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Comparison of Visual Evoked Potentials and Perimetry Changes in Patients with Idiopathic Intracranial Hypertension

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Abstract

***Background*:** Idiopathic intracranial hypertension (IIH) is associated with visual loss in 25% of patients. Some studies point to frequent visual evoked potentials abnormality and its value in management of patients with IIH. Due to the lack of adequate research in this area, in the present study we assessed visual evoked potentials and perimetry changes in patients with IIH at admission and one month later.

***Materials and Methods*:** This cross sectional study was conducted on 30 patients with idiopathic intracranial hypertension. The diagnosis was confirmed according to Friedman and Jacobson criteria. Perimetry and visual evoked potentials were performed at admission and one month later. Results were analyzed by Independent *t*-test and χ^2 tests.

***Results*:** In this study, 27 (90%) of patients were female and the others were male. Perimetry abnormality was found in 24 (80%) patients at admission and 16 (53.3%) patients one month later. Also, visual evoked potential abnormality was seen in 7(23.3%) patients at admission and 5 (16.6%) patients one month later. There was no significant difference between mean waves' latency (P100, N75 and N135) with perimetry changes at admission and one month later ($p \leq 0.05$). P100 latency abnormality was more frequent in men at one month follow up ($p=0.009$).

***Conclusion*:** Visual evoked potentials abnormality is less frequent than perimetry abnormality at admission and one month later. So, visual evoked potential is less sensitive than perimetry for follow up of patients with IIH. Maybe, men are more prone to optic nerve damage.

Introduction

Increased intracranial pressure (ICP) is called idiopathic intracranial hypertension (IIH) or pseudotumor cerebri, when intracranial mass, obstructive hydrocephalus, intracranial infections, hypertensive encephalopathy and cerebral venous sinus thrombosis are excluded [1]. Annual incidence of IIH in general population and obese women of childbearing age is 1 to 2 and 19 to 20 per 100,000, respectively [2]. With the increasing obesity epidemic in the world, the incidence and prevalence of IIH is rising [3, 4]. Permanent visual loss due to optic nerve atrophy is the main complication and can be seen in 25% of patients [5, 6]. Due to the chronic course of the disease and the risk of delay visual loss, patients need to long term follow up [6, 7]. At now, perimetry is the usual method for evaluation of visual system in patients with IIH [8], but it can show this complication only in 58% to 87% of patients [9, 10] and many researchers want to find more sensitive methods, which among them Ocular Coherence Tomography (OCT) [11, 12] and Vascular Doppler sonography [13] can be noted. Visual evoked potential (VEP) is a sensitive and non-invasive method for evaluation of visual function that has been used for many years [14]. Some studies show VEPs abnormality in patients with IIH and point to its value in evaluation of visual dysfunction, for example, Rizzo et al. found that some IIH patients have abnormal prolonged P100 latency [15].

In another study, Falsini et al. confirmed VEPs abnormality at admission [16]. Also another study in Spain showed that these changes are present in acute and chronic period of IIH [17]. Due to the lack of adequate research in this field, we decided to evaluate the VEPs abnormality and its value in patients with IIH. Also, this is the first study that compared frequency of VEPs abnormality with perimetry abnormality simultaneously at admission and one month later in order to get better conclusion.

Materials and Methods

This is a cross sectional study on all 30 patients with IIH referring to Shafa hospital, Kerman from Oct 2011 to Sep 2012. The diagnosis was confirmed according to Friedman and Jacobson criteria [2]. All patients underwent MRI and magnetic resonance venography (MRV). If necessary, contrast media were used for diagnosis confirmation. Lumbar puncture was done for everyone and CSF pressure was more than 25 cm/H_2O with normal laboratory analysis. Also all patients were examined by an ophthalmologist and were excluded if there was suspicion of any eye disorder except

papilledema [18]. VEP performed by Nihon Kohden, made in Japan, using standard rout in method in neurology department of Shafa hospital in Kerman. To do this, patient sat in a dark side room in front of a monitor with 50 cm distance with one of her eyes covered. According to the international regulation 20-10, electrodes attached on Fz, Oz points and patient looked at the center of the monitor with the opened eye. Visual excited potential repeated twice for each eye separately to ensure of its reliability.

Delays of N75, P100 and N135 were measured. P100 latency was considered abnormal if there is not any wave, latency longer than 116 ms in each of eyes or a difference equal or more than 6 ms between two eyes [19]. Humphrey automated perimetry of visual field was performed by a skilled optometrist (5 years experience) using ZEISS (made in Germany) and, any disruption in the visual field was considered abnormal [12]. After IIH diagnosis, all patients treated with acetazolamide and one month later, VEPs and perimetry was performed with the same condition again.

The sample size in this study was calculated based on α=5% and with 90% study power. The presence of these patients in the study was with consent and ethics committee of Kerman University approved this study. To analyze the data, SPSS-17 statistical software and Independent *t*-test and χ^2 test were used. In this study, $p \leq 0.05$ was considered statistically significant.

Results

In the present study, 30 patients were evaluated. The age range was 20 to 52 years. Twenty seven (90%) of patients were female and the rests were male. At admission 24 (80%) patients had visual field defect at least in one eye in perimetry with mean P100 latency 115.76±5.12 and 6 (20%) patients had normal visual field in perimetry with mean P100 latency 107.30±1.50 (Table 1).

Comparison mean P100, N75 and N135 latencies with normal and abnormal perimetry did not show any statistically significant by using Independent *t*-test. Also, P100 latency was abnormal in 7 (23.3%) patients. Perimetry was abnormal in all patients with prolonged P100 latency. At admission no statistically significant was seen between normal and abnormal perimetry with normal and abnormal P100 by using χ^2 test (Table 2). At admission mean P100 latency in female was 113.90±8.08 and mean of P100 latency in male was 131.20±8.08 which this difference was not statistically significant. All 3 male patients had prolonged P100 latency. Also, at admission, 16 (53%) patients had CSF pressure less than 30 cm/H_2O, 12 (40%) patients had CSF pressure between 30 to 39 cm/H_2O and 2 (7%) patients had CSF pressure higher than 40 cm/H_2O. There was no significant difference between CSF pressure and P100 latency. In term of age, 17 (56.6%) patients were between 20 to 30 years and 13 (43.4%) patients were above 30 years. At admission, mean P100 latency was 120.00±6.85 and 108.60±2.7 respectively. There was no significant difference between P100 latency with age.

One month later, one of the female patients was excluded due to delay in coming to the follow up and study was continued with 29 patients. At this time, 16 (55%) patients had perimetry abnormality with mean P100 latency 111.70±5.12 and 13 (45%) patients had normal perimetry with mean P100 latency of 104.41±1.50 which comparison of P100 latency was statistically significant between two groups (Table 1). There was no significant difference between perimetry with normal and abnormal P100 latency (Table 2). At one month later, mean P100 latency in female was 107.10±4.41 and mean P100 latency in male was 119.96±5.95 which this difference was statistically significant (p=0.009). Mean P100 latency in 20 to 30 years old patients and above 30 years was 110.30±2.18 and 106.14±2.1 respectively. Comparison of mean P100 latency in these groups did not show any significant difference.

Table 1. Comparison of mean VEPs and perimetry at admission and one month later

Perimetry	On admission		*p*-Value	One month later		*p*-Value
	Normal	Abnormal		Normal	Abnormal	
Number (%)	6 (20)	24 (80)	-	13 (45)	16 (55)	-
Mean P100	107.30±1.50	117.76±5.12	0.102	104.41±1.50	111.70±5.12	0.019
Mean N75	77.42±1.29	85.85±3.54	0.08	77.89±1.30	84.10±2.88	0.09
Mean N135	153.00±6.84	156.60±5.47	0.7	145.93±3.64	149.27±3.27	0.5

Table 2. Comparison of frequency of abnormal P100 cases and perimetry results at admission and one month later

Perimetry		On admission		*p*-Value	One month later		*p*-Value
		Normal N (%)	Abnormal N (%)		Normal N (%)	Abnormal N (%)	
P100	Normal	6 (20)	17 (57)	0.131	13 (45)	11 (38)	0.220
	Abnormal	0 (0)	7 (23)		0 (0)	5 (17)	
	Total	6 (20)	24 (80)		13 (45)	16 (55)	

Discussion

Our findings show that some of IIH patients have VEPs abnormality not only at admission (23.3%) but also at one month later (16.6%). This finding is almost as same as the results of researches in other countries.

Kesler et al. evaluated 20 patients and found that 55% of their patients had abnormal VEP in chronic phase of disease [20]. Undoubtedly, one reason for variety of results in those articles, is related to time of VEPs doing [16, 20].

Verplank et al. reported abnormal VEP in 5 (17%) eyes of 30 eyes in the acute phase of IIH [21], and Sorensen et al., reported abnormal P100 latency in 4 (30.7%) patients (total patients were 13) at admission which this difference was statistically significant [22].

Similar to our study, Sureda et al. study showed that 25% of patients with IIH had VEP abnormality and mean P100 latency was prolonged [17]. However, there are studies that have reported higher frequency of VEPs abnormality. For example, Falsini et al. reported VEPs abnormalities in 10 (55%) patients with IIH [16]. Also, frequency of perimetry abnormality in our study was as same as the other studies. At admission 80% and after one month 53.3% of our patients had abnormal perimetry which these finding were as same as (58-87%) results in other studies [9, 10, 12, 23]. VEPs abnormality was far less frequent than perimetry abnormality, both at admission and in one month later, and this result was the main finding of our study.

In other words, this finding indicates that VEPs is less sensitive than perimetry in IIH patients fallow up. Although previous studies had reported low frequency of VEPs abnormality [16, 17, 20-22] but, this is the only study that simultaneously compared these 2 methods at admission and one month later and according to our findings VEPs do not have sensivity as same as perimetry sensitivity in initial evaluation and follow up of patients with IIH, a finding that also Wall points to it in the USA [24]. Some previous studies reported P100 latency prolongation before decreased visual acuity or visual fields defect in perimetry in some patients with IIH [17, 21, 22].

Therefore it should be noted that although VEP is less sensitive than perimetry, but it maybe have prognostic value. Also, our results show that mean P100 latency was significant after one month but these finding do not have any clinical significance. In term of sex, 3 (10%) of our patients were male. At now, the main cause of visual impairment and finally changes in perimetry and VEPs is not clear [25]. A recent large study confirms that only about 9% of patients with IIH are males. This study also showed that men with IIH are twice more likely to have severe visual loss [26]. Obstructive sleep apnea and sex hormones may have a role in the pathogenesis of IIH in men [27]. At one month follow up, P100 latency prolongation was seen in all male patients. This difference was statistically significant. This finding may show that men are more prone to optic damage than women. However, this result should be noted with caution because in our study, we have only 3 male patents. Two main hypotheses are dysfunction in axonal transfer and optic nerve ischemia [24]. Some other factors such as inflammation or demyelination of the optic nerve have role in IIH pathogenesis [5, 20]. The main limitation of our study was short term follow up. According to long course of IIH, we think, that the length of follow-up is important in identifying the value of VEPs. In conclusion, visual evoked potentials abnormality is less frequent than perimetry abnormality at admission and one month later. So, visual evoked potentials are less sensitive than perimetry for follow up of patients with IIH.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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