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CORRELATION OF PERIPHERAL BLOOD PARAMETERS WITH RISK FACTORS FOR STAGE 3 ARTERIAL HYPERTENSION

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ABSTRACT — In order to assess the correlation of the main parameters of peripheral blood with risk factors (RFs) on a gender basis in patients with stage 3 hypertension (HTN) undergoing hypotensive therapy, 98 patients were examined. They were divided into 2 groups based on their gender (men — 45; women — 53). The following FRs were studied: age, disease duration, body mass index, blood lipid profile: total cholesterol, low-density lipoproteins, triglycerides; blood glucose, glomerular filtration rate (GFR, ml / min / 1.73 m²). The main parameters of peripheral blood were studied: the number of erythrocytes, hemoglobin concentration, total white blood cell count, erythrocyte sedimentation rate. During the treatment, the systolic BP (SBP) was approximately 130 mm Hg, the diastolic BP (DBP) — 80 mm Hg. It has been established that blood parameters differ in men and women. It has been found that the total number of white blood cells in men directly correlates with the contents of triglycerides and blood glucose, and in women it is directly related to the level of triglycerides and GFR and inversely related with the blood glucose concentration. It can be assumed that the gender of patients determines the relationship between the RFs and peripheral blood parameters.

KEYWORDS — arterial hypertension, risk factors, gender, blood parameters.

Arterial hypertension (HTN) is considered to be a major risk factor (RF) for cardiovascular disease (CVD) causing the development of acute cerebral circulatory disorders, myocardial infarction, chronic heart and kidney failure which determine high mortality and disease prognosis of patients with this pathology [1, 5, 6]. Combinations of different RFs lead to the progression of HTN with subsequent malfunctioning of some of the organ systems. An example of this is the blood system. Some patients have erythrocytosis detected in the peripheral blood [2–4] or anemic syndrome of various severity [5, 7], while others have normal blood parameters. Analysis of the relationship of the RFs with the main parameters of peripheral blood in patients with Stage 3 HTN is of great scientific interest and importance.

The aim of the study

Is to evaluate the main parameters of peripheral blood and their correlation with the RFs on a gender basis in patients with Stage 3 HTN undergoing hypotensive therapy.

MATERIAL AND METHODS

The study was conducted in accordance with the WMA Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Subjects and approved by the Ethics Committee of Tver State Medical University. The patients gave voluntary informed consent to be included in the study. The primary inclusion criterion for the participants was Stage 3 HTN. Patients with cancer, acute and chronic diseases in the acute stage, with Stage 3 chronic heart failure were excluded from the study.

We randomly examined 98 patients (men — 45, women — 53, average age — 64.45 years) with verified Stage 3 HTN undergoing treatment in Tver Regional Clinical Hospital. The patients were divided into 2 groups based on their gender (men — 45, average age — 63.5±9.12; women — 53, average age — 65.19±10.02). The following RFs were studied using the interview method, physical examination and analysis of laboratory investigations: age, disease duration (DD, years), obesity (weight, kg), body mass index (BMI, kg/m²), blood lipid profile: total cholesterol (TCh, mmol/l), low density lipoproteins (LDLs, mmol/l), triglycerides (TGs, mmol/l); blood glucose (BG, mmol/l), glomerular filtration rate (GFR, ml/min/1.73 m², according to the CKD-EPI and MDRD formulas). The main parameters of the participants' peripheral blood were assessed: the number of red blood cells (RBCs · 10¹²/L), hemoglobin concentration (HB, g/L), the total number of white blood cells (WBCs · 10⁹/L), erythrocyte sedimentation rate (ESR, mm/h). During the administered treatment, the systolic blood pressure (SBP) was approximately 130 mm Hg, the diastolic blood pressure (DBP) was 80 mm Hg.

Statistical data processing was carried out using the program package "Microsoft Excel", "Bio-stat-2007". The data is presented as M±SD. Significance evaluation of the differences was carried out by the one-factor variance analysis and Fisher criterion, correlation (r) was determined using Spearman's method. The correlation coefficient significance was determined by the correlation table.

RESULTS

The two groups were comparable in age, number of subjects and examination methods. The peripheral blood parameters in the patients with Stage 3 HTN were within normal limits. Correlation analysis showed that in the men, the RBC count was inversely correlated with TCh and LDLs ($r=-0.43$, $p=0.01$, $r=-0.51$, $p=0.001$, respectively). The Hb concentration was directly correlated with weight, BMI ($r=0.39$, $p=0.01$, and $r=0.40$, $p=0.01$, respectively) and GFR (according to the CKD-EPI formula, $r=0.295$, $p=0.05$, and the MDRD formula, $r=0.36$, $p=0.05$). The ESR showed correlation with LDL concentration ($r=0.41$, $p=0.01$). The total WBC count was associated with the TGs and BG values ($r=0.37$, $p=0.05$, $r=0.294$, $p=0.05$ respectively).

In the women, the number of RBCs showed inverse correlation with age ($r=-0.26$, $p=0.05$), DD ($r=-0.34$, $p=0.05$), TCh ($r=-0.31$, $p=0.05$), TGs ($r=-0.352$, $p=0.01$) and there was a direct correlation with GFR (according to the MDRD formula, $r=0.31$, $p=0.05$).

The study showed evidence of inverse dependence of the HB concentration on the patients' age ($r=-0.38$, $p=0.01$) and DD ($r=-0.34$, $p=0.05$) and the GFR (according to the formula CKD-EPI $r=-0.32$, $p=0.05$, according to the formula MDRD $r=-0.31$, $p=0.05$). The ESR ($r=0.30$, $p=0.05$) directly correlated with the age. The total WBC count directly correlated with the TG ($r=0.272$, $p=0.05$) and GFR (according to the formula MDRD $r=0.34$, $p=0.05$) values and inversely correlated with the BG parameters ($r=-0.29$, $p=0.05$) and the values of systolic and diastolic BPs ($r=-0.30$, $p=0.05$, $r=-0.30$, $p=0.05$, respectively).

Overall, these results indicate that in the men and women with Stage 3 HTN, FRs showed a multidirectional correlation with the main parameters of peripheral blood. It can be noted that the decrease in RBCs and Hb in the men was observed with increased levels of TCh, LDLs and TGs. A decrease in GFR led to a decrease in Hb concentration. The ESR value grew with the increased LDL content.

In the female participants, with increasing age and DD, there was a decrease in the RBC count and Hb concentration. Like the male participants, they showed an increase in TCh and TGs and a decrease in the GFR which led to a decrease in the RBC count. The increased ESR values were caused by age and LDLs. It can be assumed that the decreased RBC count is associated with a decrease in their deformability, alongside with an increase in lipids, atherosclerosis progression, and changes in the RBC cytoskeleton during HTN [7].

In the men, an increase in TGs and BG led to an increase in the total WBC count. In the women, the

total number of WBCs varied depending on the TG, BG and GFR values. They showed a decrease in the total number of WBCs with an increase in the SBP and DBP parameters, and an increase in the total number of WBCs was observed with a decrease in the GFR.

CONCLUSION

Analysis of the correlation of peripheral blood parameters with RFs in Stage 3 HTN shows a focus on reducing RBCs and Hb and forming the anemic syndrome. Blood parameters in men and women differ. It has been found that the total WBC count in men directly correlates with TG and BG values, and in women directly correlates with the levels of TGs and GFR and inversely correlates with BG concentration. It can be assumed that the gender of patients is a vector that affects the relationship between the RFs and peripheral blood parameters. In men, an increase in TGs and BG led to an increase in the total WBC count. In women, the total number of WBCs varied depending on the values of TGs, BG and GFR. They showed a decrease in the total number of WBCs with an increase in SBP and DBP parameters, and an increase in the total number of WBCs was observed with a decrease in the GFR.

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