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The administration of transcranial electric treatment for affective disturbances therapy in alcoholic patients

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In a double blind placebo-controlled investigation it was shown that transcranial electric treatment (TET), comprising the combination of a constant current with a pulse current of square impulses of 70–80 Hz is an effective method to correct affective disturbances (anxiety, depression) in alcoholic patients. The medical effects of TET are accompanied by changes in the metabolism of GABA and monoamines, but not of β-endorphine, and also by a decrease in the latency of α-rhythm appearance after closing of the eyes.

Key words: alcoholics; anxiety; depression; transcranial electric treatment; β-endorphine; amine oxidase; GABA; α-rhythm

Introduction

The affective disturbances, first of all, depressive and anxious states, occupy an essential place in the clinical picture of alcoholism, and are closely connected with pathological craving for alcohol [1,2], the pivotal symptom of this disease. According to various authors [3] the number of depressive disturbances in alcoholic patients fluctuates from 3% up to 98%, apparently due to the fact that in these investigations the depressive symptomatology of the alcohol withdrawal syndrome (AWS) was included. More homogeneous results (depressive symptomatology registered in 6–15% of patients [4–6]) were received when the frequency of depressive disturbances was studied in patients abstaining from alcohol for more than 3 weeks. The number of affective disorders in alcoholics out of AWS and not limited to depressive ones, was considerably higher [7]. The not diagnosed and not treated affective disturbances, especially depression, present risks of relapse and suicide [8,9]. For the treatment of anxious and depressive states induced by alcoholism are recommended tranquilizers, tricyclic antidepressants and lithium [10,11]. However, chronic alcohol intoxication and lesions of the parenchymal organs, cardio-vascular system and CNS in alcoholics, increase the probability of side-effects of these drugs [9]. Antidepressants in combination with alcohol or disulfiram may lead to severe complications [12]. Tranquilizers, especially when combined with alcohol, decrease attention and induce myorelaxation and dependence. All this calls for developing simple and effective non-medicamental methods for treating the affective

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disturbances of anxiously-depressive character in alcoholic patients. Since a functional β-endorphine deficiency in the CNS [13] plays, possibly, a definite part in the pathogenesis of depressive disturbances connected with alcoholism, it seemed appropriate for us to use a therapy regime of transcranial electric treatment (TET) developed by Lebedev et al. [14]. This treatment activates endorphinergic brain systems and owing to this fact has a specific therapeutic effect on an endorphine deficiency condition — the alcoholic withdrawal syndrome [15].

Subjects and methods

The investigation was carried out in 20 volunteers — alcoholic patients with affective disorders. All patients were abstinent for not less than 3—4 weeks, i.e., their affective disturbances were not AWS symptoms. The depressive disorders were expressed moderately or weakly in all patients and proceeded as subdepressions which is typical for the affective disturbances of alcoholic patients in remission out of AWS [1]. All patients were divided by chance into two groups of 10. An increased anxiety level was noted in both patient groups. In the experimental group TET was carried out for 30 min every day for 4 weeks (i.e., the whole course was 20 procedures) in the form of a combination of constant electric current with a pulse current of square impulses of 70—80 Hz and 4—7 mA, i.e., in a regime activating endorphinergic brain systems [14,15]. Epicutaneous electrodes were situated on the forehead (cathode) and behind the ears (anode). The control group received placebo treatment for 4 weeks in the form of a very weak constant current (up to 1 mA). During the whole investigation both groups were not prescribed psychotropic drugs. The groups did not significantly differ statistically in age nor in AWS expression nor in the duration of addiction (Table I). The study was double blind placebo-controlled.

As I.V. Bokij [1] noted the study of affective disturbances by clinical observation only is insufficient. It is expedient to use psychological experimental methods for a more subtle judgement of emotional conditions. Therefore Zung's and MMPI tests which as relevent methods for the diagnosis of depressive disturbances in alcoholic patients [8,16] were used for the quantitative evaluation of depressive symptomatology. Since increased anxiety typical for alcoholic patients is as a rule combined with depressive symptomatology [1], we used Spielberger's test adapted by Ju.L. Khanin [17] for the evaluation of the level of personal and reactive anxiety and also Taylor's anxiety scale of MMPI. All patients were subjected to these three tests before TET, in the middle of treatment (day 14) and every other day until the end (day 29).

MAO-B activity in blood platelets was determined as well as plasma levels of serotonine, dopamine, GABA and β-endorphine — the metabolic disturbances of which are connected with the development of affective disorders [12,13,18,19] — in both patient groups before the first TET, before the 10th TET and on the day after the 20th TET (1st, 14th and 29th

Table I. Characteristics of patients.

Group	Age (years)	Duration of abstinence from alcohol to moment of investigation (days)	Duration of AWS (years)	Character of leading syndrome		
				Anxiously-depressive	Astheno-depressive	Melancholic
Experimental	39.5 ± 3.1	51.8 ± 2.6	11.7 ± 3.5	1 (10%)	6 (60%)	3 (30%)
Control	36.0 ± 1.8	49.6 ± 2.5	10.4 ± 1.3	3 (30%)	5 (50%)	2 (20%)

investigation days). The dopamine concentration in plasma was determined by Kogan's method [20]; serotonine by the method of Loboda and Makarov [21]; GABA by Sutton and Simmonds' method [22], β-endorphine level by radioimmunoassay [23]; and MAO-B activity in blood platelets as described by Voloshina and Moskvitina [24]. The electroencephalogram (situation of electrodes by "10-20" system) was recorded in both patient groups before and after TET (1st and 29th day). The latency of α-rhythm appearance in occipital leads was determined after close of eyes [25].

Results

The data of psychological investigation realized with MMPI, Zung's and Spielberger's tests testify (Table II) that there was initially nonviolently expressed depression (subdepression) in patients of both groups and a high level of reactive and personal anxiety. On the first day of investigation the experimental and control groups did not significantly differ statistically by expressivity of these affective disturbances. However, the expressivity of depressive symptomatology (according to the data of MMPI depression scale and Zung's test) was reliably decreased in the experimental group after 10 TET procedures. The reactive anxiety (by Spielberger) and anxiety by Taylor's scale were also reliably diminished (Table II). These improvements were more expressed after 20 TET procedures. The indices of all tests did not practically differ from average normative in the experimental group on day 29, which reflects the considerable improvement of the patients clinical condition and reduction of affective disturbances by TET. The patients became more tranquil, well-balanced, active, and their mood was improved. At the same time these positive changes were not observed in one of the tests carried out in the control group. Moreover, the indices of all three tests demonstrated a tendency toward a definite aggravation of the state and some increase of affective disturbances in the control group. The clear differences between the experimental and control group as revealed by Taylor's anxiety and MMPI depression scales and Zung's test were already noted after 10 TET procedures. Besides, real differences were registered by the scale of reactive anxiety of Spielberger's test after all TET courses.

The activity of MAO-B in blood platelets and GABA concentration in blood (Table III) were increased in the experimental group after 20 TET procedures, which correspond to the considerable state improvement of patients at the end of the treatment course. The concentrations of serotonine, dopamine and β-endorphine in blood were not substantially changed. These changes of biochemical indices were not registered in the control group where the tendency towards decreased MAO-B activity and GABA level in blood corresponded with a definite increase of affective disturbances at the end of the course. At this time the differences between the control and experimental group were statistically significant.

The EEG analysis showed that the latency of α-rhythm appearance in occipital leads after closing eyes was decreased after TET in the experimenhtal group, whereas in the control group it was practically not changed and considerably exceeded the indices of the experimental group (Table IV).

Discussion

The above mentioned results allow us to conclude that transcranial electric treatment (TET) is an effective non-pharmacological method to treat affective disturbances (depressions, anxieties) in alcoholic patients in remission. In our investigation TET was not accompanied by side-effects nor complications and was well tolerated by the patients. TET tends to avoid side-effects and complications sometimes observed in antidepressant therapy [9,12] and tranquilizers [26].

As the decreasing of MAO-B activity in blood platelets, and also GABA level in blood has been shown to be connected with the development of affective disturbances [18,19], our results can be considered as further evidence of

Table II. Expressivity of affective disorders.

Zung's test (marks)			Reactive anxiety by Spielberger's test (marks)			Personal anxiety by Spielberger's test (marks)			MMPI, Taylor's anxiety scale (marks)			MMPI, depression scale (T-marks)		
1*	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Experimental group														
55.3 ± 2.06	47.0+** ± 2.60	43.4** ± 3.00	51.7 ± 3.14	43.0* ± 3.36	39.6** ± 2.15	51.4 ± 3.09	46.7 ± 2.60	43.8 ± 5.15	26.6 ± 1.79	18.0** ± 2.38	14.0** ± 3.43	83.9 ± 3.79	68.5** ± 4.98	68.0* ± 6.22
Control group														
54.2 ± 0.97	55.8+· ± 1.70	57.5·· ± 1.70	51.7 ± 2.81	50.6 ± 2.05	53.0· ± 3.46	55.9 ± 2.71	50.3 ± 2.98	51.2 ± 4.93	28.5 ± 1.99	26.8· ± 2.48	28.0· ± 3.21	83.4 ± 3.13	86.6· ± 5.32	89.3· ± 5.04

1 — 1st day of investigation; 2 — 14th day of investigation (before 10th TET); 3 — 29th day of investigation (day after 20th TET).
*Difference between day 14 or 29th and day 1. *$P < 0.05$; **$P < 0.01$.
+Difference between experimental and control groups: ·$P < 0.05$; ··$P < 0.01$; Student's t-test.

Table III. Biochemical indices in alcoholic patients with affective disorders.

MAO-B in blood platelets (nmol/mg · h)			GABA (ng/ml)			Serotonine (μg/ml)			Dopamine (ng/ml)			β-endorphine (pmol/l)		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Experimental group														
79.89 ± 7.13	90.85 ± 7.46	105.62* ± 9.98	44.1 ± 2.38	49.6 ± 6.30	51.6* ± 2.90	0.055 ± 0.004	0.053 ± 0.004	0.046 ± 0.004	117.6 ± 8.54	116.9 ± 9.94	112.5 ± 8.25	8.44 ± 0.81	9.75 ± 1.35	11.24 ± 1.62
Control group														
89.09 ± 8.90	82.80 ± 6.76	78.56 ± 10.50	48.6 ± 3.19	45.9 ± 4.29	39.76 ± 5.90	0.050 ± 0.002	0.046 ± 0.003	0.043 ± 0.003	118.6 ± 7.80	117.4 ± 10.50	119.2 ± 10.20	7.86 ± 0.37	7.34 ± 0.82	10.8 ± 1.40

Notes: See Table II.

Table IV. Latency of α-rhythm appearance in occipital leads after closure of eyes before and after TET.

	Latency of α-rhythm appearance in occipital leads			
	Before TET (1st day)		After TET (29th day)	
	D	S	D	S
Experimental	1.26 ± 0.20	1.40 ± 0.20	0.63[a]* ± 0.16	0.67* ± 0.13
Control	1.1 ± 0.20	1.40 ± 0.33	1.43[a] ± 0.20	1.50* ± 0.30

D = right hemisphere; S = left hemisphere.

[a]Difference between experimental and control groups, $^{a}P < 0.05$.

[b]Difference between before and after TET in the same group; $^{*}P < 0.05$; Student's t-test.

the positive effect of TET on the clinically-psychological state of alcoholic patients with affective disturbances, and also as indirect evidence of TET influence on some neurochemical disorders in these states.

The changes of GABA blood level can be to a certain extent connected with the reduction of depressive symptomatology [19] whereas the increase of MAO-B activity in blood platelets, most probably can be connected with the diminution of anxious disturbances, since the anxiogenic phenylethylamine [27] is one of the endogenic substrates of MAO-B in blood platelets and, besides, blood platelets can be considered as a peripheral metabolic model of CNS monoaminergic neurons [28].

In this study the blood level of β-endorphine did not differ really from previous data [15] on β-endorphine concentration in blood of healthy subjects. Thus, our findings of the absence both of an initial decrease of β-endorphine and of its subsequent changes in both groups do not coincide with those of K. Blum et al. [13] about the connection of affective disturbances in alcoholics with a functional β-endorphine deficiency. This is probably due to the less expressed subclinical character of affective disorders in our patients. At the same time our findings do not contradict results of our previous study [15] showing the connection of medical TET affects on the alcohol withdrawal syndrome (AWS) with an activation of endorphinergic brain systems. Unlike in AWS, the initial decrease of the β-endorphine blood level in comparison with healthy subjects is absent in the alcoholic patients with affective disturbances. Further, in the present study blood was withdrawn on the day after TET, whereas the distinct but transitory increase of the β-endorphine blood level continues, about 12 hours [15] after TET and then returns to normal. Thus, the effect of TET on the affective disturbances in alcoholics is most likely not due to an action on the endogenic opioid neuropeptides system, but is more probably connected with changes in monoamine- and GAB-ergic neuromediatory structures.

The reduced latency of α-rhythm appearance after closing eyes under TET is evidence of a reduced rigidity in the CNS stimulation process and of enhanced activity of the α-rhythym generating systems. It can be considered as indirect evidence of the reduction of affective disturbances in alcoholics [25], and also as one of the possible neurphysiological mechanisms of the medical effects of TET.

In conclusion it should be noted that a parallelism of positive dynamics of clinically-psychological and some biochemical and physiological indices in the experimental patients group allows to consider TET not only as an effective method of the affective disturbances therapy but, to a definite extent, as a correction method of some neurochemical and neurophysiological disorders connected with these disturbances in alcoholic patients in remission.

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