M.V. Churyukanov1,2, N.A. Krupina3, M.L. Kukushkin2, V.V. Alekseev1, N.N. Yakhno1

1The A.Ya.Kozhevnikov Clinic of Nervous Diseases, Chair of Nervous Diseases, The I.M. Sechenov First Moscow State Medical University, 2Laboratory of Fundamental and Applied Problems of Pain, Institute of General Pathology and Pathophysiology of Russian Academy of Medical Sciences, Moscow, Russia 3Laboratory of General Pathology of Nervous System, Institute of General Pathology and Pathophysiology of Russian Academy of Medical Sciences, Moscow, Russia

BACKGROUND

Pain has a significant impact on the quality of life of patients with multiple sclerosis (MS). According to data of pain occurs in 50-85% of MS patients, where 25-30% of patients suffer from central neuropathic pain (CNP) (Archibald et al., 1994; Ehde et al., 2003; Moulin et al., 1989; Osterberg et al., 2005; Svensson et al., 2003). Only patients with lesions affecting spinothalamic pathways develop CNP in MS (Östing et al., 2010). However, it is unknown, why in many cases signs of lesions may occur without causing pain. It is suggested that involvement of somatosensory system in pathological process of CNP formation is rather ambiguous than a sufficient condition. At the same time, we know, that patients with neuropathic pain have EEG changes, which are thought to occur due to development of thalamocortical dysrhythmia. At present we have no data on the features of the brain electrical activity in MS patients with CNP.

AIM

To study background EEG changes in multiple sclerosis patients with and without central neuropathic pain.

METHODS

1. Clinical neurological examination
2. Psychological examination: Beck Depression Inventory (BDI), State Trait Anxiety Inventory for Adults (STAI), Spielberger scale, Symptom Checklist-90 Revised (SCL-90R), Pain Catastrophizing Scale (PCS), Chronic Pain Coping Inventory (CPCI), Toronto Alexithymia Scale (TAS).
3. EEG: the EEG data was analyzed using "BRAINSY" software package. After applying the Fast Fourier Transform, the absolute and relative spectral EEG powers and spectral coherence measures for each pair of electrodes were studied in the following frequency bands: delta (up to 4.0 Hz), theta (4.0 to 8.0 Hz), alpha (10.0 to 13.0 Hz), beta1 (13.0 to 20.0 Hz) and beta2 (20.0 to 30.0 Hz). We also calculated peak frequencies (the frequencies of the dominant peak of the spectrum) for each frequency band.
4. MRI
5. Methods of statistical analysis: Kolmogorov-Smirnov Test, Fisher exact test, Students T-test, one way ANOVA, Mann-Whitney, Kruskal-Wallis tests. Correlations were estimated using non parametric Spearman’s rank coefficient. Data was considered significant at the 0.05 level.

RESULTS

2. Statistically significant differences in absolute spectral power between the groups were identified in the three frequency ranges - theta, beta1 and beta2. Group I was increased for the beta1-band in the spectrum of the left temporal right hemisphere region (T4) compared to the control group, for the beta1-band - in the temporal lobes of the right hemisphere (T6, T4, F8), for the beta2-band - in the occipital derivation in the right hemisphere (O2, parietal P3 and P4), mid-temporal (T3 and T4), and postero-temporal (T5 and T6) lobes of both hemispheres as compared to both control and group II, and in the left occipital (O1) and right fronto-temporal (F8) lobes comparing to the control.

3. In patients of group I we revealed a positive correlation between absolute spectral power in the beta-2-band in the occipital derivatives of both hemispheres and pain intensity according to VAS.

4. With respect to relative spectral power, statistically significant differences between the groups were revealed in the theta- and alpha-bands. In MS patients with CNP relative powers for the alpha-band were lower than in the control group in the left occipital and parietal lobes, while for the theta-band relative powers were higher than in control in the frontallobes.

RESULTS 1.

Patients age, gender (male/female), comorbid disorders, depression, anxiety and fatigue scores did not associate with CNP.

According to SCL-90R, the development of CNP was accompanied by somatization disorder and psychotism. A higher level of catastrophizing was identified in patients from group I, and in this group ‘keeping’ and ‘rest’ predominated over all other pain coping strategies (p<0.05).

RESULTS 2.

Patients number of persons: I - MS patients with CNP (n=12), group II - MS patients without pain (n=12) and group II - healthy control (n=12). During EEG registration group I patients were not in pain.

RESULTS 3.

In the delta-band, MS patients with CNP showed increased peak frequencies in the central and frontal lobes (C3, C4, F3 and F4) as compared to control, while MS patients without CNP on the contrary, showed decreased peak frequency in the left postero-temporal lobe (T5). In the beta2-band, peak frequencies in the left hemisphere (O1, P3, T5, and F7) were higher in group I than in the healthy control.

RESULTS 4.

In group I the inter-hemispheric coherence between mid temporal left-right electrodes (T3-T4) was higher than in control in the beta1- and beta2-bands while in group II - only in the beta2-band. The inter-hemispheric coherence between right central and mid-temporal electrodes (C4-T4) in the high frequency bands was higher in MS patients with than without CNP.

CONCLUSION

The difference between spectral EEG patterns in MS patients with and without CNP could represent specific CNS changes related to central pain in MS patients. Data obtained and results of our previous studies in patients with brain-gut dysregulation and CNP believe the increase of spectral power in the beta-bands to be a marker of CNS pathology that cause disorders including CNP.

REFERENCES


Results presented at the annual meeting of the European Society of Neurology, Florence, Italy.