and can be potentially treated.^{3,4}

A shift in the normal balance of excitation and inhibition within the central nervous system results in seizure. The observations stressed the concept that the many cause of seizures and epilepsy result from a dynamic interplay

between endogenous factors, epileptogenic factors and precipitating factors.⁵

In order to diagnose and find out the etiology of the lesion, there are many neuro radiological investigations that can be utilized. These include X-ray of skull, Pneumocephalography, Cerebrospinal fluid examination, Carotid angiography, Electroencephalogram, Computed tomography and Magnetic resonance imaging.⁶

CT is an appropriate choice in emergency setting for evaluation of new onset seizure patients with symptomatic causes, however has no role in pre operative evaluation of patient with intractable epilepsy or of children with new onset seizures who have no detectable cause.

Since the mid 1980's, when MRI became widely available for clinical use it has brought on revolutionary changes in the management of patients with epilepsy. With its higher sensitivity, better spatial resolution, excellent soft tissue contrast, multiplanar imaging capability and lack of ionizing radiation it has emerged as the primary modality of choice in the evaluation of seizure disorder. MR Imaging is an excellent tool for detecting anatomic substrates that underlie regional brain epileptogenesis and aids in formulating a syndromic or etiological diagnosis so as to plan further management as surgery or pharmacotherapy.⁴

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.

Coregistration of MRI with other functional imaging modalities including PET and SPECT has also been proven valuable in localization of structural and functional alteration.²

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.² Postoperative MR may detect reasons for failure such as inadequate resection and can monitor tumour recurrence on follow up imaging and useful for prognosticating postoperative seizure control.²

METHODS

A total of 110 patients were included in the study those, who referred to the department of Radiodiagnosis from various out or in patient departments with clinical symptoms and signs of seizures from January 2018 to October 2018. Patients with pacemakers, MR non compatible metallic implants, aneurysmal clips, claustrophobia or anxiety disorders exacerbated by MRI and not willing to give consent were excluded from the study. Consent was taken from the subjects included in

the study as well as ethical committee clearance was obtained from institution.

Every patient undergone a meticulous detailed history taking, history of reaction to any drugs/contrast media and routine general physical examination. Details of the study protocol was explained to the subjects including the risks of contrast examination. MRI was performed with a 1.5 Tesla MRI machine of PHILIPS ACHEIVA system. Contrast study, MRS, T2 Relaxometry and Volumetry was performed as and when required. Studied parameters were age, sex, and radiographic findings if any pathology was present. All data and detailed findings were collected and observation was made.

RESULTS

Out of total patients included 68 were male and 42 were females. Slight male preponderance was noted with male to female ratio of 1.6:1. Maximum patients were of 2nd decade followed by 3rd decade (Figure 1).

Figure 1: Age and sex wise distribution.

Figure 2: Percentage of abnormal MR diagnosis.

Maximum number of patients were presented with GTCS type of seizures (75.5%), followed by myoclonic seizures (9.09%). Total of 26 patients associated with fever and 22 patients associated with headache. The MRI findings were normal in 45 (41%) cases and revealed spectrum of

abnormalities in 65 (59%) cases. There were 43 male and 22 females. Out of 65 abnormal MR findings patients (Figure 2). MR positivity was highest in complex partial seizure, absence seizure, motor seizure and febrile seizure.

Table 1: Distribution of seizures on the basis of MR positivity was also correlated.

Type of seizures	MR positivity	Percentage
GTCS	46/83	55.42
Myoclonic seizures	7/10	70
Simple partial seizures	3/6	50
Complex partial seizures	4/4	100
Absence seizures	1/1	100
Temporal lobe seizures	1/2	50
Motor seizures	1/1	100
Neonatal seizures	0/1	0
Febrile seizures	1/1	100

Table 2: Distribution of patients on the basis of MR diagnosis.

MR diagnosis	No. of patients	Percentage
Normal study	45	41
Infarct with gliosis	22	20.00
CNS infections	Tuberculoma	12
	NCC	08
	Cerebral abscess	01
		00.91
Atrophy	06	05.45
Venous thrombosis	04	03.64
Developmental malformations	04	03.64
CNS Tumours	Glioma	02
	Meningioma	01
Neurocutaneous syndromes	Tuberous sclerosis	02
	Sturge-weber syndrome	01
		00.91
Cavernoma	02	01.82

MR abnormality was detected in 46 patients, out of 83 patients presented with GTCS (Table 1).

The common abnormalities were cerebral infarction with gliosis (20%), infections - NCC (7.2%) and tuberculoma (11%), cerebral atrophy (5.45%), developmental cortical malformations (3.6%), venous thrombosis (3.6%), tuberous sclerosis (1.82%), developmental vascular malformations (1.82%), low grade glioma (1.82%), SWS (0.91%), meningioma (0.91%), cerebral abscess (0.91%) were among the abnormal findings (Table 2).

Patients were given appropriate treatments as per diagnosis and followed for outcome. (Figure 3). Total of 97 patients were improved after proper treatment while 13 patients were referred to higher center (Figure 4).

Figure 3: Distribution of patient on the basis of treatment given after MR diagnosis.

Figure 4: Distribution of patient after treatment given.

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.

Patients presented with seizures of varying duration ranging from few days to few months. GTCS was the most common clinical diagnosis constituting (75.5%) cases followed by myoclonic seizures (9.09%).

In this study, 68% patients were aged <45 years, 12% patients among 45-60 years, and 10% patients >60 years. In various studies, Kaur S et al, and pannang et al, also similar age distribution was reported.^{7,8} In studies by Murlidhara et al, (64%), Hirani et al, (54%), highest proportion of patients were also aged < 40 years.^{9,10}

There was male predominance, male 68 (61.8%) and female 42 (38.2%). Male to female ratio was 1.6:1 in our study. Literature reported mild to moderate preponderance of males, as seen in studies by Muralidhar et al, (2.12:1), Hirani et al, (1.17:1), and Sendil et al, (1.63:1).⁹⁻¹¹

The MR examination revealed normal study in 45 (41%) patients. That indicate most common cause of seizure disorder is idiopathic. Jiménez et al, and Hirani et al, also reported a high prevalence of idiopathic seizures in adults (51% and 40%, respectively).^{10,12} However, it is higher than study done by Kaur et al, (30%).⁷ But this study is comparable to study done by Pannag KN et al, (45.7%).⁸

The MR examination revealed pathological findings in 65 out of 110 patients (59%) which includes, cerebral infarct with gliosis (20%), NCC (7.27%), atrophy (5.45%), gliomas (1.82%), developmental malformations (3.64%), tuberculoma (11%), venous thrombosis (3.64%), cavernoma (1.82%), tuberous sclerosis (1.82%), cerebral abscess (0.91%), Sturge weber syndrome (0.91%) meningioma (0.91%).

Sinha et al, also observed that MRI brain was normal in 44.2%, whereas in remaining patients, MRI revealed ischemic infarcts (16.3%), intracranial hemorrhage (14%), tumor (11.6%), calcified granuloma (7%), NCC (4.6%), and gliosis (2.3%).¹³ Similar findings were also noted in study done by Pannag and Ravi et al.⁸

Cerebral infarcts with gliosis was observed in 22 patients (20%) on MRI study. Out of 22 patients, 15 patients were older than 46 years of age suggesting that after age of 40 years stroke is the main cause of seizures. This fact is supported by study conducted by Ludorf et al¹⁴ stating that beyond age 50, stroke is the most frequent cause of seizures. This study is comparable to results of Pannag et al, (20%) and Kaur S et al, (16.3%) studies.^{7,8}

Out of the CNS infections causing seizures, most common was CNS TB (57.14%), followed by neurocysticercosis (38.09%). Less common CNS infections was brain abscess. Kanitkar et al, reported that among infectious causes of seizures, CNS TB contributed to 60% and neurocysticercosis to 40% cases.¹⁵ Quraishi et al, also reported that among neuroinfections causing seizures, tuberculoma was the most common (36.8%), followed by neurocysticercosis (31.5%), meningitis (15.8%).¹⁶

This study reveals slightly higher incidence of tuberculoma and neurocysticercosis in southern Rajasthan population. In study done by Pannag et al, (9.7%), (2.4%), Kaur S et al, (6.9%), Sinha et al, (7%), (4.6%) for tuberculoma and neurocysticercosis respectively.^{7,8,13} While in study of Gupta RK, Lufkin RB et al, on MR imaging and spectroscopy of central nervous system infection stated that in developing countries

tuberculoma accounts for 15-50% of intracranial lesions.¹⁷

Most common neuroimaging abnormalities associated with seizure disorder in southern Rajasthan population were cerebrovascular diseases, infections and developmental malformations. However slightly higher incidence of CNS infections was noted in southern Rajasthan population than rest of the country.

Assessment of the etiology of seizure disorder is a frequently encountered problem in clinical practice. MR imaging plays an important role in the evaluation of patients with seizures as well as in refractory cases.

Accurate diagnosis of the etiology of seizure is crucial for providing an effective treatment. MRI has been shown to be highly sensitive and specific in identifying the underlying cause in seizures. With its high spatial resolution, excellent inherent soft tissue contrast, multiplanar imaging capability and lack of ionizing radiation, MR imaging has emerged as a versatile tool in the evaluation of patients with seizures.

MR imaging identifies specific epileptogenic substrates as well as 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 the first investigation of choice in epileptic syndrome, acute cerebrovascular disease with seizure, developmental cortical malformations, and vascular malformations. It's ability in identifying subtle lesions, location, extent of the lesions and number of findings are excellent.

Hence, authors conclude that MRI plays a significant role in patients presenting with seizures to confirm or rule out any organic, developmental lesions or to detect residual substrate at the operative site, previously unrecognized epileptogenic substrates and persistent connections in functional hemispherectomies.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Chabarwal S, Kardam NK. Role of MRI in evaluation of seizure disorder in Southern Rajasthan, India. *Int J Res Med Sci* 2019;7:2095-9.