

CLINICAL AND NEUROPHYSIOLOGICAL CORRELATION IN PATIENTS WITH ISCHAEMIC CEREBROVASCULAR DISEASE

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The aim of this study is to objectify the functional state of the brain in CT-negative cases with clinical diagnosis of acute cerebrovascular disease (CVD). The CT scan, cerebral SPECT, brainstem auditory evoked potential (BAEP) and EEG with quantitative analysis (qEEG) were performed in 20 patients with ischaemic CVD. Of them, 6 were with transitory ischaemic attack (TIA), 8 with ischaemic stroke (IS) in the territory of the middle cerebral artery and 6 with brainstem infarction (BI). The zones with increased slow-wave activity described by the brain maps showed a good correlation ($r=0,47$) with the revealed decreased radiotracer uptake. The investigation of brain perfusion by SPECT alone cannot objectify the brainstem stroke. In these cases, the data from BAEP can help the topical diagnosis. Our results confirm the clinical importance of the qEEG for diagnosis of acute CVD, especially in relation with other electrophysiological and neuroimaging methods.

Key-words: Ischaemic cerebrovascular disease, CT, SPECT, qEEG, BAEP

The cerebral SPECT is one of the few neuroimaging methods for early detection of subtle abnormalities of the regional blood flow changes in CT-negative patients with an acute ischaemic cerebrovascular disease (CVD) (1,2). On the other hand, several spectral EEG parameters are highly correlated with brain perfusion. For these reasons the investigation of quantitative EEG

(qEEG) could provide additional diagnostic opportunities (3,4).

In order to prove the possibilities of computerised quantitative analysis of EEG background activity to determine the topical and differential diagnosis in CT-negative ischaemic CVD, we compared clinical to electrophysiological and SPECT findings.

MATERIAL AND METHODS

Twenty patients (8 females and 12 males) in age range from 28 to 55 years admitted at the Neurology

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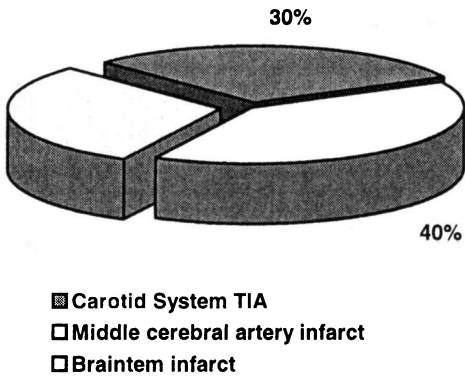


Fig. 1. Clinical distribution of patients' groups

Clinic, Varna University Hospital, were investigated. All of them showed normal CT findings at the admission. The dynamic follow-up of the neurological assesment determined three clinically distinct groups of patients (Fig. 1). The group of controls consisted of 40 healthy individuals matched by sex and age with the clinical cases. The CT scan, SPECT and electrophysiological assessment were performed within 24 hours from the admission. The absolute power (AP), relative power (RP), peak power (PP), median frequency (MF), and peak frequency (PF) were calculated for each epoch off-line. The Z scores for all EEG variables were calculated. The brainstem auditory evoked potentials (BAEP) were investigated by two-channel Neuropack apparatus with standardised recording techniques.

Statistical processing was made by Excel 4.0 for Windows including a variation and correlative analysis.

RESULTS AND DISCUSSION

1. EEG findings

The background activity changes by the visually assessed EEG consisted of slowed alpha rhythm, diffusal appearance of some 6-7 Hz wave and slight dysrhythmia without hemisphere asymmetry in 17 patients. Four of them were with brainstem infarction, 7 with infarction in the area of MCA and 6 with carotid system TIA. In one of the records belonging to a patient with supratentorial stroke focal changes from theta activity corresponding to the clinically determined topic of the CVD were described. No statistically significant difference between the character of the visually settled, abnormal EEG changes for patients with MCA stroke and these with carotid system TIA was found. Two records of patients with brainstem infarction (BI) showed activity near to normal one while one of them registered alpha rhythm reactive to external stimuli.

2. BAEP

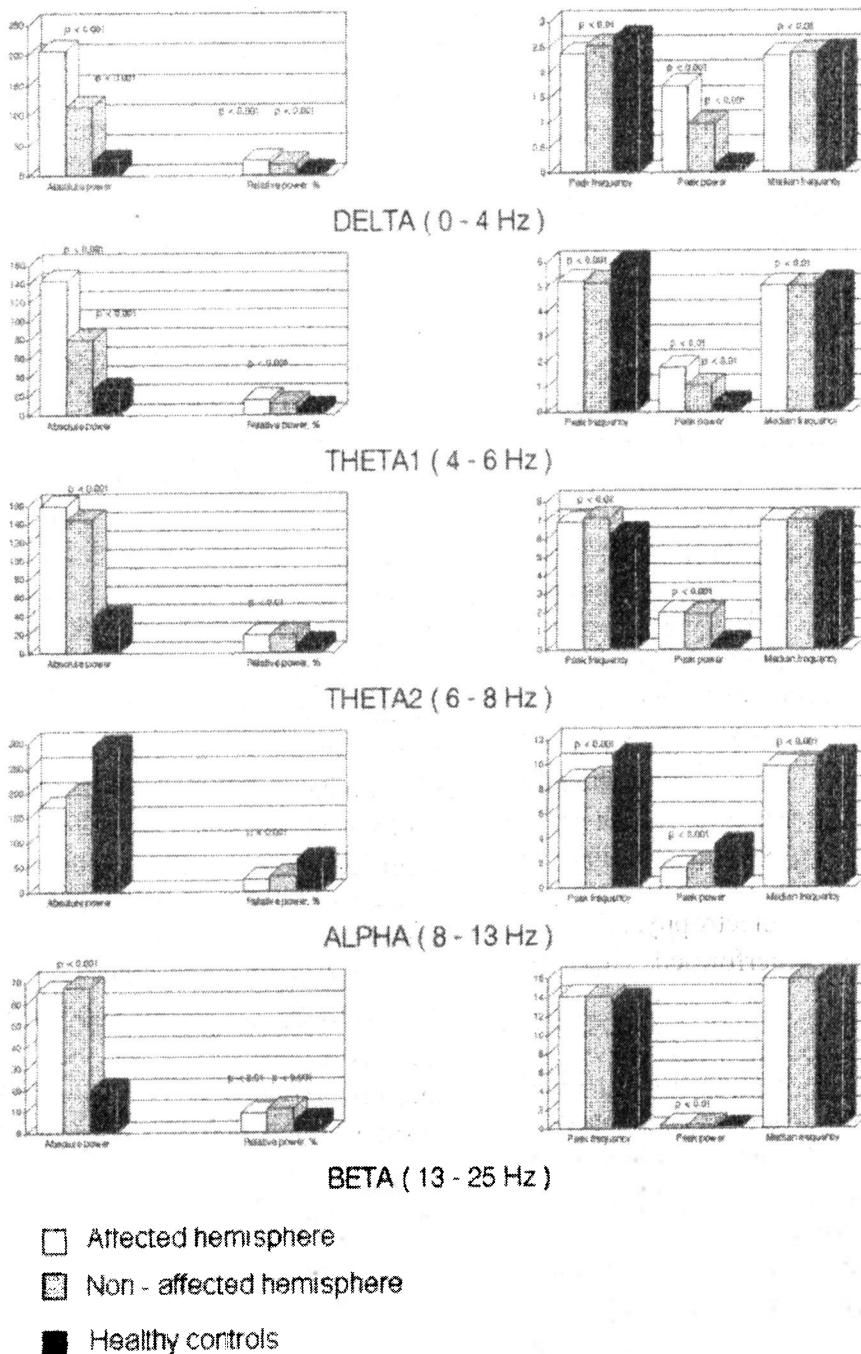


Fig. 2. Comparison of spectral EEG parameters in acute ischaemic stroke patients and healthy controls

BAEP have not certain diagnostic value in patients with supratentorial CVD. In 5 patients with brainstem lesion, the changes of BAEP consist of lateralized lowering of the amplitude of the third, fourth and fifth waves and latency and interpeak times changes of the same waves.

3. qEEG

In 8 patients, all of them with MCA infarction, the brain maps showed lateralized changes corresponding to the clinical findings while for the affected hemisphere the highest statistically important difference in relation to the control group ($p < 0,001$) was proved for the AP, RP, and PP from the delta frequency range. The rest parameters of this range, namely the PF and MF from the affected hemisphere had statistically significant difference ($p < 0,01$ and $p < 0,05$) compared to the control group data. In alpha frequency range statistically important difference ($p < 0,001$) in relation to control group only for RP was found. For this frequency range the reduction ($p < 0,001$) of the PF and MF for the patients with MCA stroke also should be noted (Fig. 2).

The distribution of the spectral parameters in patients with TIA was similar with these with MCA stroke. The lack of frequency changes in the Delta range compared to the control group for patients with TIA was the

more important difference between the two clinical group. The data from the spectral analysis of EEG for patients with brainstem infarction could not be related with the topic and type of the stroke.

4. SPECT findings

In 6 patients there were no perfusion changes. All of them were with clinical data of BI. In 8 patients, 6 with TIA and 2 with MCA stroke, a decreased tracer deposition in zones corresponding to the clinical data was revealed which outlines were difficult to distinguish from the resting parenchyma. These data were confirmed by the program Threshold, as the index R/L was not higher than 1,15. In the rest 6 patients with clinical diagnosis of MCA stroke, SPECT findings revealed well-outlined decreased radiotracer uptake in the affected hemisphere. In three of these patients perfusional changes also in the non-affected hemisphere were found. The index R/L in Threshold program varied from 1,17 to 1,32.

The data of spectral analysis of background activity proves the great superiority of the qEEG over the conventional methods to detect abnormal changes in patients with CVD. The comparative analysis of the spectral EEG parameters between the affected and non-affected hemisphere showed that the highest absolute value of AP, RP and PP in delta

frequency band, together with the lower RP in alpha band could focus with a great significance the unilateral supratentorial CVD. The zones with increased slow-wave activity described by the brain maps showed a good correlation ($r=0,47$) with the revealed decreased radiotracer uptake. Although corresponding to the clinical data, the lateralized changes of spectral EEG parameters are not sufficient criteria to determine the topic of the CVD as supra- or subtentorial. The investigation of brain perfusion only by SPECT also cannot objectify the brainstem stroke. In these cases the data from BAEP can help the topical diagnosis.

CONCLUSIONS

The quantitative analysis of EEG enlarges the topico-diagnostic

possibilities of the conventional EEG methods. The unilateral prevailing of AP, RP and PP in delta and theta frequency band together with the lower values of alpha RP on the same hemisphere could be related with the availability of unilateral supratentorial CVD. These parameters show a good correlation with SPECT revealed findings. The bilateral appearance of abnormal spectral EEG changes in patients with unilateral CVD proves the participation of both hemispheres in the pathogenesis of the disease. These data are confirmed by SPECT findings. In case of subtentorial CVD the BAEP changes can help the topical diagnosis while the routine EEG, qEEG and SPECT do not play significant role for localization of the perfusial changes.

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Клинични и неврофизиологични корелации у болни с остри ишемични нарушения на мозъчното кръвообращение

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Резюме: Целта на проучването е да обективизира функционалното състояние на мозъка у болни с клинични данни за остро ишемично нарушение на мозъчното кръвообращение (ОИНМК) и негативна компютър-томографна находка (КТ). КТ, НМРАО-SPECT на мозъка, слухови ппредизвикани потенциали (СПП) и ЕЕГ с количествен анализ (кЕЕГ) бяха осъществени у 20 болни с ОИНМК. От тях 6 са с преходни нарушения на мозъчното кръвообращение /ПНМК/, 8 - с ишемичен мозъчен инсулт (ИМИ) в територията на средна мозъчна артерия и 6- със стволлов инфаркт. Описаните от кЕЕГ зони с повишена бавновълнова активност показват добра корелация ($r=0,47$) с областите на намалено натрупване на радионуклеида, установени чрез SPPECT. Изследването на мозъчната перфузия само с изотопните методи не може да обективизира стволловите инсулти. В тези случаи данните от СПП могат да помогнат за топичната диагноза. Нашите резултати потвърждават клиничната значимост на кЕЕГ при диагностиката на ОИНМК, особено в съчетание с други електрофизиологични и невроизобразяващи методи.