ORIGINAL ARTICLE

Neuroimaging in Epilepsy: Magnetic Resonance Imaging (MRI) Evaluation in Refractory Complex Partial Seizures

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ABSTRACT

Aim: To describe various types of epileptogenic lesions causing seizures in adults on MRI.
Methods: This case series descriptive study was conducted in Department of Diagnostic Imaging in Lahore General Hospital, Lahore. Sixty adult patients of seizures were included in the study. The optimum protocol was axial T1-weighted and axial T2-weighted, coronal T1-weighted/coronal T2-weighted images, and non-enhanced fluid attenuated inversion recovery sequence images.
Results: Out of sixty patients, 50 patients (83.3%) were found to have epileptogenic lesion, 10 patients (16.7%) were having normal MRI. 32 (53.3%) were male and 28 (46.7%) were females. Majority belongs to age group 21 to 30 years. Common types of seizures were complex partial seizures 53.3%. Common epileptogenic lesions identified were tumors 33.3%, focal cortical dysplasia 10%, mesial temporal sclerosis 13.3%, infarcts 13.3%, metastasis 6.7% and granulomas 6.7%. Ventricular compression was seen in 40% of patients having epileptogenic lesion.
Conclusion: MRI is an important and reliable tool to diagnose most of epileptogenic lesions causing seizures.
Keywords: Epilepsy, Epileptogenic lesion, MRI

INTRODUCTION

Epilepsy is defined as paroxysmal and transitory disturbance of the brain, which develops suddenly, ceases spontaneously, and exhibits a conspicuous tendency to recurrence. Though in its typical form, it is characterized by sudden loss of consciousness, which may or may not be associated with tonic spasm and clonic contractions of muscles.[1] Seizures may be divided into generalized seizures and partial seizures. Generalized seizures imply abnormal electrical activity discharges, which are widespread in the brain. Partial seizures are further subdivided into suspected lobe or region of origin based on seizure semiology. Thus we have temporal lobe seizures (mesial or lateral temporal neocortex), frontal (Jacksonian, supplementary motor, premotor, cingulate, orbito-frontal) and parieto-occipital. Complex partial seizures are subset of partial seizures that is characterized by impairment of consciousness or memory[2].

Overall prevalence of epilepsy in Pakistan is estimated to be 9.99 per 1000 population. Higher prevalence is seen in people younger than 30 years of age[3]. The understanding of the physiopathology underlying the seizures and exact localization of the epileptogenic lesion has been greatly improved by the possibility to examine these patients with advance forms of neuroimaging. Among different forms of investigations, neuroimaging techniques play a vital role in identifying the seizure focus and decision making in the care of patients with epilepsy.[4] Neuro-imaging techniques are of two main types: the first one, structural imaging, detects visible abnormalities of cerebral structure, such as brain tumors, blood clots, malformations or scar tissue that might be causing seizures, and helps to establish the etiology of the disease; the second is functional and identifies abnormalities in brain metabolism. The principal forms of structural imaging to diagnose epileptogenic lesion causing seizures are magnetic resonance imaging (MRI), computerized tomography (CT) and angiography. Functional imaging test are single photon emission computed tomography (SPECT), positron emission tomography (PET), and functional MRI (fMRI)[5].

Magnetic resonance imaging because of its high contrast resolution and multiplanar capability is the ideal imaging modality. Magnetic resonance imaging is the most sensitive neuroimaging technique for detection of the lesion causing epilepsy. It uses harmless magnetic fields and radio waves to form an image of the structure of the brain. MRI examination is highly contributive to the detection of structural brain abnormalities and has a major impact on the management of patients with epilepsy because it reveals epileptogenic lesion not detected by CT[6]. The specific MR imaging technique to be followed depends on the specific type of seizures. MRI has increased substantially the ability to detect causes of seizure disorders, localize the lesion and to plan medical or surgical therapy. MRI must be performed

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with techniques that will maximize the detection of potentially epileptogenic lesion, especially in candidates for epilepsy surgery[7].

Magnetic resonance imaging has revolutionized the management & understanding of epilepsy. It has the potential to improve lesion detection, access lesion burden more accurately, characterize cortical abnormalities and determine the location and extent of associated cortical and deep gray nuclei involvement. Contribution of the MRI in exploration of different types of partial epilepsy is outstanding. So modern neuroimaging with the help of MRI can help us to clarify the etiology i.e., in detecting epileptogenic lesion, informing the person with the etiology, exploring the prognosis, providing genetic advice and assisting in planning epilepsy surgery.

PATIENTS AND METHODS

This purposive non-probability sampling study was carried out between July 2007 to December 2007 in the Department of Radiology. Sixty patients of seizures who as judged on clinical assessment fulfilled the inclusion criteria were included. These cases were selected from OPD and indoor of neurosurgery department. Patients age 13-90 years of either sex, generalized or partial seizures, new onset seizures and seizures associated with progressive neurologic deficit were included. Those patients having contra-indications to MRI, traumatic fits, metabolic disturbances causing fits and fits of cardiovascular origin were excluded from the study. Patient fulfilling the criteria were registered. They were asked to sign an informed consent for the procedure and using their data in research. The equipment used was 1.5-T super conducting MR system (Philips Intera Achieva, Holland). Tl-weighted images (T1, WI; TR, 500 ms; TE, 20 ms), T2-weighted images (T2 WI; TR, 3,000 ms; TE, 90 ms), proton density (PD; TR, 3,000 ms; TE, 35 ms), and fluid attenuation inverson recovery (FLAIR; TR, 8,500 ms; TE, 100 ms; T1, 2,000 ms) images were obtained in the axial, coronal, and sagittal planes, The slice thickness was 3 mm. Morphologic changes were evaluated mainly on T1-weighted images, and abnormal signal intensity was evaluated on T2-weighted images, proton density (PD) and FLAIR images. Functional MRI was not done on any patient. The specific MRI imaging technique followed, depended upon the specific type of Seizures that the patient had. Patients above 50 years of age were evaluated with the combination of non-enhanced T2-weighted or FLAIR images and T1-weighted images before and after the administration of gadolinium-based contrast material to rule out brain tumors. T2-weighted or FLAIR imaging was also done to demonstrate necrotic portions of the tumor in glioblastoma multiforme and surrounding vasogenic edema. Data was stored and analyzed by using computer software SPSS version 10. The variables of MRI findings included site of lesion, ventricular compression, midline shift, asymmetry of the temporal horn and the type of lesion on the basis of these findings. These variables were qualitative in nature; therefore they were presented as frequency distribution. The outcome of MRI findings location of the lesion was correlated with some of the variables noted from the history (type of seizures). Frequencies of different types of epileptogenic lesions in temporal lobe epilepsy were also evaluated.

RESULTS

There were 32 males and 28 females between 11-60 years (Table 1). Four patients (6.7%) belonged upper middle class, 15 patients (26.6%) belonged to lower middle class and 40 patients (66.7%) belonged to low class (Table 2). According to type of seizures, 10 patients (16.7%) have simple partial seizures, 32 patients (53.3%) have complex partial seizures and 18 patients (30%) have generalized seizures (Table 3). Eight patients (33.3%) have mesial temporal sclerosis, 8 patients (33.3%) have low grade astrocytoma, 4 patients (16.7%) have cavernous haemangiomas, 2 patients (8.3%) have arteriovenous malformation and 2 patients (8.3%) have choroids plexus papilloma respectively (Table 4, Fig.1). The outcome of MRI of lesion site with complex partial seizures, 24 patients (75%) have temporal lobe, 2 patients (8.2%) each in frontal lobe, parietal lobe, occipital lobe and multi lobe respectively (Table 5).

Table 1: Distribution of cases by age and sex

Age (years)	Male	Female	Total
11-20	2	2	4
21-30	14	12	26
31-40	5	5	10
41-50	7	5	12
51-60	4	4	8
Total	32	28	60

Table 2: Distribution of patients by social status

Social status	n	%age
Upper middle	4	6.7
Lower middle	16	26.6
Low	40	66.7
Total	60	100

Table 3: Distribution of cases at the time of presentation by types of seizures

Type of seizure	Male	Female	%age
Simple partial seizures	4	6	16.7
Complex partial seizures	18	14	53.3
Generalized seizures	10	8	30.0

Table 4: Distribution of patients in relation to MRI outcome of epileptogenic lesions temporal lobe epilepsy (among 24 patients having temporal lobe epilepsy)

Type of lesion	n	%age
Mesial temporal sclerosis	8	33.3
Low grade astrocytoma	8	33.3
Cavernous haemangiomas	4	16.7
Arteriovenous malformation	2	8.3
Choroids plexus papilloma	2	8.3

Table 5: Distribution of patient in relation to MRI outcome of lesion site with complex partial seizures (out of 32 patients with complex partial seizures)

Site of lesion	n	%age
Temporal lobe	24	75.0
Frontal lobe	2	6.2
Parietal lobe	2	6.2
Occipital lobe	2	6.2
Multi lobe	2	6.2

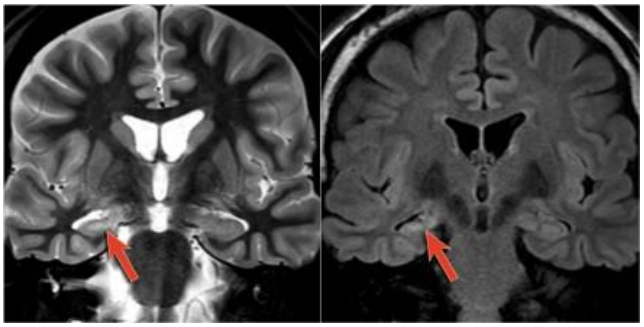

Fig. 1: Right-sided mesial temporal sclerosis

DISCUSSION

Epilepsy is a worldwide medical problem and is quite common in Pakistan. Neuroimaging has advanced the diagnosis, management and understanding of the epilepsy. The importance of the diagnostic role of MRI for the evaluation of seizures is well known for the last two decade. The present study supports the importance of MRI in the evaluation of epileptogenic lesions.[4,5,8] One of the common causes of medically intractable epilepsy is mesial temporal sclerosis. In this study all patient having mesial temporal sclerosis presented with history of complex partial seizures 7 (87%) out of 8 patients presented with history of drug resistance and 4 (50%) out of 8 patients presented with previous history of febrile seizures. Asatiani also found the association of febrile seizures with mesial temporal sclerosis.[9] Mrabet et al[10] also observed the association of medically intractable partial seizures, with drug resistance in 77% of the case of mesial temporal lobe epilepsy and history of febrile seizures was found in 55%.

The specific magnetic resonance characteristics of mesial temporal sclerosis are increased signal intensity of hippocampus on T2-weighted imaging and ipsilateral dilatation of the inferior horn of lateral ventricle. In the study of Burneo etal mesial temporal sclerosis was found in 30% of the patients having TLE while in my study 8 out of 24 patients (33.3%) ware found to have MTLE[11] In most of the international studies MRI appearance of mesial temporal sclerosis has been described as hippocampal atrophy asymmetry (in case of unilateral atrophy) and increased signal intensity of the hippocampus on T2-weighted imaging. It usually presents with unilateral or clearly asymmetric hippocampal atrophy and sclerosis of the hippocampus seen increased signal in T2 weighted images. My study supports this fact[10]. In the study of Coan et al abnormal T2 signal were noted in 74% of the cases and in my study 6 out of 8(75%) patients of (MTS) were showing abnormal T2 signals in hippocampal head.[12] In the study of Urback et al tumors constitute 20% of all cases while tumors constitute 33% in current study; reason being is that Lahore General Hospital, Lahore is the only government hospital of the town where brain surgery is performed.[13] The problems encountered during this study were poor socio economic status of the population, unawareness and poor medical education of the community. The diagnostic challenge encountered during this study was that low grade gliomas can be confused with focal cortical dysplasia and requires biopsy co-relation. The accuracy of MRI in detecting epileptogenic lesions increases its importance in the diagnosis and management of seizures. Knowledge of various risk factors and history is the basis for MRI technique to be followed. Early intervention is frequently essential in the management of seizures as recurrent seizures can further cause neuronal damage.

CONCLUSION

Magnetic resonance imaging (MRI) has increased substantially the ability to detect various epileptogenic lesions causing seizures, to plan medical or surgical therapy, and to prognosticate the outcome of disorders and therapy. Success in epilepsy surgery depends upon the exact localization of epileptogenic lesion, locating and documenting this area involves a progressive series of diagnostic evaluation and test, starting with a careful history and in selected cases, intracranial monitoring. In all such evaluations, a pivotal role is played by high resolution magnetic resonance imaging. Clinician can help the radiologist by providing adequate medical history and clinical examination, to select proper MRI protocol, which will increase the detection of epileptogenic lesion and minimize the cost.

REFERENCES

1. Clark CRA. Neurological diseases. In: Kumar P, Clark M. Kumar & Clark Clinical medicine.5th ed. Philadelphia: W B Saunders; 2002; 73-80.
2. Sutton D, Stevens J, Miszikiel K. Textbook of radiology and imaging. 7th ed. London: Churchill Livingstone; 2003: 1804-7.
3. Khatri lA, lannaccone ST, llyas MS, Abdullah M, Saleem S. Epidemiology of epilepsy in Pakistan: review of literature. J Pak Med Assoc 2003; 53: 594-6.
4. Bonilha L, Montenegro MA, Cendes F, Li L. The role of neuroimaging in the investigation of patients with single seizures,febrile seizures,or refractory partial seizures. Med Sci Moni 2004; 10: 40-6.
5. KuzniecKly RI, Knowlton RC. Neuroimaging of epilepsy. Semin Neurol 2002; 22: 279-88.
6. Dupont S, Baulac M. Contribution of MRI to the exploration of partial refractory epilepsy. Rev Neurol 2004; 160: 91-7.
7. So EL. Role of neuroimaging in the management of seizure disorders. Mayo Clin Proc 2002;77: 1251-64.
8. Kuzniecky RI. Neuroimaging of epilepsy: therapeutic implications. Neuro Rx 2005; 2: 384-93.
9. Astiani A. MRI findings in patients with epilepsy debuting with febrile seizures. Georgian Med News 2005; 122: 37-9.
10. Mrabet H, elBahri Ben Mrad F, Fredj M, Ben Seghaier R, Mrabet A. Mesial temporal lobe epilepsy. Nine case reports. Tunis Med 2004; 82: 47-50.
11. Bureno JG, Black L, Knowlton RC, Faught E, Morawetz R, Kuznieck RI. Racial disparities in the use of surgical treatment for intractable temporal lobe epilepsy. Neurology 2005; 64: 8-9.
12. Coan AC, Kobayashi E, Lopes-Cendes I, Li LM, Cendes F. Abnormalities of hippocampal signal intensity in patients with familial mesial temporal lobe epilepsy. Braz J Med Biol Res 2004; 37: 827-32.
13. Maixner W. Hypohalamic hamaratomas-clinical, neuropathological and surgical aspects. Childs Nerv Syst 2006; 22: 867-73.