THE INFLUENCE OF CORTICAL FACTORS ON NEURO-VEGETATIVE REACTIVITY

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The problem of interrelations between the cervical cortex and its higher vegetative centers has an essential bearing on the complex process of influencing and regulating functions in the organism. Recently it has assumed a particular actuality, brought about by the rapid progress of our knowledge on the physiological importance of formatio reticularis in which higher vegetative centers are included. With the purpose of studying some particular aspects in this interrelation, we investigated the changes in the neuro-vegetative reactivity during examination sessions of students; as well known, in them a widespread radiation occurs of excitation processes produced by the examination state. The influence of the functional conditions of the cerebral cortex on some of the vegetative functions during examination of students was also subject to investigation by Gotzev and associates (1, 2, 3, 4, 5).

Method of investigation

The studies were carried out on a group of 37 female and 26 male students (total 63 individuals), with mean age 22,43 (σ $\pm$2,73). The neurovegetative reactivity was established after the electrophoretic dermogram method (EPhDG) (6,78) one month prior to and during taking examination in physiology in the June 1963 session. The changes in electroconductivity were measured with Galvanometer Multiflex (2.10^{-7}, A, 60 ohm). Evaluation was made of the neurovegetative reactivity in accordance with a scheme and method of interpretation suggested by us (9, 10). Parallel with this, the pulse rate was also measured for one minute periods.

Results and Discussion

The distribution of the individuals studied according to the pattern of EPhDG, previous to and during examination, is illustrated in table 1. It shows that before examination, of all the EPhDG thypes, the largest relative part belongs to the "low curves" type (68,25%), next ranking the "acetylcholine dissociation" (15,87%) and "mean curves" (12,70%). The "adrenalin dissociation" and the "high curves" are represented with one case each (total 3,18%).

It is quite evident from the data in the table that during examination, forty four of the individuals studied (69,84%) have sustained a

Table 1

EPhDG curve pattern	Prior to examination: individuals investigated		Changes in the EPhDG during examination: adrenalin dissociation		acetylcholine dissociation		mean curves		low curves		high curves		remaining in the same group according to EPhDG type	
	number	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
Lom curves	43	68,25	25	58,14	1	2,33	2	4,65	—	—	1	2,33	14	32,56
Acetylcholine dissociation	10	15,87	5	50	—	—	2	20	1	10	—	—	2	20
Mean curves	8	12,70	4	50	—	—	—	—	2	25	—	—	2	25
Adrenalin dissociation	1	1,59	—	—	—	—	—	—	—	—	—	—	1	100
High curves	1	1,59	—	—	—	—	1	100	—	—	—	—	—	—
Total	63	100	34	X	1	X	5	X	3	X	1	X	19	X
% of the total number of individuals studied	63	100	34	53,97	1	1,59	5	7,94	3	4,76	1	1,59	19	30,16

change in the type of EPhDG, with the "adrenalin dissociation" becoming most frequent (from 1.59% to 53,97%). Considering however that one of the individuals (with "adrenalin dissociation" prior to examination) preserved the type of EPhDG during the examination, the relative part of this group amounts to 55,56%. Next the "mean curves" follow (7,94%) and the "low curves" (4,76%). The "acetylcholine dissociation" and the "high curves" are represented with one case each.

The summarized curves of the EPhDG, common for all the persons investigated and according to the pre-examination type, are demonstrated on the uppermost line of fig. 1. Underneath in the same figure

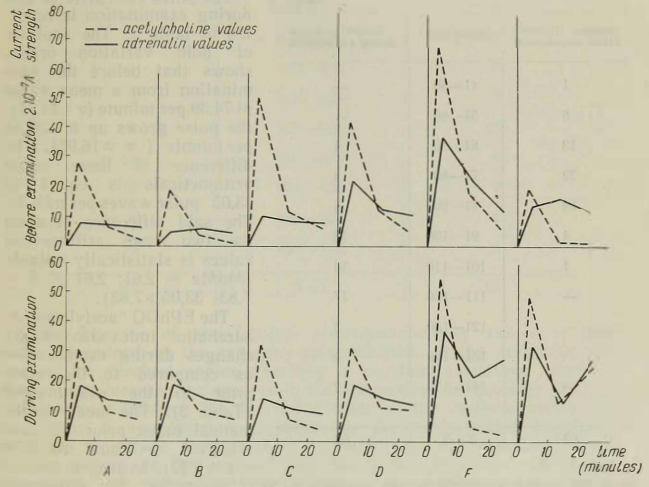

Fig. 1

the summarized curves are presented according to the types of the same individuals during examination, regardless of the fact that the type of EPhDG is preserved only in 30,16% of the studied.

The values of acetylcholine and adrenalin in the "lower curves" (Fig. 1-b) are substantially higher during examination as compared to those prior to the examination, much more pronounced being the increase of adrenalin values (nearly two times). During examination a strong decrease of acetylcholine values is noted as well as increase of the adrenalin values in the "acetylcholine dissociation" (Fig. 1-b). In the "mean curves" type (Fig. 1-d) alteration during the exam occurs only in the acetylcholine values, which are decreased as compared to

the same prior to examination. The picture is similar with the "high curves" type (Fig. 1-e). In the "adrenalin dissociation" pattern the values of acetylcholine and adrenalin are elevated during examination (Fig. 1-f).

The arithmetical means with respect to electroconductivity for acetylcholine and adrenalin of all the individuals studied during examination, compared to the data before examination, show a substantial increase of the values for adrenalin (Fig. 1-a). Modification of the acetylcholine values during the first measuring is virtually unobserved whereas during the second and third measurement an alteration is noted, more particularly an increase.

Table 2

Number of cases before examination	Pulse rate	Number of cases during examination
1	41—50	—
8	51—60	—
13	61—70	1
22	71—80	4
14	81—90	4
4	91—100	13
1	101—110	14
—	111—120	17
—	121—130	3
—	131—140	4
—	141 – 150	2
63	X—X	62

The pulse rate prior to and during examination is reported in table 2. The analysis of both variation orders shows that before the examination from a mean value of 74,39 per minute ($\sigma \pm 11,91$), the pulse grows up to 107,44 per minute ($\sigma \pm 16,95$). The difference of these mean arithmeticals is equal to 33,05 pulse waves per minute. The said difference between the two mean arithmetical values is statistically reliable (MdMa = 2,61; $2,61 \times 3 = 7,83$; $33,05 > 7,83$).

The EPhDG "acetylcholine adrenalin" index also exhibits changes during examination as compared to the state prior to the examination (Table 3). The mean arithmetical index prior to examination is equal to 0,74 ($\sigma \pm 0,20$). During examination the same amounts to an average of 0,52 ($\sigma \pm 0,22$). The difference between the two mean arithmetical values is 0,22. The latter too is statistically reliable (MdMa = 0,012; $0,012 \times 3 = 0,036$; $0,22 > 0,036$).

The data obtained (table 1) prove that during examination sessions the "adrenalin dissociation" type predominates, which fact is related to a marked increase of the skin electroconductivity, brought about by the electrophoretically introduced adrenalin. This change in electroconductivity is most probably substantiated by the involvement of the sympathetic reactivity on one hand, and by altering the sensibility of the structures, on the other, which react to this mediator. It seems that the excitation, extensively irradiating along the cerebral cortex under the conditions of examination, sets in the situated in the diencephalon higher vegetative centers which on their part account for an increase of sympathetic reactivity. It is very likely that hormonal factors also play an important role in this increase of values of adrenalin electro-

conductivity during examination, as for instance involvement of the hypophysis-adrenalin system according to the conception as postulated by Selye. The findings for accelerated pulse during examination with an average of 33,05 pulse waves per minute further support this statement.

Table 3

Number of cases before examination	Acetylcholine-adrenalin index of EPhDG	Number of cases during examination
1	0,01—0,10	1
—	0,11—0,20	2
1	0,21—0,30	10
1	0,31—0,40	8
2	0,41—0,50	9
6	0,51—0,60	11
13	0,61—0,70	8
16	0,71—0,80	7
8	0,81—0,90	4
15	0,91—1,00	3
63	X—X	63

The decrease of acetylcholine electroconductivity values is most likely determined by the excessive intensification of the excitation process in the cerebral cortex, reaching a constant excitation, which instead of an increase, brings about the attenuation in question. The interdependance between the functional state of the cerebral cortex and the values of acetylcholine supports our previously stated hypothesis according to which, the acetylcholine values in electroconductivity of the skin during the first measurement are mainly cortically conditioned, whereas the adrenalin values are related to the reactivity of the higher vegetative centers.

The finding that the "low curve" types leads to an increase of adrenalin and acetylcholine values demonstrates that the reactions related to the state of examination depend on the functional condition of the cerebral cortex.

Very interesting from theoretical viewpoint is the dissociation manifested between the EPhDG index and pulse rate. In three of the students investigated (4,76%) absolutely slight alterations are detected of the pulse, e.g. slowing down, whereas the change of theEPhDG index is substantial, always in the general trend of decrease. On the contrary, in eleven of our cases (17,46%) the index modification of EPhDG displayes an increase from 0,01 to 0,70 with markedly quicker pulse rate.

There is enough ground to assume that under special conditions of the organism, the external (environmental) factor involves in a different fashion the separate reflex links, by means of which the functions of a particular effector are markedly intensified, whereas those of other effectors are almost unchanged, and vice versa. This could also serve as a theoretical explanation of the routine practical findings in which it is obvious that a given group of individuals, under similar unfavourable environmental factors, sustain functional and morphological lesions of various organs and systems: in some of them the functions are mainly affected of the cardio-vascular system, in others — of the digestive system etc.

Inferences

1) In 69,84% of the individuals studied during examination sessions the type of the EPhDG is altered, the "adrenalin dissociation" (55,56%) being most frequent.

2) The adrenalin and acetylocholine values of skin electroconductivity in the "low curves" pattern are increased during examination.

3) In all the remaining patterns the acetylcholine values are decreased during examination.

4) During examination the "acetylcholine-adrenalin" EPhDG index is reduced from 0,74 to 0,52, and the pulse rate becomes quicker — from 74,39 per minute to 107,44 per minute.

5) In 14 of the individuals investigated (22,22%) dissociation is established during examination between the EPhDG index and pulse rate.

REFERENCES

1. Гоцев, Т., А. Иванов — *Годишник на Соф. унив., мед. фак.*, 28, 405, 1948.—2. Гоцев, Т., А. Иванов.—*Годишник на Соф. унив., мед. фак.*, 29, 1. 1949.— 3. Gotsev, T., A. Ivanov. — *Acta Physiol. Hung.*, 1, 53, 1950. — 4. Gotsev, T., A. Ivanov. — *Acta Physiol. Hung.*, 6, 427, 1954. — 5. Гоцев, Т., А. Иванов, Н. Добрева. — *Физиол. журнал*, СССР, XII, 7, 565, 1956. — 6. Daskalov, D., M. Markov, E. Milarov. — *Compt. Rend. de l'Acad. Bulg. Sc.*, 10, 2, 169, 1957. — 7. Daskalov, D., M. Markov, E. Milarov. — *Congr. national de Sc. méd.* II, 25, Bucarest, 1957. — 8. Даскалов, Д., М. Марков, Е. Миларов. — *Изв. на Отд. за биол. и мед. науки*, III, 1, 25, 1959. — 9. Даскалов, Д., М. Марков, Е. Миларов. — *Изв. на Отд. за биол. и мед. науки*, 2, 1959. — 10. Даскалов, Д. — *Изв. на Отд. за биол. и мед. науки*, V, 163, 1963.

ВЛИЯНИЕ КОРКОВЫХ ФАКТОРОВ НА НЕВРОВЕГЕТАТИВНУЮ РЕАКТИВНОСТЬ

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РЕЗЮМЕ

При помощи метода электрофоретической дермограммы (ЭФДГ) и отсчитывания частоты пульса перед и во время экзамена, были исследованы 63 студента, чтобы установить невровегетативную реактивность.

Пред экзаменом „низкие кривые" встречаются в 68,25%. Во время экзамена — в 69,84% наблюдений тип ЭФДГ изменяется. Самой многочисленной делается „адреналиновая диссоциация" — 55,56%. Стоимости адреналина и ацетилхолина при „низких кривых" — повышаются. У остальных типов, ацетилхолиновые стоимости снижаются. Уменьшается и индекс ЭФДГ на 0,22, а пульс учащается на 33,05. В 22,22% наблюдении получаются диссоциации между частотой пульса и индексом ЭФДГ.

Предполагается, что во время экзамена включается симпатикусовая реактивность и реактивность чувствительных к адреналину структур и, что возбуждение от коры головного мозга иррадиируют к высшим вегетативным центрам диэнцефалона. Наступает изменение функционального состояния коры головного мозга и в виде стоящего возбуждения.