

EVALUATION OF EEG TESTS IN THE AMATEUR DIVING INSTRUCTOR GROUP AND CORRELATION WITH THE OCCURRENCE OF STERILE BONE NECROSIS

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ABSTRACT

The research undertaken was a continuation of previous studies relating to professional divers. The bioelectrical activity of the brain with an electronic electroencephalograph (EEG) was studied in a group of 89 instructors for amateur diving between 21 and 50 years of age. Pathological patterns were found in 15.7% of the subjects. In comparison with professional divers, the disturbances were significantly less frequent, but considerably more frequent in comparison with the control group. There was no relationship between the occurrence of the disorders in relation to the age of the examined person, however, the occurrence of the disorders was more frequent in persons with the least experience. Moreover, a correlation was found in one age group between abnormalities of EEG recording and the occurrence of sterile bone necrosis.

Keywords: amateur diving, EEG, sterile bone necrosis.

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INTRODUCTION

An electroencephalographic examination (EEG) was carried out on a group of 89 amateur-diving instructors, whose age ranged from 21 to 50 years old, and who had been diving instructors for between 1 to 21 years. The research was carried out using an 8-channel EEG apparatus manufactured by the GDR, or a similar device manufactured by the Dutch company Van Gogh, using longitudinal and transverse montages according to the international 10/20 system and 3-minute hyperventilation as a provocation method. The obtained results of the EEG were divided into correct, borderline and pathological norms and compared with the data previously obtained during the study of a group of 150 professional divers, and a control group consisting of 50 healthy, age-appropriate individuals [3].

On the basis of the results of the EEG examination, it was found that 70 (78.7%) scuba divers had results falling within the norm, 5 (5.6%) – had results on the borderline of the norm, and in 14 (15.7%) individuals, pathological records were detected, however of low intensity.

Incorrect recordings are mainly characterised by dispersed free theta waves of 5-7 hertz frequency and voltage up to 50 microvolts. In some recordings, located in the temporal region, in isolated cases single sharp waves occur. In 3 individuals hyperventilation shows a tendency to discharge small groups of dysrhythmic waves. This applies to young individuals – 20 years old. Abnormal EEG recordings in clinically healthy juveniles may be associated with delayed maturation of brain bioelectrical activity or with constitutionally conditioned impaired bioelectrogenesis [5]. They may, on the other hand, be a temporary functional disorder or a permanent lesion following a trauma to the central nervous system, or a pre-existing preclinical symptom of a current condition of that system. In our cases, we are rather dealing with electroencephalographic symptoms of delayed bioelectric maturation.

The data obtained were compared with the results of EEG studies previously carried out in the group of professional divers and in the control group, as shown in Table 1.

Tab. 1

Results of EEG studies in particular groups.

EEG groups	Norm		Borderline		Pathology		Total	
	n	%	n	%	n	%	n	%
Divers	85	57.0	5	3.0	60	40.0	150	100.0
Scuba divers	70	78.7	5	5.6	14	15.7	89	100.0
Control	43	86.0	2	4.0	5	10.0	50	100.0

It shows that in the group of professional divers, irregular changes in EEG records are much more frequent, namely in 40% of cases, while records that border on the norm occur in 3% of cases. The control group shows 10% and 4% of changes respectively. In accordance with the literature [2,4], it is assumed that in a population of healthy individuals, 5 - 20% of the subjects show minor abnormal changes in EEG records, which can still be regarded as a broadly defined electroencephalographic standard. The table presented here shows that the results of the diver's and control group's EEGs are within these limits, while the

results of the professional divers' group's EEGs are well above the norm. This state of affairs could be linked to the different degree of high-pressure effects, different both in size and in duration in the group of divers and scuba divers [1]. There is no correlation between incorrect changes in divers' EEGs and their age, as shown in Table 2. However, there is a certain tendency for these changes to correlate with diving experience, as illustrated in Table 3.

Tab. 2

Results of EEG examinations of scuba divers in relation to age (in years).

Age EEG	21-30		31-40		41-50	
	n	%	n	%	n	%
Norm	20	69.0	33	80.0	17	90.0
Borderline	1	3.0	3	8.0	1	5.0
Pathology	8	28.0	5	12.0	1	5.0
Total	29	100.0	41	100.0	19	100.0

Tab. 3

Results of EEG examinations of scuba divers in relations to diving experience (in years).

Seniority EEG	0-1		2-5		6-10		11	
	n	%	n	%	n	%	n	%
Norm	2	29.0	15	83.0	31	84.0	22	82.0
Borderline	-	-	-	-	3	8.0	2	7.0
Pathology	5	71.0	3	17.0	3	8.0	3	11.0
Total	7	100.0	18	100.0	37	100.0	27	100.0

However, it is important to take into account the stipulation that the changes in the EEG revealed in subjects with up to one year of training (71%) concern young people and may be a symptom of the already mentioned delayed maturation of the bioelectric brain. A significant proportion of professional divers from the comparative group presented here, with abnormal changes in EEG records, have experienced more or less severe symptoms of decompression sickness. Among scuba divers, only 3 individuals reported experiencing mild symptoms of decompression sickness, of whom only one presented abnormal changes in the EEG records.

In addition to the results of radiological examinations of bones in the group of scuba divers, an attempt was made to correlate discrete, or moderately more pronounced, aseptic necrosis bone lesions with those found in the EEG study.

Among 19 individuals with pathological or borderline lesions in the EEG record, 5 individuals (26%)

were diagnosed as having dysbaric bone necrosis. These are mostly thirty-year-old individuals with an average of 5 years of diving experience. Therefore, in these five cases, the existence of a common pathogenetic factor may be suggested, i.e. the effect of hyperbaria on the body, with the production of chronic bone lesions and, in this case, neurological (bioelectrical) brain lesions.

However, in general, our EEG results do not seem to indicate that amateur diving has a lasting negative effect on brain bioelectrical activity and that it leads to permanent neurological changes under current diving conditions. This does not, however, preclude the negative effects of hyperbaria in individual cases, particularly in the more predisposed individuals, who do not always follow the relevant diving safety rules.

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