Sex-Related Differences in the Variability of Vascular Blood Flow in Middle-Age Individuals

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Analysis of spectral parameters of vascular blood flow variability revealed some sex-related peculiarities. The amplitude of aortic pulsation and total variability power of this parameter and its four components (ultralow frequency, very low frequency, low frequency, and high frequency range) were higher in women. The amplitude of microvascular pulsation and total variability power of this parameter and components were higher in men. In male patients, the relative variability power for the amplitude of microvascular pulsation was higher in the high frequency and low frequency ranges, but lower in the very low frequency and ultralow frequency ranges.

Key Words: *variability of vascular blood flow; age of maturity; sex differences*

Gender differences exist in the main hemodynamic parameters: women have lower systolic volume (by 30-40%) and minute volume (by 10-15%, despite heart rate in women is higher by 6-8 bpm than in men), blood pressure, *etc*. [1,2]. Little is known about gender differences in the variability of vascular blood flow in middle age.

This work was designed to evaluate sex differences in the variability of vascular blood flow in adult subjects.

MATERIALS AND METHODS

We examined 198 practically healthy subjects aging 23-55 years. There were 99 men (33.0±8.8 years) and 99 women (33.3±9.3 years).

Blood circulation was studied on a Kentavr noninvasive bioimpedance device (Mikrolyuks) by means of electrocardiography, rheography, and photoplethysmography. Beat-to-beat measurements were performed for 5-15 min (500 heart beats) to evaluate the amplitude of aortic pulsation (AAP) and amplitude of microvascular pulsation (AMP) in foot fingers at rest (lying on the back, voluntary breathing).

The mean values of the test parameters were automatically calculated from a set of 500 values by the end of recording. Spectral analysis of parameter variability was performed by the method of fast Fourier transform. We estimated the total power (in points, 1 point=measurement unit/Hz), midband frequency, and absolute and relative power in 4 ranges of ultralow frequency (ULF, 0-0.025 Hz), very low frequency (VLF, 0.025-0.075 Hz), low frequency (LF, 0.075-0.150 Hz), and high frequency (HF, 0.15-0.50 Hz).

The results were analyzed by Kolmogorov—Smirnov test, Mann—Whitney test, and χ^2 test. The critical level of significance in verification of statistical hypotheses was 0.05.

For the analysis of experimental data, classification by the major frequency component was used.

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RESULTS

Study of spectral parameters of AAP variability showed that the mean value, total power spectrum, absolute values, ULF, VLF, LF, and HF in women were higher than in men (Table 1). No differences were revealed in the mid-band frequency and relative values of ULF, VLF, LF, and HF.

Analysis of individual spectra showed that AAP variability spectrum included primarily HF (93% men and 89% women; Fig. 1, *a*), LF (6% men and 10% women), or very-ULF (1% subjects). No gender differences were found in the frequency of any profile of the AAP variability spectrum.

Evaluation of spectral parameters of AMP variability showed that the mean value, total power, absolute values, ULF, VLF, LF, and HF in men are higher than in women (Table 2). Male subjects were characterized by lower relative values of VLF and ULF than females.

Our results indicate that activity of the main regulatory mechanisms for microvascular pulsation in men is higher than in women. The contribution of respiratory and myogenic components is higher, while the role of neurogenic and endothelial processes is lower in men than in women.

Analysis of the individual profiles of AMP variability spectra showed that ULF is more often observed in women than in men (80 and 57%, respec-

TABLE 1. Descriptive Statistics of Spectral Parameters for the AAP Variability in Men and Women

Parameter		Median (25%, 75% percentiles)	
		men	women
Mean value, mW		161 (128-205)	240 (195-281)*
Total power (T), points		1052 (656-2323)	2029 (1390-3762)*
Absolute values, points	ULF	0.20 (0.17-0.25)	0.21 (0.16-0.26)*
	VLF	28 (10-60)	56 (25-138)*
	LF	99 (40-185)	152 (87-465)*
	HF	284 (121-610)	506 (272-1049)*
Mid-band frequency, Hz		616 (396-1220)	1376 (893-2412)
Relative values, %T	ULF	2 (1-4)	3 (1-5)
	VLF	10 (5-13)	8 (6-13)
	LF	24 (17-31)	25 (16-31)
	HF	62 (53-71)	63 (55-71)

Note. Here and in Table 2: *$p<0.01$ compared to men.

TABLE 2. Descriptive Statistics of Spectral Parameters for the AMP Variability in Men and Women

Parameter		Median (25%, 75% percentiles)	
		men	women
Mean value, rel. units		36 (26-55)	27 (15-42)*
Total power (T), points		111 (18-355)	25 (4-127)*
Absolute values, points	ULF	0.04 (0.03-0.10)	0.03 (0.02-0.04)*
	VLF	10 (2-41)	5 (1-32)*
	LF	36 (5-77)	12 (2-60)*
	HF	16 (2-103)	2 (0.4-15)*
Mid-band frequency, Hz		6 (1-110)	1 (0.1-4)*
Relative values, %T	ULF	17 (8-32)	27 (17-38)*
	VLF	43 (23-51)	48 (40-55)*
	LF	17 (11-29)	13 (5-20)*
	HF	13 (4-35)	4 (1-14)*

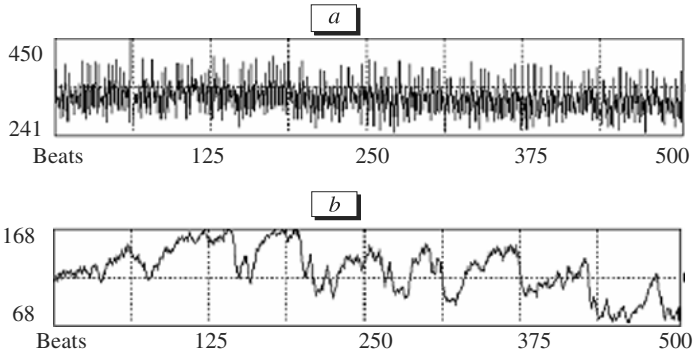

Fig. 1. Spectral parameters and trends for the variability of AAP (*a*) and AMP (*b*) in the female subject (Sh., 36 years.

tively). However, women differed from men in the lower prevalence of LF (10 and 14%, respectively) and HF (10 and 26%, respectively). No sex differences were found in the spectral profile with a major ULF component.

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