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Visual Evoked Potential in Multiple Sclerosis

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Abstract

Background and objectives: Multiple sclerosis, a neurological disease with or without optic neuritis may cause abnormal visual evoked potential finding. This study aimed to evaluate role of visual evoked potential in diagnosing multiple sclerosis.

Methods: In a comparative cross-sectional study, conducted between 1stJune to 15thAugust 2023 in Shahid Aso teaching hospital, Sulaimani, Iraq. Visual evoked potential and brain magnetic resonance imaging performed for twenty patients which clinically diagnosed or suspected as multiple sclerosis. The data was analyzed by (Statistical Package for the Social Science).

Results: In this study eleven male and nine female patients in age range of 18 to 54 years participated, no significant relationship found between visual evoked potential finding with age and gender. Thirteen patients had prolonged visual evoked potential findings. Abnormal brain magnetic resonance imaging findings found in 50% of patients, from which 80% showed prolonged visual evoked potential findings. Fifty percent of patients with normal brain magnetic resonance imaging had prolonged p100 latency. There is a significant relationship at 0.01level between prolonged p100 latency and presence of finding on brain MRI.

Conclusion: Visual evoked potential, as a paraclinical biomarker helps diagnosing multiple sclerosis in patients with or without optic neuritis. In this study, abnormal brain magnetic resonance imaging was positively related with prolonging P100 latency on visual evoked potential in multiple sclerosis patients.

Keywords: Brain magnetic resonance imaging, Multiple sclerosis, Optic neuritis, Visual evoked potential

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Introduction

Multiple sclerosis (MS) is a demyelinating disease of the white matter of central nervous system (CNS) that is relatively common and debilitating. It is more prevalent between ages of 20 to 40 years old. Demyelination of the white matter causes disorders in the CNS. In the early stages of the disease, recovery and recurrence occur in different ways. Focal neurological disorders and symptoms such as motor weakness, visual impairment, paresthesia etc. may develop.[1] The effects of demyelination are delaying or stopping nerve signal transmission, and prolonging immobilization.[2] In MS patient with or without optic neuritis, abnormal waves in the visual evoked potential (VEP) may be seen.[3]Unfortunately, early diagnosis of MS is difficult.[4,5] despite several methods of evalution.[6-7] Recently, progress made in the field of harmonizing diagnostic criteria and therapeutic measures.[8] Clinical diagnosis of MS has always maintained its high value, at the same time; some paraclinical diagnostic methods can also help diagnosing MS.[9] Magnetic resonance imaging (MRI), color vision, and VEP are non-invasive methods for diagnosing MS.[10,11] Using VEP helps diagnosing MS when clinical diagnosis and MRI criteria is inconclusive.[12] Visual evoked potential in MS patient is a diagnostic test that assesses the integrity of the visual pathway. In VEP test, visual stimuli were presented to the patient, while electrodes placed on the scalp measure the electrical activity generated by the visual pathway.[13] These electrical responses known as evoked potentials. In MS patient, demyelination of the optic nerves slows or disrupts transmission of visual signals. Using VEP detect these abnormalities by measuring the time taken for the signals to travel from the eye to the brain. Delayed or distorted VEPs may indicate optic nerve damage or the presence of MS-related lesions along the visual pathway.[14] Using VEP can provide information about the extent and severity of visual impairment in MS patients, even in cases where there are no obvious symptoms. A non-invasive and objective test can assist diagnosing MS, monitoring disease progression, and evaluating treatment effectiveness.[12,14] Using MRI is another essential way in diagnosing and managing MS patients. Using MRI provides images of the CNS, visualize MS-related lesions in the CNS. In the context of MS, MRI help diagnosis, monitoring disease activity, assessing treatment effectiveness, and predicting disease course.[15] Both VEP and MRI in MS diagnosis have complementary roles in assessing different aspects of the disease. They provide information about visual system involvement in different aspects of the pathology. While VEP evaluates functional abnormalities, MRI visualizes the structural changes in CNS.[16] Combining information from these tests provide a more comprehensive understanding of the disease and aid in treatment decision-making. For example, if a patient presents with visual symptoms and abnormal VEP findings, an MRI can be performed to detect MS-related lesions in the visual pathways. This combined information support diagnosis and guide treatment strategies. According to some reports, VEP as the only sensory evoked potential is more sensitive than MRI in detecting optic nerve demyelination. In patients without vision problem, the evoked potential of vision is impaired, which indicates involvement of this nerve pathway.[13-17] In this work, the evolving role of VEPs in the diagnosis of patients with MS discussed. The prevalence of abnormal VEPs increases with the likelihood of the diagnosis of MS even in those patients with no history of visual symptoms, and in many studies approaches 100% in patients with known optic neuritis, and also to compare the role of VEP to Brain MRI in diagnosing MS.

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Patients and methods

In a hospital based cross-sectional study, VEP is performed for forty eyes (twenty patients) with clinical diagnosis of MS or MS suspect regardless of age and gender in Shahid Aso Teaching Hospital from 1st Jun-15th august 2023. Each patient received ophthalmological examination of best-corrected visual acuity, checking intraocular pressure, checking for relative afferent pupillary defect, red color discrimination, anterior and posterior segment slit lamp examination. Patients with glaucoma, severe retinal disease and intracranial mass lesion are excluded. By using RETI-port/scan 21 electrophysiologic diagnostic system, pattern VEP 1,0 deg (M) and pattern VEP 15min (M) performed monocularly for both eyes of each patient at a distance of one meter, in a light adapted patient (photopic condition), after refraction correction for one meter of viewing distance and putting 3X EEG-Electrode at channel one, with impedance <10kOhm.For pattern VEP the variable of P100 latency in millisecond of more than 116 is consider as abnormal (prolonged) and for brain MRI evidence of at least one demyelinating plaque along the visual pathway considered as abnormal. The data was analyzed by SPSS statistical software after collection. The significant value for P is less than 0.05. The Kurdistan Higher Council of Medical Specialties Ethics Committee granted its ethical approval for this study at 26th November 2023, No (9).

Results

The patients in this study were in the age range of 18 to 54 years, and their average age was 34.75 with a standard deviation of 12.752. Since the P value was equal to 0.411, no significant relationship observed between the P100 latency on pattern VEP and age. 55% of the patients in this study were men and 45% of them were women. No significant relationship observed between the P100 latency on pattern VEP and gender, because the P value was equal to 0. 423.The table of brain MRI findings and VEP findings in all cases (20cases) given in Table (1). Brain MRI findings were observed in 10 cases (50%), and in the other 10 cases (50%), no brain MRI findings were observed. The P100 latency on pattern VEP was normal for 7 cases (35%) and prolonged in 13 cases (65%). From the 10 cases who, had finding on brain MRI, 8 cases had prolonged p100 latency on VEP, while 2 cases had normal VEP. From the 10cases who had no finding on brain MRI, 5 cases had prolonged p100 latency on VEP, and 5 cases had normal VEP.

Table (1): Table of brain MRI findings and VEP findings in all cases

Findings		frequency	
		Present	Absent
Brain MRI		10	10
VEP	Normal	2	5
	Prolonged	8	5

Moreover, there is a significant relationship at 0.01level between prolonged p100 latency on VEP and presence of finding on brain MRI. The table of presentation of the cases is given in Table (2); 16 cases (80%) related to optic neuritis and other presentation of MS, while 4 cases (20%) related to other presentation of MS without optic neuritis.

Table (2): Table of the presentation of cases

Presentation	Percentage (%)
Other presentation without optic neuritis	20
Optic neuritis & Other presentation	80

The number of cases with each presentation shown in Table (3); The most common presentation was related to optic neuritis, which includes 16 patients. The lowest presentation was belonged to internuclear

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ophthalmoplegia, which includes two patients.

Table (3): The number of cases shown with each presentation

Presentation	Frequency (N)
Optic neuritis	16
Sensory loss	9
Weakness	10
Internuclear Ophthalmoplegia	2
Bladder Symptom	4

The percentage of cases with optic neuritis that had prolonged p100 latency on VEP was 62.5%, while 43.75% of cases with optic neuritis had finding on brain MRI and 37.5% of cases with optic neuritis had both brain MRI finding and prolongation of P100 latency on VEP.

Seventy five percent (3cases) of the cases who had other presentation of MS without optic neuritis, had prolonged p100 latency on VEP or presence of finding on brain MRI, but the percentage of cases with other presentation without optic neuritis that had both finding on brain MRI and prolonged p100 latency on VEP 50%.

Discussion

The VEP has a high diagnostic value in multiple sclerosis patients with visual impairment, and even in cases where the patient does not have visual impairment, it can detect involvement of the visual system. Some authors have suggested that an abnormal VEP in a clinical context suggestive of MS is sufficient to classify the patient as definite MS. However, paying too much attention to this issue should not lead to neglecting other possible diagnoses that disturb the VEP. The present study was conducted to investigate the role of VEPs in the diagnosis of MS patients and also to compare the role of VEPs with brain MRI in the diagnosis of MS. The studied patients were in the age range of 18-54 years, and their average age was 34.75 years. Of the 20 patients studied, 11 were men and 9 were women, which was consistent with the studies of Sisto et al., who stated that the percentage of men was slightly higher than women.[18] In this study, 65% of multiple sclerosis patients had abnormal VEP, while in other studies, this rate varied from 70 to 85%.[19-20] Only half of patients with multiple sclerosis have abnormal brain MRI findings. 80% of patients with abnormal brain MRI findings have prolonged VEP. 50% of patients for whom abnormal brain MRI findings were not observed also have prolonged VEP. The patients studied in this study classified as cases of optic neuritis with other presentation 80% and cases with other presentation without optic neuritis 20%. Also, significant relationship was observed between history and P100 latency on pattern VEP. These findings were consistent with the studies of Sulejmanpasic et al., who reported that a significant relationship between history and VEP.[21,22] The number of cases with each presentation was analyzed for patients, which, included 16 with optic neuritis, 10 with weakness, 9 with sensory loss, 4 with bladder symptoms, and 2 with internuclear ophthalmoplegia has been reported. Javalkar et al. also reported same finding in agreement with the present study. From cases who had optic neuritis 62.5% had prolongation of p100 latency on VEP and 75% of cases without optic neuritis also had prolonged p100 latency on VEP.

Conclusion

Visual evoked potential as a paraclinical biomarker can be used to support the diagnosis of MS.

Acute optic neuritis or inflammation of the optic nerve in a significant number of cases will be a symptom of multiple sclerosis and the beginning of it, while some cases with multiple sclerosis have no visual problem but still have abnormal VEP finding. Most

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people having multiple sclerosis with or without optic neuritis have prolonged latency of p100 wave on pattern VEP.
Abnormal brain MRI was positively related with prolonging p100 latency onVEP.

Conflict of interests

There were no conflicts of interest.

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