# DIAGNOSTIC POTENTIAL OF ERGOREFLEX ACTIVITY IN ASSESSING HEART FAILURE SEVERITY AND DYNAMIC EVALUATION PHYSICAL REHABILITATION EFFECTIVENESS IN HEART FAILURE PATIENTS

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**Background:**

The degree of ergoreflex activity (ERF) reflects severity heart failure myopathy.

**Aim:**

To determine the diagnostic potential of ERF activity in relation to heart failure severity assessment and assessment of physical rehabilitation (PR) effectiveness dynamic in HF patients.

**Methods:**

297 HF patients III Class, 55 years old (37;63), BMI – 22(21;26)kg/m2, LVEF – 33 (19;39)% were examined. Patients were divided into 2 groups performing (FR) of varying intensity for 9 months. In the main group (MG), 237 patients performed training walking daily for 60 minutes at a speed set at 95% of the speed reached at the lactate threshold (LT). 60 patients of the control group (KG) performed training walking three times a week at a speed registered at 55% VO2peak. ERF activity was evaluated according to a standardized method using the Oxycon Pro equipment (Jaeger, Germany). CRT was performed on a treadmill model: GE Medical Systems Information Technologies using Oxycon Pro equipment (Jaeger, Germany). All patients underwent a general clinical blood test. The number of shaped blood elements was determined on automatic hematological analyzer SISMEX XT-1800. The data obtained were processed using Microsoft Excel, Statistica for Windows 10.0 application programs, the differences were considered significant at a significance level of $p<0.05$.To study the relationship of quantitative parameters, the Spearman correlation coefficient was calculated, estimating the measure of the linear relationship between the features.

**Results:**

After the course of PR, HF severity Cecreased to II Class in 75% MG patients, in 44% KG patients ($p= 0.003$).VO2LT in MG and KG increased by 24% and 15% ($p=0.001$), respectively; and VO2peak - by 45% and 17%, respectively ($p=0.005$). Initially, direct links were revealed between the initial

ERF activity (according to ΔVE) and VO2peak (r=-0.67, p=0.001), ERF (according to ΔVE) and (VO2LT) (r=-0.72, p=0.001), ERF (according to ΔVE) and the absolute number of peripheral blood monocytes (r=0.42, p=0.02), and the ratio of neutrophils and leukocytes (r=0.4, p=0.03). The association of ERF with HF etiology (r=0.2, p=0.05), sex (r=0.18, p=0.06), age (r=0.21, p=0.03), LVL (r=0.22, p=0.05) was not revealed. After training, MG patients registered a more pronounced decrease in ERF activity compared to KG patients: in terms of DAP - by 40%, in VE - in MG by 53%, in VCO2 - by 38%, and in KG - by 21%, 23% and 15%, respectively (pDAP= 0.002, pVE = 0.001, pVCO2 = 0.04) (Table 1). After PR, when in some HF patients NYHA Class fell to II, revealed a direct association between ERF (for ΔVE) and NYHA Class (r=-0.57, p=0.01) and between ERF activity (for ΔVE), and VO2LT (r=-0,55, p=0.001), and VO2peak (r=0,49, p=0.001), and monocytes content (r=0.63, p=0.01). In MG significantly more decreased the severity of systemic inflammation than in CG (table. 1).

**Table 1**

Dynamics of HF severity, physical performance, ERF activity and systemic inflammation

| Group / Indicator | MG | | CG | | p | |
|---|---|---|---|---|---|---|
| | initially | 9 months | initially | 9 months | $p_{MG-CG\ initially}$ | $p_{MG-CG9months}$ |
| $VO_{2LT}$, Me [LQ;UQ] | 8,4 [6,5;9,9] | 10,3 [8.9;12,5] | 8,5 [6,6;U10.1] | 9,5 [7,6;10.7] | p=0,07 | p=0,001 |
| $VO_{2peak}$, Me [LQ;UQ] | 14.4 [11.1;17,1] | 18 [15,9;24,7] | 13,8 [11,6;16,5] | Me [LQ;UQ] | p=0,1 | p=0,005 |
| ERF activity | | | | | | |
| (ΔDAP1- ΔDAP2), mm.Hg, Me [LQ;UQ] | 18 [12;36] | 18 [12;35] | 10 [7;16] | 16 [12;32] | p=0,053 | p=0,02 |
| (Δ $V_E$1- Δ $V_E$2), L/min, Me [LQ;UQ] | 9 [6,3;15,7] | 3,4 [2;6] | 8,7 [6,5;15] | 7,1 [5,4;14] | p=0,05 | p=0,001 |
| (Δ$VCO_2$1-Δ$VCO_2$2), ml/min/kg, Me [LQ;UQ] | 163 [99;313] | 101 [75;178] | 170[107;298 ] | 143 [95;284] | p=0,2 | p=0,04 |
| Systemic inflammation activity | | | | | | |
| Leukocytes, $10^9$/L, Me [LQ;UQ] | 8.31 [6,1;9,67] | 6,35 [4,32;6,98] | 8,15 [6,55;9,53] | 8,25 [6,55;9,98] | p=0,066 | p=0,01 |
| Monocytes, $10^9$/L, Me [LQ;UQ] | 0,81 [0,75;0,93] | 0,64[0,58; 0,76] | 0,8 [0,75;0,92] | 0,77 [0,73;0,87] | p=0,09 | p=0, |

**Note:** Me is the median, LQ is the lower quartile, UQ is the upper quartile, VO2LT - oxygen volume absorbed at the LT level, VO2peak - oxygen volume absorbed at exercise peak, Δ - studied parameters dynamics, VE - minute ventilation volume , DBP - diastolic blood pressure, VCO2 - carbon dioxide released volume.

Conclusions: 1. PR calculated on LT basis contributed more to a decrease HF severity, increase in VO2peak, a decrease in ergoreflex activity and systemic inflammation than training calculated on 55% VO2peak basis. 2. There is a diagnostic potential of ergoreflex activity in relation to the assessment of heart failure severity and the dynamic assessment of physical rehabilitation effectiveness in HF patients.