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ON THE RELATIONSHIP OF CARDIOVASCULAR DISEASE EXACERBATION TO HELIOGEOPHYSICAL DISTURBANCES

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Abstract. The relationship of the dynamics of applying of patients having the cardiovascular pathology for the medical aid to geophysical disturbances is studied. The search for the relationship has been carried out comparing statistical data of the Yakutsk ambulance service and data from the geophysical observation complex for 1992 and 1998 and also using individual event for October-November 2003. It has been found that the quantity of applying of patients having hypertensive diseases, hypertensive crises and also sick people registered in a dispensary significantly increases 2-4 days before a geophysical disturbance. Besides the reaction of sick people during the period preceding geophysical disturbances, the second peak in the number of sick people applied to the ambulance in 2-4 days after a disturbance is observed. But the value of the second peak in amplitude is less than the previous peak. The possible reasons of advanced applying for the medical aid of sick people having the cardiovascular pathology with respect to a geophysical disturbance are discussed.

Introduction

The dependence of cardiovascular pathologies on the solar activity and its manifestations in geophysical phenomena was studied by many researchers. However, the results of studies of some researchers are contradictory. Lipa et al. (1976) studying the mortality by cardiovascular diseases didn't reveal any dependence between the daily mortality and planetary daily average amplitude of the Earth's magnetic field variation of Ap-index. Breus (2003) refers to the results of American scientists who analyzed many statistical data on cases of mortality by a coronary incompetence and insults of cerebrum and reveal no significant correlation relations to heliogeophysical parameters. In contrast to this fact, Strivastova et al. (1976) studying the data of hospitalization of patients having cardiovascular diseases found that the number of sick people who admitted to the hospital is proportional to the sum of 3-hourly K-indices of the magnetic activity. They showed that this dependence is nearly linear and a linear correlation coefficient is equal to 0,76±0,2.

In the paper by Gurfinkel et al. (2003) the analysis results of geomagnetic disturbance effect on cases of acute myocardial infarction and acute impairment of cerebral circulation are presented. It is shown that the geomagnetic disturbance effect on a cardiovascular system of a patient having the ischemic heart disease is most strongly manifested during the first three days after the onset of disturbance. Nesmeyanovich and Bukalov (2003) on the basis of data from the Kiev ambulance service for the ~10 year period came to the conclusion that the dynamics of infarctions doesn't correlate with the disturbance of the Earth's magnetic field and the most number of infarctions happen 9-11 days before a magnetic storm. Chirkov and Vershinina (1977) studied the relationship of the myocardial infarction to magnetic storms by data from Kiev for 1969. They showed that for the isolated magnetic storms (17 storms) 5-9 days before a magnetic storm onset the large fluctuations (with the amplitude 28±9%) in the number of myocardial infarctions are observed.

The above results on the dynamics of human organism reaction to geomagnetic storms are not in agreement with each other. The aim of the present work is to study the dynamics of cardiovascular system relative to the magnetic storm onset during years of high and low geophysical disturbance.

Data and Treatment Methods

To study the relationship of dynamics of cardiovascular disease exacertition to magnetic storms 145000 medical cards of the Yakutsk ambulance service have been looked through and analyzed for 1992 and 1998. The information on a hypertensive disease (HD), hypertensive crisis (HC) and sick people registered on a dispensary on occasion of cardiovascular diseases (RD) have been accumulated.

The magnetic activity indices (K-indices) have been obtained from the observations at the Yakutsk magnetic station. In geophysical disturbed 1992 year 24 magnetic storms with K-index ≥30 have been selected. In geophysical quiet 1998 there were 16 strong magnetic storms.

Besides these statistical data the dynamics of diseases during the most powerful for the recent years geophysical disturbance in October-November 2003 is considered as an example of the individual event.

The statistical treatment of data has been carried out by using the superposed epoch technique.

Results and Discussion

Results of statistical treatment of medical showings and geophysical activity by the superposed epoch technique for 1992 are presented in Fig.1. The days before and after a "zero day" are plotted on the abscissa axis. The magnetic disturbance observation day is taken as a "zero" day. It is marked with a vertical dashed line. On the ordinate axis there is the number of applying of sick people for the first medical aid normalized to one geophysical disturbance.

It is seen from Fig.1 that in 1992 in the dynamics of applying of sick people for the first medical aid in relation to the geophysical disturbance there are two stages of the increase of the number of applying. The first stage is 2-4 days before a geophysical disturbance; the second one is in 2-4 days after a storm. On one of the panel of Fig.1 we have shown a summary dynamics by three medical showings (HD +HC +RD) of applying of sick people having the cardiovascular pathology for the medical aid. It is seen that the number of applying for the medical aid before a geophysical disturbance is more than after it. Both in this case and in that one the same sick people can be. However, the case when the part of patients responds to the change of electromagnetic parameters of the environment before a storm and another part – to the changes of medium parameters after a storm must not be ruled out. This problem requires further special research.

In the year of low geophysical disturbance (1998) the peculiarity of dynamics of applying of sick people for the medical aid before and after the magnetic storm remains in general outline, but the effect is expressed less distinctly than in the year of high geophysical disturbance.

Further the dynamics of cardiovascular diseases during the individual very strong geophysical disturbance in October-November 2003 has been considered. The dynamics of geomagnetic activity and medical showings during that period is shown in Fig.2. The time of maximum geomagnetic disturbance is shown by a dashed vertical line. The number of applying of sick people for the medical aid increases for all kinds of diseases 2-4 days before a storm. The morbidity rise at that time is from 1,5÷2 to 5÷6.

In 3-4 days after the maximum of geophysical disturbance on October, 29 the poststorm increase of the number of applying for the ambulance on the occasion of HD, HC and RD has been observed. The dynamics of the number of the ambulance patients with the diagnosis of myocardial infarction (MI), acute impairment of cerebral circulation (AICC) and attendant pathology (AP) also shows the presence of the poststorm maximum on the 5^{th} day after the storm. Besides that, as opposed to the dynamics of applying for the medical aid on occasion of HD, HC and RD, in dynamics of applying of patients having MI and AICC the additional maximum (exceeding a quiet level by a factor of 7-8) during the most development of geophysical disturbance of October 29, 2003 is observed. The above analysis results of the dynamics of applying of sick people for the medical aid show that solar and geophysical disturbances have an effect on the state of sick people with the cardiovascular pathology. The reaction of sick people to the magnetic storm during the geophysical disturbed year (1992) was manifested more distinctly than in the year of low geophysical disturbance (1998). One can understand the reaction of cardiovascular patients which is ahead of geomagnetic disturbances if we suppose that besides a reaction to the geophysical disturbances caused by corpuscular streams from the Sun there exists another agent connected with active processes on the Sun changing electromagnetic parameters of environments that lead to the health worsening of sick people. The propagation velocity of this agent must be very high and the reaction of the near – Earth environmental space to it must develop almost simultaneously with active processes on the Sun. The electromagnetic radiation reaching the Earth's orbit in 8 min after the event on the Sun can be a similar agent.

Conclusions

1. Results of statistical analysis of the dynamics of applying of sick people for the medical aid on the occasion of HD, HC and RD in the year of high geophysical disturbance show a distinct reaction of sick people to the geophysical disturbance. It is found that in distribution of applying of patients there are two maxima, one of them is ahead of a geophysical disturbance by 2-4 days (prestorm) and the second one lags behind by 2-4 days (poststorm). The poststorm effect in amplitude is some weaker than the prestorm one. In the year of low geophysical disturbance the reaction of sick people to the magnetic storms is expressed in a similar way but less distinctly.
2. The analysis of the individual event of applying dynamics of patients for the medical aid on the occasion of MI and AICC during very powerful geophysical disturbance of October 29, 2003 has shown the presence of the same prestorm and poststorm effects as for HD, HC and RD. But in addition to the two maxima, in the dynamics of applying of patients having MI and AICC, one more maximum observed directly during the maximum value of geophysical disturbance exceeding the usual undisturbed level by a factor of 7-8 has been revealed.

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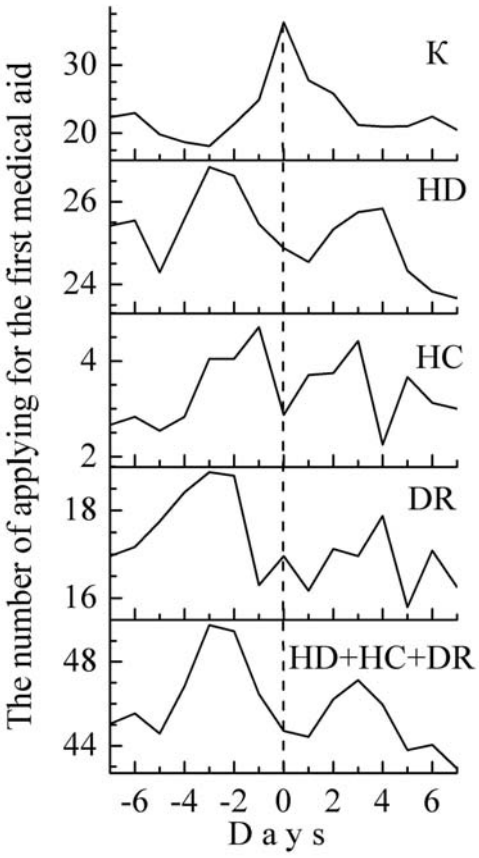

Fig.1 Dynamics of applying of sick people to the ambulance service in connection with geophysical disturbances

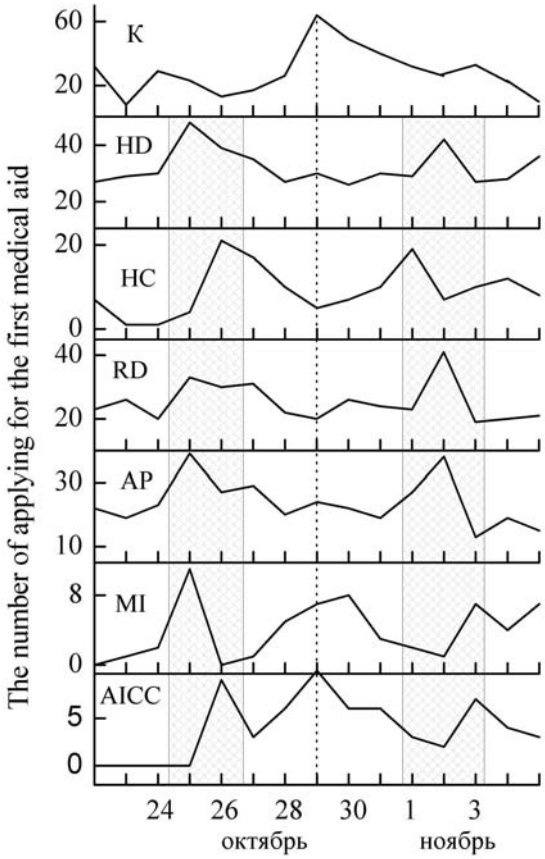

Fig.2 Dynamics of applying of sick people to the Yakutsk ambulance service during the geomagnetic disturbance of October 29, 2003