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ASSESSMENT OF RENAL FUNCTION IN THE INDIGENOUS PEOPLES OF YAKUTIA WITH ARTERIAL HYPERTENSION

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The aim of the study was to assess the functional state of the kidneys in the group of people with arterial hypertension (n=159), representatives of the indigenous population of the Republic of Sakha (Yakutia). The average age of the subjects was 60.6 years. 78% of the examined individuals have signs of decreased renal function. Most number of participants, along with existing hypertension, have additional risk factors that contribute to the development of renal dysfunction. The surveyed women are characterized by a more unfavorable profile of risk factors for chronic non-communicable diseases, which probably accounts for a higher proportion of women with signs of chronic kidney diseases.

Keywords: arterial hypertension, renal function, glomerular filtration rate, risk factors, indigenous population, Arctic.

Diseases of the circulatory system remain the leading cause of death in the world. In the Russian Federation, according to data from 2019, these diseases attributed to 46.8% of all deaths [2]. Arterial hypertension (AH) and chronic kidney disease (CKD) are considered as independent risk factors for the development of cardiovascular diseases and their complications, simultaneously, each of these conditions can be the cause of the other. Thus, a decrease in renal function leads to an increase in blood pressure, and long-term hypertension affects the glomerular filtration rate, leading to renal failure [9, 10, 12, 14].

Chronic kidney disease is a term that encompasses all degrees of decline in kidney function. Moreover, all its stages are associated with an increased risk of cardiovascular diseases, premature mortality and a decrease in the quality of life [5]. Currently, the glomerular filtration rate (GFR) and the level of albuminuria are used for: determining the stage of CKD, risk stratification, and prognosis [1, 11]. Due to the fact that GFR is difficult to measure directly, various equations are used that take into account serum creatinine level, age, race, sex and body surface area [4, 6, 7].

The aim of the study: assessment of renal function in the indigenous peoples of Yakutia with arterial hypertension.

Materials and methods. A group of people with arterial hypertension was formed during an epidemiological study among the populations of the Tomtor village of Oymyakonskiy district and the city of Srednekolymsk of Srednekolymskiy disctrict in expeditionary conditions. Inclusion criteria were: ages 20 and older, belonging to an indigenous ethnic group by self-identification, presence of an elevated blood pressure when measured (according to ESH/ESC criteria, 2013), taking antihypertensive drugs during the examination period or less than 2 weeks before the examination, regardless of the measured blood pressure level. The Yakuts and representatives of the indigenous small-numbered peoples of the North were attributed to the indigenous peoples of Yakutia. The analysis included data from 159 people, including 58 men and 101 women. The average age of men was 59.3 ± 2.36 years, women 61.4 ± 1.36 years (p = 0.347). All participants were representatives of the indigenous ethnic groups of Yakutia (Yakuts, Evens, Evenks, Chukchi, Yukagirs).

Research program included the following sections: a questionnaire for objective assessment of state; informed consent of the respondent to conduct research and donate blood (according to the protocol of the Ethics committee of YSC CMP); anthropometric examination with measurement of height and weight with calculation of body mass index, waist and hips measurements; blood sampling from the cubital vein in the morning on an empty stomach with 12-hour abstinence from food. After centrifugation, blood serum was stored in a freezer (-70°C) until analysis.

For further analysis, the traditional indicator was used - body mass index (BMI) or Quetelet index, which was calculated by the following formula: BMI (kg / m²) = body weight (kg) / height (m²). Overweight was considered to be a BMI ≥ 25 and <30 kg/m², obesity was determined at a BMI of ≥ 30 kg/m² [according to European recommendations of the III revision, 2003]. The abdominal obesity (AO) is exposed to the value of the waist measurement (WM) ≥ 80 cm on women, ≥94 cm on (VNOK, 2009).

Blood pressure (BP) was measured twice with an OMRON M2 Basic automatic tonometer (Japan) in a sitting position with calculation of average blood pressure with a margin of permissible measurement error of ± 3 mm Hg. (ESH/ESC, 2013) according to the instructions for the correct measurement of blood pressure, outlined in the European clinical guidelines for the diagnosis and treatment of

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hypertension. Hypertension is present at the 140/90 mmHg or taking antihypertensive drugs during the study or stopping them less than 2 weeks before the study (2017 ACC/AHA Guideline).

Laboratory methods of the research included biochemical analysis: blood lipids test total cholesterol (TC), triglycerides (TG), HDL Cholesterol, LDL Cholesterol, levels glucose, urea, creatinine.

When judging the incidence of disorders of the blood lipid profile in a population, we used the Russian recommendations of the VII revision of Society of cardiology of Russian Federation, 2020, into account the European recommendations, 2019. Hypercholesterolemia (HCS) is the level of total cholesterol (TC) ≥ 5,0 mmol/l (190 mg/dl) taking into account the risk of cardiovascular death on the SCORE scale, the high LDL Cholesterol level >3,0 mmol/l (115 mg/dl) with low, > 2.6 mmol/l with moderate, >1,8 mmol/l with high, > 1,4 mmol/l with very high and extreme risk, the low HDL Cholesterol level <1,0 mmol/l on men; <1,2 mmol/l on women, the hypertriglyceridemia (HTG) is the TG level is >1,7 mmol/l. A hyperglycemia (HG) on an empty stomach (a glucose in a blood plasma on an empty stomach > 5,6 mmol/l). Respondents with these disorders also included participants receiving specific medication for these conditions.

Kidney function was assessed by the value of the glomerular filtration rate (GFR). The CKD-EPI formula (Chronic Kidney Disease Epidemiology Collaboration) was used to calculate the indicator. The formula includes correction factors based on race and gender. The coefficients for "white and other races" were used in the calculation.

CKD-EPI = a × (blood creatinine (mg/dL)/b) c × (0.993) age,

where a has the following values depending on race and gender: women = 144; men = 141; b: women = 0.7; men = 0.9; variable c has the following values for women: blood creatinine <= 0.7 mg/dl = -0.329; blood creatinine> 0.7 mg/dl = -1.209. Men: blood creatinine <= 0.7 mg/dl = -0.411; blood creatinine > 0.7 mg/dl = -1.209 [4].

In accordance with the Clinical Guidelines for Chronic Kidney Disease of the Association of Nephrologists of Russia in 2019, renal function was assessed depending on the level of GFR in ml/min/1.73m2 as “high or optimal” at GFR values> 90; "Slightly reduced" - at 60-89; "Moderately reduced" - at 45-59; "Significantly reduced" - at 30-44; "Sharply reduced" - at 15-29; end-stage renal failure - at <15 [1].

Table 1

Characteristics of indigenous people with arterial hypertension

Indicator	Men n=58	Women n=101	p
	Me (Q1-Q3)	Me (Q1-Q3)	
Height, sm	163 (158-166)	151 (147.5-156.5)	<0.001
Body mass, kg	66 (60-75)	65 (54-75)	0.193
Body mass index, kg/m^2	25.6 (23-27.5)	27.6 (23.2-31.8)	0.036
Waist measurement, sm	93 (85-99)	93 (85-105.5)	0.346
Systolic blood pressure, mmHg	150 (138.8-160)	160 (140-180)	0.003
Diastolic blood pressure, mmHg	90 (87.5-100)	100 (90-100)	0.001
TC mmol/l	4.9 (4.2-5.3)	5.4 (4.6-6.1)	0.001
HDL mmol/l	1.2 (1-1.5)	1.4 (1.1-1.6)	0.018
LDL mmol/l	3.0 (2.6-3.6)	3.5 (2.9-4.1)	0.002
TG mmol/l	0.9 (0.7-1.3)	1 (0.7-1.2)	0.416
Glucose mmol/l	4.7 (4.2-5.3)	4.4 (4.1-4.8)	0.016
Urea mmol/l	5.7 (4.8-6.9)	5.9 (4.7-7.1)	0.476
Creatinine mg/dl	1 (0.9-1.1)	0.9 (0.8-1.0)	<0.001
CKD-EPI ml/min/1,73m^2	80.4 (73.3-91)	72.2 (59.5-84.2)	0.003

Note: p is the achieved level of significance of differences when comparing groups (Mann-Whitney test).

Table 2

The frequency of metabolic disorders and concomitant diseases in the examined group

Condition / disease	Men n (%)	Women n (%)	p
Obesity at a BMI	5 (9.1)	35 (34.7)	0.002
Abdominal obesity	28 (48.3)	91 (90.1)	<0.001
Hypercholesterolemia	20 (34.5)	58 (57.4)	0.005
The low HDL Cholesterol	14 (24.1)	41 (41.0)	0.047
The high LDL Cholesterol	5 (8.6)	23 (23.0)	0.024
Hypertriglyceridemia	6 (10.3)	9 (8.9)	0.766
A hyperglycemia on an empty stomach	5 (8.6)	6 (5.6)	0.521
Accompanying diseases			
Diabetes 2 type	3 (5.2)	2 (2.0)	0.267
History of cerebral stroke	7 (12.1)	13 (12.9)	0.883
Ischemic heart disease	14 (24.1)	16 (15.8)	0.198

Note: p is the achieved level of significance of differences when comparing groups (Pearson $\chi 2$ test).

Table 3

Distribution of the subjects under study by the level of GFR

CKD stage	Characteristics of global kidney function	Men		Women		Total	
			%	n	%	n	%
C1	High or optimal	15	25.9	20	19.8	35	22.0
C2	Slightly reduced	37	63.8	54	53.5	91	57.2
C3a	Moderately reduced	4	6.9	24	23.8	28	17.6
C3б	Significantly reduced	1	1.7	2	2.0	3	1.9
C4	Sharply reduced	1	1.7	1	1.0	2	1.3

Statistical analysis was performed using the IBM SPSS Statistics software package (version 22.0). Qualitative variables are described by absolute and relative frequencies (percentages), quantitative variables are described using the median (Me) and the interquartile range in the Me format (Q_1; Q_3). Spearman's correlation analysis was used to determine the relationship between the indicators. When comparing groups, the Pearson χ^2 and Mann-Whitney tests were used, depending on the data type. Differences were considered statistically significant at $p < 0.05$.

Results and discussion. The anthropometric and laboratory characteristics of participants of the study are presented in Table 1. Women, in contrast to men, had statistically significant higher body mass index, blood pressure levels, total cholesterol, HDL cholesterol, LDL cholesterol, and lower serum glucose and creatinine levels. The quartile distribution of SBP and DBP levels indicates that the target blood pressure levels have not been achieved in the overwhelming majority of cases. Renal function in the whole group, in accordance with the calculated CKD-EPI, was assessed as "slightly reduced". Patient age correlated positively with serum creatinine values (r=0.17, p=0.033) and negatively with CKD-EPI values (r=-0.61, p <0.001).

Further analysis demonstrated (Table 2) that in the examined group there is a high frequency of such risk factors for chronic noncommunicable diseases as obesity and dyslipidemia. That is, along with existing hypertension, there are additional factors that contribute to the development of renal dysfunction. The high frequency of AO, which is a metabolically more unfavorable type of fat accumulation, should be noted as well. AO was observed in 48% of men and 90% of women with hypertension (p <0.001). In general, the frequency of obesity, metabolic disorders of cholesterol and its fractions was statistically significantly higher in women than in men (p <0.05). 12-13% of the surveyed had a history of cerebral stroke, 16-24% suffered from ischemic heart disease. Thus, in the studied group, there is a high frequency of risk factors for renal dysfunction, more pronounced in women.

Assessment of renal function using GFR showed that 78% of the examined individuals with hypertension have renal dysfunction (Table 3). This has also been observed in numerous studies demonstrating the negative effect of hypertension on renal function. According to the researchers' estimates, each increase in blood pressure by 10 mm Hg. is associated with a decrease in calculated GFR [3, 8, 13, 14].

In the study group, women were more likely to have higher degrees of decline in renal function. Thus, in 26.8% of women and 10.3% of men, the assessment of renal function by stages of CKD ranged from "moderately reduced" to "sharply reduced" (χ^2 = 6.02, p = 0.014). Gender differences in the progression of chronic kidney disease continue to be studied. In a systematic review and meta-analysis of the results of studies of 6 cohorts, with a total of 2382712 people, the effect of hypertension on the risk of developing CKD and end-stage renal failure was assessed. The analysis demonstrated that the relative risk of developing these conditions in women was 23% lower than in men (RR 0.77 [95% CI, 0.63–0.95]) [15]. It is likely that the gender differences identified in this study are largely due to a more unfavorable profile of risk factors in women than in men (Tables 1-2).

Conclusion. The results of the study indicate that 78% of the examined individuals with arterial hypertension have a decrease in kidney function. In general, a significant number of participants have additional risk factors, such as obesity and dyslipidemia, in addition to existing hypertension, which contribute to the development of renal dysfunction. The examined women are characterized by a more unfavorable profile of risk factors for chronic noncommunicable diseases, which probably accounts for a higher proportion of women with signs of CKD.

It should be noted that the examined group of people with arterial hypertension with an average age of 60 years is a typical cross-section of real outpatient practice in the regions of the Republic of Sakha (Yakutia). The revealed high frequency of renal dysfunction in patients with hypertension indicates the need to determine the glomerular filtration rate in the presence of arterial hypertension everywhere in the Republic, including the hard-to-reach places of compact residence of the indigenous population. This will make it possible to adjust the tactics of non-drug and drug therapy in a timely manner, monitor renal function and prevent the early development of cardiovascular complications.

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