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MAGNETIC RESONANCE IMAGING FINDINGS IN SEIZURE PATIENTS WITH NORMAL NEUROLOGICAL EXAMINATION

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ABSTRACT

Background: Imaging plays a critical role in the treatment and diagnosis of individuals experiencing seizures, particularly those whose seizures cannot be explained. In various circumstances, CT scans and MRIs (Magnetic Resonance Imaging) are utilized in tandem.
Objective: The purpose of this research was to evaluate the MRI findings of patients referred to Alavi Hospital with seizures and a normal neurological examination.
Methods: This case-series study examined one hundred patients with epilepsy who underwent normal neurological examinations. All patients' imaging reports were meticulously examined, and any changes were documented in pre-established checklists that comprised of the following: age, gender, family history, EEG (electroencephalogram) results, neurological assessments (including motor, plantar, and tendon reflexes), and MRI findings derived from the patients' files and clinical histories.
Result: In the range of 11 to 58 years, the mean age of patients was 7.46 + 32.62 years. Males comprised forty-six (46%) of the patients. In45% of the cases, a familial history of seizures was documented (n=45). Normal EEG results were obtained in 62 cases (62%). Twenty cases (20%) of abnormalities were detected on MRI, seven of which were tumor lesions, as reported by the radiologist. The imaging of the patient's brain revealed no significant correlation between the pathological findings and variables such as age, gender, or family history. No significant correlation was observed between electroencephalogram results and pathological findings on brain imaging in patients with epilepsy.
Conclusion: brain imaging partially compensates for the false negatives that occur during electroencephalograms, and concurrently employing both modalities enhances the ability to diagnose underlying issues in patients experiencing seizures.

Keywords: Seizure, Epilepsy, MRI, EEG

Introduction

Convulsion, an abrupt alteration in neurological functionality induced by sudden, coordinated, and simultaneous electrical discharges of neurons in the brain, has the potential to manifest in over 10% of the populace.[1] Epilepsy, which is characterized by recurrent seizures, is a chronic disease that affects approximately 2% of the populace. Particularly significant in the case of patients experiencing unexplained seizures is the diagnostic and therapeutic utility of imaging in patients with epilepsy and seizures. In various contexts, CT scans and magnetic resonance imaging (MRI) are utilized interchangeably. MRI is the imaging modality of choice for the diagnosis of epileptic patients, and its advantages are more pronounced and involve fewer complications than CT scans. The sensitivity of MRI in diagnosing abnormalities in epileptic patients depends on the underlying pathology, MRI technique and the experience of the treating physician, and CT scan is the main part of emergency imaging.[4] Indications for emergency imaging of the brain are accompanied with danger symptoms: recurrent seizures, sudden focal seizures, continuous changes in level of consciousness, local abnormality in neurological examinations, headache, trauma, fever, blood pressure and changes in vital signs, travel to cystic sarcosis endemic areas, use of anticoagulants, history of stroke, hemorrhagic diseases, hydrocephalus, immunodeficiency virus, immunodeficiency, malignancy and recent symptomatic diseases are accompanied.[5] Imaging in the brain is clearly complex and its role depends on clinical manifestations, and most imaging interventions must be performed along with tests and brain scans before starting the treatment process at the patient's bedside.[6] History and clinical examinations are the basis for diagnosing the first seizure, even in the period of imaging and digital EEG. Many evidences show that experts support the history of the disease and physical examination more than EEG and

imaging in the evaluation of epilepsy.[7] In many cases, a doctor does not witness seizure events, or sufficient and convincing evidence is not obtained from witnesses of seizures, but definitive symptoms such as biting of the tongue, urinary incontinence, and self-harm that occur along with seizures must be identified in a clinical examination.[8] The purpose of this study was to investigate MRI findings in seizure patients with normal neurological examination.

Methods

This is a case-series study that was conducted on 100 seizure patients with normal neurological examination who referred to Neurology Center in Alavi hospital at Ardabil city in 2020. Brain imaging was performed for all patients and their reports were studied and reviewed carefully and their changes were recorded. Also, information including age, gender, family history, EEG findings, neurological examinations including (motor, plantar reflexes and tendon reflexes, etc.) and MRI findings by obtaining a clinical history (by the phone from the patient himself or his companion) and also according to the information in the patient's file were collected by a checklist. Neurological examination was performed by a neurologist and MRI examination of these patients was performed by an expert radiologist. After collecting the data, it was entered into SPSS software version 26 and then analyzed using descriptive statistical methods in the form of tables, frequency, percentage and descriptive statistics indicators. Chi-square test was used to check the relationship between qualitative variables. The significance level was considered less than 0.05. The study was approved by the ethics committee of Ardabil University of Medical Sciences and registered with code IR.ARUMS.REC.1399.215.

Results

The average age of the patients was 32.62+7.46 in range 11 to 58 years. 46 patients (46%) were male. Family history of seizures was reported in 45 cases (45%). EEG findings were normal in 62 (62%) of seizure patients (Table 1).

Table 1. Demographic information and EEG findings in the studied patients

Variables	n	%
Age Groups		
<20	6	6
20-30	31	31
30-40	51	51
40-50	11	11
>50	1	1
Gender		
Male	46	46
Female	54	54
Family History		
Yes	45	45
No	55	55
EEG Findings		
Normal	62	62
Slowing Waves	13	13
Epileptic Discharge	25	25
MRI Findings		
Abnormal	20	20
Normal	80	80

The most common abnormality in MRI with 7 cases (35%) related to tumoral lesion, 5 cases (25%) developmental lesion, 4 cases (20%) vascular lesion, 1 case (5%) infectious lesion and 3 cases (15%) were other unclassified lesions. The pathological findings reported in the brain imaging of the patients had no significant relationship with the age of the patients, so that the average age of patients with normal MRI was 32.2±8.1 and abnormal with 34.1±32.2 7.3 years was not different. There was no significant difference between normal and abnormal MRI findings in terms of gender, family history of the disease, and electroencephalogram (EEG) findings (Table 2).

Table 2. Frequency distribution of positive MRI findings in seizure patients

Variables	Positive finding in MRI				p-value
	Yes		No		
	n	%	n	%	
Gender					
Male	8	17.4	17.4	82.6	0.547
Female	12	22.2	22.2	77.8	
Family History					
Yes	10	22.2	22.2	77.8	0.615
No	10	18.2	18.2	81.8	
EEG Findings					
Normal	15	75	75	58.8	0.396
Abnormal	5	25	25	41.2	

Discussion

It is estimated that 10% of the population suffers from seizures at some stage of their lives.[9] The first seizure can be a frightening experience and quickly raise concerns about the underlying conditions causing the seizure.[10] Neuroimaging is used to detect an underlying abnormality that can explain seizures and is used in diagnosis, monitoring complications, and guiding critical medical treatments. CT scan remains as the first-line imaging tool in most acute care centers due to its power in quickly identifying intracranial hemorrhage or a mass that requires immediate neurosurgery intervention.[11] CT scan performed in the emergency department can effectively guide the management of seizures, especially when there is evidence of focal onset or an abnormal neurological examination along with a history of predisposing factors, but when the neurological examination is normal, the situation is completely different. Because in such cases the role of CT scan modality is reduced.[12-13] A CT-scan is quite adequate to detect epileptic foci secondary to stroke, trauma, and infection, which account for a significant proportion of unprovoked seizures in adults. Indeed, CT may be the imaging modality of choice for elderly patients because it is faster and less sensitive to motion.[14] When CT is negative and other imaging modalities are available, the role of neuroimaging shifts to identifying a more subtle lesion that could be causing the seizure.[15] In particular, MRI is the preferred modality due to its better representation of brain anatomy. A direct comparison of CT and MRI has shown that MRI has a higher diagnostic yield for epileptic lesions.[16] Previous studies have investigated the role of neuroimaging in patients who presented with seizures, CT and MRI were reported to be abnormal in 1% to 60% of cases. In these studies, brain mass lesions, vascular lesions and brain infectious diseases were the most common abnormalities that affected patient management.[12,17-18]

In the current study, the frequency of abnormal findings in the MRI of seizure patients was 20%, and the most common cases identified were tumoral lesions, developmental lesions, vascular lesions, and infectious lesions, which were exactly the same observations that were repeated in other studies. Of course, perhaps the only unique difference of the current study is the high prevalence of developmental lesions, which can be justified considering the more general age group of the current study compared to the mentioned studies. In fact, other studies have mostly been conducted on older patients.

The most common way of paraclinical diagnosis of epilepsy is EEG. However, due to the fact that the false negative cases in this diagnostic method are relatively high (up to 40% in some types of epilepsy), so different activation methods have been suggested to reduce these negative cases in various validity comparison studies. In activation and without activation brain tape has been performed in epileptic patients. Among other things, a clinical study was conducted on 500 epileptic patients whose epilepsy was clinically definite. After performing the initial EEG, patients with abnormal EEG were discarded and patients who had normal EEG despite the disease were randomly divided into 5 groups (one control group and 4 case groups) subject to re-imaging with different models like activation included deep and rapid breathing (HV), light stimulation (PS), sleep and sleep deprivation, and EEG was performed again. Out of 500 patients, 386 (77.2%) had abnormal EEG and 114 had normal EEG. No positive cases were reported in the control group. Fisher's exact test showed that activation was effective in EEG positivity ($P<0.01$), but the amount of positivity in activation groups was not statistically different. The use of different activation models in tonic-clonic epilepsy reduced false negative cases by 3.3%, absence by 9.5% and other types of epilepsy by 12.45%. According to the results of this study, although EEG is the best way of para-clinical diagnosis of types of epilepsy, but if it is done routinely and without activation, a lot of false negatives are seen in it, and if different models of activation are done, more validity can be obtained from it. However, in the present study, although there were abnormal findings in 38% of patients' EEG, but there was not much overlap between patients with abnormal EEG and abnormal imaging findings.

Our work has limitations in terms of carefully examining patient risk factors and associated clinical symptoms. Patient assessment and documentation of clinical findings were not standardized primarily due to the retrospective nature of the study. Misclassification of final diagnoses and the possibility of underestimating delayed disease manifestations are possible. This study was conducted in an academic medical center with referred patients and therefore, the results may not be reproducible in other hospitals.

Conclusion

The results showed that brain imaging partially compensates for the false negatives that occur during electroencephalograms, and concurrently employing both modalities enhances the ability to diagnose underlying issues in patients experiencing. It is suggested that prospective studies be conducted in larger groups to investigate the optimal combination of features related to imaging findings that lead to acute treatment changes, and also to investigate reversible MRI abnormalities (caused by seizures) in patients with isolated seizures to differentiate between different pathologies should be investigated.

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Conflict of Interest

None.

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