

– Abstract –

VEP Pattern in Brain Injured Patients According to the Involvement of Visual Pathway

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Objectives: The purpose of this study is to investigate the VEP patterns and its clinical usefulness in assessing the involvement of visual pathway.

Methods: Twenty-eight patients (17 men and 11 women) who complained of decreased visual acuity after brain injury were investigated. There were ten patients with hemorrhagic stroke, eight with cerebral infarction, and ten with traumatic brain injury. The control group were twenty-five adult without ophthalmologic problem and neurologic abnormality. On the basis of the findings of brain CT and MR images, the patients were divided into two groups with the lesion on visual pathway (n=8) or without that (n=20). Full-field VEP study with the stimulation of pattern reversal and recording at Oz (center of occiput) and 5 cm lateral to Oz (O1, O2) were performed. P100 latency and N75-P100 amplitude were obtained and compared between groups.

Results: There was no difference in visual acuity between the patients with visual pathway involvement and patients without involvement. The patients with visual pathway involvement showed significantly prolonged P100 latency compared with the control group ($p < 0.01$) and the patients without visual pathway involvement ($p < 0.05$).

Conclusion: In patients who have decreased visual acuity after brain injury, VEP can be helpful to detect whether visual pathway is injured or not.

Key Words: VEP, Brain injury, Visual pathway

(lateral geniculate body)

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(calcarine sulcus) 가

가

2 1981 York 3

VEP N2

1994 Papathana

VEP

가

sopoulos 4

VEP가

1997 Sobolewski 5

가

VEP 가 VEP

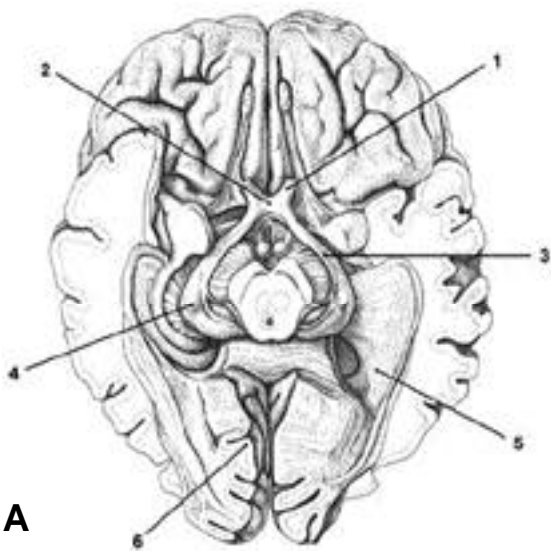


Fig. 1. A. Visual pathway. 1) optic tract 2) optic chiasm 3) optic nerve 4) lateral geniculate body 5) optic radiation 6) visual cortex
B. MRI image of the patient with involvement of thalamus

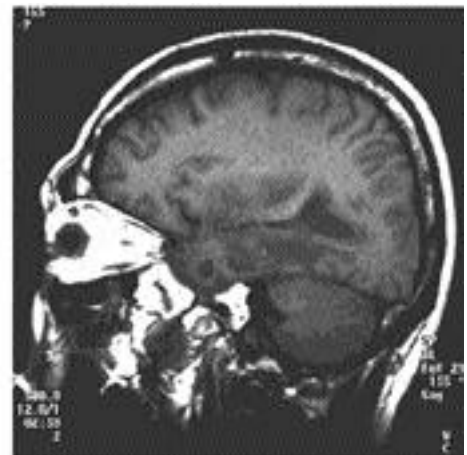
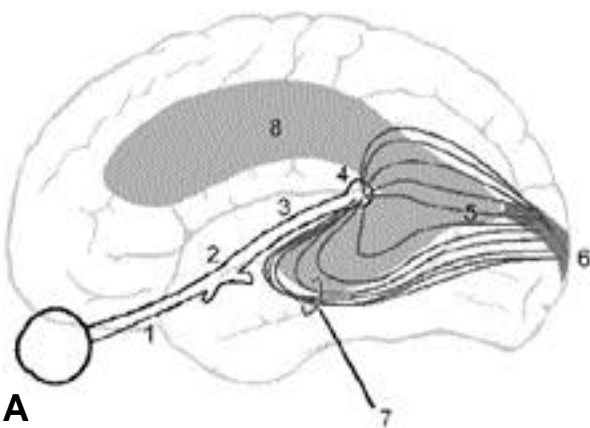


Fig 2. A. Visual pathway. 1) optic tract 2) optic chiasm 3) optic nerve 4) lateral geniculate body 5) optic radiation 6) visual cortex
 7) Meyer's loop 8) lateral ventricle
B. MRI image of the patient with involvement of optic radiation

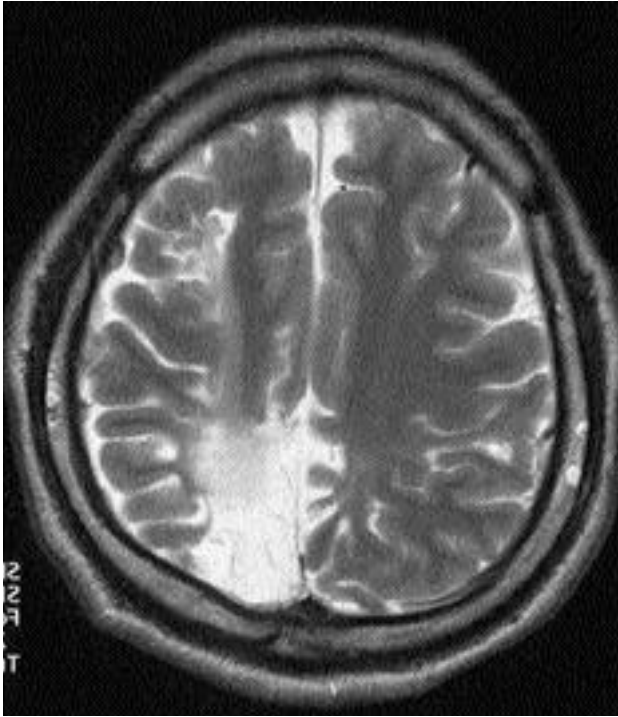


Fig. 3. MRI image of the patient with involvement of optic cortex

1.
 2001 3 8
 28
 가 17 , 가 11 45.0±14.5 10
 , 8 , 10
 25
 (44.9±14.4)
 2.
 VEP Nicolet Viking IV
 (Oz) 5 cm
 (O1, O2) 90 cm
 11 가

Table 1. Visual Acuity of the Control Group and the Patient Group

	Left eye	Right eye
Control group	1.05 ± 0.21	1.09 ± 0.20
Patient group	0.52 ± 0.20*	0.49 ± 0.19*
With intact visual pathway	0.57 ± 0.25	0.53 ± 0.23
With injured visual pathway	0.42 ± 0.14	0.43 ± 0.14

Values are mean ± standard deviation.

* p value < 0.05

Table 2. VEP Results of the Control Group and the Patient Group

	Control group		Patient group	
	Left eye	Right eye	Left eye	Right eye
P100 latency (ms)				
O 1	101 ± 4.94	101 ± 6.02	104 ± 7.87	103 ± 7.51
O z	101 ± 5.97	101 ± 6.86	105 ± 7.33	105 ± 7.12
O 2	101 ± 5.99	101 ± 5.63	104 ± 7.14	104 ± 6.61
N75-P100 amplitude (µV)				
O 1	5.18 ± 1.11	5.22 ± 1.08	5.02 ± 2.33	5.03 ± 1.94
O z	5.83 ± 1.05	5.93 ± 1.08	5.89 ± 2.28	5.50 ± 1.93
O 2	5.08 ± 1.04	5.34 ± 1.06	5.40 ± 2.61	5.18 ± 2.07

*Values are mean ± standard deviation

Table 3. VEP Results of the Patient Group According to the Involvement of Visual Pathway

	Involvement (+)		Involvement (-)	
	Left eye	Right eye	Left eye	Right eye
P 100 latency (ms)				
O 1	109 ± 3.50*	108 ± 3.30	101 ± 5.18	100 ± 5.63
O z	110 ± 3.45*	109 ± 4.47	103 ± 6.39	103 ± 6.60
O 2	108 ± 3.64*	108 ± 3.93	102 ± 6.34	101 ± 5.59
N75-P100 amplitude (µV)				
O 1	4.73 ± 1.93	4.90 ± 2.22	5.13 ± 2.44	5.08 ± 1.85
O z	5.35 ± 1.73	5.78 ± 2.10	5.82 ± 2.42	5.39 ± 1.86
O 2	4.97 ± 2.19	5.20 ± 1.89	5.58 ± 2.72	5.17 ± 2.13

Values are mean ± standard deviation

* p value < 0.05

Table 4. Sensitivity and Specificity of VEP in Detecting Visual Pathway Involvement

	2 SD	1 SD
Sensitivity (%)	50	87.5
Specificity (%)	80	50

2. VEP
P100 O1, Oz, O2가
101±4.94, 101±5.97, 101±5.99 ms,
101±6.02, 101±6.86, 101±5.63 ms
104±7.87, 105±7.33, 104±7.14
ms, 103±7.51, 105±7.12, 104±6.61 ms
P100 가

N75-P100
(Table 2).

3, (Fig. 2) 3, (Fig. 3)
2
가 P100 N75-
P100 Mann-Whit
ney U test

3. P100
가 P100
109±3.50, 110±3.45, 108±3.64 ms,
108±3.30, 109±4.47, 108±3.93 ms
가 (101±5.18, 103±6.39,
102±6.34 ms, 100±5.63, 103±6.60, 101±
5.59 ms)
(p<0.05, Table 3).

1. 1.09±0.20
0.20, 0.49±0.19
가 0.53±0.23 가
0.42±0.14, 0.43±0.14)
(Table 1).

4. N75 - P100
가 N75-P100
4.73±1.93, 5.35±1.73, 4.97±2.19 ms,
4.90±2.22, 5.78±2.10, 5.20±1.89 ms
가 (5.13±2.44, 5.82
±2.42, 5.58±2.72 ms, 5.08±1.85, 5.39±

1. Suchoff IB, Kapoor N, Waxman R, Ference W: The occurrence of ocular and visual dysfunctions in an acquired brain injured patient sample, *J Am Optom Asso*, 1999; 70(5): 301-308
2. Shahrohki F, Chiappa KH, Young RR: Pattern shift visual evoked response, Two hundred patients with optic neuritis and/or multiple sclerosis, *Arch Neurol*, 1978; 35: 65-71
3. York DH, Pulliam MW, Rosenfeld JG, Watt C: Relationship between visual evoked potentials and intracranial pressure, *J Neurosurg*, 1981; 55(6): 909-916
4. Papathanasopoulou P, Konstantinou D, Flaburiani K, Bezarianos A, Papadakis N, Papapetropoulos: Pattern reversal visual evoked potentials in minor head injury, *Eur Neurol*, 1994; 34(5): 268-71
5. Sobolewski P, Stankiewicz A: Evaluation of visual evoked potentials in partial optic nerve atrophy, *Klin Oczna*, 1997; 99(5): 299-302
6. Chiappa KH: Pattern-shift visual evoked potentials. In: Chiappa KH editor, *Evoked potentials in clinical medicine*, second edition: New York, Raven Press, 1988, 111-154
7. Marg E, Freeman DN, Pelzman P, Goldstein PJ: Visual acuity development in human infants, *Invest Ophthalmol*, 1976; 15: 150-153
8. Kupersmith MJ, Weiss PA, Carr RE: The visual evoked potential in tobacco-alcohol and nutritional amblyopia, *Am J Ophthalmol*, 1983; 95: 307-314
9. Grant DB, Hertle RW, Quinn GE, Breton ME: The visual evoked response in infants with central visual impairment, *Am J Ophthalmol*, 1993; 116: 437-443
10. Regan D: Evoked potentials specific to spatial patterns of luminance and color, *Vision Res*, 1973; 13: 2381-2402
11. Skaft B, Eizinman M, Katz LM, Bachynski B, Klein R: A new VEP system for studying binocular single vision in human infants, *J Pediatr Ophthalmol Strabismus*, 1993; 30: 237-242
12. Monnier M: Retinal, cortical and motor response to phonic stimulation in man, *J Neurophysiol*, 1952; 15: 469
13. Cobb WA, Morton MB, Ettlenger G: Cerebral potentials evoked by pattern reversal and their suppression in visual rivalry, *Nature*, 1967; 216: 1123-1125