



ORIGINAL RESEARCH ARTICLE

The abnormal bifid W-waveform visual evoked potential early indicated of demyelination optic neuritis is a primary sign of multiple sclerosis disease

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Abstract

Objective: Multiple sclerosis (MS) is the inflammatory demyelinating process resulting in the episodic neurological dysfunction, involvement of the retinal pathway in the form of optic neuritis. These are clinical causes of ophthalmic symptoms, such as the blurring of vision, impaired of vision, and some cases are silent and the visual evoked potential (VEP) may be beneficial if there is abnormality along the optic tract.

Methods: A total of 20 elected patients with MS compared with 15 healthy control groups. All groups in the present study conducted by the reversal pattern of VEP test for both eyes identify the N75-P100-N145 parameters and the percentage of the bifid W-waveform recorded in VEP.

Results: The VEPs study recorded the highly significant difference in comparing between the patients and the control group; we found the significant difference (<0.005) in latency of N75, P100, N145 and N75/P100 amplitude in both eyes. The bifid W-waveform of abnormal VEP recorded in 65% of patients, 45% of the patients had bifid changes in both eyes and 20% of patients had changes in the left eye. These changes of waveform ship had a significant relationship to loss of amplitude but not related to prolong of P100 latency.

Conclusion: The bifid W-shape waveform in abnormal VEP indication in early diagnosis the demyelination lesions of the optic pathway in patients with clinical and subclinical ophthalmic manifestation, a primary sign of MS diseases.

Keywords: Multiple sclerosis, Demyelination, Visual Evoked Potential, reversal pattern of visual evokedpotential, latency, amplitude, bifid W-waveform.

Introduction

Multiple sclerosis (MS) is a central nervous system (CNS) disorder, causes the damage of nerve fiber within characterized by a slowing of the neuronal signals by the inflammatory demyelinating process, thus, resulting in the episodic neurological dysfunction ultimately leads to relapses in its earlier course and subsequent progression over time¹ the changes of the inflammation are irreversible if the degenerative process starts. For this reason, there is an imperative to diagnose MS as early as possible², it starts in young adulthood, and a considerable burden for both the individual and the society³. The visual pathways are usually required in MS as an initial manifestation in the form of optic neuritis, or during the course of the disease.⁴ The MS is getting down with the ret-

inal pathway that can lead to clinically evident of ophthalmic manifestations, such as blurring of vision, impaired of vision, diplopia and nystagmus and to more frequent subclinical manifestations. The visual acuity is normal, but the patient reports blurred vision. In some cases, no ophthalmic symptoms are put down, merely by the examinations reported subclinical abnormalities.⁵ Evoked potentials (EP) are noninvasive functional neurophysiological methods that measure the sensory response of the CNS by the different external stimuli that have been used in MS especially in its early diagnosis^{6,7}.

The optic neuritis is an inflammatory disorder of the optic tract; it can be range from blurring of vision to a complete loss of vision. It involves a single eye or both eyes at the same time or one after another⁸. The characterization of the impaired visual functions in patients with MS typically presents with sudden monocular visual loss and eye pain more common in young adult women⁹,

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the optic nerve transmits sensory information through the neurons of the visual pathway to the visual area of the occipital cortex. Exposure to light stimulus causes the electrical signal in the nerve fibers inside the visual pathways—this is called the visual evoked potential (VEP). The VEP is extracted, amplified, filtered and then displayed as a characteristic VEP waveform¹⁰. The VEP, assesses visual pathway functional integrity of the retina to the occipital cortex by measuring the reaction times, amplitudes and symmetry of cortical responses to similar visual stimuli. Its high spatial resolution, however, is useful in assessing structural changes in the retinal layers arising from axonal loss and neurodegeneration¹¹.

The VEP is the method for assessing the vision, and is highly detected the inflammation of the retinal pathway from the optic nerve to the occipital cortex. The activation of the primary visual area in the cortex takes place from the optical domain. The VEPs recorded the abnormality within this pathway, including the eye, the retina, the visual nerve, optic radiations and occipital cortex¹². In the diagnosis of MS, the VEP is widely used as an objective indication of visual pathophysiological abnormality with one major limitation of this test is that the abnormality is not specific to MS, the rationale was to include for visual abnormality, which is evident to some demyelination of optic nerve rapidly¹³. The VEP is used in early diagnosis of MS. They are extremely sensitive to detect subclinical optic neuritis more than magnetic resonance, EPs are highly sensitive in revealing “silent lesions” especially at the beginning of MS and/or when no obvious neurological symptoms occur. The VEPs are used to assess the retinal pathway by the reversal pattern stimulus and may be affected by a variety of physiological factors, including age, sex, visual acuity and papillary size^{6,14}. The reversal pattern of VEP (PRVEP) is highly recognized to measure of the demyelination in the visual pathway, then magnetic resonance scanning¹⁵. Prolonged P100 latency has been accounted to be significantly in approximately 90% of patients with a clinical history of optic neuritis. It has been suggested that low amplitude of N75P100 and prolonged P100 latency reflects demyelination, and may be due to conduction blockage¹⁶. The PRVEP has proved to be useful for the construction of early MS in the diagnosis of the sub-clinical optic nerve demyelination¹⁷. The abnormalities of P100 bifid W-waveform shape present with two peaks separated by a 10–50 ms interval¹⁸. The PRVEPs averaged are the evidence of combine between the time and space accordingly, these reflected to abnormal distributed activation of the retinal pathway¹⁹ since it is beyond the upper limit of normal latency of P100 potential. The rule of reversal visual evoked responses having an abnormal waveform with P100 breaking up into two waves is recorded commonly in the diseases affecting the optic tracts for e.g., in MS¹⁹.

The aim of this written report to evaluate the distribution of the N75-P100-N145 latency abnormalities and bifid W-waveform with ophthalmic manifestation early

indicated to demyelination optic neuritis is a primary sign of MS disease.

Patients and visual evoked potential study

For the patients brought to neurophysiology for VEP with the principal diagnosis of MS, 20 patients elected to this study had documented signs and symptoms of MS by the neurologist, all elected patients notice of the impaired visual functions, a dimming of the visual sense, usually the color vision is involved and some patients with sore eyes; particularly, when move the optics. All the elected patients recorded positive finding in magnetic resonance imaging scanning of the brain or spinal cord.

About 20 elected patients with MS (11 women and 9 men) with an age of (37.0 ± 7.4) years) had the signs of optic neuritis compare with the 15 healthy control group were included (8 women and 7 men), with an age of (37.8 ± 2.9) years), the study was conducted during the period from January 2013 to the November 2014.

All groups in the present study conducted by Nicolet Biomedical VikingQuast Visual Evoked Potential system model 2004 with the help of 2015 visual stimulator, used selectable checkerboard 12 · 16 and used the white/black background/foreground with the red large static target. The distance between the patients and stimulator is 200 cm and used the PRVEP. In the PRVEP test, mono-ocular was done on one eye with the other eye covered with dark room, checking the impedance electrode start averaging till 250 stimulus repetition complete and stop automatically, the procedure was repeated for the other eye and identify the NPN parameters include the duration of the N75, duration of P100, duration of N145 (or distal latency of N75-P100-N145) of both eyes, the amplitude of N/P and the percentage of the bifid W-waveform recorded in VEP.

All statistical analysis was obtained using SPSS version 21.0 software. Information from each patient and control groups were compared using ANOVA tests, frequencies of descriptive statistic and mean \pm SD by comparing mean.

Results

The patients were enrolled in this study presented with ophthalmic manifestation of optic neuritis more than signs and symptom of MS, the diagnosis documented of MS later by a consultant neurologist and by the positive findings in magnetic resonance imaging scanning. The electrophysiological findings of VEPs study recorded highly statistically significant difference on compares between the elected 20 patients and the control group; we comprise the significant difference ($P < 0.005$) in latency of N75, P100, N145 and N75/P100 amplitude in both eyes.

The latency of P100 value is indicated for abnormal VEP more than other value, but the amplitude of NP value and the waveform shape give the indicator for the degree of demyelination optic nerve in the retinal pathway.

The bifid W-waveform of abnormal VEP recorded in 65% of patients, 45% of the patients had bifid changes in both eyes (Table 1) and 20% of patients had changes in the left eye. These changes of waveform ship had a significant relationship to loss of amplitude but not related to prolong of P100 latency.

Discussion

The optic nerve carries sensory information through the neurons of the visual pathway to the occipital cortex of the brain, the time from stimulus onset to the maximum positive deflection of the VEP waveform of referred to as the peak time, most constant VEP waves is the N75-P100-N145 complex. The VEP abnormalities include delayed peak times, reduced amplitudes and unusual waveform shape. The VEPs are associated statistically significant with the

increased the risk for developing MS. Because the VEPs suspected the optic neuritis lesion without identifying unsuspected lesions, it is not surprising that the MS predictive value with abnormal VEPs¹⁴.

This study showed that comparison was made between the patients with ophthalmic manifestation with expected to optic neuritis from MS and normal control group, we found high statistically significant difference in N75 latency, P100 latency, N145 latency and NP amplitude ($P < 0.000$) in both eyes with the [Figs. 1–4] show the comparison between elected patients to this study and control group, these findings similar or near to that of previous findings reported by other authors^{2,14,20} and the VEPs abnormality improved the ability to predict which MS suspects, but either author recorded patients with suspected MS with normal VEPs^{21–23}.

The demyelination of the optic neuritis causes low of VEP amplitudes, and bifid W-waveforms, which have the amplitude and analyses of the optic neuritis indicted to MS. The explores the capacity of bifid W-waveform VEPs given the detailed information about the inflammatory demyelination in the retinal tracts or optic neuritis, as it offers better sensitivity and specificity for diagnosis and the causes of blurred and import of the visual sense. The W-shape or bifid or superimposed quasi-sinusoidal sequences of negative–positive waves described in another author as identify the demyelination process. In this study, the bifid W-waveform of abnormal VEP recorded in 65% patients of ophthalmic manifestation in relationship with low amplitude and prolonged P100 latency. Because VEPs may simply support the presence of a clinically suspected lesion in the optic nerve, without identifying unsuspected lesions, Table 2 recorded the highly significant difference and high

Table 1 VEP parameter values

Parameter	Optic Neuritis Mean ± SD	Control Mean ± SD	P-value
Number	20	15	0.000
N75 right eye	95.0 ± 12.28	64.44 ± 6.28	0.000
N75 left eye	86.96 ± 8.61	68.16 ± 3.22	0.000
P100 right eye	140.90 ± 19.41	102.05 ± 2.49	0.000
P100 left eye	141.40 ± 25.62	101.84 ± 3.09	0.000
N145 right eye	204.60 ± 32.84	139.98 ± 4.87	0.000
N145 left eye	216.70 ± 45.06	139.78 ± 7.15	0.000
NPN amplitude right eye	4.15 ± 2.31	6.46 ± 0.49	0.004
NPN amplitude left eye	2.10 ± 1.43	5.79 ± 0.33	0.000

Table 2 Comprise of number of patient’s abnormality and bifid waveform with P100 latency and N/P amplitude

Parameter	Count & percentage		Right P100 latency Mean ± SD	Left P100 latency Mean ± SD	Right NP Amplitude Mean ± SD	Left NP Amplitude Mean ± SD
	Mild ophthalmic manifestation	7	35%	127.14 ± 4.87	128.28 ± 6.72	5.21 ± 0.49
Mild to moderate ophthalmic manifestation	7	35%	137.42 ± 4.39	132.0 ± 2.72	4.25 ± 1.85	2.12 ± 0.61
Moderate ophthalmic manifestation	6	30%	161.0 ± 24.78	167.66 ± 35.21	2.81 ± 3.31	0.80 ± 0.23
No bifid W-waveform VEP	7	35%	148.85 ± 31.86	155.42 ± 41.42	4.04 ± 2.51	2.71 ± 0.95
Bilateral eye bifid W-waveform VEP	9	45%	135.78 ± 5.02	133.11 ± 3.26	4.74 ± 1.88	1.73 ± 1.86
Right eye bifid W-waveform VEP	0	00%	0 00%	0 00%	0 00%	0 00%
Left eye bifid W-waveform VEP	4	20%	138.5 ± 7.51	135.5 ± 7.51	3.01 ± 3.00	1.87 ± 0.86

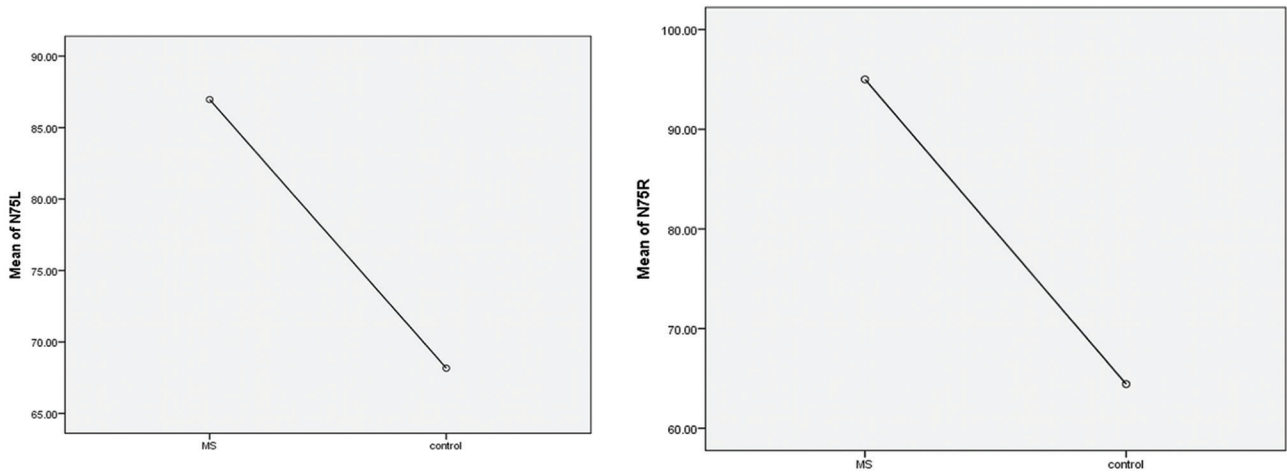


Figure 1 Means plots N75 latency.

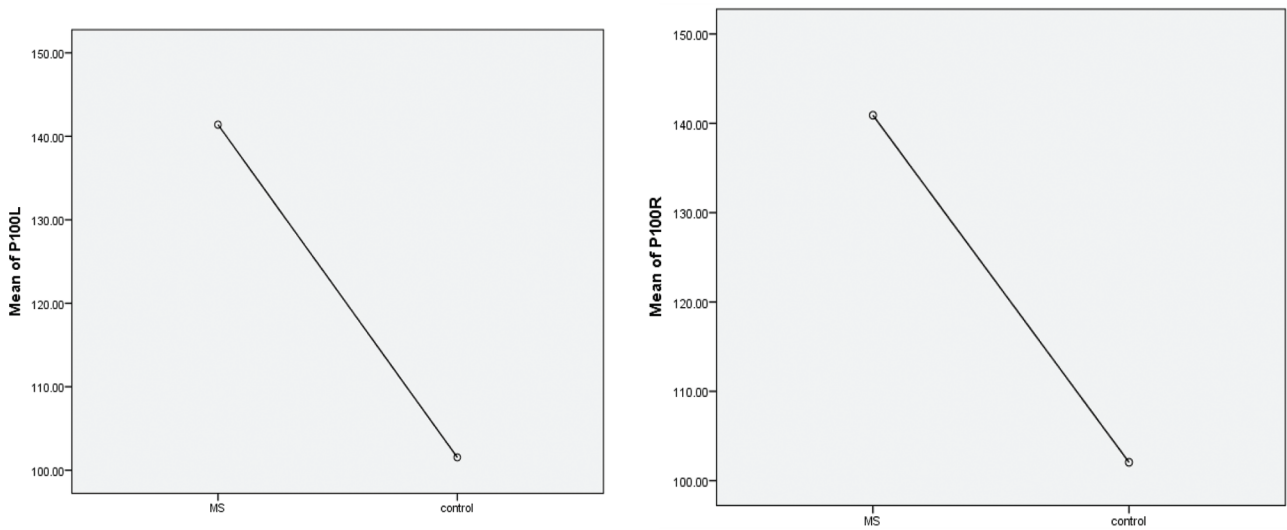


Figure 2 Means plots P100 latency.

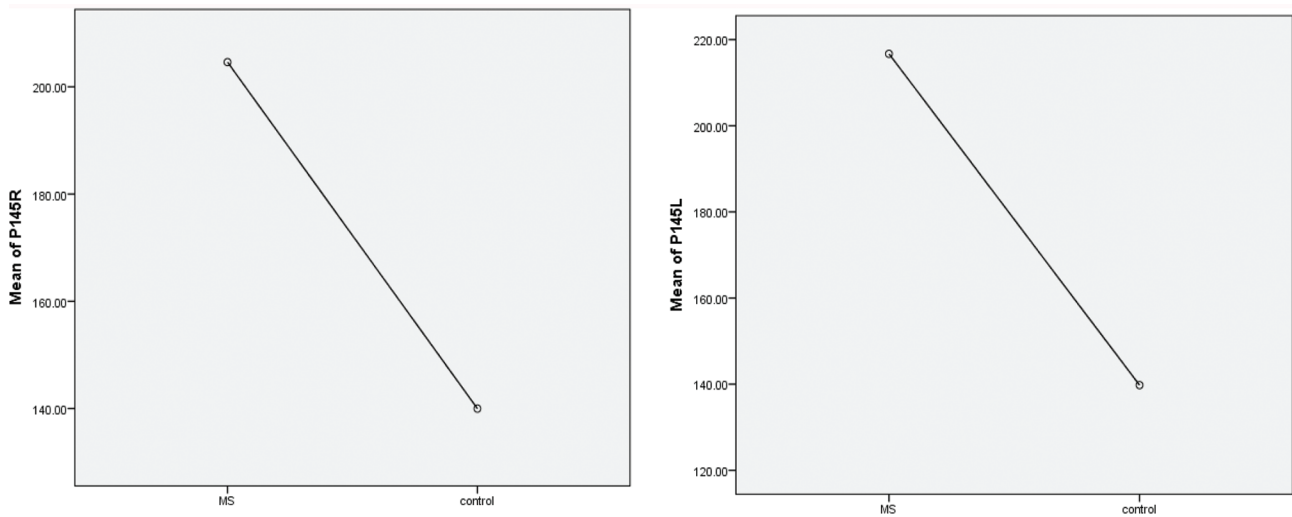


Figure 3 Means plots N145 latency.

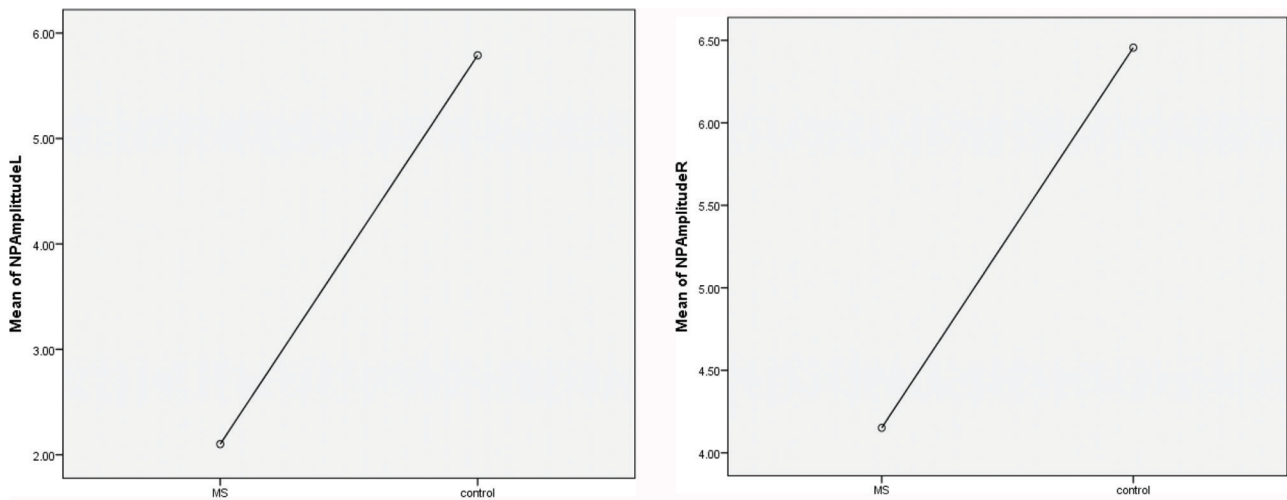


Figure 4 Means plots N75/P100 amplitude.

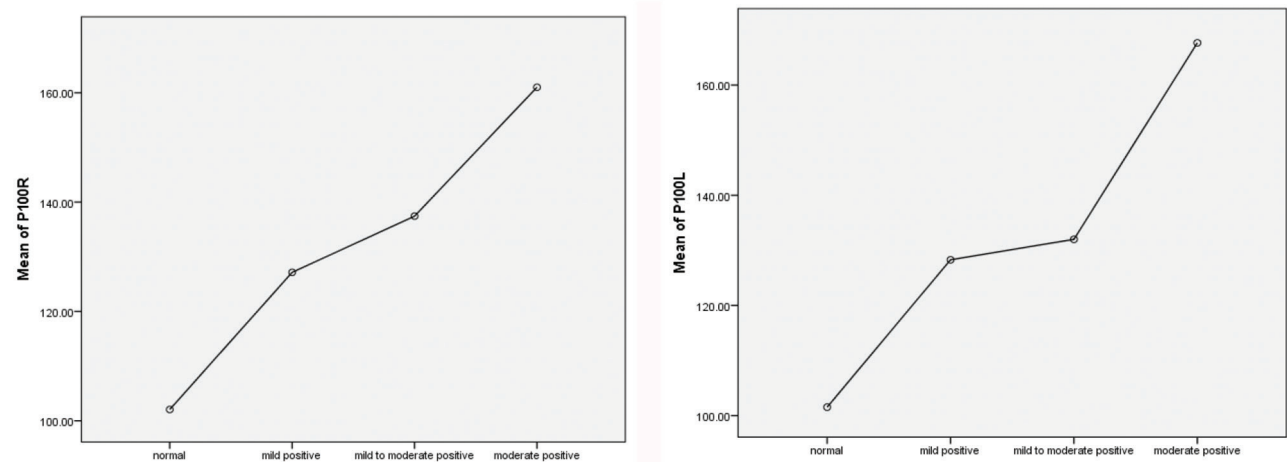


Figure 5 Means plots relationship between the severity and P100 latency.

relationship between the severity of ophthalmic manifestation and the prolonged P100 latency and NP amplitude. We establish a strong correlation between N75/P100 amplitude and a strong positive correlation of P100 latency with a severity of ophthalmic manifestation^{2,5,6}. (Fig. 5).

The bifid W-waveform is an aberrant response that is interpretation of the source of controversy may have significant of delayed P100 latency is reflecting to demyelination of optic tract a significantly indicator to MS not only the delayed in P100 latency a significant indicator the distortions in the VEP pattern, such as reflecting a bifid W-waveform pattern, but also a significant indicator for demyelination lesions in the optic tract indicative of MS^{19,24-26}. In obvious, clinically, the bifid W-waveform VEP can help to differentiate the optic nerve demyelination from other optic nerve diseases^{24,26}.

Conclusion and Recommendation

In early diagnosis, the bifid W-shape waveform in abnormal VEP indication, the demyelination lesions of an optic pathway in patients with clinical and subclinical ophthalmic manifestation are the primary sign of MS disease. The VEP indicated to follow up investigation monthly to exclude exaggeration of the optic neuritis and neurodegeneration complication and relationship with medication.

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