

## ON THE RESULTS FROM SOME PSYCHOPHYSIOLOGICAL INVESTIGATIONS OF ALCOHOLIC DISEASE

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The problem of mechanisms of the appearance of alcohol dependence and the course of alcoholic disease (chronic alcoholism) remains still unsolved despite its actuality. One important task is namely to find out "biological markers" facilitating the setting in of the illness. The aim of the present work is to study in common the higher nervous activity and the bioelectrical brain activity in order to clarify some pathophysiological and pathogenetical mechanisms.

### Material and methods

We studied 15 patients with chronic alcoholism and as controls — 15 healthy individuals and 15 neurosis patients (namely neurasthenia). Bioelectrical activity (BEA) was estimated at rest (with closed and open eyes) as well as immediately after an active mental activity: working out of tasks after Raven's method of "progressive matrixes", performing of associative experiment and formation of conditionally-conditional verbally-speech-expressive reflex (after our own method with original character presented essentially as a physiological model of inductive conclusion).

We carried out a spectral analysis after Fourier. BEA was registered by using a 2 channel spectroanalysator Berg-Fourier (product of OTE Biomedica, Italy). Its action was based on an algorithm "rapid transformation after Fourier". The recording was performed from occipital, temporal, postcentrally-parietal and frontally-precentral brain lobes, one by one for each hemisphere.

### Results and discussion

The patients with chronic alcoholism demonstrated a decreased slow alpha-rhythm (as compared with the controls) on the background recording in occipital region more than threefold as well as an increased rate of rapid components ( $\beta_1$  and  $\beta_2$ ) 2—3 times more than that of the controls. Almost such changes were established in postcentrally-parietal region, too. These analogous changes were more apparent in temporal region (alpha<sub>1</sub>-rhythm reduction about 5—6 times and rapid rhythms increase about 4—7 times). Slow alpha-component decrease was similar when also precentral lobe was concerned, however, rapid rhythm increase was rather less expressed here (nearly 1,5 times). These differences are statistically significant ( $p < 0,001$ ). Other authors (4, 10) also report an  $\beta$ -index increase in chronic alcoholism patients. It is noted that  $\beta_1$ -rhythm increases in other diseases of functional and organic origin, too. Our investigations demonstrated also high  $\beta_1$ -index rates in neurasthenic neurosis patients.

Rapid ( $\beta$ ) rhythm increase within BEA scope is considered a function of reticular formation and structures related to it (2, 5, 8), a result of increased sub-cortical excitedness (3), an increase of activating influences of reticular formation which induces a process of excitation in the cerebral cortex (7). The decrease of spectral power of alpha-rhythm could be due to the increased asynchrony of the links of thalamo-cortical system. If we suppose that these changes have appeared — by various reasons — before alcoholism itself it could be assumed that alcohol consumption presents a peculiar "compensation" and "adaptation", an attempt to settle the instability of nervous processes. In this sense J. Gray (11) states his opinion, too. On the other hand, other investigators (12) interpret reticular formation activating as a result from the action of ethyl alcohol.

The results from the associative experiment were evaluated not only "by the common way" but also by means of so-called quality coefficient after a special formula created by ourselves (6). In our healthy individuals "the norm" (calculated after percentils method) was in the range 1.50—5.16. Alcoholism patients showed lower (partially under the norm) rates: 0.54—3.57. The reduction of "quality coefficient" in alcoholism patients originated mainly at the account of the responses of lower type.

Therefore, we found out that alcoholism patients showed predominantly qualitative and not roughly quantitative changes: suppression of higher, essential connections at the account of inessential ones, of "accidental", illogical associations. The absence of bradypsychia and other organic manifestations together with the similarity — by an indirect way — with neurotic alterations gives an evidence for the predominantly functional character of these disorders.

The formation of new conditional reflexes in psychically healthy persons was normally performed: all the individuals studied created new associations at the average on the 7<sup>th</sup> conjunction between conditionally-conditional signals with mean latent period of 1,90 sec. Approximately 1/3 of alcoholism and neurosis patients failed to elaborate new conditional reflexes. By this way, in spite of the predominance of an excitation process, we establish its "inadequacy". It is evident that the disturbed balance of the nervous processes is due not only to the increase of the process of excitation alone but also and in a greater extent to weakening of the process of internal suppression which inhibits the normal dynamics of the higher nervous activity. The mentioned change of the character of associations (connections) as well as the "appearance" of lower, including analogous ones, argues for the "desadaptation" of the process of excitation (essentially, for phasic state formation). This can be considered a peculiar manifestation of paradoxal and ultraparadoxal stage, respectively.

There is a bilateral  $\alpha_1$ - and  $\alpha_2$ -rhythms and delta-rhythm reduction during examination by using Raven's method in healthy individuals. It is notable that  $\alpha_2$ -rhythm decreases in the right hemisphere but  $\beta_1$ -,  $\beta_2$ - and  $\Theta$ -rhythm increases. After finishing the experiment rhythmic changes show a tendency towards balancing.

Alpha-rhythms also decrease bilaterally but more expressed in the left side in chronic alcoholism patients.  $\Theta$ -rhythm decreases when slow rhythms are concerned only. During the experiment  $\beta_2$ -rhythm increases and remains at a high level after test application. Some other differences with comparison with healthy persons are observed that will not be discussed here. There is a predominantly quantitative difference when neurosis patients are concerned.

The above-described BEA dynamics can be interpreted as an expression of "pathologic explosiveness" of excitation process: under the influence of stimuli the afferentation flow to the cerebral cortex increases while the process of suppression is weakened. On the other hand, excitation process is labil.

The following conclusions can be drawn:

The steadiness between the processes of excitation and suppression is disturbed with excitation prevalence in chronic alcoholism patients. BEA demonstrates an intensive increase of rapid (mainly  $\beta_2$ ) oscillations and an  $\alpha_1$ -index decrease which can be interpreted as result from the increased activity of reticular formation. However, for all that excitation process is not only inoptimal, but in the contrary: "the quality" of the higher nervous activity decreases, associations of lower type actualize, the formation of new conditional connections is troubled, and latent period of reaction is prolonged. Although BEA changes under the influence of intellectual activity correspond in general in both chronic alcoholism patients and healthy individuals it is to be emphasized that there is a "pathologic explosiveness" of excitation process in these patients. However, it is unstable from the one hand, and it tends to inertness and parabolic reactivity, from the other.

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#### О РЕЗУЛЬТАТАХ НЕКОТОРЫХ ПСИХОФИЗИОЛОГИЧЕСКИХ ИССЛЕДОВАНИЙ ПРИ АЛКОГОЛЬНОЙ БОЛЕЗНИ

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#### РЕЗЮМЕ

Исследована биоэлектрическая активность в состоянии покоя при активной психической деятельности (ассоциативный опыт, прогрессивные матрицы Raven, образование речевых условных рефлексов по оригинальной методике). Исследовано 15 больных алкогольной болезнью, 15 здоровых лиц в контрольной группе и 15 больных невращающейся, причем проведен спектральный анализ на основе алгоритмов «быстрое преобразование по Fourier». У больных хроническим алкоголизмом наблюдается нарушение равновесия между процессами возбуждения и торможения с преобладанием возбуждения: интенсивное нарастание быстрых (на первом месте  $\beta_2$ ) колебаний и понижение  $\alpha_1$ -индекса, что можно считать результатом повышенной активности ретикулярной формации.

Процесс возбуждения однако не оптимален, а наоборот — «качество» высшей нервной деятельности понижается, актуализуются связи высшего типа, затрудняется формирование новых условных связей, удлиняется латентный период реакции. У больных хроническим алкоголизмом устанавливается «патологическая эксплозивность» процесса возбуждения, который отличается, с одной стороны, неустойчивостью, а с другой — проявляет тенденцию к инертности и к параболотической реактивности.