Vascular condition assessment in patients
with arterial hypertension

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Objective. *To study vascular age, 5-year risk of cardiovascular complications and atherogenic coefficient in men and women with arterial hypertension.*

Materials and methods. *We observed medical history of 105 patients, who were admitted to the department of internal medicine of Syrdarya central hospital. The estimation of vascular age and 5-year risk of cardiovascular complications was performed with the ASCORE risk score model. Atherogenic coefficient was calculated with the formula: (conventional unit) (total cholesterol — high density lipoproteins)/ high density lipoproteins. Statistical data processing was performed using the STATISTICA 10 software and correlation and regression analysis.*

Results *The average age for men was 64.6 ± 9.5 years and 66.9 ± 10.05 years for women. Vascular age, estimated with ASCORE, and biological age were different and tended to increase in both groups (70.2 ± 10.8 and 74.2 ± 9.8, respectively). 2.56 % of men had low risk, 25.64 % had moderate risk, 69.23 % had high risk and 2.56 % — very high 5-year risk of cardiovascular complications estimated with ASCORE. 6.06 % of women had low risk, 30.3 % had moderate risk, 60.6 % had high, and 3.03 % had very high risk of cardiovascular complications. Atherogenic coeffi-*

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cient had direct correlation with the 5-yesr risk of cardiovascular complications (r = 7019; p = 0.0000). Vascular age also correlated with the 5-year risk of cardiovascular complications (regression coefficient R^2 = 57.6 %; p= 0.0000).

41.1 % of men had normal atherogenic coefficient, 51.3 % had moderate risk of atherosclerosis, and 3 % had high risk of atherosclerosis. 43.9 % of women had normal atherogenic coefficient, 39.9 % and 16.6 % had moderate and high risks of atherosclerosis, respectively.

Conclusion. *Thus, we established a correlation between vascular age, atherogenic coefficient and 5-year risk of cardiovascular complications in patients with arterial hypertension. Vascular age can be an independent prognostic factor for arterial hypertension and cardiovascular complications development.*

Vascular age can be used as a screening method for examining patients with arterial hypertension, as a biomarker for predicting cardiovascular complications.

Key words: *arterial hypertension, vascular age, ASCORE risk score, vascular risk assessment, atherogenic coefficient.*

Introduction

We estimated vascular age and 5-year risk of cardiovascular complications in men and women with arterial hypertension (AH). We also estimated the difference between vascular and biological age. All patients were treated in the department of internal medicine of Syrdarya central hospital of Kyzylorda Region.

AH is one of the most important risk factors for all cardiovascular diseases (CVD), including coronary artery disease (CAD), left ventricular hypertrophy, valvular heart disease, heart rhythm disturbances, including atrial fibrillation, stroke and kidney failure. The difference between high normal blood pressure and arterial hypertension is based on the correlation of blood pressure (BP) with cardiovascular complications (CVC). Arterial hypertension prevalence is about 30–45 % in European population with sharp increase with age. Recommendations for the treatment and prevention of CVD should be based on total cardiovascular risk, which can be estimated using different models. However, age significantly affects total risk, so young people (especially women) are unlikely to achieve high risk, even if they have more than one major risk factor and obvious increase of relative risk. Therefore, models based on age and blood pressure should also include ethnical factor due to large differences between countries [1, 2]. One of the most clear and informative indicators is the atherogenic cholesterol coefficient by A.N. Klimov [4]. Calculation of the coefficient is based on the levels of total cholesterol (TC) and high-density lipoproteins (HDL). The index of atherogenicity has high prognostic value on the risk mortality associated with atherosclerosis (CAD and stroke) [3, 4].

Experts create national programs, improve guidelines and develop new scales to estimate total risk of these diseases [5]. However, nowadays there is no single concept that integrates age, atherosclerotic, hypertensive, metabolic and functional changes in the vascular wall [7]. Cardiovascular mortality is still high and there's need for new pathophysiological models for better understanding of cardiovascular risks based on the new data. An assessment of the functional state and structure of vascular wall — vascular age — can predict the development of cardiovascular pathology and its complications [5]. Vascular age is easy to determine and reflects individual cardiovascular risk [6]. In 2013 experts developed the new algorithm called ASCORE for risk estimation in patients with AH without previous CVD and antihypertensive treatment based on the results of 5-year ASCOT BPLA (n = 15955) trial [9]. They also developed simple scale (ASCORE-S) that allows to disregard laboratory parameters [10, 11]. Various literature sources showed the correlation between atherogenic coefficient and the risk of cardiovascular complications (CVC). Therefore, we decided to use this parameter in our study [13].

Objective

To study vascular age, 5-year risk of CVC and atherogenic coefficient in men and women with arterial hypertension.

Materials and methods

We observed medical history of 105 patients, who were admitted to the department of internal medi-

cine of Syrdarya central hospital. Average age of all patients was 66,06 ± 9,9. 39 men and 66 women. Patients were divided into two groups depending on their gender. The inclusion criterium was the history of 2nd or 3d grade of AH. Patients with NYHA classes III–IV of heart failure, cancer, decompensated diseases of different organ systems, MI and acute cerebrovascular accident (ACA) survivors and patients with chronic cardiovascular and hematological diseases were excluded from the study. Vascular age and the risk of cardiovascular complications were estimated with ASCORE. Atherogenic coefficient was calculated with the formula: (conventional unit) (TC — HDL) [14]. We also took into account demographic parameters, smoking, the level of systolic blood pressure (SBP), TC, HDL, glucose and creatinine [11]. Statistical data processing was performed using the STATISTICA 10 software and correlation and regression analysis.

Results and discussion

The average age for men was 64.6 ± 9.5 years and 66.9 ± 10.05 years for women. Vascular age, estimated with ASCORE, and biological age were different and tended to increase in both groups (70.2 ± 10.8 and 74.2 ± 9.8, respectively)(figure 1). 2.56 % of men had low risk, 25.64 % had moderate risk, 69.23 % had high risk and 2.56 % — very high 5-year risk of cardiovascular complications estimated with ASCORE (figure 2). 6.06 % of women had low risk, 30.3 % had moderate risk, 60.6 % had high, and 3.03 % had very high risk of cardiovascular complications (Figure 3).

We analyzed lipid spectrum of the patients to estimate atherogenic coefficient. TC in men was 4,6 ± 0,9 and HDL — 1,2 ± 0,4, in women — 4,1 ± 1,0 and 1,2 ± 0,6, respectively. Low density lipoproteins (LDL) — 2,2 ± 0,4 in men and 2,3 ± 0,9 in women. Triglycerides — 1,2 ± 0,1 and 1,17 ± 0,6, respectively. Atherogenic coefficient correlated with the risk of cardiovascular complications (r = 7019; p = 0,0000) (figure 4). Vascular age also correlated with the 5-year risk of

cardiovascular complications in regression analysis (regression coefficient R^2 = 57.6 %; p = 0.0000).

41.1 % of group 1 (men) had normal atherogenic coefficient, 51.3 % had moderate risk of atherosclerosis, and 3 % had high risk of atherosclerosis (figure 5).
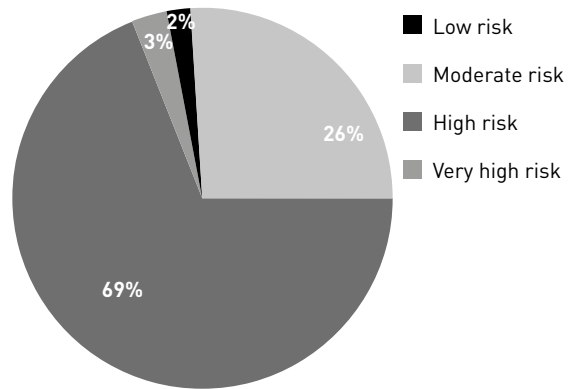

Figure 2. Results of 5-year risk of cardiovascular complications estimation with ASCORE in men (%)
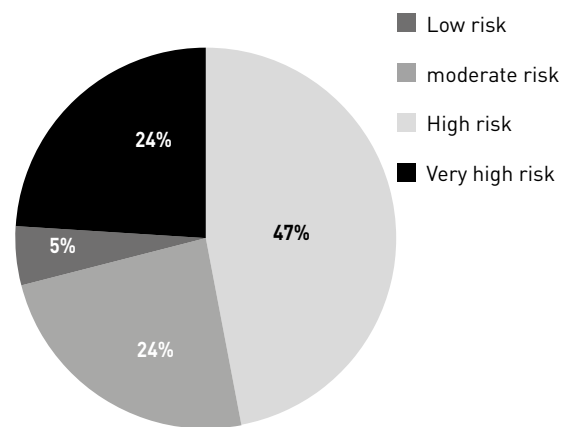

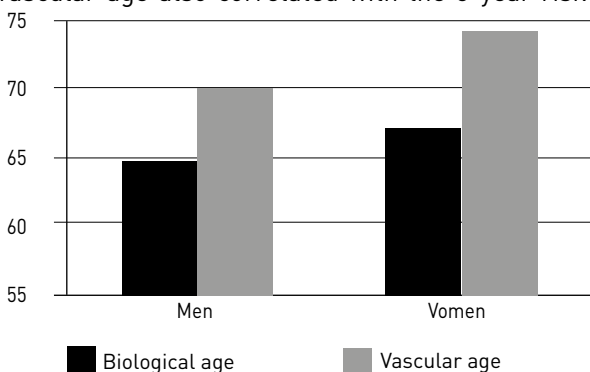**Figure 3.** Results of 5-year risk of cardiovascular complications estimation with ASCORE in women (%)

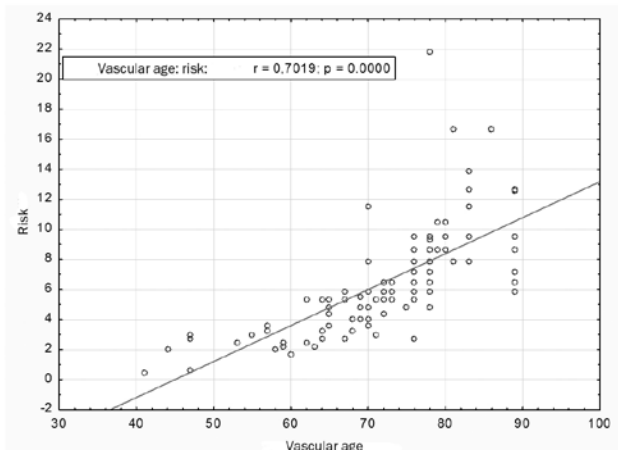**Figure 1.** The difference between vascular and biological age

Figure 4. Correlation between vascular age and 5-year risk of cardiovascular complications
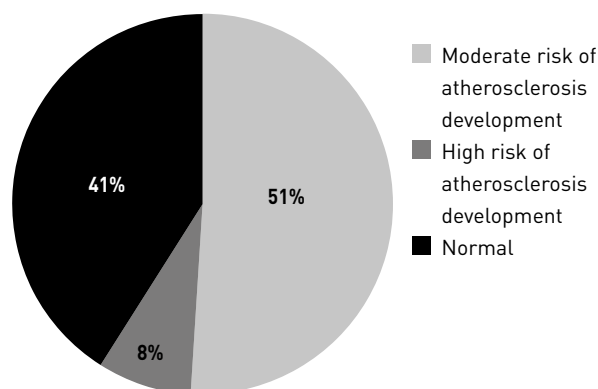
Figure 5. The risk of atherosclerosis development in patients with AH (men,%)
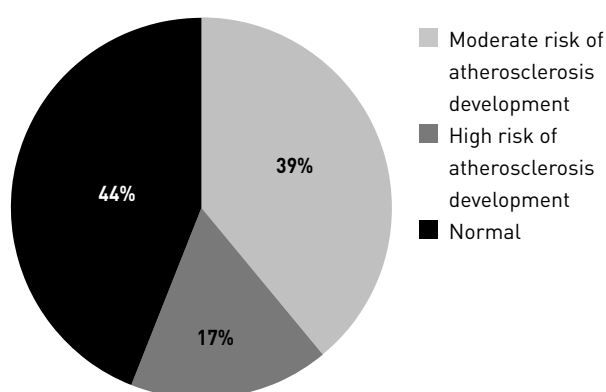

Figure 6. The risk of atherosclerosis development in patients with AH (women,%)

43.9% of group 2 (women) had normal atherogenic coefficient, 39.9% and 16.6% had moderate and high risks of atherosclerosis, respectively (figure 6).

According to Russian authors (Kutmeneva K.A., Abdullaeva E.Kh., Budnikova N.V.) [12] there's an increase of vascular age and 5-year risk of cardiovascular complications in relation to biological age in patients with AH. According to other authors (Gómez-Marcos M.A., Martínez-Salgado C., Martin-Cantera C., Recio-Rodríguez J.I., Castaño-Sánchez Y., Giné-Garriga M., Rodriguez-Sanchez E., García-Ortiz L.) there's an increase of atherogenic index — the risk of atherosclerosis in patients with AH.

Conclusion

Thus, we established a correlation between vascular age, atherogenic coefficient and 5-year risk of CVC in patients AH. Vascular age can be an independent prognostic factor for AH and CVC.

Vascular age can be used as a screening method for examining patients with AH, as a biomarker for predicting CVC.

Conflict of interest: None declared.

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