Arterial hypertension - a view from the perspective of gender differences

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Abstract. An individual approach to the prevention and treatment of arterial hypertension should be the basis of personalized medicine, taking into account gender and gender characteristics. On the clinical basis of the university, 36 men and 44 women with previously diagnosed AH were examined. The comparison was carried out according to anthropometric data, indicators of biochemical blood tests, an indicator of the thickness of the intima-media complex of the common carotid artery. An increase in the equivalent of abdominal obesity, regardless of gender, was revealed as the blood pressure numbers increased. The absence of subclinical atherosclerosis in men and the opposite result in women was determined, consistent with the theory of the loss of cardioprotective effects of female sex hormones with the onset of menopause.

Keywords: arterial hypertension, gender differences, menopause

In the recommendations of the ESC/ESH (European Society of Cardiology/European Society of Hypertension) from 2018, not only metabolic and hemodynamic (heart rate, HR), but also socioeconomic and psychosocial factors are mentioned as risk factors for arterial hypertension [1]. An individual approach to the prevention and treatment of diseases should be the basis of personalized medicine, which takes into account gender and gender characteristics [2]. In studies on the male population, the highest significance of such risk factors for diseases of the circulatory system as overweight, smoking, and hypercholesterolemia was noted [3,4]. The first myocardial infarction among women is recorded at the age of 65-72 years, and in the male population - from 55 to 65 years old [5-7]. Worldwide, cardiovascular diseases are the leading cause of morbidity, disability and mortality among both men and women [8]. Current research makes sure to take into account potential gender differences that were not previously considered even in the study design, when most of the studies were conducted in middle-aged men.

Thus, despite the prevalence of diseases of the cardiovascular system, both among men and among women, there are undoubted facts indicating significant gender differences in their formation, course, prognosis and prevention.

At the clinical base of the Moscow State University of Medicine and Dentistry, 80 patients with previously diagnosed with AH were observed, of which 44 patients suffered from stage I AH and 36 patients had stage II AH.

In both groups, men and women were comparable in age, absence of concomitant diseases of the cardiovascular system, diabetes mellitus, acute forms or exacerbation of chronic inflammatory diseases. All patients signed written informed consent. The clinical examination included clarification of complaints, clarification of the gynecological history in women, clinical examination, which included measuring blood pressure (BP), heart rate (HR), height, weight, waist and hips, calculating body mass index by the Quetelet index [body weight (kg)/height(m^2)]. The patients underwent a biochemical blood test: the level of CH, TG, HDLP, LDLP, glucose, creatinine, CRP was determined. The GFR was calculated using the CKD-EPI formula and measured in ml/min/1.73m^2. Doppler ultrasound examination of the extracranial vessels of the neck was carried out in order to assess the state of the vascular wall, its echogenicity, surface with the determination of the IMC thickness of the common carotid artery. During statistical processing, the arithmetic mean of the corresponding parameter and the standard deviation (M±SD) were calculated. The groups were compared using the nonparametric Smirnov-Kolmogorov test (for paired comparisons of indicators within the groups), the differences were considered statistically significant at $p<0.05$.

Results

Main anthropometric parameters and metabolic status in patients with AH stage I depending on gender

Indicator	Men of the group (N=11)	Women of the group (N=33)	Reference values
Height (cm)	176.82±3.06	163.49±5.34*	-
Weight (kg)	82.83±10.15	73.70±14.31*	-
BMI (kg/m^2)	26.55±3.16	27.34±4.64	<25
WG (cm)	91.00±5.61	83.33±11.73	<102 for men <88 for women
HG (cm)	102.25±2.87	106.30±10.36	-
WG/HG	0.88±0.05	0.78±0.06*	<0.9 for men, <0.85 for women
SBP (mmHg)	130.00±7.82	120.45±14.33	<140
DBP (mmHg)	82.00±6.32	78.48±10.49	<90

HR (bpm)	64.25±7.96	72.42±10.71*	<80 bpm
TCH (mmol/l)	5.48±0.79	5.68±0.91	<5
TG (mmol/l)	1.57±0.85	1.40±0.85	<1.7
Xc-LDLP(mmol/l)	3.18±0.67	3.96±0.83*	<3
Xc-HDLP (mmol/l)	1.43±0.41	1.48±0.42	<1.0 for men, <1.2 for women
Glucose (mmol/l)	5.29±0.93	5.19±0.70	≤5.5
Creatinine (mmol/l)	84.44±8.11	79.26±18.54	<115 for men, <107 for women
GFR (ml/min/1.73m²)	92.33±11.25	76.48±17.79*	>90
CRP (mg/l)	4.33±3.67	1.87±3.21*	<5
IMC (mm)	0.69±0.35	0.95±0.15	<0.9

* - $p<0.05$ between groups of men and women with stage 1 AH

Data on gender comparison of the above indicators in patients with stage I AH are presented in table 1. Despite the absence of significant differences in waist and hip measurements, there is a difference in the WG/HG ratio in men and women - 0.88±0.05 and 0.78±0.06, respectively. At the same time, the significance of the difference in the Xc-LDLP indicator is noteworthy, although in both groups the average level of Xc-LDLP exceeds 3.0 mmol/l. It should be noted that the differences in C-reactive protein are significant. Thus, in men, less pronounced changes in lipid metabolism and in the thickness of the intima-media complex were observed than in women of the same age with AH of comparable severity.

The group of patients with stage II arterial hypertension included 11 women and 25 men (table 2). Analyzing table 2, in both groups there is a tendency to an increase in overweight. Hyperlipidemia due to the atherogenic fraction in men is higher than in women and the thickening of the intima-media complex in women is up to 1.03±0.09 mm than in men (0.84±0.29 mm). However, compared with men, women with a similar disease have significantly less pronounced WG/HG, CRP and glomerular filtration rates.

Table 2

Comparison between groups of women and men suffering from AH stage II in terms of the main anthropometric parameters and metabolic status

INDICATOR	MEN OF THE GROUP (N=11)	WOMEN OF THE GROUP (N=25)	Target values
Height (cm)	175.20±4.98	164.64±3.91*	-
Weight (kg)	85.58±11.55	84.27±9.62	-
ИМТ (kg/m²)	27.81±2.98	30.39±3.15	<25
WG (cm)	94.85±6.82	95.73±11.66	<102 for men <88 for women
HG (cm)	102.45±4.87	113.10±9.49*	-
WG/HG	0.93±0.07	0.83±0.05*	<0.9 for men, <0.85 for women
SBP (mmHg)	131.00±12.33	141.36±18.72	<140
DBP (mmHg)	83.04±6.53	91.82±9.82*	<90
HR (bpm)	66.59±9.05	68.82±7.09	<80 bpm
TCH (mmol/l)	5.32±0.93	6.31±1.53	<5
TG (mmol/l)	1.61±0.98	1.29±0.38	<1.7
Xc-LDLP (mmol/l)	3.32±0.88	3.29±0.26	<3
Xc-HDLP (mmol/l)	1.23±0.34	1.31±0.27	<1.0 for men, <1.2 for women
Glucose (mmol/l)	5.28±0.49	5.19±0.47	≤5.5
Creatinine(mmol/l)	89.61±13.73	80.89±9.43	<115 for men, <107 for women
GFR(ml/min/1.73m²)	88.83±15.05	71.33±8.41*	>90
CRP (mg/l)	4.67±2.69	1.30±1.89*	<5

IMC (mm)	0.84±0.29	1.03±0.09	<0,9

* - $p<0.05$ between groups of women and men with stage 2 AH

Discussion

The Framingham Heart Study was the first study to show significant differences between men and women. The main unchanged risk factors for AH are generally known, age and gender, with most population studies noting that the prevalence of AH increases with age. Under the age of 50, the prevalence of AH is higher among men, while in older age groups this pattern changes, which can be explained by an increase in the number of risk factors that form AH in women [9].

In our study, it was noted that in stage I AH, men had higher blood pressure values than women. Significant differences in diastolic BP in group II AH between men and women should be noted. Thus, as the severity of hypertension worsened with increasing age, there were higher mean values of both systolic and diastolic BP in men than in women.

In our study, patients with stage I AH showed similar results in terms of mass index. In the group with stage II AH in women, BMI increased to 30.39±3.15 kg/m², while in men this indicator remained practically unchanged (BMI=27.81±2.98 kg/m²). Menopause is associated with an increase in body weight and the development of abdominal obesity [10, 11], so the findings are consistent with the literature.

Metabolic risk factors are more common with high BP than with low BP. In the scientific literature of recent years, more attention has been noted to the indicators of waist volume and the ratio of waist to hips, rather than to body mass index, since these indicators more accurately reflect the presence of abdominal obesity [10]. In the recommendations for arterial hypertension, it is indicated that the limit values of the waist volume - for men, this value was 102 cm and 88 cm for women, and the indicator of the ratio of waist to hips (WG/HG) should not exceed 0.8 regardless of gender [1]. According to our data, in the case of stage I AH in both women and men, the average waist measurement did not exceed the recommended values. It should be noted that the WG/HG indicator was significantly higher in men and exceeded the threshold value of 0.8. In patients with stage II AH, the following data were obtained: in women, both the waist measurement and the WG/HG level exceeded the recommended values. In men, the average values of the waist volume did not exceed the threshold level, while the WG/HG indicator not only exceeded the recommended value, but also turned out to be significantly lower than the analogous indicator in women. Thus, our data are consistent with the literature data that as the blood pressure numbers increase, there is an increase in the WG/HG indicator as an equivalent of abdominal obesity, regardless of gender [2].

Numerous epidemiological studies have shown that there is a clear positive relationship between elevated blood levels of total cholesterol, Xc-LDLP, triglycerides and the risk of atherosclerosis, while Xc-HDLP has a negative relationship [1]. In our work, we obtained data on the similarity of the average total cholesterol between women and men in both stage 1 AH and stage 2 AH. Noteworthy is the fact that all the obtained average values for total cholesterol exceed the recommended level of 4.9 mmol/l. At the same time, the situation with the level of triglycerides turned out to be the opposite - the average values in both sexes, both at the first and at the second stage of AH, did not exceed the threshold value of 1.7 mmol/l.

When analyzing the data on the level of Xc-LDLP in the group with AH stage I between women and men, significant differences were noted. In stage II AH, no significant differences in Xc-LDLP were obtained. There is a similar situation with the level of total cholesterol - in both groups, the average values of Xc-LDLP exceeded the recommended value of 3.0 mmol/l.

In our work, in patients with stage I AH, a similar level of Xc-HDLP in men and women is determined. The mean values in patients with stage II AH are lower than those with stage I, but did not fall to the threshold level for Xc-HDLP less than 1.2 mmol/l.

When assessing the glomerular filtration rate, we obtained the reliability of differences in this criterion by gender in both comparison groups. It should be noted that the mean values in the male population were significantly higher in both stage I AH and stage II AH. At the same time, regardless of gender, as AH progresses, a decrease in GFR is noted.

It is generally known that in the presence of AH in a patient, an increase in the thickness of the IMC at the level of the common carotid artery is observed under the influence of pressure loading not associated with atherosclerosis. According to the 2018 AH guidelines, asymptomatic target organ damage can be considered when a thickening of the common carotid artery wall (IMC>0.9 mm) or plaque is detected in a patient with AH.

In our study, patients with stage I AH in men had significantly lower IMC values than in women with comparable pathology. It should be noted that in the group with stage II AH, men again demonstrated a significantly lower IMC value (0.84±0.29 mm) than women (1.03±0.09 mm). Thus, it is legitimate to assume the absence of subclinical atherosclerosis in the male population.

Analyzing the metabolic parameters of patients with AH, it should be noted that all examined women had increased BMI values corresponding to various degrees of obesity, as well as lipid metabolism disorders corresponding to atherogenic dyslipidemia (increased concentration of Xc-LDLP and decreased Xc-HDLP). Thus, metabolic disorders of varying severity are present even in the early stages of arterial hypertension in women, which is consistent with the theory that the cardioprotective effects of female sex hormones are lost with the onset of menopause [12].

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