The Comparative Laboratory-Instrumental Analysis of Patients Having Cardiovascular Diseases: A New Look at Routine Tests


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Abstract: Cardiovascular diseases continue to be the leaders in prevalence, people’s incapacitation and death rate despite modern technologies of diagnosis and treatment. At present, they perform an active study of interconnections and possible prognostic role of various components of peripheral blood, lipids and echocardiographic indexes in occurrence and progression of diseases associated with atherogenesis. The authors have studied and evaluated the predictive significance of screening indexes and the structural-functional condition of a myocardium in the development of some cardiovascular diseases. The authors ascertained intergroup differences in the content of eosinophils, basophils and lymphocytes. The absolute values of LDL-C and VLDL-C grew depending on the severity of coronary pathology while the HDL-C remained stably low. The condition of homeostasis system was characterized by primary activation of vascular-thrombocyte part and by exhaustion of fibrinolysis. The count of leucocytes, granulocyte and monocytes is not less significant as traditional factors including sex, age, total cholesterol and fibrinogen level in prediction of cardiovascular diseases.

Key words: Arterial hypertension • Forms of IHD • Hemogram • Predicators

INTRODUCTION

Cardiovascular diseases continue to be the leaders in prevalence, people’s incapacitation and death rate despite modern technologies of diagnosis and treatment [1, 2]. Thanks to epidemiological research, they detected a row of internal and external factors that can influence diseases associated with atherogenesis. The range of these diseases continues to widen up to now [1, 3, 4]. This is partly caused by the fact that such unconditional risk factors as arterial hypertension, dyslipidemia and smoking are only the half of all reasons for cardiovascular pathology [5]. Other patients’ disease seems to be impossible to explain traditionally. This is obviously the ground for the interest in the inflammatory theory of atherosclerosis that increased in the late 19th century. At present, they perform an active study of interconnections and possible prognostic role of various components of peripheral blood, lipids and echocardiographic indexes in occurrence and progression of diseases associated with atherogenesis. The above stated determined the goal for this research – to study and evaluate the predictive significance of screening indexes and the structural-functional condition of a myocardium in the development of some cardiovascular diseases.

MATERIALS AND METHODS

The research scope was 282 persons including 249 patients of the Clinical Hospital of Permskiy Kray, 157 persons were male (55.7%). The study was open, parallel, cross-sectional and uncontrolled. Disregard criteria included: carbohydrate metabolism disorder, endocrine disorder, bronchial asthma, cardiac defects, malignant neoplasms, acute inflammatory diseases or exacerbation of a chronic disease in previous two weeks. As patients gave their written consents to the medical intervention, the groups were created, according to age and the disregard criteria: group I – the patients having the effort angina of 3 functional class – 32 persons; group II – 32 persons having the healing Q-positive myocardial infarction; group III – 15 persons having the healing Q-negative myocardial infarction; group IV – 15 persons having the instable angina; group V – 40 persons having the persistent atrial fibrillation; group VI – 35 patients having the clinically significant chronic heart failure with
RESULTS AND DISCUSSION

The authors didn’t find out any apparent deviations in red blood cell values in the groups. All groups were statistically equivalent in the platelet count with the exception of the group of patients having the arterial hypertension and the persistent atrial fibrillation (257.4±81.07×10⁹/l and 216.7±44.86×10⁹/l, p=0.02), the group with persistent atrial fibrillation and the control group (216.7±44.86×10⁹/l and 238.2±47.72×10⁹/l, p=0.048). The total count of leucocytes did not exceed the normal values in all groups. Nevertheless, according to literature data, the leucocyte count is an independent predictor of rising death rates among people having the peripheral arterial disease, especially when associated with smoking [6, 7]. This predictor is stronger than C-reactive protein. Thereupon, one can pay attention to the received trustworthy differences in this parameter between patients having the instable angina, the myocardial infarction without Q and the control group (p=0.008 and p=0.01, respectively), between those who had the instable angina and the persistent atrial fibrillation (p=0.002). Patients with the arterial hypertension had much more leucocytes than those who had the persistent atrial fibrillation and the myocardial infarction without Q (p=0.01 and p=0.04, respectively). Some authors attest that the leucocyte count of this group of patients is of great value as an independent predictor of death rate due to cardiovascular diseases [8, 9]. The patients that took part in the research varied greatly in eosinophil count – the maximum for those who had the instable angina and the minimum for those who had the Q-positive myocardial infarction. At the same time, there were no allergic reactions denoted in the anamnesis of these patients. In a row of modern researches [10], they testify the importance of eosinophils as an unfavourable predictor of the ischemic heart disease and transformation of its chronic forms into the acute ones. Prospective researches show the association of the eosinophilia with a higher death risk and all future coronary events. It is assumed that eosinophilic cathionic protein, being known for its cytotoxic properties, can cause the additional myocardial damage. Besides, an impressing range of synthesized cytokines (ΦНО-α, ΗΦΗ-γ, Η2-1-6, etc.) and vasoactive substances, entering blood due to mast cell degranulation, can also influence the cardiovascular system. All patients having cardiovascular diseases differed reliably from the control group in basophile count (p1-8=0.001, p2-8=0.047, p3-8=0.006, p4-8=0.0003, p5-8=0.001, p6-8=0.0005, p7-8=0.0006). The fact that patients with cardiovascular diseases have low basophile count can indicate their migration (as eosinophiles) to an area of latent inflammation. All patients were intercomparable by this index. The maximum basophilia usually marking a chronic inflammatory response with T-helpers of the second type was detected in the group...
with Q-positive myocardial infarction. Poor literature information definitely indicates the contribution of basophiles into macroorganism’s antibacterial defense and also assumes their participation in cardiovascular diseases at the expense of the ability to stimulate fibroplastic processes together with mast cells and to convert angiotensin I into angiotensin II [11, 12].

When analyzing the total count of neutrophilic granulocytes, one can notice the fact of their significant increase among patients having the instable angina as opposed to the control group, patients with the persistent atrial fibrillation and with the arterial hypertension (p=0.03, p=0.008, p=0.047, respectively). According to some researchers, this index can precisely correlate with the severity of the coronary atherosclerosis [13]. It is known that activated neutrophils, in case of plaque destabilization due to proteases, promote platelet penetration deep into a vascular wall, activation and adhesion of Willebrand’s factor to the collagenous matrix of a vascular wall followed by the stimulation of adhesion properties of platelets [14]. Thereupon, the peculiarity that we found can partly promote the unfavourable course of instable angina among patients under observation.

Patients with the arterial hypertension and conditionally healthy people had reliably more high indexes of lymphocyte count in comparison with those who had the myocardial infarction without Q (p=0.01, p=0.03). It should be noted that monocyte count varies depending on the type of a cardiovascular disease: the differences were received between the groups 1, 2 and 8 (p=0.04, p=0.02), between the groups 2 and 4, 6 (p=0.0009, p=0.04), between the groups 4 and 3, 5, 8 (p=0.02, p=0.003, p=0.00009), between the groups 6 and 8 (p=0.01), between the groups 7 and 2, 3, 5, 8 (p=0.0002, p=0.04, p=0.0005, p=0.000004). A row of researchers testify the independent predictive importance of monocyte count as the most significant component of an inflammatory response in an atherosclerosis plaque, for ischemic heart disease, myocardial infarction and congestive cardiac failure [15]. In our observation, the maximum absolute count of monocytes was detected among patients having arterial hypertension and instable angina.

All patients with cardiovascular diseases reliably differed from the control group by the erythrocyte sedimentation rate (p=0.000, p=0.0003, p=0.00001, p=0.0000007, p=0.0003, p=0.0000007, p=0.0000001). In the range of studied cardiovascular diseases differences in the erythrocyte sedimentation rate were detected between the groups 1 and 2, 5, 7 (p=0.02, p=0.000, p=0.009), between the groups 2 and 3, 5 (p=0.04, p=0.04), between the groups 3 and 5, 7 (p=0.00006, p=0.0007), between the groups 5 and 4, 6 (p=0.008, p=0.00001). The defects of serum lipid composition were detected among patients with all studied nosologies. In different groups, the average level of total cholesterol fluctuated between 4.6±0.67 and 6.6±1.53 mill mole per liter reaching the maximum if the group of patients having the stable angina. The dislipidemia had been always characterized by the increase of atherogenic fraction and the decrease of antiatherogenic fractions. In our research, the absolute values of LDL-C and VLDL-C grew depending on the severity of coronary pathology while the HDL-C remained stably low.

The condition of homeostasis system of patients with different forms of ischemic heart disease and the arterial hypertension was characterized by primary activation of vascular-thrombocyte part and by exhaustion of fibrinolysis. The maximally apparent hyperfibrinogenemia – 4.7±1.89 gpl – could be found among patients having the stable angina. XIIa-dependent fibrinolysis time extending was detected in all groups with no intergroup differences. Patients with the atrial fibrillation had a normal count of fibrinogen and a low spontaneous thrombocyte aggregation (3.4±0.58 gpl and 1.1±0.02 rel. units, respectively).

A 24-hour blood pressure monitoring was conducted in group 7, that’s why a comparative analysis was not made. Comparative echocardiographic peculiarities were searched for mainly among groups with certain cardiovascular pathologies, without regard to indexes of the control group, because they didn’t go beyond the acceptable limits. Global myocardial contractility remained stable in all groups but patients with arterial hypertension had the best values of ejection fraction. Patients with the effort angina had concentric hypertrophy, eccentric hypertrophy and a concentric remodeling with equal frequency. Eccentric hypertrophy of the left ventricle prevailed among those who had the persistent atrial fibrillation – 61.3%. Analysis of groups with different types of myocardial infarction and instable angina shows that patients with eccentric hypertrophy of the left ventricle and its eccentric remodeling are equidistributed in these groups.

The regression analyses in the groups gave the following result: patients with the effort angina appeared to have a direct connection between the eosinophilia and the atherogenicity index. It seems that the HDL-C has a
positive effect on the aggregative ability of platelets and immunocompetent cell count in peripheral blood. Besides, immune mechanisms seem to be interested in left heart geometry changes. Inflammatory markers (fibrinogen, monocytosis, neutrocytosis) continue to be the independent predictors of the effort angina. Positive influence of high HDL-C count is detected among patients having the Q-positive myocardial infarction. Total cholesterol increase is associated with ejection fraction decrease. Only fibrinogen was of independent predictive value in this group. Small quantity of average force correlations was detected among patients with the Q-negative myocardial infarction: the majority of them indicate possible negative influence of total cholesterol and HDL to the LVM index. Besides, peripheral blood basophiles may have an impact on HDL-C increase and mediate in changes of interventricular septum thickness while their count has an independent predictive value. In group 4, atherogenic lipid fractions have an obvious negative influence on structural characteristics of left heart and aorta, on intensification of blood coagulation and neutrophil responses. In course of the multifactorial regression analysis, only the count of monocytes and basophiles preserved an independent predictive value.

The maximum diversity of relations of indexes was detected among patients with atrial fibrillation. Patients of this group had a relatively good background. But at the same time their correlations were the most strong and dangerous. Besides, only total cholesterol, being a traditional risk factor, had an independent predictive value to atrial fibrillation. It should be noted that patients with clinically apparent chronic heart failure with ischemic genesis had an interconnections of inflammatory atherogenic lipid fractions and platelet count, prothrombin time reduction due to basophile count increase. This group of patients had fibrinogen and basophile count as independent predictive markers. Correlation analysis of indexes received from hypertensive patients allows us to state a positive influence of HDL-C on fibrinogen count and negative influence of atherogenic lipid fractions on platelet count and coagulation indexes of homeostasis, along with the ability to interact with inflammatory blood cells directly. For the first time, it was found out in all groups that glucose level influences the LVM-index and there is a hypercoagulation trend due to average night DBP increase. The levels of fibrinogen and total cholesterol have a strong predictive ability for arterial hypertension.

CONCLUSION

Patients having the arterial hypertension and various forms of ischemic heart disease, in comparison with their healthy peers, are notable for reaction of immune cells of peripheral blood, lipid storage disease, primary activation of vascular-thrombocyte part of homeostasis and fibrinolysis exhaustion. In general, patients with arterial hypertension and various forms of ischemic heart disease had the reaction of peripheral blood cells, especially immune cells. First it concerns the change of total leucocyte count and then there are deranged correlations inside a differential leucocyte count: monocyte count increases while basophile count decreases. ESR, as a nonspecific inflammatory marker, also increases. It should be noted that in spite of many intergroup CBC differences revealed, there were no statistically significant discrepancies of respective data between patients with angina and with Q-negative myocardial infarction, between those with chronic heart failure and with instable angina, between patients with arterial hypertension and with angina.

Unfavourable associations were detected among atherogenic lipid fractions, coagulation indexes, peripheral blood cells and structural changes of myocardium. Acute-phase markers have an independent predictive value for studied diseases. It is worth noticing that the count of leucocytes, granulocytes and monocytes is equal to such traditional factors as sex, age, total level of cholesterol and fibrinogen in ability to predict cardiovascular diseases.

REFERENCES


