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MONITORING OF PSYCHOTHERAPEUTIC PATIENTS BY ASSESSING MOTOR ACTIVITY DURING NIGHT SLEEP

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ABSTRACT — In order to monitor the state of patients in the psychotherapy department by assessing motor activity during their night sleep, we examined 16 patients of both sexes with diagnosis of a depressive episode and neurotic, stress-related and somatoform disorders. Data on motor activity during sleep were obtained and processed using a special information-analytical system with the following parameters: the number of movements, the maximum jerk magnitude and the coefficient of motor activity. It showed a high efficiency of monitoring the condition of patients in comparison with healthy people by assessing motor activity during their night sleep.

KEYWORDS — monitoring in psychotherapy, physical activity during sleep, information-analytical system, depressive episode, neurotic, stress-related, and somatoform disorders.

INTRODUCTION

Modern advances in disease monitoring determine the need for *not just monitoring*, but long-term and clinically controlled monitoring of diseases. Despite the fact that traditional methods of diagnosing psychiatric disorders are informative to a certain extent, they are practically not suitable for continuous daily, hourly, minute-to-minute monitoring. Therefore, there is a need for a system capable of continuous monitoring of psychiatric patients [1].

To analyze the effectiveness of treatment and dosage of medications for psychiatric disorders, there is a need for information about a person's health and physical activity. To obtain qualitative and quantitative information about health, there are instrumental methods such as electroencephalography (EEG), video-EEG monitoring and positron emission tomography. These methods are informative, but at the same time have common drawbacks of impossibility of constant monitoring of the patient, limitations of use at home, high cost and non-absolute verification of the process [2].

From the point of view of metrology, the process of instrumental diagnostics in medical practice is most effective with the largest number of studies carried out under the same conditions [3]. Therefore, in order to increase the reliability of the study, it must be carried out several times under the same conditions. It was demonstrated in the work of University College London, which was dedicated to a new method for measuring blood pressure based on long-term monitoring using a new mobile device. This enabled to increase the reliability of the study by 50% [4].

MATERIALS AND METHODS

At the Tambov Psychiatric Clinical Hospital 16 patients (8 men and 8 women) aged 34 to 73 years were examined. According to the International Classification of Diseases (ICD-10) the patients were diagnosed as follows: F40-48 (neurotic, stress-related, and somatoform disorders) and F32 (depressive episode) [5]. All the patients were monitored before the start of treatment and after the end of treatment according to clinical guidelines.

The study was carried out during the period of night sleep: the information and analytical system (IAS) was working from the moment of going to bed, followed by falling asleep until the moment of awakening when the IAS was switched off. A detailed research methodology was described in our previous works (a study of young healthy people and a study of patients with Parkinson's disease) [6, 7].

To solve the problem of measuring and recording motor activity, we have developed an IAS with a primary measuring transducer based on a 3-D accelerometer and recording the measured values of motor activity on a memory card with their subsequent interpretation using specialized software [8]. Later, using specially developed software [9], the obtained data were processed and presented for further analysis of the following parameters (Fig. 1, 2):

1 — number of movements — the maximum number of hand movements along each axis for the entire study period (dimensionless value);

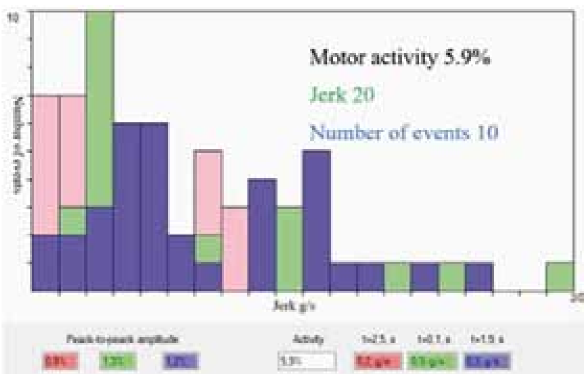

***Fig. 1.** Monitoring patients with depressive episode before treatment*

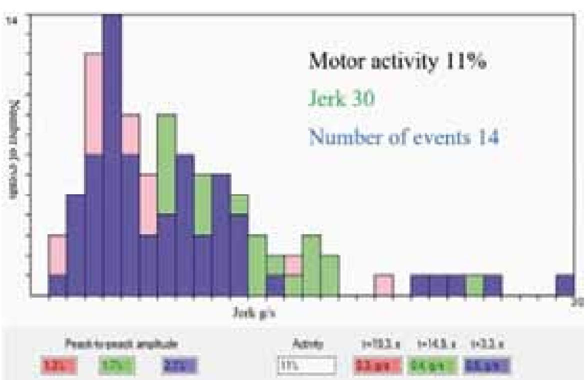

***Fig. 2.** Monitoring patients with depressive episode after treatment*

2 — maximum jerk value — the maximum value of the modules of the rate of acceleration change during data recording (g/s);

3 — coefficient of physical activity — the ratio of the number of files with significant physical activity to the total number of files (%).

RESULTS

As a result of the study, the following data were obtained.

In the group of patients with neurotic and somatoform disorders before treatment, the following results were obtained: the average value for the number of movements was 13.1; the maximum value was 23; the minimum value was 9. The average value of the maximum jerk magnitude was 24.4 g/s; the maximum value was 36 g/s; the minimum value was 10 g/s. The average value of the coefficient of motor activity was 11.4%; the maximum value was 40.8%; the minimum value was 5.9%. After treatment: the average value for the number of movements was 18.2; the maximum value was 29; the minimum value was 11. The average value of the maximum jerk magnitude was 22.9 g/s; the maximum value was 36 g/s; the minimum value was 17 g/s. The average value of the coefficient of motor activity was 15.8%; the maximum value was 28.1%; the minimum value was 8.5%.

In the group of patients with depressive episodes before treatment, the following results were obtained: the average value for the number of movements was 21.5; the maximum value was 40; the minimum value was 12. The average value of the maximum jerk magnitude was 34.0 g/s; the maximum value was 43.1 g/s; the minimum value was 30.1 g/s. The average value of the coefficient of motor activity was 29.0%; the maximum values was 35.1%; the minimum value was 22.9%. After treatment: the average value for the number of movements was 15.7; the maximum values was 33; the minimum value was 10. The average value of the maximum jerk magnitude was 18.9 g/s; the maximum values was 29 g/s; the minimum value was 13 g/s. The average value of the coefficient of motor activity was 26.9%; the maximum values was 38.4%; the minimum value was 14.5% (Fig. 1, 2).

DISCUSSION

In patients diagnosed with F40-48, the following dynamics of indicators was revealed in comparison with the state before treatment and the state after treatment. The average value of the number of movements increased from 13.1 to 18.2 — by 40.2%. The average value of the maximum jerk magnitude decreased from 24.4 g/s to 22.9 g/s — by 6.1%. The average value of the coefficient of physical activity increased from 11.4% to 15.8% — by 38.6%.

Patients diagnosed with F 32 showed the following dynamics of indicators in comparison with the state before treatment and the state after treatment. The average value of the number of movements decreased from 21.5 to 15.7 — by 26.9%. The average value of the maximum jerk value decreased from 34.0 g/s to 18.9 g/s — by 44.4%. The average value of the coefficient of motor activity decreased from 29.0% to 26.9% — by 0.7% (Fig. 1, 2).

CONCLUSION

When compared with the results in healthy people [6], there are noticeable differences in patients with diagnoses F 40-48 and F 32 in terms of the parameters of the coefficient of motor activity and the number of movements.

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