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Zoran Peric[1,2], Vojislav Cvetkovic[3]
Irina Stojanovic[2]

[1]Department of Neurology,
Faculty of Medicine
University of Nis
[2]Clinic for Mental Health
Protection, Clinical Centre Nis
[3]Dispensary for Railroad
Employee Health Protection Nis

ELECTRONEUROGRAPHICAL FINDINGS IN PATIENTS WITH ESSENTIAL TREMOR

SUMMARY

The aim of the paper was to consider the characteristics of electroneurographical finding in patients with essential tremor and to compare them with the findings of healthy subjects.

We analysed 34 patients with essential tremor, 18 females and 16 males, mean age 47.3 (X±SD=47.3±8.9) years; the values of nervus medianus and nervus peroneus motor and sensory conduction velocities (in m/s) were determined as well as the values od NM and NP M-potential amplitude (in mV) registered with surface electrode over opponens pollicis and extensor digitorum brevis muscles, respectively. The control group (CG) consisted of 34 age-matched healthy subjects. The Student t-test was used for statistical analysis.

In patients with essential tremor we registered statistically significantly ($p<0.01$) lower nervus peroneus M-potential amplitude values (6.7±1.4 mV) compared to CG (8.9±1.7 mV). Other electroneurographical parameter values were not statistically different ($p>0.05$) in patients with essential tremor and subjects in the control group.

Essential tremor may have influence on some electroneurographical parameter values, but most of the electroneurographical parameter values in patients with essential tremor are within normal ranges. Reduction of nervus peroneus M-potential amplitude value in patients with essenetial tremor may be associated with chronic muscle fatique and/or change of motor units function during tremor and other factors.

Key words: **essential tremor, electroneurographical finding**

INTRODUCTION

Essential tremor (ET) is a common adult tremor disorder and the incidence and prevalence of ET increase with advancing age (1). By the age of 65 years, the prevalence is 2% to 5% and ET affects both sexes equally (2). Some studies have presented ET prevalence rate of up to 14% in elederly patients (3) and much lower prevalence in children (4). ET is about 20 times more frequent than Parkinson´s disease (5). Various mechanisms of ET generation and their sites of action along motor pathways were considered. One of them is the hypothesis of central nervous system 10 Hz range oscillatory activity which could modulate descending motor pathways to limb muscles and possibly, subtle abnormality of this oscillation, such as slightly lower olivary oscillation frequency, an abnormal influence of deep cerebellar nuclei or abnormal gama amino butheric acid (GABA)-mediated electrotonic olivary coupling, could result in ET. However, there are other evidence which indicate that ET may be derived, at least partly, from peripheral oscillations, suggesting that it could arise through some

Corresponding author. Zoran Peric • Phone +38118230778, 0612299814 • E-mail: zoran.peric@yahoo.com

abnormality in reflex loops rather than through a fixed pathological central oscillation (6). This is the reason why we wanted to consider electroneurographical (ENG) finding in patients with ET, besides electromyographic (EMG) finding which is important in making the diagnosis of ET.

MATERIAL AND METHODS

We analyzed 34 patients (18 females and 16 males), average age 47,3 years (X±SD=47,3±8,9) with signs of ET. We used the diagnostic criteria for a definite ET, by Lerner (7). Duration of tremor was longer than 1 year. Neurological findings were normal, except for registered tremor. Medications, alcohol, psychogenic factors, Parkinsonism, dystonia, other basal ganglionic disorders and hyperthyroidism were excluded as potential etiological factors. Control group (CG) consisted of 34 age-matched healthy subjects. ENG examination was performed by standard techiques presented in literature, using surface electrodes (8). We registered motor (MCV) and sensory/antidromically/conduction velocities (SCV) values (in m/s) of nervus medianus (NM) and nervus peroneus (NP). Besides, we measured M-potential amplitude (in mV) of NM (registered over the opponens pollicis muscle) and NP (registered over extensor digitorum brevis muscle). M-potential amplitude was measured from positive to negative peak of the potential. The values of skin temperature in the patients' hands and feet were maintained at 32^0C.

We performed a statistical analysis to determine the arithmetical mean (X) and standard deviation (SD) of the registered electro-neurographical parameters. The results were evaluated for statistical significance using the Student´s t-test. We also determined the Pearson correlation (sig.2-tailed) coefficient (r) between the registered electroneurographical parameters and the age of the patients and subjects in the CG.

RESULTS

1. Mean values (X±SD) of electro-neurographical parameters in patients with ET and CG subjects.

In the patients with ET statistically significantly ($p<0.01$) lower M-potential amplitude values of NP (6.7±1.4 mV) were reported compared to CG subjects (8.9±1.7 mV). Other electroneurographical parameter values were not statistically different ($p>0.05$) in both groups (Table 1).

Table 1. Mean values (X±SD) of electroneurographical parameters in patients with essential tremor and subjects in control group

Electroneuro-graphical parameter	Patients with essential tremor	Subjects in control group	p
NM MCV (m/s)	58.6±5.9	60.5±7.3	>0.05
NM SCV (m/s)	64.8 ±7.1	65.9±6.7	>0.05
NM M-potential amplitude (mV)	8.8±1.9	9.1±2.1	>0.05
NP MCV (m/s)	49.8±4.7	52.2±5.2	>0.05
NP SCV (m/s)	51.1±3.9	53.1±4.8	>0.05
NP M-potential amplitude (mV)	6.7±1.4	8.9±1.7	*<0.01

**Statistically significant difference*
NM=nervus medianus
NP=nervus peroneus
MCV=motor conduction velocity
SCV=sensory conduction velocity

2. Pearson correlation (r) /sig.2-tailed/ between electroneurographical parameters values and the age of patients with ET and subjects in CG.

No significant correlation ($p>0.05$) was observed between the registered electroneurographical parameters values and the age of patients with ET and subjects in CG.

DISCUSSION

Statistically significant lower ($p<0.01$) M-potential amplitude values of NP were reported in patients with ET compared to CG subjects, but other analyzed electroneurographical parameters values were not statistically different in both groups. Our results indicate that in the patients with ET most of the ENG parameter values are within normal range. We used Medline database to search for similar articles and compare them with our results. Surprisingly, we did not manage to find any. Many articles analyzed electrophysiological characteristics of ET (EMG, evoked potentials, EEG, transcranial magnetic stimulation), but those investigations were differently designed compared to our study. Recently, it has been published in literature that the main cause of Parkinsonian tremor appears to be an indirect consequence of overactivity in subthalamus (9). What is the main cause of ET ? Up to the present moment, that issue has not been resolved. In one study, 20% of analyzed patients with ET also had rest tremor and some of these patients (with severe tremor and longer tremor duration) had electrophysiologic features consistent with Parkinsonism. The basis for the rest tremor could be the basal ganglia involvement, and that fact raises the possibility that the pathologic process responsible

for ET may extend to these structures (10). Some authors consider mild asymmetry as a fundamental property of ET and emphasize that ET is more severe in the nondominant arm (11). But which factors can contribute to the reduction of NP M-potential amplitude in our patients with ET ? Our patients with ET did not have the clinical signs of peripheral nervous system, neuromuscular junction or muscle lesions. We suppose that continuous tremor can cause muscle fatique, which could have influence M-potential amplitude reduction registered in the muscles. The next unresolved question is why we registered the reduction of M-potential in the extensor digotorum brevis muscle after NP electrical stimulation and did not in the opponens pollicis muscle after electrical stimulation of NM? One of the criteria for definite ET is registered postural tremor of at least one arm; head tremor may also be present, but it is not sufficient for the diagnosis (7). Tremor of the head and jaw is present in about half of the cases, and tremor of the legs occurs in about one-third (5). We suppose that the reduction of NP M-potential amplitude value in patients with ET may also be associated with a change of motor unit (MJ) function during tremor or other factors. Active tremor is arising from a sum of MJ forces and this is found for remaining its frequency at around 10 Hz range despite different contraction strengths and changing mean MJ firing rates, which could be explained on the basis that newly recruited units firing at the minimum 8 to 10 Hz range firing frequency would be larger and would tend to dominate the faster firing units (6). Corticomuscular delays were compatible with transmission in fast corticospinal pathways and feedback of the tremor signal. Thus, the tremor rhythm is intermittently relayed only in different cortical motor areas (12). Some autors consider that whereas in adults the central oscillators are directly responsible for the genesis of ET, in children and adolescents peripheral structures are important. In children, the mean ET frequency was 5.3 Hz, versus 9 Hz in adolescents when arms were extended (4). Our results indicate that some functional changes of peripheral structures appear in adults, too.

CONCLUSION

1. In patients with ET, statistically significant lower M-potential amplitude values of NP were reported compared to the CG subjects. These may be associated with chronic muscle fatique and/or change in motor units function during tremor and other factors.

2. Other analyzed electroneurographical parameter values were not statisticaly different in patients with ET and subjects in the CG, so that most of ENG parameter values in patients with ET are within normal ranges.

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ELEKTRONEUROGRAFSKI NALAZ KOD BOLESNIKA SA ESENCIJALNIM TREMOROM

Zoran Perić[1,2], Vojislav Cvetković[3], Irina Stojanović[2]

[1]Katedra za neurologiju Medicinskog fakulteta, Univerzitet u Nišu
[2]Klinika za zaštitu mentalnog zdravlja, Klinički centar u Nišu
[3]Dispanzer za zdravstvenu zaštitu radnika ŽTP Beograd-Niš

SAŽETAK

Cilj ovog istraživanja bio je da se sagledaju karakteristike elektroneurografskog nalaza kod bolesnika sa esencijalnim tremorom i da se kompariraju sa nalazom kod zdravih osoba kontrolne grupe.

Kod 34 bolesnika sa esencijalnim tremorom, 18 žena i 16 muškaraca, prosečne starosti 47.3 (X±SD=47.3±8.9) godina, određivane su vrednosti motornih i senzitivnih brzina (u m/s) provođenja impulsa duž nervus medianus-a i nervus peroneus-a, kao i amplitude (u mV) M-potencijala nervus medianus-a i nervus peroneus-a registrovane površinskom elektrodom iznad musculus opponens pollicis i musculus extensor digitorum brevis. Kontrolnu grupu sačinjavale su 34 zdrave osobe odgovarajuće starosti. Značajnost (p) razlika dobijenih rezultata istraživanja određivana je pomoću Student-ovog t-testa.

Kod bolesnika sa esencijalnim tremorom registrovana vrednost amplitude M-potencijala nervus peroneus-a bila je značajno ($p<0.01$) manja (6.7 ±1.4 mV) u odnosu na zdrave ispitanike kontrolne grupe (8.9±1.7 mV). Vrednosti ostalih ispitanih elektroneurografskih parametara nisu se značajno razlikovale ($p>0.05$) kod bolesnika sa esencijalnim tremorom i ispitanika kontrolne grupe.

Esencijalni tremor može da utiče na vrednost pojedinih parametara ENG nalaza kod bolesnika sa ovim poremećajem iako su vrednosti većine elektroneurografskih parametara u granicama fizioloških varijacija. Značajna redukcija amplitude registrovanog M-potencijala nervus peroneus-a može biti povezana sa nastankom hroničnog zamora mišića, izmenom funkcionisanja motornih jedinica u uslovima tremora i drugim uzrocima.

Ključne reči: **esencijalni tremor, elektroneurografski nalaz**