HEART RATE RECOVERY POST-6-MINUTE WALKING TEST MORBIDITY AND MORTALITY IN PATIENTS WITH HEART FAILURE

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Introduction
The heart rate measuring can determine the autonomic nervous system behavior. One of the non-invasive means to monitor the response of the autonomic nervous system is the heart rate recovery (HRR) after exercise, which is defined as the rate at which the heart rate decreases after performing moderate or intense exercise. The recovery heart rate is faster when the subject's aerobic fitness is better therefore the same percentage increase as the fitness level rises. In its regulation affects the sympathetic system and the parasympathetic variables neuro - humoral hence the prevalence of poor recovery of heart rate in patients with heart failure (neuro-humoral defects are part of the etiology of heart failure). Altering the activity of the parasympathetic nervous system and sympathetic predominance prolonged autonomous system and increased activity of the sinus node neurohumoral has been associated with an alteration in the control of heart rate limits their compensatory response to physical activity in patients with cardiac abnormalities. Arousing interest in the evaluation of heart rate recovery as a predictor of morbidity and mortality in patients with cardiac disorders, specially in Chronic heart failure (CHF) is the final common pathway of most heart disease.

Purpose
The aim of this study was to define the relationship between HRR in the first minute after the 6 minutes walk test (6MWT) and the proportion of cardiovascular hospitalization or death in patients with heart failure after a telephonic follow up.

Significance
This study seeks to determine the self assessment of HRR in six-minute walk in patients with heart failure could be a predictor of cardiovascular hospitalization and or mortality in this patient group.

Design
A relational study, Analytical, cohort type, longitudinal retrospective was conducted.

Methods
The 6MWT database from de cardiac rehabilitation program from the Shaio Clinic was revised and analyzed since 2008 to 2013 in patients with heart failure and left ventricular ejection fraction less than 40%. The variables of age, gender, distance and heart rate recovery in the first minute after completion the 6MWT were collected. The data were classified depending on a heart rate recovery less or more than 12 beats per minute (bpm) in the first minute. During February 2014 telephone calls were made to conduct a survey to know whether the patient would have had a new hospitalization or had died. An analysis is then conducted to determine whether there was relationship between beats per minute recovery and frequency of hospitalization and death in patients.
Data were recorded in a matrix of stacked data (Excel spreadsheet). It was evaluated whether the comparison parameter (HRR and distance) had the same or different (Levene Test) variances, assuming a significance level of 95% for a permissible error of 5% (α), analysis of difference was established of means for independent samples (t-test for independent samples) of HRR and distance with hospitalization outcomes and / or death. Data were analyzed with the statistical software SPSS version 22.0.

Results
48 clinical records and telephone interviews were evaluated. The average age of the subjects was 58.6 years, male gender contribute 81.3% of the data, most had functional class II. All patients were using beta blockers (Tables 1 and 2). The average time elapsed since the 6MWT to the telephone survey was 654.25 days, in that, 16.7% and 27.08% reported death and / or hospitalization respectively. Likewise an analysis was performed by contingency tables and estimation Pearson analysis X2, dichotomizing exposure variable (HRR) to <12 bpm for the exposed group and> 12 bpm for not exposed, comparing this with the outcomes of hospitalization and death.

Table 1. Study Population

	n	%	Total
Male	39	81,3	
Female	9	18,8	
Functional Class			
I	13	27,1	
II	19	39,6	
III	15	31,3	
IV	1	2,1	
LVEF (%)			20,31 ± 8,99

LVEF: Left ventricular ejection fraction

Table 2. Patient Characteristics According to the HRR After First Minute post 6MWT

	HR Recovery > 12 bpm 1 min post 6MWT	HR Recovery < 12 bpm 1 min post 6MWT
n	24	24
Gender F - M %	33.3 / 66.6	16.6 / 83.4
Age (years)	63 ± 6	60 ± 8
HR Rest bpm	64 ± 9	64 ± 10
HR Max during 6MWT (bpm)	100 ± 4	90 ± 6
HRR 1 min (bpm)	72 ± 2	81 ± 3
Walk Distance (m)	393.8 ± 197.2	406.5 ± 193.7
LVEF (%)	20.2 ± 14.3	24,4 ± 16.1

F: Female,M: Male, LVEF: Left ventricular ejection fraction, HR: Heart rate, HRR: heart rate recovery, bpm: beats per minute, 6MWT: six minute walking test

In the group recovered less than 12 bpm, 13 events occurred; six (46.1%) were deaths from cardiac causes and seven events (53.8%) were revenue emergency / hospitalization, in this group the number of cardiac events was similar in patients with non-ischemic (53.8%) and ischemic heart failure (46.2%). In the group recovered more than 12 bpm one death from cardiac causes (14%), and other was kidney disease and 6 income (85.7%) to the emergency room or hospitalization was presented, in this group the events had a higher prevalence in patients with heart failure was of origin non ischemic (71.4%).

After analyzing the events results there not significant changes in the walking distance, 405,5 m and 415,2 m for the group recovered less o more 12 bpm respectively (Figures 1 and 2). The analysis of contingency tables Contingency table for HRR <12 bpm (exposure) and hospitalization and death outcomes showed no significant differences (Table 3 and 4).

Table 3. Relationship Between HRR After 1 Minute 6MWT and Hospitalization

	Hospitalization				
	Yes	%	No	%	Total
HRR < 12 bpm	7	29,2	17	70,8	24
HRR > 12 bpm	6	25	18	75	24
Total	13	27,1	35	72,9	48

HRR: Heart Rate Recovery
RR= 1,116 (0,459 - 2,96) X^2 = 0,10 (p= 0,74)

Table 4. Relationship Between HRR After 1 Minute 6MWT and Death

	Death				
	Yes	%	No	%	Total
HRR < 12 bpm	6	25	18	75	24
HRR > 12 bpm	2	8,3	22	91,7	24
Total	8	16,7	40	83,3	48

RR= 3 (0,671 - 13,40) X^2 = 2,40 (p= 0,12)

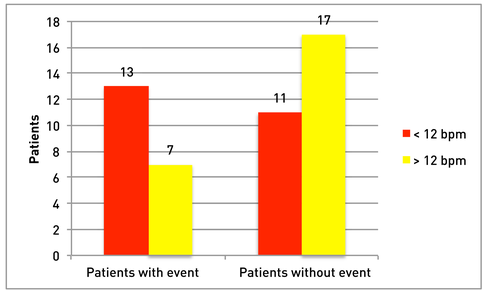

Figure 1. Relation Between Total Events and Heart Rate Recovery a Minute After Finishing 6MWT in Beats per Minute

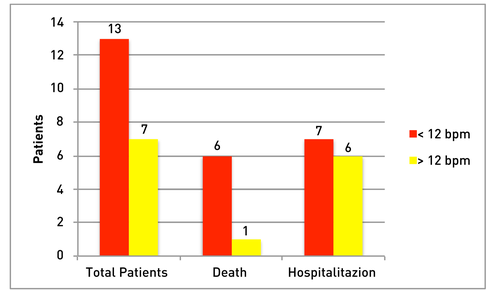

Figure 2. Relation Between Cardiovascular Hospitalization and Death and Heart Rate Recovery a Minute After Finishing 6MWT in Beats per Minute

Conclusions
Heart rate recovery in the first minute after the walk ended, showed no statistically be an independent predictor of the risk of hospitalization and death, also, do not to show the relationship between HRR and distance in 6MWT to cardiovascular hospitalization or death in patients with heart failure, functional class II to III and ejection fraction below 40%.
It requires further studies with large sample sizes and follow long-term cohort for other predictors of hospitalization and death power.

Implications
This clinical study was the first to investigate the role of heart rate recovery after 6MWT in patients with heart failure as a prognostic factor for mortality / morbidity at 2600 meters above sea level. More studies are needed on the subject to learn more the implications of this variable (HRR).

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