IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 6 Ver. III (June. 2016), PP 18-21
www.iosrjournals.org

Visual evoked potentials in Parkinson's disease and its correlation with age and disease severity: an Indian study

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Abstract: *Parkinson's disease (PD) is a progressive neurological disorder. While the motor symptoms pre-dominate the clinical picture of PD and define the Parkinsonian syndrome, many patients have other complaints that are classified as non-motor. Few studies have shown that visual impairment occurs as co-morbidity in old PD patients. They are not often discernible by regular clinical tests. With the help of the electrophysiological testing method – visual evoked potentials (VEP), this study enables to find out the subclinical involvement of visual pathway in those patients and to assess the correlation of VEP changes with age and disease severity. Thirty idiopathic Parkinson's disease patients were subjected to VEP testing and their results were compared with controls. The mean values of P100 wave latency of VEP in PD patients were 106.25 ± 7.31 and 108.86 ± 9.76 ms in the left and right eye respectively which were found to be significantly (P<0.001) prolonged when compared to controls. The N75 wave latency was also significantly prolonged in PD patients and the N75-P100 amplitude was significantly lesser in the patients compared to controls. With the help of this study, visual disturbances which are believed to be associated with decreased retinal dopamine in this disease can be diagnosed.*

Keywords: - *Parkinson's disease, P100 latency, VEP, Visual impairment.*

I. Introduction

Parkinson's disease (PD) is a disabling and progressive neurological disorder characterized by combination of the six independent, cardinal motor features: resting tremor, bradykinesia, rigidity, freezing, flexed posture, and loss of postural reflexes.[1] Early-onset and advanced PD creates economic problems for the healthcare system as well as long-term care providers. A study conducted in Kolkata, from 2003 to 2007 estimated that the prevalence rate of PD and annual incidence rate were 52.85/100,000 and 5.71/100,000 per year, respectively.[2]

While the motor symptoms pre-dominate the clinical picture of PD many patients have other complaints that are classified as non-motor. Visual symptoms are common in PD but remain under-reported, under-recognized, and poorly understood. Patients frequently feel impaired vision and difficulty in reading, inspite of normal visual acuity.[3] Many of these visual disturbances are believed to be associated with decreased retinal dopamine.[4] Although these symptoms have been noted in early-stage PD, they are not often discernible by regular eye tests and may increase in severity with disease progression.

II. Aim And Objectives

With the help of visual Evoked potential recording, this study was done to find out the subclinical involvement of visual pathway in Idiopathic Parkinson's disease and to assess the correlation of visual evoked potential changes with age of the patient and severity of the disease.

III. Materials and Methods

Study group:

A total of 30 Idiopathic Parkinson's disease patients of both the sexes with age group ranging from 34 to 73 years participated in this study. Patients of all stages of the disease were included and the average duration of disease ranged from 1to 6 years. All the patients were on treatment.

Control group:

30 age matched normal subjects without visual disorders, diabetes mellitus and those not on miotics and mydriatics were selected as control group.

Inclusion criteria:

Patients with clinical diagnosis of Idiopathic Parkinson's disease based on the United Kingdom Parkinson's Disease Society Brain Bank Clinical Diagnostic Criteria were included in the study group.[5] Disease staging was done according to Hoehn & Yahr staging system.[6] The patients were evaluated according to The Unified Parkinson's Disease Rating Scale (UPDRS).[7] This scale rates a patient on 31 different items, each with a score of 0 to 4. The rating scale covers three areas: mentation, behaviour and mood (4 items); activities of daily living (13 items); and motor examination (14 items).

Exclusion criteria:

Patients with Parkinson plus syndromes (Progressive supranuclear palsy, cortico-basal ganglionic degeneration, multiple system atrophy, diffuse lewy body disease, drug induced Parkinsonism) were excluded from the study. Patients with known diabetes mellitus, visual disorders like uncorrected refractive errors, glaucoma, retinopathies, other neurological diseases and those on miotics and mydriatics were also excluded from the study.

IV. Methodology

This is a cross sectional study conducted in the Institute of Physiology and Experimental Medicine, Madras Medical college after getting the approval from the Institutional Ethics committee. For both the study and control group after taking history and clinical examination, vision was assessed by testing visual acuity using Snellen's chart, field of vision by perimetry, colour vision by Ishihara's chart. The VEP testing was performed using RMS, EMG, EP – MARK II (Recorders Medicare System) machine. After cleaning the skin, Standard disc EEG silver – silver chloride surface electrodes were placed according to the 10-20 International system of EEG electrode placement [Active electrode (Oz) is placed 3cm above inion; Reference electrode (Fp_z) is placed 12cm above nasion; Ground electrode (C_z) is placed over the forehead]. [8]

Each eye was tested separately. The Patients were made to sit in a dark room at a .distance of 100cm from the black and white checkerboard pattern full field stimulus and asked to fix the gaze at the central red square while closing the other eye. The field size was 8^0,with 80% contrast, 20-40 cd/m2 Background luminance and 50 cd/m2 central luminance. The size of pattern was 8x8 min and stimulation rate was 1 Hz. The amplification range was 20000-1,00,000, sweep speed:350ms, sweep duration: 50 ms/D and sweep sensitivity:2μv. The filter range was 2-100Hz, number of epochs were 300 and the impedence was kept below 5KΩ.

The clinical interpretation of pattern VEPs is based mainly on the measurement of the P100 latency. The other parameters measured were N75 and N145 latency and N75-P100 amplitude. Statistical analysis was done using SPSS 7.5 for windows student version software. The data were analyzed using independent students t – test and p value <0.05 was considered as statistically significant.

V. Results

TABLE 1: Clinical assessment of Parkinson's disease patients

	Parkinson's disease patients
Duration of illness (Years)	3.33 ± 1.69
Hoehn & Yahr staging	2.05 ± 0.7
Unified Parkinson's disease rating scale score (UPDRS)	35.4 ± 11.04

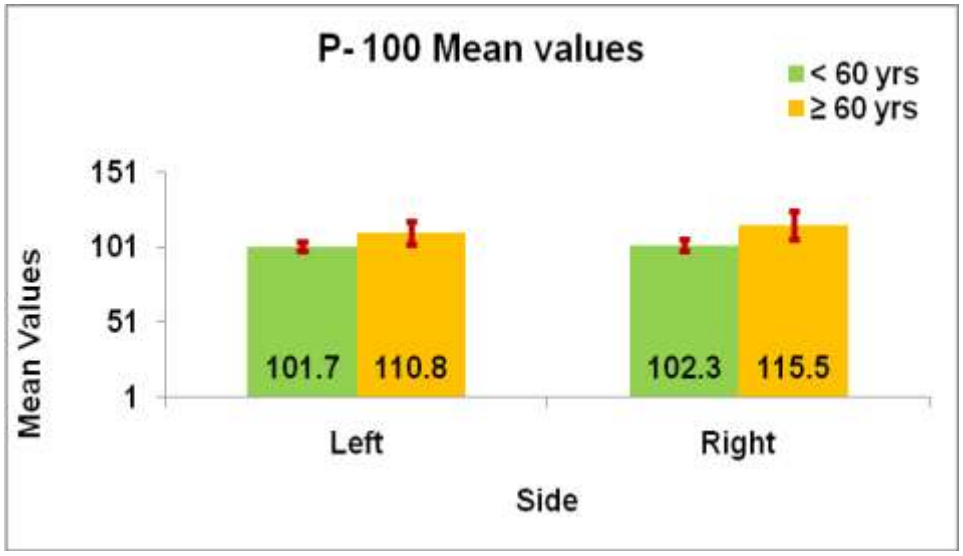
The VEP variables N75 latency and P100 latency were found to be significantly prolonged and the N75-P100 amplitude was significantly decreased in Parkinson's disease patients compared to the control group. The P100 latency was significantly prolonged in patients above 60 years of age when compared with patients below 60 years whereas there was no statistically significant difference in P100 latency between early disease group and advanced disease group.

TABLE 2: Comparison of mean ± S.D. of VEP variables between control and Parkinson's disease patients

VEP Variables	Control	Parkinson's Disease Patients	P value
N75 Latency			
Left eye	66.19±3.45	70.17±6.40	0.004*
Right eye	65.71±3.33	71.13±7.18	< 0.001*
P100 Latency			
Left eye	94.27±3.55	106.25±7.31	<0.001*
Right eye	94.07±4.10	108.86±9.76	<0.001*
N145 Latency			
Left eye	143.00±8.06	144.23±10.31	0.609

Right eye	141.36±8.09	145.71±9.51	0.061
N75-P100 Amplitude			
Left eye	5.69±1.93	4.19±1.60	0.002*
Right eye	5.63±2.04	3.83±1.47	<0.001*

*-Highly Significant (p value < 0.01)



P Value: Left eye - <0.001*Right eye-<0.001*

FIGURE 1: Comparison of P100 latency between <60 years and >60 years age group of Parkinson's disease patients (Mean latency in milliseconds)

TABLE 3: P100 latency between early & advanced Parkinson's disease patients

VEP Variable	Early disease (UPDRS Score:<35 Hoehn&Yahr stage:<2.5)	Advanced disease (UPDRS Score:>35 Hoehn&Yahr stage:>2.5)	P value
P100 Latency			
Left eye	106.0±8.929	106.5±5.558	0.879
Right eye	106.7±8.503	111.0±10.736	0.235

VI. Discussion

The significant P100 latency prolongation in PD patients found in this study is in agreement with the findings of MuneeraA.Al-Bunyan et al.[9] and Okuda B et al.,.[10] Nightingale et al., [11] also obtained significantly reduced N75-P100 amplitude in PD patients. The VEP abnormalities in PD could be due to retinal dopaminergic alteration, inner retinal layer thinning, reduction in the dopaminergic activity in the lateral geniculate body and visual cortex and a decrease in the metabolism in visual cortex. The P100 latency was significantly prolonged in PD patients above 60 years of age when compared to patients below 60 years which could be due to the synergistic effect of aging on the pathological process of the disease responsible for the VEP abnormality. There was no significant difference in P100 latency between early and advanced disease group. Thus VEP latency deterioration doesn't seem to proceed at the same rate as clinical deterioration.

VII. Conclusion

This study proves the involvement of visual pathway in patients with Idiopathic Parkinson's disease. Hence VEP study can be used as a screening test to diagnose the subclinical involvement of visual pathway which may help to reduce the morbidity of the disease. Further studies should be done to find whether there is any improvement in visual acuity following regular treatment with dopamine or other anti-Parkinsonian drugs in patients with Parkinson's disease.

Acknowledgements

We thank Prof. Dr. Boopathy, M.D, D.M, .Prof. Dr. K, Bhanu, DNB (Med) DM and Prof. Dr. Lakshmi Narasimman, M.D., D. M., Institute of Neurology, Rajiv Gandhi Government General Hospital, Chennai for their extreme support, guidance and encouragement for doing this study.

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