

**Research Article** 

# Orthostatic Reaction of the Dorsal Hand Skin Microcirculation in Healthy People Assessed by Laser Doppler Fluxometry

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### Abstract

Laser Doppler Fluxometry (LDF), used to assess a function of microcirculation (mc), creates new opportunities of noninvasive assessment of reaction of autonomic system on pionization (orthostatic reaction). In conducted research the basic flow (BF) of the dorsal hand skin mc of the non-dominant extremity before and after pionization in 26 healthy persons of both sex in age of 41,07 ± 11,15 years was assessed. After the pionization, in the examined area of microcirculation a reduction of perfussion (16,38 ± 7,65 vs 8,78 ± 3,29 PU, p<0,0001) was observed, as the result of adrenergic stimulation and veno-capillary reflexes. In effect, the reduction of signals power amplitude was observed i.e. as the result of increase of the precapillary sphincters tone. Decrease of amplitude was accompanied by increase of examined rhythms frequency, as independent from microcirculation level (heart rhythm, respiratory rhythm) and at the same level of the microcirculation (precapillary sphincters tone rhythm: myogenic, neurogenic, endothelial).

Keywords: Orthostatic reaction; Laser Doppler Fluxometry (LDF)

# Introduction

Laser Doppler Fluxometry (LDF), used to assess a function of microcirculation (mc), creates new opportunities of noninvasive assessment of reaction of autonomic nervous system on pionization (orthostatic reaction). In spite of the limited area of microcirculation examination, by the analysis of vasodilatation rhythms, it allows to assess the adrenergic reaction on the heart level, of respiratory system and precapillary sphincters in the domain of miogenic, neurogenic and endothelial component [1-3].

### Materials and Methods

In LDF the basic flow (BF) of the dorsal hand skin mc of the nondominant extremity before and after pionization in 26 healthy persons of both sex in age of 41,07 ± 11,15 years was assessed. In obtained record, before (pd) and after (po) pionization were assessed: PP (in perfusion units - PU) and analysing the frequency spectrum (rhythm frequency - cycles/minute and amplitude - units of signal power) -Heart Rhythm (HR) and its amplitude (HRa), Respiratory rhythm (Rr) and its amplitude (ROa), miogenic rhythm of precapillary sphincters tone (MR) and its amplitude (MRa), neurogenic rhythm of precapillary sphincters tone (NR) and its amplitude (NRa) and endotheliumdependent rhythm of precapillary sphincters tone (ER) and its amplitude (ERa). Rhythm was assessed in cycles/minute, the amplitude by value of signal power. Means (x) and standard deviations  $(\pm SD)$ were defined; differences were assessed with t-Student test.

The flow (BF) of the dorsal hand skin microcirculation was examined with the help of the laser doppler fluxometry, apparatus Periflux 4001, the Perimed company, generating laser light of 632,8 µm wavelength. Optode was located on the dorsal hand skin of the dominant extremity between the first and second metacarpal bone. It was attached to the hand with the help of two-sided adhesive tape. Area surface of measurement was 1,2 mm<sup>2</sup> and the light penetration into the skin depth - about 2 mm. Time of examination (recording) was 4 minutes before and 4 minutes after pionization.

# Results

After the pionization, in the examined area of microcirculation

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a reduction of perfusion (16,38 ± 7,65 vs 8,78 ± 3,29 PU, p<0,0001) was observed, as the result of adrenergic stimulation and venocapillary reflexes. In effect, the reduction of signals power amplitude was observed i.e. as a result of increase of the precapillary sphincters tone. Decrease of amplitude was accompanied by increase of examined rhythms frequency, as the independent from microcirculation level (heart rhythm, respiratory rhythm) and at the same level of the microcirculation (precapillary sphincters tone rhythm: myogenic, neurogenic, endothelial) (Table 1).

### Discussion

The pionization caused changes in flow regulation with perfusion reduction in the examined area of the microcirculation, as the result of increase of adrenergic tension and local reaction of the microcirculation on the growth of hydrostatic pressure, in the way of miogenic autoregulation and veno-capillary reflex. LDF enabled multilevel assessment of adrenergic reaction. The smallest intensification of changes concerned the endothelial component of vasodilatation, what is in agreement with physiology of the orthostatic reaction. Genesis of changes is connected with the activity of adrenergic system, but for each rhythm is related to the other level of regulation. On the basis of the records it seems that reduction of perfusion of the examined area was connected with decrease of rhythm amplitude with simultaneous increase (apart from the endothelium-dependent) of their frequencies.

Pionization reaction in examined group was not ideally homogeneous. In examination period in 3 persons, without symptoms of orthostatic hypotony and drop of total perfusion in the examined Citation: Tubek S, Sobieszczanska M, Szygula R (2012) Orthostatic Reaction of the Dorsal Hand Skin Microcirculation in Healthy People Assessed by Laser Doppler Fluxometry. J Clin Exp Cardiolog 3:190. doi:10.4172/2155-9880.1000190

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Lp	PARAMETERS	x + SD	Statistical relevance (p)
1	PUpd : PUpo	 16,38 ± 7,65 vs 8,78 ± 3,29	< 0,0001
2	HRpd : HRpo	65,85 ± 10,43 vs 78,27 ± 13,00	<0,001
3	vHRpd : vHRpo	0,66 ± 0,50 vs 0,22 ± 0,16	<0,0001
4	Rrpd : Rrpo	13,55 ± 2,73 vs 14,68 ± 2,88	< 0,05
5	Rrapd : Rrapo	0,32 ± 0,22 vs 0,21 ± 0,11	<0,01
6	MRpd : MRpo	4,27 ± 0,77 vs 4,64 ± 0,72	<0,05
7	MRapd : MRapo	1,01 ± 1,08 vs 0,50 ± 0,30	<0,01
8	NRpd : NRpo	2,01 ± 0,46 vs 2,28 ± 0,49	<0,001
9	NRapd : NRapo	1,17 ± 1,00 vs 0,68 ± 0,58	<0,01
10	ERpd : ERpo	0,62 ± 0,13 vs 0,78 ± 0,68	ns
11	ERapd : ERapo	1,40 ± 1,19 vs 0,96 ± 0,71	<0,05

Explanation of the abbreviations in text

Table 1: Changes of individual parameters of function of dorsal hand skin microcirculation in laser doppler fluxometry (LDF) after pionization in healthy people.

area, absence of increase in the heart rate frequency and the rhythms changes only on the precapillary sphincters levels were observed. To define the ranges of norm for the changes, in the further research on vegetative system with the help of the LDF during the function tests, attention should be paid on such reactions.

The wide range of received data and noninvasiveness of the method – LDF – create a possibility of wide clinical use of this method in assessment of fuction of the vegetative system in physiological and pathological states, especially in diabetes [4] and hypertension [5].

At the appropriately long records of the flows in microcirculation, it can be tried to assess the variation of heart rhythms, respiration and precapillary sphincters.

# Conclusions

The LDF enables the simultaneous multilevel assessment of

changes of the vegetative system tension in the examined area of the microcirculation.

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