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Research Article

ROLE OF MRI IN EVALUATION OF SEIZURE DISORDER

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ABSTRACT

Objectives: The present study was conducted to identify structural abnormalities on the brain imaging that may be associated with the cause of seizures and to study the spectrum of MRI findings in patients with seizures.

Methods: This time-bound descriptive study was conducted on 100 seizure patients in the department of radiodiagnosis of GMC, Patiala. Informed consent was obtained and then MR imaging of brain was done. The results were analyzed.

Results: Mean age was 39.59±15.96 years (range: 18–85 years) with 70% male and 30% female patients. The majority of the patients (80%) had generalized tonic–clonic seizures, followed by myoclonic seizures (8%), simple partial seizures (5%), complex partial seizures (2%), absence seizures (2%), motor seizures (1%), febrile seizures (1%), and tonic seizures (1%). The mean seizure duration was 2.15±1.48 months. On magnetic resource imaging (MRI), 44% patients had normal MRI. In remaining patients, MRI findings were infarct with gliosis (20%), ring enhancing lesions (18%), atrophy (6%), neoplasm (4%), thrombosis (3%), venous malformation (2%), and developmental malformations (3%).

Conclusion: The most common type of seizures is GTCS. MRI can be normal in the majority of the patients of seizures. Common MRI abnormalities were infarct with gliosis and ring-enhancing lesions. Hence, MRI plays a significant role in the initial evaluation of seizures patients to rule out any organic or developmental lesions.

Keywords: Seizures, Generalized tonic–clonic seizure, Myoclonic seizures, Infarct with gliosis, Ring-enhancing lesions.

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INTRODUCTION

Seizure is a paroxysmal alteration in neurologic function resulting from abnormal excessive neuronal electrical activity [1]. Seizures may be acute symptomatic or unprovoked. Acute symptomatic seizures are seizures occurring at the time of a systemic insult or in close temporal association with a documented brain insult. Unprovoked seizures are seizures occurring in the absence of precipitating factors and may be caused by a static injury (remote symptomatic seizures) or a progressing injury (progressive symptomatic seizures). Unprovoked seizures may be single or recurrent (epilepsy) [2]. Approximately 2.5% of the population in their lifetime have at least one non-febrile seizure [3,4].

Neuroimaging techniques have evolved progressively since the early 1970s through which the pathology is now easily revealed that previously could not be imaged [5]. It helps to determine whether the seizure was generated by a structural abnormality of the brain or its surroundings. With the computed tomography scan-based radiological analysis of the brain, a new era began in the diagnosis of epileptogenic lesions. The visualization of gross structural lesions, particularly those with calcified components, helped in the reduction of the number of patients that underwent surgery without diagnosis [6].

With the introduction of magnetic resource imaging (MRI) in clinical practice, new insights were discovered into the structural basis of epilepsy and in the identification of the causative lesions of uncontrolled seizures [1]. MRI has been proved to be more diagnostically beneficial for the localization of epileptogenic focus preoperatively. It can be attributed to its excellent soft-tissue contrast, permitting a detailed visualization of anatomy, lack of harmful radiations and beam-hardening artifact in the basal brain. The diagnosis of epilepsy with the help of MRI has made this diagnostic instrument more preferred over the other investigations, making it neuroimaging study of choice. It has been proved that MRI is the most important and beneficial plan of action in the diagnosis, management, and follow-up of patients with inflammatory and parasitic lesions of the brain such as neurocysticercosis, tuberculoma, brain abscess, mass lesion, and encephalitis [1,7].

The present study was conducted to identify structural abnormalities on the brain imaging that may be associated with the cause of seizures and to study the spectrum of MRI findings in patients with seizures.

METHODS

This time-bound descriptive study was conducted on 100 patients in the Department of Radiodiagnosis, Government Medical College and Rajindra Hospital, Patiala (Punjab) in the year of 2020–2022. The approval of the institutional ethical committee was taken for the study protocol, and the patients were required to give informed consent before the examination. This study was performed on patients (irrespective of gender) presenting with clinical symptoms and signs of seizures with the following inclusion and exclusion criteria. Depending on the radiological features, a provisional diagnosis was made correlating the clinical features.

Inclusion criteria

- All patients presented with seizures
- Age group >18 years.

Exclusion criteria

- Contraindications to MRI studies, such as patients with pacemakers, metallic implants, and aneurysmal clips.
- Patients <18 years.
- Claustrophobia or anxiety disorders exacerbated by MRI.
- Inability to provide consent.

Equipment

MR techniques by the 1.5-T superconductive scanner (Siemens 1.5T Magnetom Aera MRI machine) were used.

The results of observations of individual subjects were pooled and analyzed. Data were entered into MS Excel sheet, and SPSS software version 20.0 Chicago, Illinois, USA was used for analyzing data.

RESULTS

In the present study, the mean age (±SD) of patients was 39.59±15.96 years. The patients were in the age range of 18–85 years. The majority of patients (29%) belonged to the age group of 21–30 years. Out of 100 patients, 70 patients (70%) were males and 30 patients (30%) were females. There was a male preponderance with a Male: Female ratio of approximately 7: 3 (Table 1). The majority of the patients (80%) had generalized tonic–clonic seizures, followed by myoclonic seizures (8%), simple partial seizures (5%), complex partial seizures (2%), absence seizures (2%), motor seizures (1%), febrile seizures (1%), and tonic seizures (1%) (Fig. 1). The following MRI findings were identified – infarct with gliosis (20%), Ring-enhancing lesions (18%), atrophy (6%), neoplasm (4%), thrombosis (3%), venous malformation (2%), and developmental malformations (3%). Rest of normal were normal (Table 2 and Figs. 2-5).

DISCUSSION

Demographic profile

The mean age of presentation of patients was 39.59±15.96 years. The majority of patients (29%) belonged to the age group of 21–30 years. The patients were in the age range of 18–85 years. 70 patients (70%) out of 100 patients were males and 30 patients (30%) were females. The male: female ratio was approximately 7: 3. The results of the present study were found to be similar to the study conducted by Narra *et al.* which reported that the maximum number of patients were in the age group of 1–30 years (63%) [8]. Chabarwal and Kardam also noted that the maximum number of patients was of 2nd decade, followed by 3rd decade [9]. Patel *et al.* also found a male predominance with 62.67% male patients and 37.33% females [10].

Table 1: Age and gender distribution of patients

Age group (years)	Male	Female	Total
≤20 years	8 (8%)	3 (3%)	11 (11%)
21–30 years	22 (22%)	7 (7%)	29 (29%)
31–40 years	10 (10%)	8 (8%)	18 (18%)
41–50 years	8 (8%)	6 (6%)	14 (14%)
51–60 years	16 (16%)	4 (4%)	20 (20%)
>60 years	6 (6%)	2 (2%)	8 (8%)
Total	70 (70%)	30 (30%)	100 (100%)
Mean±SD (age)	39.59±15.96 years		
Range (age)	18-85 years		

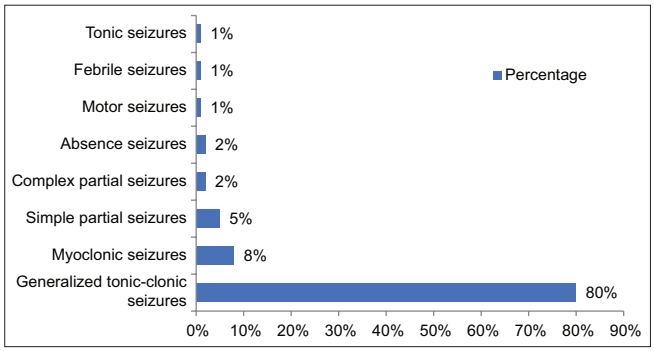

Fig. 1: Distribution of cases based on the type of seizure

Davagnanam *et al.* reported similar results with 58% males and 42% females [11].

Distribution of cases based on the type of seizure

The majority of the patients (80%) had generalized tonic–clonic seizures, followed by myoclonic seizures (8%), simple partial seizures (5%), complex partial seizures (2%), absence seizures (2%), motor seizures (1%), febrile seizures (1%), and tonic seizures (1%). Davagnanam *et al.* reported that 88% of individuals had focal, 9.1% had generalized, and 0.17% had combined epilepsy; 2.9% had unknown classification [11].

Table 2: Distribution of cases based on MRI findings

MRI findings	Patients	Percentage
Infarct with gliosis	20	20
Ring enhancing lesions	18	18
Atrophy	6	6
Neoplasm	4	4
Thrombosis	3	3
Venous malformation	2	2
Developmental malformations	3	3
Normal	44	44
Total	100	100

MRI: Magnetic resource imaging

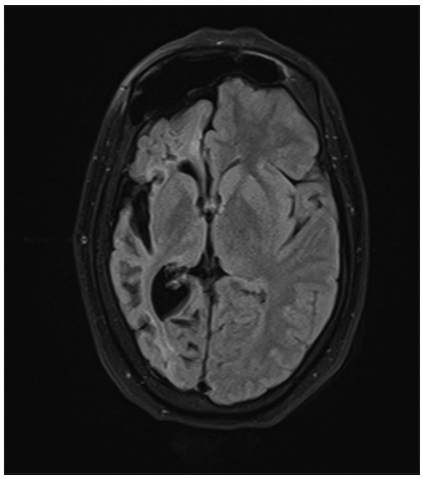

Fig. 2: Magnetic resource imaging FLAIR image –Marked atrophy of right cerebral hemisphere with hyperpneumatization of right-sided paranasal sinus - Dyke Davidoff Masson Syndrome

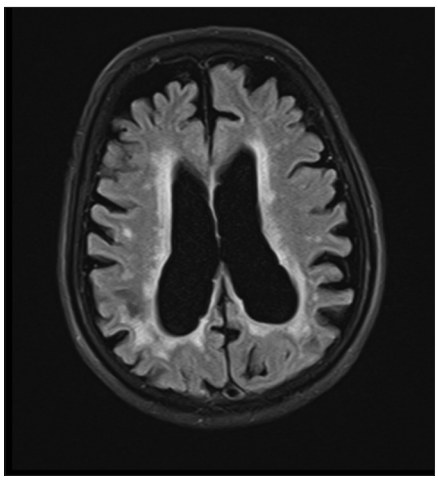

Fig. 3: Magnetic resource imaging FLAIR image – Intra- and extra-axial fluid spaces prominent with multiple bilateral hyperintensities - Diffuse cerebral atrophy

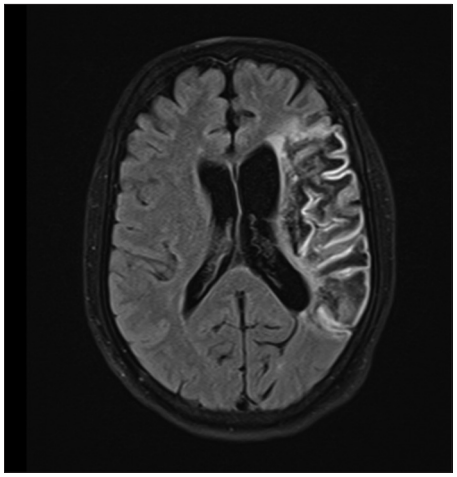

Fig. 4: Magnetic resource imaging FLAIR image - Cerebrospinal fluid signal intensity area with gliotic changes involving left parietotemporal region - Chronic infarct with gliosis.

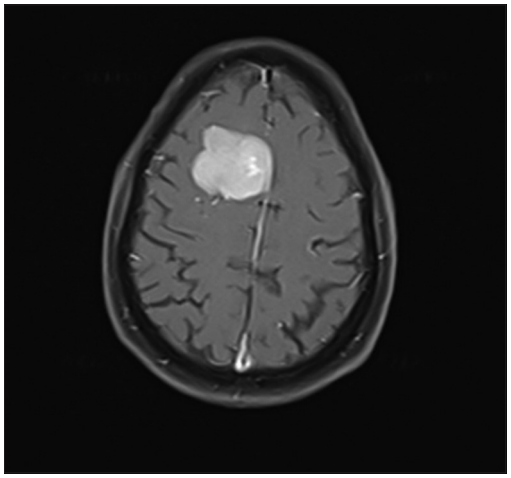

Fig. 5: T1-weighted image post-contrast image - Intensely enhancing well defined extra-axial dural-based mass lesion in the right frontal region - Meningioma

MRI findings of patients

The following MRI findings were identified – infarct with gliosis (20%), Ring-enhancing lesions (18%), atrophy (6%), neoplasm (4%), thrombosis (3%), venous malformation (2%), and developmental malformations (3%). Kushwah *et al.* reported pathological findings in 65 out of 100 patients (65%) which include cerebral infarction with gliosis (16%), infective granuloma (17%), atrophy (1%), gliomas (9%), cortical malformations (2%), meningioma (3%), and other miscellaneous causes (17%) [12]. Chabarwal and Kardam reported 41% had normal MRI, 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% [9]. Shrikrishana *et al*. reported that MRI findings were normal in 35.33% of patients. Among the abnormal MRI findings, infarct with gliosis was present in 17.33% of cases, infective granuloma in 16.66% of cases, developmental malformation in 4.6% of cases, meningioma in 4% of cases, and glioma in 1% of cases [13].

CONCLUSION

The present study found that the most common type of seizure is GTCS. MRI can be normal in majority of the patients of seizures. The most common MRI abnormalities were infarct with gliosis and ring-enhancing lesions. Hence, MRI plays a significant role in the initial evaluation of seizure patients to rule out any organic or developmental lesions.

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DECLARATION OF CONFLICTING INTERESTS

The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR (S) CONTRIBUTIONS

Dr. Neeraj Singla: Preparation of protocol, literature search, and data collection. Dr. Jarnail Singh: Overall analysis, literature search, and manuscript preparation. Dr. Amarjit Kaur: Statistical analysis of data and preparation of graphs. Dr. Rajesh K Badhan: Overall analysis, literature search, and manuscript preparation.

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