MEDICAL AND BIOLOGICAL ASPECTS OF THE ASSESSMENT OF THE RISK FACTORS

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THE IMPACT OF METEO-FACTORS ON INCREASE OF ARTERIAL BLOOD PRESSURE

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The aim of the work is to study the impact of the meteorologic factors on the increase of the arterial blood pressure in the population of Vladikavkaz city considering gender specificity. The archive data of the Vladikavkaz ambulance during the first half-year of 2012 were the material of the study, ranged according to the number of calls of the patients with the complaints on the aggravation of symptoms due to the arterial pressure increase. According to the archive data, the corresponding base of average daily indices of meteo-factors (the air temperature, atmospheric pressure, relative humidity, wind rate, cloudiness) was formed, the indices of weather pathogenicity were considered. The posthoc analysis of the obtained data was carried out with the use of the statistical analysis packet Statistica 6.0. It is indicated, that the number of the ambulance calls to the patients with the arterial hypertension increases during "acute" meteo-conditions. The number of calls in women is higher than the number of calls in men. The inverse correlation between average daily air temperature and patients asking for help in the connection with aggravation symptoms against a background of the arterial pressure increase (AP) was revealed. The peak increase of the ambulance calls frequency is observed while low temperature (< – 100 °C). A correlational link between AP increase frequency and the pathogenicity temperature index was established. AP increase frequency correlates with common pathogenicity index in women, and it may point out the high reactivity of cardio-vascular system in response to the impact of complex negative meteo-factors. The impact of the unfavorable weather conditions is the risk factor to the health as it may lead to the development of the cardiovascular catastrophe against a background of AP increase.

***Key words**: arterial pressure posthoc analysis, meteorologic factors, air temperature, pathogenicity index, «irritative» meteo conditions.*

Introduction. The natural human habitat is the Earth's atmosphere, where different physical processes continuously take place, and affect human body, being an open dissipative system. Numerous studies show the interrelation between various failures in human activity, morbidity, death incidence due to the changes in weather, solar activity, with a focus on rapid and aperiodic fluctuations in environmental factors [17, 19, 7]. Climate changes happening in the world represent critical risk factors for human health. Exposure to heat and cold waves for human health in different countries results in increasing the number of climate-related infectious diseases and their spreading to the north, as well as losses in the number of population as a result of exposure to abnormal temperatures [18, 15, 13, 14, 20].

Different atmospheric phenomena represent a stress-factor for healthy individuals, as well as precipitate exacerbation of the pre-existing pathologies [6, 9, 12]. In people with chronic diseases, any fluctuations in the air temperature, atmospheric pressure, electromagnetic field intensity can result in meteorotropic reactions in the form of exacerbation of

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the prior disease. Cardiovascular system is the most affected by meteorological factors [1, 3, 8]. Among the markers of meteorological factors that have predominant effect on the human body and increase hypertensic crisis incidence are: cloudy weather with fog and precipitation, sharp drop in temperature and increase in relative humidity, atmospheric pressure variations, dew point [10, 16, 5]. It is known that the formation of cyclones with severe frontal sections and ascending air currents, accompanied by disrupting diurnal variation of the main meteorological factors, predispose destabilization of blood pressure [4]. The problem of human meteosensitivity as of a complex biological system, along with meteorotropic reactions of a healthy and especially sick individual, is of great medical and social importance. The climatic and geographical conditions of the individual's life environment leave its mark on the specificity of responses at fluctuations of meteorological factors.

Purpose of the research. To study meteorological factors effect on the incidence of high blood pressure in the population of Vladikavkaz from a gender perspective.

Materials and methods. We performed a retrospective analysis of the number of emergency calls (ECS[1]) of patients due to deteriorating the state of health on the background of high blood pressure. We used ambulance archive records in Vladikavkaz for the first half of 2012.

The meteoparameters data (of the average daily air temperature (0^0C), atmospheric pressure (hPa), relative humidity (%), wind speed (m/s), clouds (amount)) were obtained from the weather station site http://www.rp5.ru g, as of Vladikavkaz weather station. In addition to the absolute values, we determined partial indices of weather pathogenicity, reflecting the weather dynamics of the day by changes in the air temperature (it), humidity (ih), wind speed (iv), clouds (in), as well as the day-to-day changes in these parameters. On the basis of the partial indices, we calculated the total weather pathogenicity index (WPI), which reflects the innervating effect of weather factors on human body. [2] The statistical analysis was performed using the software package Statistica 6.0. To compare the mean values in two independent groups, we used Student's t-test. Using the analysis of variance, we evaluated weather conditions effect on the frequency of ECS calls of patients due to increased blood pressure. Using the correlation analysis, we stated the ECS calls frequency value, depending on the meteorological factors. When testing statistical hypotheses, critical significance point was accepted at ≤ 0.05.

Results and discussion. During the period under study, we analyzed 6376 cases of ECS calls (1669 men and 4707 women) due to health deteriorations (headache, nausea, vomiting, dizziness, chills) associated with arterial hypertension. The monthly average number of calls during the period under study made 44.8 ± 3.31 people. It was found that women were more likely to apply for ECS, than men (32.8 ± 2.54 12.0 ± 1.89 vs. p = 0.000014). All patients were grouped according to the age into 7 groups: 20-29, 30-39, 40-49, 50-59, 60-69, 70-79 and ≥80 years old. The gender ratio (M: F) in the respective age groups varied: 2.25: 1; 0.88: 1; 0.50: 1; 0.46: 1; 0.37:1; 0.31: 1; 0.26: 1. The basic number of the ECS calls is between the ages of 70-79 years (510: males, 1624: females).

Based upon the analysis of variance, we revealed that the adverse weather conditions have an impact on ECS frequency of calls in connection with health deterioration being accompanied by an increased blood pressure (F=12,3; p=0.00001). When exposed to the "acute" weather conditions, there is a significant increase in the frequency of ECS calls; at the "innervate" weather conditions, it does not change significantly comparing to the "optimal" weather conditions.

The analysis of correlations between meteorological parameters and the ECS calls frequency showed that the strongest relation was found with the temperature factor. Pearson's correlation coefficient in a male sampling was r=-0.37 (p= 0.00006), in female sampling r = -0.42 (p=0.00000).

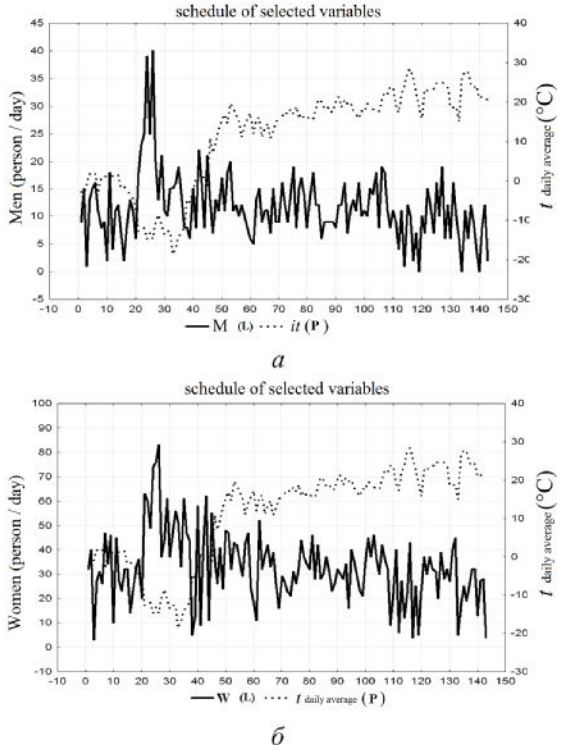

Fig. 1. Interrelation between daily average air temperature and ECS calls frequency in connection with blood pressure increase: a) in men; b) in women.

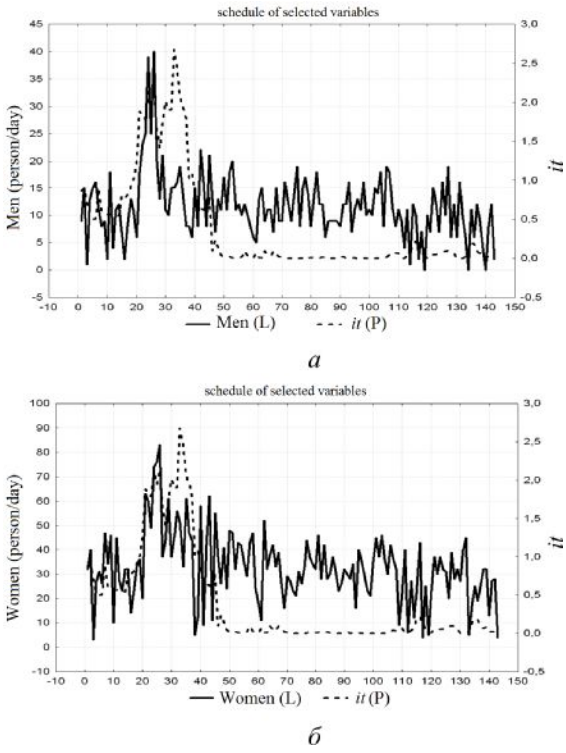

Fig. 2. Interrelation between daily average air temperature and ECS calls frequency in connection with blood pressure increase: a) in men; b) in women.

It was revealed that sharp temperature drop predispose a rise in blood pressure and patients' health deterioration, increases the number of ECS calls respectively.

The dynamics of ECS calls for men and women is slightly different. At shifting the average daily temperature to the range below -10^0C, there is a peak increase in the number of ECS calls in men observed, with a subsequent decrease to the average value (Fig. 1). Women also recorded ECS calls surge, but it remains high for a long period (17 days) (Fig. 1). The drop of air temperature under an increased atmospheric pressure generates a weather of "spastic type", precipitating the angiospastic signs of any location, accompanied by the relevant complaints and symptoms [11]. Not only the temperature factor, but the critical day-today temperature fluctuations can have negative effect on human health, especially provided the existing pathology.

We revealed positive correlation between the temperature pathogenicity index and the ECS calls frequency accompanied by an increased blood pressure, both in men (r =0.41; p=0.000002) (Fig. 2.) and women (r=0.47; p=0.000000) (Fig. 2).

In both cases, a sharp increase in the frequency of the ECS calls corresponds to the first peak of the index, followed by a decrease against the second, more evident peak. A likely explanation thereof can be the start-up of adaptation mechanisms that transfer physiological systems functions into a quasi-stable state, disturbed as a result of the adverse impact of critical fluctuations of the temperature factor.

At studying the total index of pathogenicity, including partial pathogenicity indices of various meteorological factors (it, ih, iv, in), we revealed positive correlation with the ECS calls frequency in women (r =0.24; p=0.008236). In men, no authentic connection between the exacerbations frequency and WPI identified. It can be assumed that of negative

effect on the cardiovascular system of women are not only the air temperature fluctuations, but other meteorological factors contributing to the progress of meteopathic reaction in the form of increased blood pressure.

Conclusions. The largest number of ambulance calls due to the increase in blood pressure ranges between 70 to 79 years old (gender ratio M:F - 0.31:1).

Against the "acute" weather conditions, there is an increase in the ECS calls frequency of patients due to increased blood pressure observed.

The most critical meteorological factor causing the meteorotropic reaction in the form of increased blood pressure is negative daily average air temperature (<-10^{0}C). In women, the response of the cardiovascular system to the negative effect of temperature and other meteofactors is more evident, compared to men.

Adverse weather conditions are a significant health risk factor, as they can predispose the development of cardiovascular events against the background of high blood pressure.

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