

Comorbidity of hypertension and chronic venous disease in men

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Aim. To study the clinical manifestations and characteristics of lower extremity chronic venous disorders (CVD) in working-age men with hypertension (HTN).

Material and methods. The study included 74 men with HTN at the age of 30-50 years and 41 men without HTN. HTN duration and regularity of antihypertensive medication intake were studied. We analyzed complaints and objective signs associated with CVD, their severity, structural and functional parameters of superficial, deep and perforator veins of the lower extremities using the triplex ultrasound. The prevalence and severity of cardiovascular risk factors among patients with HTN and CVD and patients with HTN and without CVD were analyzed.

Results. Men aged 30-50 with HTN showed a high prevalence of complaints (68%) associated with CVD: evening heaviness and fullness in the legs; pain decrease at rest; a combination of pain, spasm and swelling in long-time standing. Objective signs of CVD were recorded in 83,8% of men with HTN (most often — telangiectasia (38%) and swelling (24%)). Men with HTN were diagnosed with more severe manifestations of CVD than men without HTN. In patients with HTN, episodic pain and evening perimalleolar swelling were 1,8 and 4 times more likely, respectively, than in men without HTN. The presence of CVD and HTN was not associated with cardiovascular risk factors. HTN men was characterized by a large-diameter veins, pathological reflux, vein tortuosity, the presence of thrombotic masses and post-thrombotic lesions. In these patients, along with an

increased blood flow velocity in the deep and perforator veins of the lower leg, a low velocity in the deep femoral veins was observed. This indicates venous insufficiency even at rest. Orthostasis in men with HTN increased the frequency of reflux in superficial veins by 2-4 times, which indicates latent venous insufficiency.

Conclusion. HTN is characterized by an increase in the frequency and severity of symptoms and signs of CVD, which indicates their comorbidity.

Key words: men, comorbidity, hypertension, chronic vein disorders.

Relationships and Activities: not.

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Hypertension (HTN) today remains one of the most urgent research and practical problems due to the high incidence and common cardiovascular, cerebrovascular and renal complications, which are recognized as the leading causes of death in the Russian Federation [1]. Comorbidities in HTN patients increases the risk of complications and mortality, which, in turn, increase socio-economic losses for society and the state as a whole due to disability of patients, expensive diagnostics and treatment [2]. Of particular importance is the comorbidity of hypertension and chronic vascular diseases, including venous disorders, since vessels are considered as one of the main target organs for HTN [3-5]. It was previously shown that lower extremity chronic venous disorders (CVD) in men with HTN significantly reduces their working ability and quality of life [6]. However, at present, the comorbidity of HTN and lower extremity CVD remains poorly studied, even despite the fact that the arterial and venous systems are a common circulatory complex, and the adult population in Russia has a high prevalence of CVD (women — 63%, men — 37%) [7].

The aim was to study the clinical manifestations and characteristics of lower extremity CVD in working-age men with HTN.

Material and methods

The study included 115 men who were divided into two groups: experimental (n=74) — patients with HTN, control (n=41) — patients without HTN [8]. The inclusion criteria for the experimental group were male gender, age 30-50 years, the presence of HTN. Further, to identify the dependence of CVD on cardiovascular risk factors, the 1st (62 patients with hypertension and objective signs of

CVD) and the 2nd groups (12 patients with hypertension and without CVD) were selected from the experimental group.

The inclusion criteria for the control group were male gender, age 30-50 years, absence of HTN. There were following exclusion criteria for patients of both groups: drug use; cancer; endocrinopathies (diabetes, hypothyroidism, adrenal gland disorders); acute and chronic respiratory diseases; history of upper respiratory tract infections in last two weeks; acute infectious diseases; acute and chronic kidney diseases (pyelonephritis, glomerulonephritis); differentiated connective tissue disorders; anemia; hepatitis; cirrhosis; pancreatitis; gastric and duodenal ulcers; professional athletes; lower extremity fractures and surgery; spine and brain injuries; organic diseases of the central nervous system and spinal cord disorders; heart failure.

The ethics committee of E. A. Wagner Perm State Medical University approved this study. All patients signed informed consent.

Clinical characteristics of men with HTN. Participants of the experimental group had different severity of HTN: 42 patients — stage 1 HTN, 26 patients — stage 2 HTN, 6 patients — stage 3 HTN. Fifty-eight patients from the experimental group know that they have HTN, but only 17 (23%) take antihypertensive therapy. The median duration of HTN in this group was 5 (3-10) years. In 16 (22%) people, HTN was a newly diagnosed. Patients with HTN were characterized by high body weight, BMI, waist circumference, plasma glucose and total cholesterol levels (Table 1).

Clinical analysis. Health assessment was carried out according to the medical history data: HTN duration and adherence to antihypertensive therapy.

Table 1

Comparative analysis of men from the experimental and control groups

Parameter	Experimental group, n=74 Me (Q ₁ -Q ₃)	Control group, n=41	P
Age, years	41 (36-44)	40 (36-45)	0,76
Weight, kg	92 (84-100)	82 (75-87)	0,001
SBP, mm Hg	146 (140-153)	120 (110-122)	0,001
DBP, mm Hg	96 (90-100)	80 (72-82)	0,001
Heart rate, bpm	74 (67-78)	70 (64-74)	0,025
Total cholesterol, mmol/L	5,05 (4,50-5,68)	4,60 (4,20-5,30)	0,039
Fasting glucose, mmol/L	5,30 (4,80-5,60)	4,80 (4,50-5,40)	0,035
BMI, kg/m ²	30,0 (28,0-32,0)	26,0 (24,0-29,0)	0,001
Waist circumference, cm	100 (92-106)	90 (86-99)	0,001

Note: P — probability value.

Abbreviations: BMI — body mass index, DBP — diastolic blood pressure, SBP — systolic blood pressure.

Table 2

**Comparative analysis of subjective signs
of CVD between patients of from
the experimental and control groups**

Question	Experimental group, n=74	Control group, n=41	P
	Abs. (%)		
Do you feel the heaviness and fullness in the legs at the end of the day, intensifying in hot weather or in a hot room?	33 (45%)	9 (22%)	0,027
Does the pain and heaviness in the legs decrease or gone after resting in a horizontal position or when using compression stockings?	50 (68%)	16 (39%)	0,012
Do you have oedema in the lower legs and feet at the end of the day?	25 (34%)	6 (6%)	0,046
Do pain in legs, spasm, and oedema aggravated in long-time standing?	28 (38%)	7 (17%)	0,035

Note: P — probability value.

Abbreviation: CVD — chronic venous disorders.

Cardiovascular parameters were assessed by BP using a sphygmomanometer A&D UA-777. We recorded the prevalence and severity of cardiovascular risk factors, which were evaluated using the anamnesis data, instrumental and laboratory tests: blood and urine tests, chest x-ray, electrocardiography (ECG), echocardiography, Doppler ultrasound of peripheral arteries, fundoscopy [1, 2].

Assessment of CVD symptoms. To assess the subjective signs, we used a questionnaire based on the CEAP classification, which included the main complaints and clinical manifestations of CVD [9]. Lower limb examination was carried out in a standing. We assessed the following objective signs: telangiectasia, varicose veins, swelling, trophic changes in the skin and subcutaneous tissue, healed venous ulcer, open venous ulcer. The severity of CVD was assessed using the Venous Clinical Severity Score (VCSS) [10]. Lower limb venous ultrasound was performed using triplex ultrasound of different modes [11]: B-mode was used to assess venous architecture; color Doppler mapping was used for rapid evaluation of blood flow. Ultrasound was carried out together with certified ultrasound specialist S.V. Letyagina using a iU22 xMatrix system (Phillips, USA, 2014).

Lower limb venous ultrasound was performed according to anatomical localization, using anatomical nomenclature, terminology of the International Union of Phlebology, and CEAP classification [9, 11] — superficial venous system: great saphenous vein (GSV), small saphenous vein (SSV), saphenopopliteal junction (SPJ); — deep venous system: common femoral vein (CFV), posterior tibial vein (PTV), muscular (soleal and gastrocnemius) veins (MV); — perforator veins: Dodd's and Cockett's perforators. We evaluated the location, diameter, lumen area, wall thickness of veins. Peak flow velocity, venous reflux and its duration, the presence of thrombotic

masses and post-thrombotic lesions, tortuosity of deep and/or superficial veins were also assessed. Not intensified blood flow during distal compression and retrograde flow during proximal compression were identified. We also used following functional tests: Valsalva maneuver; proximal compression; distal compression; orthostatic test.

Statistical processing was carried out in the software package Statistica 6.1 (StatSoft-Russia, 2009) using nonparametric statistics. Descriptive statistics data are presented as median (Me) and first (Q1) and third (Q3) quartiles. Comparison of variational series of two independent groups was performed using the Mann-Whitney U-test, and the comparison of proportions and discrete data using the Chi-squared test. The dynamics of the proportions' comparison between groups were evaluated by the McNemar's test. Differences were considered significant at $p < 0,05$.

Results

Patients in the experimental and control groups had many complaints associated with CVD. However, some complaints were recorded more often in the experimental group (Table 2).

Compared with the control group, patients of the experimental group were 6 times more likely to have evening swelling. These patients also 2 times more often had complaints of evening heaviness and fullness in the legs, pain decrease at rest, a combination of pain, spasm and swelling in long-time standing.

Physical examination of lower extremities revealed CVD signs of C1-C4 in the experimental group, while in the control group — C1-C3. In the experimental group, objective signs of CVD were recorded in 62 patients (83,8%), which is 2,5 times more often than in the control group — 14 patients (34,1%) ($p = 0,001$). In the experimental group, telangiectasias

Table 3

**Comparative analysis of objective signs
of CVD between patients of from the experimental and control groups**

Objective sign	Experimental group, n=74	Control group, n=41	P
	Abs. (%)		
C ₀ — no visible or palpable signs	12 (16,2%)	28 (68,2%)	0,001
C ₁ — telangiectasias or reticular veins	28 (37,8%)	7 (17,1%)	0,035
C ₂ — varicose veins	15 (20,3%)	3 (7,3%)	0,11
C ₃ — oedema	18 (24,3%)	3 (7,3%)	0,045
C ₄ — secondary skin alterations	1 (1,4%)	0 (0,0%)	0,76
C ₅ — healed ulcer	0 (0,0%)	0 (0,0%)	-
C ₆ — open ulcer	0 (0,0%)	0 (0,0%)	-

Note: P — probability value.

Abbreviation: CVD — chronic venous disorders.

Table 4

**Analysis of contingency table between
the experimental and control groups**

Symptoms	Experimental group, n=74				Control group, n=41				P	
	Severity (points)									
	0	1	2	3	0	1	2	3		
	Abs. number of cases									
Pain	32	42	0	0	28	13	0	0	0,017	
Varicose veins	59	8	7	0	38	2	1	0	0,117	
Oedema	50	21	2	0	38	3	0	0	0,012	
Hyperpigmentation	72	2	0	0	41	0	0	0	0,751	

Note: P — probability value.

Abbreviation: CVD — chronic venous disorders.

and oedema were recorded more often than in the control group (Table 3).

Using the VCSS, we conducted a comparative analysis, which showed significant differences between the groups in terms of severity of pain and oedema (Table 4).

Patients with HTN had pain in the legs 1,8 times more often than patients of the control group (57% vs 32%, respectively). Patients with HTN also experienced perimaleolar oedema 4 times more often (28% vs 7%). Severe manifestations of CVD such as inflammation, induration, ulcers, and cases of compression therapy were not recorded.

A comparative analysis of the prevalence of cardiovascular risk factors between hypertensive patients with and without objective signs of CVD did not reveal differences. This suggests that CVD in patients with HTN is not associated with the prevalence and severity of risk factors. CVD development does not depend on the duration of HTN. The prevalence of

obesity as the main risk factor of CVD was also the same.

Venous ultrasound did revealed differences in qualitative traits of the experimental and control groups. For example, the prevalence of pathological refluxes (>0,5 sec) in the superficial veins reached 10%, in the deep veins — 1,4%, in perforator veins — 33%. Venous reflux was detected 3-4 times more often in the experimental group than in the control group, but the differences was not reliable. Post-thrombotic lesions of the superficial and deep veins and thrombotic masses were revealed in 1,4% of cases; similar findings were not detected in perforator veins. In the experimental group, we observed vein tortuosity of the superficial veins in 6,8% of cases, deep veins — in 8,1%, perforator veins — in 17,8-33%.

In HTN patients, there were differences in quantitative traits: blood flow velocity, vein diameter and area (Table 5).

Table 5

**Comparative analysis of quantitative traits
of venous structure and function between
the experimental and control groups**

Parameter	Experimental group, n=74 Me (Q ₁ -Q ₃)	Control group, n=41	P
SSV, right			
Diameter, mm	2,3 (2,0-2,7)	2,1 (1,7-2,5)	0,042
CFV, left			
Blood flow velocity, cm/sec	28,1 (22,8-35,8)	31,4 (25,5-38,0)	0,01
PTV, left			
Blood flow velocity, cm/sec	12,6 (10,4-14,5)	11,2 (9,3-13,8)	0,049
Cockett's perforators, right			
Blood flow velocity, cm/sec	9,4 (6,7-12,5)	5,7 (5,1-7,3)	0,013
Cockett's perforators, left			
Lumen area, mm ²	5,4 (2,49-7,55)	3,0 (2,0-3,2)	0,04

Note: P — probability value.

Abbreviations: CFV — common femoral vein, PTV — posterior tibial vein, SSV — small saphenous vein.

HTN patients had a larger diameter of superficial veins and a larger lumen area of perforator veins than in the control group. Along with the increased blood flow velocity in the deep and perforator veins of lower leg, low blood flow velocity in the main deep veins of the thigh was characteristic for patients with HTN. This indicates venous insufficiency even at rest.

In orthostasis, refluxes in superficial and deep veins was recorded 2-4 times more often. However, a significant increase was noted only in the superficial veins — from 8% to 18%, while in the experimental group — from 3% to 10% ($p=0,027$ according to the McNemar's test).

Discussion

Previous few studies of HTN patients showed that venous and arterial blood flow have common pathogenesis of arterial and venous pressure increase, changes in regulation of vascular tone and capacitance, and microcirculatory alterations [12-14]. The study of venous circulation in HTN patients showed a relationship between HTN and venous flow changes, including in the lower extremities, related mainly to the tone and capacitance changes [15]. Changes in the veins of the lower extremities, characteristic of hypertension, were revealed — weakening of extensibility and capacitive response due to the weakened response of the venoconstrictor to unloading of the baroreceptor [11]. The possible association of hypertension and varicose veins was indicated by Mäkivaara LA, who found a higher prevalence of venous lesions in people with cardiovascular diseases, including hypertension [16]. In 2016, B. Matic

revealed common risk factors in patients with hypertension and chronic venous insufficiency of the lower extremities [17]. Thus, our data indicate that hypertension is more often combined with signs of CVD and impaired venous blood flow in the lower extremities. The results actually indicate a high probability of comorbidity of hypertension and chronic hepatitis B. AH is combined with a more pronounced clinical picture of CVD. This comorbidity increases the risk of a negative prognosis of the life and health of men of working age, which requires the development of new strategies in assessing cardiovascular risks and new approaches in choosing treatment methods for this comorbidity.

Conclusion

1. Hypertensive men aged 30-50 years had high prevalence of complaints (68%) associated with CVD: evening heaviness and fullness in the legs, pain decrease at rest, a combination of pain, spasm and oedema in long-time standing. Objective signs of CVD were recorded in 83,8% of men with HTN (most often — telangiectasia (38%) and swelling (24%)).

2. Hypertensive men were diagnosed with more severe manifestations of CVD than men without HTN. In patients with HTN, episodic pain and evening perimalleolar swelling were 1,8 and 4 times more likely, respectively, than in men without HTN. The presence of CVD and HTN was not associated with cardiovascular risk factors.

3. Hypertensive men was characterized by a large-diameter veins, pathological reflux, vein tortuosity, the

presence of thrombotic masses and post-thrombotic lesions. In these patients, along with an increased blood flow velocity in the deep and perforator veins of the lower leg, a low velocity in the deep femoral veins was observed. This indicates venous insufficiency even

at rest. Orthostasis in men with HTN increased the frequency of reflux in superficial veins by 2–4 times, which indicates latent venous insufficiency.

Relationships and Activities: not.

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