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Clinical, neuroradiological, and electroencephalographic findings of reflex epilepsies

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Background/aim: Reflex seizures are defined as epilepsies with seizures induced by a specific afferent stimulus or patient activity alone or in combination with spontaneous seizures, and/or accompanied by photoparoxysmal response on electroencephalogram (EEG). The aim of this study is to review and analyze clinical, neuroradiological, and EEG findings in reflex epilepsies.

Materials and methods: The records of 1598 follow-up patients out of 2237 patients who had been examined between July 1995 and August 2017 were analyzed retrospectively.

Results: Eighty of 1598 patients had reflex epilepsy and 72 of those patients had seizures induced by visual stimuli. Considering the somatosensory stimuli, in one patient it was associated with eating while in 7 patients it was associated with hot water. The results of neurological examination were normal in 90% while cranial imaging was normal in 82.5% of the patients. Only 53 of 80 patients' EEGs revealed pathological EEG findings. Furthermore, in 43 patients, the most frequently prescribed drug was valproate.

Conclusion: In this hospital-based study, reflex epilepsy frequency was 5% and cranial imaging was mostly found to be normal, as stated in the literature. However, patient histories revealed an unexpectedly high rate of head trauma before seizure onset and a family history of epilepsy.

Key words: Reflex seizures, generalized epilepsy, focal epilepsy, photosensitivity

1. Introduction

Reflex seizures are objectively and consistently demonstrated to be evoked by a specific afferent stimulus or by an activity of the patient. The presence of reflex epilepsy is determined by specific seizure triggering stimulus, clinical findings, and electroencephalogram (EEG) response (1). Those triggering stimuli can be a visual stimulus (flashing lights, pattern), hot water, music, reading, eating, thinking, a somatic sensory stimulus, or a proprioceptive stimulus (2). Epilepsy induced by specific stimuli was first introduced in the 1989 International League against Epilepsy (ILAE) classification (3). In the 2017 ILAE classification, reflex epilepsy was listed under the electroclinical syndromes of variable age at onset (www.epilepsydiagnosis.org). The prevalence of reflex epilepsy in patients with epilepsy is 4%–7% and the most frequent type is photosensitive epilepsy (4). The aim of this study is to review clinical, neuroradiological, and EEG findings of reflex epilepsies.

2. Materials and methods

The records of 1598 follow-up patients out of 2237 patients examined at an epilepsy outpatient clinic between July 1995 and August 2017 were studied for reflex epilepsy retrospectively. The type of epilepsy, the type of reflex epilepsy, the age of onset, the presence of epilepsy in each patient's family, a history of febrile convulsions, reflex type, EEG and cranial imaging findings, use of antiepileptic drugs, and additional pathologies in patients' histories were assessed. Frequency of reflex epilepsy, frequency of stimuli, and mean of seizure onset were also calculated. Results were compared with the literature.

3. Results

It was detected that 80 out of 1598 patients had reflex epilepsy, the frequency of which was calculated to be 5%, and 72 patients were recorded to have seizures induced by visual stimuli. Of the patients affected by the visual stimuli, 94.4% were photosensitive. Only 7 patients had both pattern and photosensitivity and only 4 of them had just pattern sensitivity. Regarding other causes, eating was determined in one patient while hot water was determined in 6. In addition, both hot water and visual stimuli were determined in only one case. The age of seizure onset ranged from 1 to 32 years, and the average age was

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calculated to be 13.2 years. History of febrile convulsion was present in 28.8% and a family history for epilepsy was present in 36 patients, while 8 patients were recorded to have both. Only 6 patients had a history of dystocia, and head trauma was present in 11 patients. Among them, 7 of 11 had seizures after head trauma, 6 of whom were photosensitive.

The types of generalized onset seizures were as follows: tonic-clonic seizures in 55, absence seizures in 41, and myoclonic seizures in 33 patients. Ten patients had one type of generalized onset seizure while 51 of them showed multiple seizure types. Furthermore, 18 patients had a combination of absence, myoclonic, and tonic-clonic seizures. The number of patients who experienced focal aware seizures, focal impaired awareness seizures, and focal to bilateral tonic- clonic seizures was 15, 5 ,and 14, respectively. The most frequent type of epilepsy syndrome was juvenile myoclonic epilepsy and it was observed in 32.5% of the patients. With 15 patients, juvenile absence epilepsy was found to be the second most common one. Nine patients had epilepsies of unknown causes. Having 7 patients in each category, hot water epilepsy, epilepsy with myoclonic absences, and photosensitive occipital lobe epilepsy were equally frequent. In addition, epilepsy with only generalized tonic-clonic seizures was seen in 5 patients. In 2 patients, epilepsies were accompanied by structural causes: one of them was right frontal cortical dysplasia while the other one was right parietal subcortical gliosis because of head trauma. One case of childhood occipital epilepsy and one of eating epilepsy were also diagnosed.

Neurological examination was normal in 90% and MRI of the brain or cranial CT were normal in 82.5% of the patients. Twenty-seven patients had no pathological EEG findings. EEG revealed generalized epileptiform discharges in 50.9% and focal epileptiform discharges in 7.5% of the patients who had pathological EEG findings. Photoparoxysmal response was present in 15 patients (one of them without clinical photosensitivity). Slow wave paroxysm was seen in 3 patients and disorganized background activity was seen in 4 patients. Pathological EEG findings were seen in 42.8% of hot water and in 68% of visual stimuli triggered reflex epilepsy patients. The patient who had eating epilepsy had normal EEG findings (Table).

The most frequently prescribed drug was valproate in the case of 43 patients; 15 patients were treated with more than one drug and 7 patients did not need any antiepileptic drug.

4. Discussion

Reflex epilepsy syndromes are characterized by epileptic seizures that are consistently precipitated by identifiable and precise triggers, which may be exogenous sensory stimuli or endogenous mental activities (5). Most patients with reflex seizures also suffer from spontaneous seizures (6,7). The prevalence of reflex epilepsy in patients with epilepsy is 4%–7% (4). In this study we found this frequency to be 5%.

Although the prevalence of reflex seizures triggered by visual stimuli in patients with epilepsy is known to be 2%–14% and it is the most common type of triggering stimuli, the rate of visual stimuli in reflex epilepsy is not known exactly (8,9). In this study we found it to be 90%, being the most common type, as in the literature. Photosensitivity and photic-induced seizures usually manifest around puberty, and 90% of patients with photic or pattern-induced seizures are reported to have an initial seizure before the age of 20 (10). In our patients, the average age of onset was 12.9 years and only 2 out of 72 patients had a seizure onset after the age of 20. As in our study, known seizure semiology frequently includes myoclonic

Table. EEG findings in our patients.

	Normal	Generalized epileptiform discharges	Focal epileptiform discharges	Photoparoxysmal response	Slow wave paroxysm	Disorganized background activity
Photosensitive	17	24	3	12	2	2
Hot water	3				1	2
Hot water and photosensitive	1					
Eating	1					
Pattern sensitive	2	1		1		
Photosensitive and pattern sensitive	3	2	1	1		
Total	27	27	4	14	3	4

seizures of the upper limbs, absences, and generalized tonic-clonic seizures (11). Considering the epilepsy syndromes associated with photosensitivity, juvenile myoclonic epilepsy is identified as the most common type. Though found as 30.5% in the study by Wolf and Goosses, the prevalence of photosensitivity is normally around 15%–20% or above (12–14). However, in this study the prevalence was 32.5%, relatively higher than in other studies.

Resting state EEG is usually normal in idiopathic photosensitive epilepsies. When the patient's eyes are closed, paroxysms occur within 1–3 s and last for 1 to 4 s in 20%–30% of cases. Similar findings may also occur with intermittent photic stimulation (4). We found normal resting state EEG findings in only 17 out of 60 purely photosensitive patients. Among them, 38.3% had generalized epileptiform discharges, and photoparoxysmal response was shown in the EEGs of 12 patients.

The recommended drug is valproate, which can suppress photosensitivity, and the seizures can usually be controlled by appropriate treatment (5). Besides drug therapy, patients have to learn to avoid or modify light and pattern sources in the environment (15). We used valproate either alone or in combination with another antiepileptic drug (mostly levetiracetam) in 37 of 68 photosensitive patients.

The relationship between photosensitivity and pattern sensitivity is well known and the frequency of their cooccurrence is about 70% (16). Seven of our patients had both photosensitivity and pattern sensitivity and the rate of those patients among pattern-sensitive patients was 63.6%.

Hot water epilepsy is a common reflex seizure type in our country. The largest case series were reported from Turkey and India (17). Though focal impaired awareness seizure is the most frequent seizure type, generalized tonic-clonic seizure can also be seen (18,19). We identified 3 focal onset seizures, 3 generalized onset seizures, and 1 absence seizure. Neurological examination, imaging, and EEG results were mostly found to be normal (3,20). In our study, out of 7 patients, 5 had normal examinations and 4 had normal EEG findings; however, only 3 of them had normal cranial imaging, with the abnormal findings including 2 arachnoid cysts, 1 Dandy–Walker variant, and 1 porencephalic cyst resulting from trauma. The seizure onset age in our study ranged from 2 to 32 years and the average was calculated as 15.4, while the age of seizure onset was reported in the literature to vary from 2 months to 58 years (19). We decided to begin with carbamazepine. According to earlier studies, seizures were also managed by changing bath rituals and using antiepileptic drugs like carbamazepine or phenytoin, but now intermittent clobazam therapy 1 or 1.5 h before bathing is recommended (17,21).

We had one case of eating epilepsy, and its frequency among reflex epilepsy cases was 0.063%. It is a very rare type of reflex epilepsy and only occurs in 1/1000–1/2000 of epileptic patients (22). Our patient had no pathological findings in EEG, cranial imaging, or neurological examination. The types of his seizures were identified as focal awareness seizures and focal to bilateral tonic-clonic seizures and they were easily controlled by low-dose carbamazepine. According to the literature, 50%–70% of eating epilepsy patients' seizures can be managed by monotherapy (23).

To conclude, in this hospital-based study reflex epilepsy frequency was found to be 5%, as in the literature. Family history of epilepsy in patients with reflex epilepsies was quite common. Our aim was to emphasize the rate of head trauma before seizure onset, which was not mentioned in other studies. Furthermore, in this study, pathological EEG and imaging findings were detected in hot water epilepsy cases, unlike the cases reported in the literature.

The limitation of this study was its retrospective design.

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