CLINICAL VALUE OF EEG IN CEREBRAL INFARCTIONS IN THE INTERNAL CAROTID ARTERY TERRITORY

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Introduction of new visualizing methods in neurological practice reduced the topico-diagnostic significance of clinical EEG without altering its prognostic possibilities to objectify the functional state of the brain in cases of acute disturbances of cerebral circulation [1-4].

The present study is directed towards the clinico-prognostic value of the EEG method in patients with proved cerebral infarction in the internal carotid artery territory.

MATERIAL AND METHODS

A total of 467 patients with cerebral infarction in the internal carotid artery area were studied during the period from 1976 till 1987 by means of the EEG method with standard functional loadings and dynamic follow-up. Diagnosis was based on the clinical, CT (in 202 cases), angiographic (in 110 cases) as well as on the pathologoanatomic examination (in 265 cases).

Electroencephalographic analysis was done on the basis of the following visually differentiated pictures: 1) complete bilateral depression; 2) unilateral α-rhythm depression, β- and flattened δ-waves with the presence of local δ-activity; 3) unilateral localization of δ-oscillations; 4) presence of bilateral phenomena of θ- and δ-waves; 5) presence of δ-waves in the opposite fronto-temporal area; 6) frequency and reactivity of α-rhythm during functional tests; 7) paroxysmal activity.

RESULTS AND DISCUSSION

Clinical findings are demonstrated on table 1. One can see the severity and characteristics of cerebral infarctions, duration of observation and the reason for the fatal outcome.

The first group consists of 82 patients with widespread cerebral infarction, continuously progredient course of general-brain manifestations, lethal outcome up to the 96th hour and main reason for death - the brain damage. EEG picture indicates the following characteristics in these cases: 1) bilateral disturbances of θ- and δ-oscillations in 82 cases; 2) presence of flattened δ-oscillations and absence of reactivity during functional tests on the side of damaged hemisphere; 3) polymorphic (in 50 patients) and/or rhythmic (in 38 patients) δ-waves in the contralateral hemisphere in the fronto-temporal area.

EEG data of 38 patients who survived the acute stage of cerebral stroke demonstrated slightly expressed general-brain manifestations.

In general, one observes parallel EEG phenomena which confirm reliably the clinical prognostic criteria in cases with disseminated infarctions with a progredient course and lethal outcome.

The second patients' group shows an insignificant restoration of focal neurological symptomatics. However, clinical picture does not offer prognostic criteria in such cases. EEG is characterized by the following pictures: 1) there is an incomplete α-rhythm depression (in 98 cases), α-rhythm restoration at late stages (in 45 cases) and an incomplete reactivity with functional tests on the side of cerebral infarction. Focal EEG signs are located in the parieto-temporal region (in 43 cases); 2) more rarely, bilateral disorders can be detected (in 18 cases); 3) there is an α-rhythm delay during the acute stage (in 80 cases), transitory θ- and single δ-waves.
Table 1

Clinical characteristics, duration of observation and reasons for fatal outcome in patients with cerebral infarction

<table>
<thead>
<tr>
<th>Development of cerebral infarction</th>
<th>Number of cases</th>
<th>Proved cerebral infarction</th>
<th>Duration of follow up (hour, day, month, year)</th>
<th>Cause for fatal outcome cerebral extracerebral</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Without involution. Large infarction with dislocation changes</td>
<td>120</td>
<td>82 38 35</td>
<td>24-96 hours</td>
<td>72 10</td>
</tr>
<tr>
<td>2. With insignificant restitution. Thrombosis of a. carotis interna</td>
<td>120</td>
<td>58 62 25</td>
<td>2 weeks - 2 years</td>
<td>20 38</td>
</tr>
<tr>
<td>3. With moderate restitution</td>
<td>50</td>
<td>35 15 15</td>
<td>1 month - 4 months</td>
<td>10 25</td>
</tr>
<tr>
<td>4. With significant restitution</td>
<td>120</td>
<td>60 60 10</td>
<td>3 weeks - 3 months</td>
<td>35 25</td>
</tr>
<tr>
<td>5. TDBC, fluctuating insult, microembolus</td>
<td>57</td>
<td>30 27 25</td>
<td>6 weeks - 4 months</td>
<td>14 16</td>
</tr>
</tbody>
</table>

with temporal localization (in 90 cases) and an incomplete reactivity with functional tests (in 75 cases) on the opposite side of cerebral infarction.

Generalization of this patients' group indicates the lack of bilateral signs in most cases that argue for a favourable outcome of the disease. The presence of depression and later on the appearance of α-rhythm in the contralateral hemisphere as well as the parieto-temporal localization of focal bilateral EEG signs can be related to a reduction of blood circulation in the opposite hemisphere and thus seems to be an unfavourable prognosis concerning life.

EEG data demonstrate less expressed alterations in patients' group characterized by a moderate restoration after stroke (in 50 cases) when compared with these of the second group. There are slightly expressed bilateral EEG changes (in 25 cases). Homolaterally, EEG shows α-rhythm reduction with an incomplete reactivity during functional tests and α-oscillations with temporal localization as well (in 35 cases). There is an α-rhythm delay and single τ-waves with fronto-temporal localization in the contralateral hemisphere.

The fourth group of stroke patients characterized by a considerable involution includes 120 individuals. There is lack of ipsilateral α-rhythm depression, rapid normalization in the course of dynamic follow-up, presence of transitory focus of τ-waves in the temporal area as well. In the opposite hemisphere one detects almost normal frequency and reactivity manifestations. These data are parallel to the favourable prognosis of cerebral infarctions.

The last patients' group - 57 cases with transitory disturbances of brain circulation (TDBC) and 42 cases with vascular accidents with fluctuating course (extracerebral phenomena) demonstrates during the acute stage both focal and diffuse bioelectrical phenomena: α-rhythm depression (in 40 cases), τ-focus with fronto-temporal localization (in 36 cases) and rapid transitory involution.
EEG finding precedes the worsening of the focal neurological symptomatics in these cases. The purpose of this study is to direct our attention to EEG prognostic value during the acute ischemic stage in the internal carotid artery territory. In cases with widespread infarctions and marked general-brain clinical manifestations EEG demonstrates rough diffuse alterations which increase in the dynamic course of the disease and indicate a poor prognosis.

There is a significant correlation between the leading neurological syndrome and EEG characteristics concerning the prognosis of patients from the II<sup>th</sup>, III<sup>th</sup>, and IV<sup>th</sup> group. Relative intactness and rapid reappearance of α-rhythm on the side of cerebral infarction as well as its homolateral and contralateral reactivity restoration belong to the favourable EEG symptoms. On the other hand, continuous ipsilateral depression, lack of reactivity and appearance of irregular homolateral local γ- and δ-waves with predominantly parietotemporal localization are indicative of an insult with an obvious residual deficit and poor prognosis.

We can conclude that clinical EEG offers an objective information about the functional state of cerebral parenchyma in a prospective aspect in cerebral ischemia.

REFERENCES