Retinal Screening of Patients Treated with Antiseizure Medications Using Electroretinography

Sanaz Abdolalizadeh1*, Mina Ghasemi2, Parastoo Mohammadzadeh1, Seyed Mohammad Masoud Shushtarian3, Ahmad Shojaei4

Abstract

Aim: This paper uses electroretinography to identify the probable side effects of antiseizure medications on the retina. A seizure is a severe involuntary shrinkage state of the skeletal muscle and occurs spasmodically. There are certain antiseizure medications, such as carbamazepine and valproic acid. These medications may affect the retinal layers of the visual system.

Methods: Twenty patients (ten males and ten females) in the age range of 15–30 years participated in this study. The patients received treatment with antiseizure medications. Full-field electroretinography was recorded in the population. The electroretinography pattern of the patient group was compared with that of the control group with healthy retina.

Results: There was no statistical difference regarding demographics, i.e., sex and age. This is while the difference in the case of the best corrected visual acuity (BCVA) was significant (P < 0.001). There was also a significant decrease in the amplitude of the ERG b-wave peak between the case and control groups (P < 0.001). However, the difference in terms of the ERG latency of the b-wave peak was not significant.

Conclusions: Antiseizure drugs may affect certain retinal layers. This effect can be diagnosed by the amplitude of ERG, b-wave peak.

Keywords: seizure; antiseizure medications; electroretinography.

Introduction

A seizure is a burst of uncontrolled electrical activity between brain cells that causes temporary abnormalities in muscle tone or behaviors, sensations, or status of awareness. Antiseizure medications are usually used to control seizures in patients. These medications are known to have some side effects, specifically on the visual system.

Electrophysiological tests of the visual system – electrooculogram (EOG), electroretinogram (ERG), and visual evoked potential (VEP) – are valuable tools for studying the different pathological conditions of the visual system. Sanaie S. et al. (2014) adopted the EOG technique to study the effect of toxoplasmosis on the visual system, particularly the retina of toxoplasmosis patients. They reported a significant difference between the Arden Index (AI) of the case and control groups, indicating pathological changes in the retina, especially the retinal pigment epithelium [1].

Sarzaeim F. et al. [2] investigated the effect of hand-arm vibration on the retina of road drilling machinery operators. They found that the hand-arm vibration produced by road drilling machinery could affect the operators' retinas. The range of this effect can be measured by ERG. In another work by the same authors, flash VEP was measured in ten patients with head trauma. Some VEP pathological changes were found, indicating visual pathway...
disturbances produced by head trauma, which could be diagnosed by VEP [3]. There is sufficient research evidence that proves the usefulness of these techniques [4–12].

Electroophthalmological techniques can also be used to study the side effects of different medications on the visual system. Extensive research on the probable toxic effect of amiodarone on various parts of the visual system i.e., the retina and visual pathway, corroborated the effect of consuming amiodarone. The range of this effect can be diagnosed by ERG & VEP [13, 14]. Allahdady F. et al. (2016) studied the toxic effect of hydroxychloroquine on the retina of arthritis rheumatoid patients using the EOG test. They concluded that EOG is a suitable technique to evaluate retinal damage caused by hydroxychloroquine [15].

Antiseizure medications, such as carbamazepine, and valproic acid, can also affect the visual system. Sarzaeim F. et al. (2022) investigated the toxic effect of antiseizure medication on the visual pathway in 20 patients. They concluded that the patients under antiseizure treatment may experience visual pathway disturbances which can be diagnosed by the VEP test [16]. Based on the above findings, a research work was planned to look for probable effect of Antiseizure drugs on retina.

Patients and Methods

Here, 20 patients (40 eyes) suffering from seizures were assigned to the case group. The patients were between 15 and 30 years of age. The case group received either monotherapy or polypharmacy for a period of more than one year to control the disease. The patients were evaluated for visual acuity and brain magnetic resonance imaging (MRI). The case group had visual acuity (BCVA) ranging from 7/10 to 10/10 and normal MRI. In the patient group, Ganzfeld electroretinography was studied. The amplitude (µv) and latency (msec) of the ERG b-wave were measured in the patient group using a Mangoni device. A total of three electrodes were used to connect the device to the patients. The active, reference, and ground electrodes were placed on the sclera, ear pinna, and forehead of patients. The same procedure was repeated for 20 subjects of the same age and sex and healthy (retina) in the control group. The results obtained in the two groups were compared to extract probable differences between them.

Results

Table 1 shows the demographic results in the case and control groups. There is no statistically significant difference between the two groups in age (P = 0.84) and sex, whereas the difference in BCVA is significant (P < 0001).

Table 2 shows the measurements of the mean amplitude and latency of the ERG b-wave in the case and control groups. The difference in amplitude of ERG and the b-wave peak is significant between the case and control groups (P<0.001), whereas the difference in latency is insignificant.

Discussion

Full-field electroretinography was tested in patients taking antiseizure medications for epilepsy treatment. It was found that ERG b-wave amplitude was reduced in the patient group compared with the healthy group.

The ERG b-wave amplitude originates from bipolar and muller cells of the retina [17]. Therefore, these two layers of the retina are affected in seizure patients consuming antiseizure medications. Our results are consistent with the findings of the following sources:

Shushtarian SM et al. [18] worked on the probable toxic effect of sodium valproate (SV) on the human retina using ERG. For this purpose, 25 patients who had consuming SV for more than three years were selected. The flash ERG was measured in patients. They reported decreased amplitude of the ERG b-wave, indicating pathological changes in the human retina due to SV treatment.

Moreno MC et al 2005 studied visual alterations in a group of Argentine patients treated with the antiepileptic drug vigabatrin. They used a scotopic electroretinogram and observed that a-wave and b-wave amplitudes of the scotopic electroretinogram were significantly reduced in most of the patients receiving vigabatrin [19].

Barret D and his research team reported a case under the antiepileptic drug treatment vigabatrin. They commented on ERG b-wave changes in the patient before imaging and visual field deterioration [20].

Conclusions

Antiseizure medications affect the retinal layers. They
mainly affect the bipolar and muller cells which can be detected by reducing the b-wave amplitude of the ERG.

References