

ON RYTHMIC CHANGES OF THE CARDIOVASCULAR DISEASE EXACERBATION AND THEIR RELATIONSHIP TO HELIOGEOPHYSICAL DISTURBANCES

S.N. Samsonov¹, V.D. Sokolov¹, A.A. Strekalovskaya², P.G. Petrova²

¹ Yu.G. Shafer Institute of Cosmophysical Research & Aeronomy, 31 Lenin Ave., 677891 Yakutsk, Russia,
e-mail: s_samsonov@ikfia.ysn.ru

² M.K. Ammosov Yakutsk State University Medical Institute, 36 Kulakovsky Str., 677001 Yakutsk, Russia

Abstract The spectral analysis of disease dynamics of patients having a cardiovascular pathology based on the statistical data on a hypertensive disease, hypertensive crisis and sick people registered in a dispensary has been carried out. The medical data have been obtained from the Yakutsk ambulance service for 1992 and 1998. In a similar way, the parameters of solar wind (magnetic field, speed and proton density) and also of geophysical disturbance (K-index and energetic electrons) have been analyzed. In the geophysically disturbed year (1992) the 30-32 day peaks are found in medical parameters. The same periodicity is observed in geophysical activity parameters. The maximum peaks of rhythm in solar wind parameters are repeated in 29-30 days. In the year of minimum geophysical disturbance (1998) in medical showings the periodicity is manifested weakly and the coincidence with the periodicity in parameters of solar wind and geophysical activity is insignificant.

Introduction

Rhythmic changes of heliogeophysical parameters were studied many times. If these factors really affect the physiological state of biological objects, in particular, a human being, then in the dynamics of medical showings the rhythmic changes observed in the heliogeophysical parameters should be present. In the paper by Kovalchuk (1974) the changes in the geomagnetic activity Ap-index and some medical showings (blood pressure, frequency of systoles and so on) with periods of 4; 5-8; 9-16 and 22-42 days were revealed. Vladimirsky and Temurjantz (2000) note that the rhythmic changes with a frequency of about one week frequently observed in the biosphere is associated with the changes of cosmophysical indications. In heliogeophysics the group of 27-28 day periodicities, their harmonics and subharmonics with periods of about 14, 7 days and so on (Breus et al., 1995) is well known. In spite of the fact that the external effect of electromagnetic fields to the biological object takes place at the level of noises, it can transfer the system into the critical state (Halberg et al, 1991; Komarov et al., 1994; Breus et. al., 1995, 2002).

The aim of the present paper is to study the relationship of rhythmic changes in exacerbation of the hypertensive disease (HD), hypertensive crisis (HC) and also for sick people registered in a dispensary (DR) because of a cardiovascular pathology to heliogeophysical disturbances.

Data and Method

The study is based on data from the Yakutsk ambulance service, geophysical observations at Yu.G. Shafer Institute of Cosmophysical Research and Aeronomy and world network data for 1992 and 1998. In the 11-year cycle of solar activity 1992 falls on the phase near the maximum and 1998 falls on the phase near the minimum of geophysical disturbances.

The medical data are presented by three showings: the hypertensive disease, hypertensive crisis and sick people registered in a dispensary on the occasion of a cardiovascular pathology.

The solar activity is presented by the number of sunspots W. The components B_x , B_y , B_z of interplanetary magnetic field (IMF), the speed (V) and the particle density (ρ) of solar wind are used as solar wind parameters. The precipitation frequency of energetic electrons by a registration of space radionoise absorption AA and K-index of geomagnetic activity are used as geophysical parameters.

The data have been mathematically processed by the calculation method of power spectrum of the above indices for the each annual interval.

Results and Discussion

The calculation results of a power spectrum of heliogeophysical and medical indices for the year of high geophysical activity (1992) are presented in Fig.1. In the components of IMF, speed and density of solar wind the

29-31 day periodicity is observed. Besides, in the speed and density of solar wind there is an evidently expressed rhythm with a period of 14 days. In the separate components of IMF this rhythm is manifested at the noise level.

In the parameters of geophysical disturbance (K-index and auroral absorption of space radionoise AA characterizing the flux of precipitating energetic electrons) there is no any dominating periodicity. The rhythmic changes with a period of 17-19, 24 and 32 days are observed of approximately equal amplitude.

It is seen from Fig.1 that in all considered medical indices (HD, HC, DR) the period of 30-32 days is manifested. In all medical showings the rhythm with a period of about 14 days is manifested at the noise level.

In the solar activity by the number of sunspots (W) the one clearly defined period of about 28 days corresponding to the synodic period of the Sun's rotation is observed.

In the year of low geophysical disturbance (1998) in the index of solar activity the rhythm with a period of 27 days dominates. In the IMF power spectrum the period of ~15 days has become dominant. The spectrum amplitude with a period of ~30 days has considerably decreased. In the solar wind speed and in the particle density there is a period of 29-31 days as before but the period equal to 14 days is not manifested. In the spectrum of indices of geophysical disturbance in 1998 the dominating periods are not observed. Only in the AA spectrum one can see the rhythms with a period of 31 and 42 days. But their amplitude is little. As far as in the year of low geophysical disturbances the periods coinciding in all studied spectra are manifested insufficiently clearly, so spectra are not presented in Fig.1.

Thus, in medical showings the identical rhythmical changes of applying for the ambulance on the occasion of HD, HC and DR with a period of 30-32 days in the year of high and low geophysical disturbances are observed. However, this periodicity in the year with a high geophysical disturbance (1992) is manifested considerably more powerfully than in the year with a low activity (1998). The periodicity of ~27-28 days dominates in the solar activity characterized by the number of sunspots in the year of high and low activity of the Sun. The IMF components vary with a rhythm of ~29-30 days. The parameters characterizing the geophysical disturbance change with the periodicity of 30-32 days. In the year of high geophysical disturbance in the solar wind speed and its density the rhythm with a period of 14 days is manifested. In the year of low geophysical disturbance such a periodicity is observed in the IMF.

In our opinion, the periodicities in solar wind parameters, such as the IMF, speed and particle density of the solar wind (29-31 days), the periodicities in geophysical parameters, such as, K-index and AA (31-32 days) and also in medical showings on HD, HC, RD (30-32 days) are related to each other. To be more precise, the periodicity of solar disturbances in the solar wind and geophysical parameters affects sick people having the cardiovascular pathology, which causes the same periodicity of their applying for the ambulance. The insignificant discrepancy taking place in the periods of heliogeophysical parameters and medical showings can appear because of the superposition of noise factors, individual time of reaction of patient's organism to the heliogeophysical disturbance and also the lack of statistical data.

The analysis of applying of patients registered in a dispensary on the occasion of cardiovascular diseases has allowed to reveal the periodicity of 63-64 days along with the 30-32 day rhythm. These periodicities are marked out in Fig.2.

One can understand the appearance of such a periodicity supposing that after the regular geophysical disturbance only a part of sick people apply to the ambulance station. The other part of sick people didn't apply for the first medical aid although they had felt worse. These patients who had not had time to recover by the next disturbance repeated in 30-32 days widened the list of sick people applied for the first medical aid. The power spectrum amplitude repeated in 63-64 days is greater than the amplitude of the 30-32 days period. It can indicate to the fact that the most sick people apply for the first medical aid if the worst comes to the worst then so that aggravating their state of health. It is easy to understand the periodicity of 63-64 days in the data on RD because these people are the most sensitive to the negative external effects. So the indicated periodicities are equally manifested during the years both of high and low geophysical disturbances.

The absence of rhythm with the periods of 27-28 days in the dynamics of applying for the first medical aid for sick people having the cardiovascular pathology indicate to the fact that Wolf numbers as an indicator of the Sun's activity are not the reason for the change of geophysical parameters affecting the health of sick people.

Conclusions

1. In the dynamics of applying for the ambulance of sick people having the cardiovascular pathology, the 30-32 day period rhythm is observed. The period of rhythm doesn't depend on the 11-year heliogeophysical activity phase.

2. The reason of 30-32 day rhythm of medical showings for sick people having the cardiovascular pathology are apparently corresponding changes of heliogeophysical parameters.

3. The 63-64 day periodicity of applying to the ambulance service for the first medical aid for sick people registered a dispensary on the occasion of the cardiovascular pathology has been found. This periodicity is a doubled value of the main period of 30-32 days.

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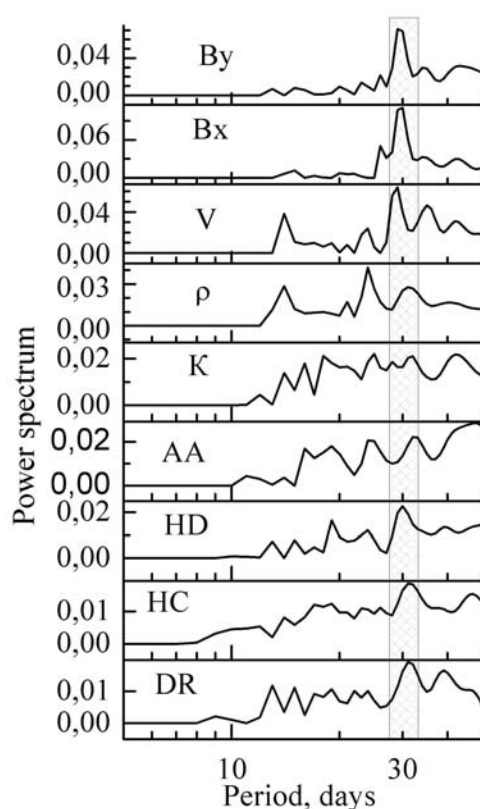


Fig1. Power spectrum of parameters of solar wind, geophysical disturbance and medical showings in 1992

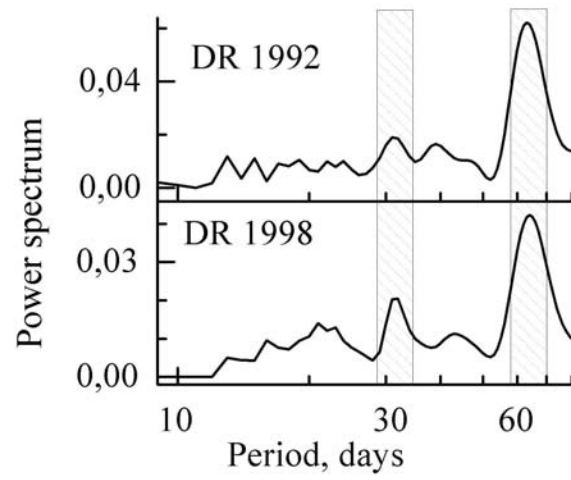


Fig.2 The manifestation of rhythm with the periods 30-32 and 60-64 days