AKADEMIJA NAUKA I UMJETNOSTI BOSNE I HERCEGOVINE
АКАДЕМИЈА НАУКА И УМЈЕТНОСТИ БОСНЕ И ХЕРЦЕГОВИНЕ
ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA

RADOVI

KNJIGA XCIII

Odjeljenje medicinskih nauka

Knjiga 33

Centar za medicinska istraživanja

Knjiga 3

SARAJEVO 2004

VISUAL AND AUDITORY EVOKED POTENTIALS IN MULTIPLE SCLEROSIS, PARKINSON'S DISEASE AND BRAINSTEM VASCULAR LESIONS

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Abstract

The aim of this study was analysis of abnormality of visual (VEP) and auditory evoked potentials (AEP) in patients with multiple sclerosis, Parkinson's disease (PD) and brainstem vascular lesions (BSVL). The study included 29 patients with MS (10 males or 34.5%, 19 females or 65.5%) with the mean age of 39.2+/-10.6 years; 59 PD patients (33 or 55.9% males and 22 or 44.1 % females) with average age of 63.79+/-7.97 years, and 40 patients with BSVL (22 males or 55.0%, 18 females or 45%) with mean age of 53.5+/-12.0 years. Evoked potentials were done using «Premier» machine («Medelec» company) and disc electrodes placed over the scalp according to international 10-20 electrodes placement. Visual stimulus «pattern reversal» for VEPs and auditory stimulus «click» type for AEPs was chosen. All analyses were performed in Division of Clinical Neurophysiology (Lab for EPs), Department of Neurology, University of Tuzla, and obtained parameters were compared with laboratory standards. In MS patients VEP abnormalities were found in 27 (93.1%), and AEP in 24 (82.8%) of them; the VEP abnormalities in PD patients were found in 29 (49%), and AEP in 32 out of 41 (78.1%) cases; in the BSVL patients AEP abnormalities were found in 37 (92.5%) cases. It is concluded that different abnormalities of visual and auditory evoked potentials in multiple sclerosis, Parkinson's disease and brainstem vascular lesions are common findings in routine clinical neurophysiology testing, and very important for diagnostics and evaluation of these disorders.

Key words: Multiple sclerosis - Parkinson's disease – Brainstem vascular lesions - Visual evoked potentials – Auditory evoked potentials

Introduction

Evoked potentials (EPs) are the electric responses of the nervous system (cortical response) to motor or sensory stimulation. Pattern-shift visual, brain stem auditory and short-latency somatosensory evoked potentials are reliable diagnostic tests that yield reproducible results today in routine clinical practice (fig. 1). These tests provide sensitive, quantitative extensions of the clinical neurological examination. They primarily afford numerical data, but

sometimes the absence of wave or an abnormal configuration of its potentials also provides useful information (1-2).

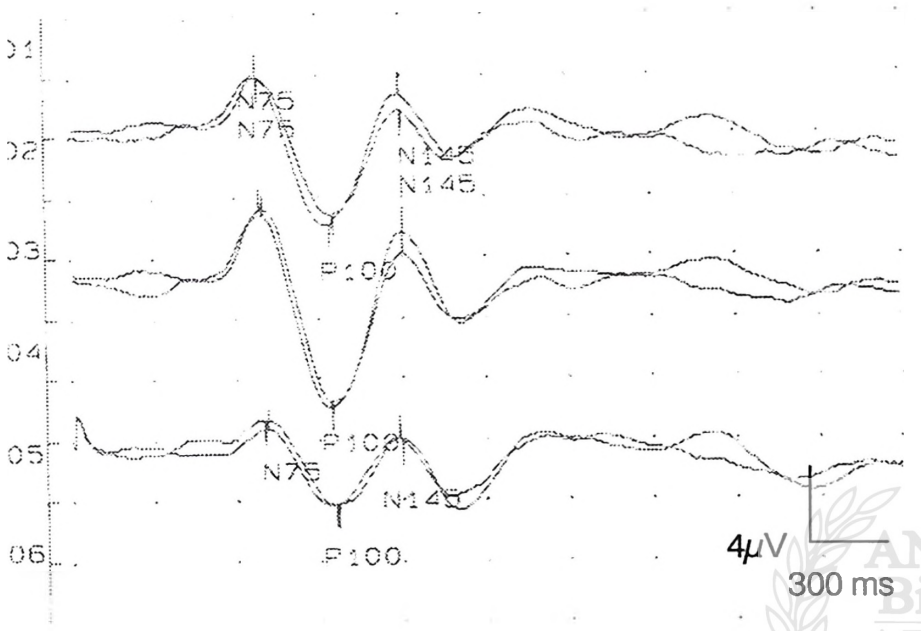

Figure 1. Normal visual evoked potentials

The numerous disorders have been shown to have different abnormalities of VEPs and AEPs, and among them multiple sclerosis (MS), Parkinson's disease (PD) and brainstem lesions (1-3). However, they are most often used in providing additional evidence in support of diagnosis of MS (4).

Aim of this study was analyze abnormality of visual (VEPs) and auditory evoked potentials (AEPs) in patients with MS and PD, and abnormality of AEPs in patients with brainstem vascular lesions (BSVL).

Patients and Methods

Visual evoked potentials (VEPs) were recorded in 59 Parkinson's disease (PD) patients (33 or 55.9% males and 22 or 44.1% females) with average age of 63.79+/-7.97 years, and in 29 patients with multiple sclerosis (MS)(10 males or 34.5%, 19 females or 65.5%) with the mean age of 39.2+/-10.6 years.

Auditory evoked potentials (AEPs) were recorded in 41 PD patients (25 or 58.5% males and 16 or 41.5 females) with average age of 62.76+/-7.92 years, 29 MS patients and 40 patients with brainstem vascular lesions (BSVL)(22 males or 55.0%, 18 females or 45%) with mean age of 53.5+/- 12.0 years. Diagnostics of these conditions included typical anamnesis and clinical features, brain CT scan for all, and MRI for MS patients.

Patients were selected on consecutive way from database of Neurophysiology lab, Department of Neurology, University Clinical center Tuzla in last two years of work.

Evoked potentials were performed using «Premier» machine («Medelec» company) with pattern-shift stimulation for VEPs and click to an audiologic earphone for AEPs and fixation of 10-20 electrodes according to international system standardizing. All analyses were performed et Division of Clinical Neurophysiology (Lab for EPs), Department of Neurology, University Clinical Center Tuzla, and obtained parameters were compared with laboratory standards. Patients were selected on consecutive way from Lab database in last two years of work.

Results and Discussion

Multiple sclerosis

Multiple sclerosis is the most common form of central demyelination. It is a disease of unknown etiology, but immunulogically mediated, characterized pathologically by widespread occurrence in the central nervous system of patches of demyelination followed by gliosis. Clinically, dissemination of lesions in time and space are the characteristics of the condition (1). Evoked potentials (EPs) are very useful in establishing evidence of subclinical disease in pathways not known to be affected, so contributing to the clinical criteria of disease disseminated in time and space.
They are also useful in evaluation of clinical course during time and treatment (2), and can provide not only diagnostic but also prognostic information during evaluation of MS patients (5-6).

From 29 MS patients analysed in this study in only two VEPs were normal, and in 27 (93.1%) there were different VEPs abnormalities and mainly prolongation of P100 latency (tab.1)(fig.2)

Table 1. Visual evoked potentials abnormalities in patients with multiple sclerosis

Type of abnormalities	N	%
Normal finding	2	6.9
Prolongation of P 100 latencies	23	80.3
Decreased amplitude	4	13.8
Total	29	100.00

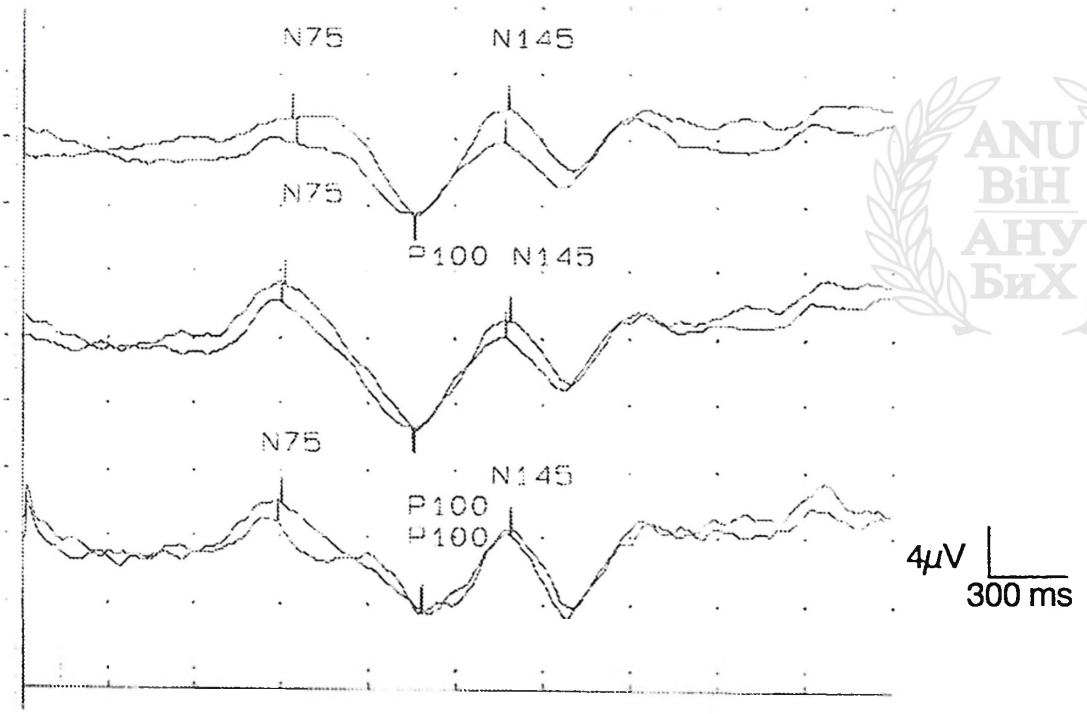

Figure 2. Prolongation of P100 latency in patient with multiple sclerosis

Abnormal VEP parameters in MS patient are typical finding in MS patients, and incidence of VEP abnormalities ranges from a high 96% to a low 47% (fig. 3)(2,5). According to Chiappa and Hill (2), in 26 clinical series, published in seventies and early eighties, encompassing about 1950 patients with all MS classifications, the average abnormality rate found was 63%.

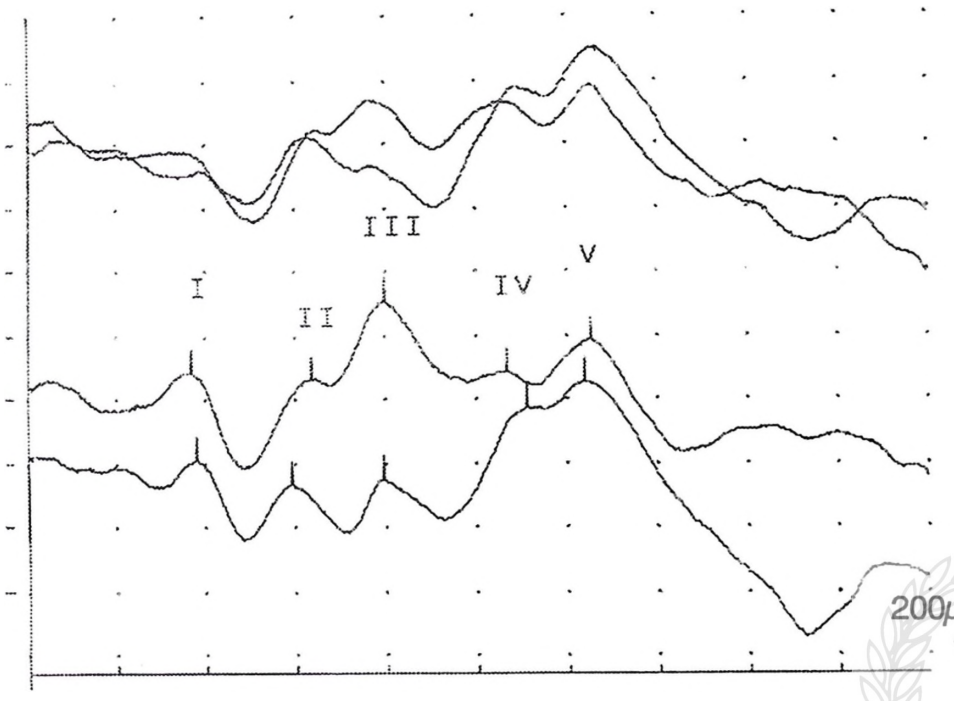

Figure 3. Abnormality of auditory evoked potentials in patient with multiple sclerosis

Of 464, 322, and 799 patients classified as possible, probable, and definite MS, the average abnormality rates were 37%, 58%, and 85%, respectively. P100 latency abnormalities are usually present, as it is in our study (prolongation of P100 latency was in 80.3%)

In case of AEPs, normal finding was recorded in five and different abnormalities in 24 (82.8%) out of 29 examined MS patients. Most frequent findings were absence or marked reduction of V wave amplitude (24.1%) and prolongation of inter-peak III-V latencies (20.7%)(tab.2).

Table 2. Auditory evoked potential abnormalities in patients with multiple sclerosis

Type of abnormalities	N	%
Normal finding	5	17.3
Decreased amplitude of I-V waves	5	17.3
Absence of IV and V waves	4	13.8
Absence or marked reduction of V wave amplitude	7	24.1
Prolongation of latencies for I-V waves	1	3.4
Prolongation of latencies for II-V waves	1	3.4
Prolongation of inter-peak III-V latencies	6	20.7
Total	29	100.0

There has been a large number of studies of AEPs in patients with MS. Of 1006 patients with varying classifications of MS from some of these studies in eighties, 466 (46%) had abnormal AEPs. Of 351, 180, and 206 patients classified as definite, probable, and possible MS, the average abnormality rates were 67%, 41%, and 30%, respectively. Differences in definitions of MS (and diagnostic criteria), patient populations, and techniques account for the variations between studies (2). In our study all MS patients were with definite diagnosis confirmed with MRI.

Parkinson's disease

Parkinson's disease is the most common movement disorder characterized by slowness of emotional and voluntary movement (bradykinesia, muscle rigidity), tremor and disturbances of postural mechanisms. The diagnosis of PD is easy task and usually made as the patient walks into the consulting room. EPs are not useful in establishing diagnosis but may be useful in evaluation of disease course (2,7)

In this study completely normal VEPs were recorded in 29 (49%), and different abnormalities in 30 (51%) PD examined patients. The prolongation of the P100 latency was present in 13 (22%), and reduction of NPN

complex amplitudes in 16 (27%) PD patients, and in one case (2%) NPN complex was absent (tab. 3)(fig. 4).

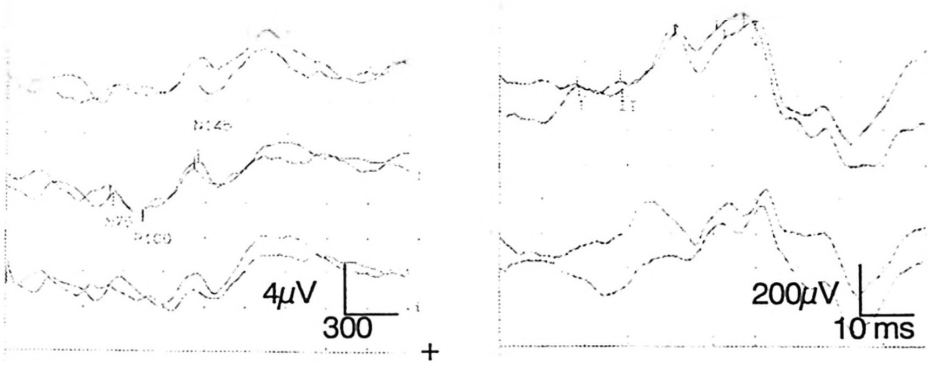

Figure 4. Abnormalities of VEPs (a) and AEPs (b) in patients with Parkinson's disease

Although there has been some debate regarding abnormalities in VEPs in PD, according to majority of reports, the most common VEP abnormality in PD is an increase Pl00 latency (1-2,7-8). Okuda et al. (1995) found significant prolongation of P100 latency in PD with dementia comparing with PD patients without dementia.

Table 3. Visual evoked potentials abnormalities in Parkinson's disease patients

Type of VEP abnormalities	N	%
Normal finding	29	49.1
Decreased amplitudes of NPN complex	16	27.1
Prolongation of P 100 latency	13	22.0
Absence of NPN complex	1	1.8
Total	59	100.0

(n=59)

In an evoked potentials (EPs) comparison (auditory endogenous event-related potentials and flash visual evoked potentials) O'Mahnoy et al. (8) did not found significant EPs difference between the Alzheimer's dementia and PD dementia, except for shorter flash VEP N1 latency. Furthermore, prolongation of P 100 latency has been found even in the early stage of PD (7,9).

AEP which were recorded in 41 PD patients, were completely normal only in 9 (21.9%), but in other 32 (78.1%) different abnormalities were presented: the reduction of amplitudes of all waves were present in 17 (41.5%)(in 13 as isolated finding); absence of waves IV and V in 4 (9.8%); absence or amplitude reduction of wave V in 5 (12.2%); prolongation of latencies for all waves in 2 (4.9%); prolongation of latencies for waves II-V in 8 (19.6%), and prolongation of inter-peak III-V latencies were recorded in 5 (12.2%) PD patients (tab. 4).

Table 4. Different abnormalities of auditory evoked potentials in patients with Parkinson's disease

Type of AEP abnormalities	N	%
Normal AEP	9	21.9
Decreased amplitudes of I-V waves	17	41.5
Absence or marked reduction of Wave V amplitude	5	12.2
Prolongation of I-V waves latencies	2	4.9
Prolongation of II-V waves latencies	8	19.6
Prolongation of inter-peak III-V latencies	5	12.2

(n=41)

Gawel et al. (10) found no delay in wave I but a large delay in wave V. On the other hand, Pierelli et al.(11) and Chiappa and Hill (12) did not found AEPs abnormalities in PD patients. In the study of 23 patients with early onset PD, Muthane et al. (7) found abnormal AEP in 26% of patients examined. The inter-peak latencies between waves I and V in PD patients were significantly longer than those of the normal subjects in study performed by Tachibana et al. (13).

Brainstem vascular lesions

Brainstem vascular lesions are not so frequent and include different brainstem syndromes, which often involve cranial nerves (14). CT scan is not a rare

negative, especially in case of ischemic stroke, and AEP can be very useful in diagnostics and the location of the lesions in posterior fossa stroke (1,15-18).

Out of 40 patients with clinical or CT confirmed diagnosis of brain steam vascular lesion. Only in three patients (7.5%) AEP was normal, and abnormal in 37 (92.5%) (tab. 5).

Table 5. Different abnormalities of auditory evoked potentials in patients with brainstem vascular lesions

Type of AEP abnormalities	N	%
Normal finding	3	7.5
Prolongation of III-V wave latencies	16	40.0
Reduction of IV and V wave amplitudes	13	32.5
Absence of V wave	8	20.0
Total	40	100.0

The most frequent abnormality was prolongation of III-V wave latencies, and then reduction of IV and V wave amplitudes and absence of V wave (fig.5), which always indicate brainstem lesion (1,2,18).

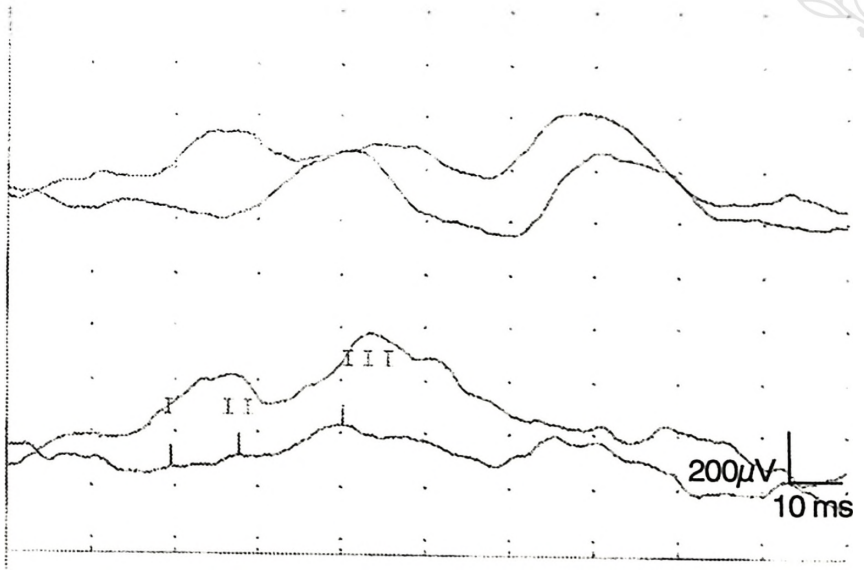

Figure 5. Typical abnormality of AEPs in patient with brainstem vascular lesion

Conclusion

Different abnormalities of visual and auditory evoked potentials in multiple sclerosis, Parkinson's disease and brainstem vascular lesions are common findings in clinical neurophysiology testings, and very important for diagnostics and evaluation of these disorders.

Apstrakt

VIZUELNI I AUDIO EVOCIRANI POTENCIJALI KOD MULTIPLE SKLEROZE, PARKINSONOVE BOLESTI I VASKULARNIH LEZIJA MOŽDANOG STABLA

Cilj ove studije je analiza abnormalnih vizuelnih (VEP) i audio evociranih (AEP) potencijala kod pacijenata sa multiple sklerozom (MS), Parkinsonovom bolesti (PD) i vaskularnim lezijama moždanog stabla (BSVLs). Studija obuhvata 29 pacijenata sa MS (10 muškaraca ili 34,5%, 19 žena ili 65,5%) u granicama starosne dobi od 39,2+/-10,6 godina; 59 PD pacijenata (33 ili 55,9% muškaraca i 22 ili 44,1% žena) u granicama starosne dobi od 63,79+/-7,97 godina i 40 pacijenata sa BSVLs (22 muškarca ili 55%, 18 žena ili 45%) u granicama starosne dobi od 53,5+/-12 godina. Evocirani potencijal (Eps) je postignut primjenom "Premier" uređaja ("Medelec" kompanije) i disk electrode postavljene iznad tjemena u skladu sa internacionalnim rasporedom 10 – 20 elektroda. Za VEPs je izabran tip vizuelne stimulacije "povratnog modela", a za AEPs tip audio stimulacija "Klik". Sve analize su izvršene u odsjeku Klinike za neurofiziologiju (laboratorija za Eps), Odjel neurologije Univerziteta Tuzla i dobiveni parametric su komparirani sa laboratorijskim standardima. Kod MS pacijenata odstupanja u vrijednostima VEP su nađene u 27 (93,1%) i vrijednostima AEP u 24 (82,8%), od toga VEP odstupanja u PD pacijenata je nađeno u 29 (49%) slučajeva i odstupanja AEPs u 32 od 41(78,1%) slučaja; kod BSVL pacijenata AEP odstupanje vrijednosti je nađeno kod 37 (92,5%) slučajeva. To dovodi do zaključka da su različita odstupanja VEPs i AEPs u multiple sklerozi, Parkinsonovoj bolesti i vaskularnih lezija moždanog stabla česti nalazi u rutinskim kliničkim neurofiziološkim ispitivanjima i vrlo značajni za dijagnostiku i ramatranje ovih poremećaja.

Ključne riječi: Multipla skleroza, Parkinsonova bolest, vaskularne lezije moždanog stabla, vizuelno izazvani potencijal, audio izazvani potencijal

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