09 07. 25.

EEG Reactivity to Eye Opening in Patients with Ischemic Stroke or Transient Ischemic Attack.

Introduction.

An important task of neurology is to search for the features of the electroencephalogram in patients with Ischemic Stroke (IS) or Transient Ischemic Attack(TIA). EEG is one of such promising tests.

Determination of the characteristics of the EEG response to eye opening (eo) in patients who have suffered ischemic stroke including those with TIA, in early stage.

Material and methods.

Routine EEG was recorded in 23 right-handed patients who suffered ischemic stroke including those with transient ischemic attack which had disturbances in the carotid basin and without epileptic seizures and hemianopia, 2-3 days after the episode. Most patients had hypertension: Background EEG, then with opening (e o) for 10 seconds

was performed. Quantitative visual analysis of EEG reactivity on e o period and in the background EEG were carried out in the occipital lead on the affected side in the terms of amplitude and index of the rhythm . The bioelectrical activity after eye opening was measured and calculated according to the frequency bands (alpha, beta, theta and delta-waves). For comparison, such a reaction was also studied in two additional groups: in 25 healthy individuals aged 55-80 years old, and in 11 patients with epileptic seizure of the same age. The patients were examined neurologically. The reaction to e o was studied by three parameters: 1. by the change in the average index of the alpha- rhythm and its average amplitude in relation to its background indices, 2. by the expression of the slow-wave activity of the theta range, 3. the presence of sharp fast waves of the beta range. The coefficient of reactivity K, derived and described by us earlier for healthy people, accepted as the norm, was equal to **3** or more.

Results.

The statistical analysis of the numbers for the EEG reactivity determined in three groups when comparing their eye-opening periods indicated significant differences between the groups. The desynchronization in the brain function

showed the replacement of fast activity by alpha or/and theta- waves (called synchronization) was pronounced in different ways. In the group of **healthy subjects**, slow oscillations of the theta- and delta- ranges were not detected during e o period at all. In e o period attenuation of the alpha- rhythm and its replacement by more frequent oscillations, i.e. desynchronization, were observed in 100% of cases. The coefficient of reactivity **K**, proposed and described by us earlier in healthy individuals, is the quotient of the division of the average indices of the index and amplitude of the alpha- rhythm of the background to their indices with the eyes open. It was equal to 3 in more than in 95% of cases (good reactivity). In patients with **vascular disorder** only short-term desynchronization was observed in the first 2-3 seconds after opening their eyes, and the reactivity coefficient **K** was **less** than 3 in 45% of cases (poor reactivity). In this group, during e o single or group of theta waves were also recorded, the index of which sometimes reached 30%, and the amplitude was 40-50 μV. Such bioelectrical activity was noted in 8% of vascular patients. Sharp beta waves were recorded in 4% of patients. No pronounced delta- activity was detected in these patients. In the group of **epileptics,** for comparison, with e o, single theta- waves were not expressed (exception was theta in complexes “peak-and-waves”). The coefficient of reactivity

was, as a rule, less than 3 in 92% of patients, and the alpha-wave index was 90%-100% during e o. So, they are the cases when alpha- waves were almost not suppressed with e o. As can be seen, the reactivity to e o in both groups of patients was reduced, compared to healthy people in the form of reduction of desynchronization, both in alpha- waves and in the presence of theta- waves.

As we can see reactivity to e o is connected not only to the visual system impairment but also to the type of disorder. It should be borne in mind that the EEG method is limited here and requires additional research methods for study. EEG results, also , may depend on the severity and stage of the disease and localization of the stroke. Additional tests are more important when focal or generalized slow activity does not occur on the background EEG.

Conclusion.

In patients with IS and TIA group, in comparison with the epileptic seizure group and especially in healthy people, statistically significant reduction of desynchronization during e o and **increase of synchronization** was detected. It was in the form of a significant predominance of theta-rhythm in the patients with vascular pathology, which may be a distinctive feature of their EEG.

Key words: EEG, EEG reactivity, eye opening, depression, ischemic stroke, transient ischemic attack.

Bibliography.

1.Жирмунская Е.А. Колтовер Е.Н. Атлас по электроэнцефалографии и морфологии мозгового инсульта. 1967. Монография.

2. Моруцци G. и Мэгун Н. Ретикулярная формация мозга, пер. с англ., М., 1962; Мэгун Г., Бодрствующий мозг, пер. с англ., 2 изд., М., 1965.

3.Русинов В.С. Клиническая электроэнцефалография.1973. Монография.

4. Шмелькина Р. Д. Применение количественного критерия для характеристики реакции альфа-ритма ЭЭГ

на открывание глаз у здоровых разного возаста. Международный журнал фундаментальных исследований.2017. Статья в журнале РАЕ.

5. Шмелькин Д.Г. Биоэлектрические нарушения при опухолях затылочной Доли. Журнал Невропатологии и психиатрии. Медгиз, Москва, 1958. Статья.

6. Чухрова В.А., Верещагин Н.В., Джибладзе Д.Г. Изменения электрической активности у больных с поражениями магистральных сосудов мозга (сонных и

позвоночных артерий). Ж. невропатол. и психиатр., 1962, т. 62, с. 1181-1188.

7. Шмелькина Р.Д.”Реактивность ЭЭГ на открывание глаз как биомаркер эпилепсии”. В книге РАЕ “Современные проблемы науки и образования.” т 24, 2024. E-library.

English resources:

1.The Bancaud and Talairach view on the epileptogenic zone: a working hypothesis 2006 Aug:8 Suppl 2:S16-26

2.RobertJ. Barry, Adam.R. Clarke, StuartJ. Johnstone, Christophe R. Brown Clinical neurophysiology Vol 120, issue 10, 2009.EEG differences in children between eyes-closed and eyes-open resting conditions

3. Moruzzi G., Magoun H. W., Brain stem reticular formation and activation of EEG, in book: Electroencephalography and clinical neurophysiology, v. 1, Boston, 1949.