Characteristics of good response to aerobic exercise training in decompensated Heart Failure patients

Bruno Delgado[1], Ivo Lopes[2], Bárbara Gomes[3] , André Novo[4]
[1]Oporto Hospital Center, Porto, Portugal; NURSEID: CINTESIS; [2] Oporto Hospital Center, Porto, Portugal; [3]NURSEID: CINTESIS; Escola Superior de Enfermagem do Porto, Porto, Portugal, [4]NURSEID: CINTESIS; Polytechnic Institute of Bragança, Health School, Bragança, Portugal

NO CONFLICTS TO DECLARE

Keywords: Exercise; Functional capacity || bruno.m.delgado@gmail.com

INTRODUCTION

Regular physical activity is associated with a decrease in cardiovascular mortality, hospitalization and improvement in quality of life[1-3]. Guidelines recommend that Heart Failure patients should be enrolled in aerobic exercise training programs to increase functional capacity and improve symptoms[2-4]. Our study included patients with multiple comorbidities, different baseline FC, reduced and preserved ejection fraction and with a significant decompensation of heart failure – patients often excluded from other studies involving exercise[5]. A way to optimize an intervention is to evaluate who are the good responders and understand the causes of no response. Knowing the factors of good response is also important to emphasize the feasibility of an intervention and to deliver it to the ones who get the most benefit of it.

PURPOSE

To identify the characteristics that lead a patients to have a better response to an aerobic exercise training program for decompensated HF inpatients – ERIC-HF (early rehabilitation in cardiology – heart failure)

METHODS

50 patients who performed ERIC-HF program during the phase of stabilization were evaluated in terms of their sociodemographic, functional and physiological characteristics and performance during the program. The main variable used to understand the performance of the patients was the variation of the distance walked in the 6-minute walking test (6MWT), performed as soon as the patient was able to do it (6MWTinitial) and at discharge (6MWTdischarge). A multivariate linear regression with stepwise algorithm and Durbin Watson test were used in order to determine which variables are related to a better variation on the 6MWT, namely: age, LCADL and Barthel index scores at admission and discharge, number of days of hospitalization, number of cardiovascular risk factors, NYHA class, etiology of HF and left ventricular function. It was assumed a significance level at $p<0.05$.

RESULTS

Patient's average age was 69.3 (±9.5) years old, 35 are male, 82% are in NYHA class III and 72% have severe left ventricular depression. Patients present a median of 73.22 points in BI at admission (minimum of 8 and maximum of 100) and a median of 32.08 at LCADL (minimum of 9 and maximum of 25 points). The mean distance walked in the 6MWTinitial performed by the patients was 199,9 (±115,92) meters and 287,6 (±128,97) meters at 6MWTdischarge, representing a 87,7 (±170,66) meters difference.

According to the linear regression an equation was obtained: Difference of the 6MWT = 454,694-1*6MWTinitial+2,981*Barthelinitial-5,554*age. This equation explains 65% of the variation of the model in this sample of patients. Using this variables it's possible to predict how much distance a patient will walk at the end of the rehabilitation program, and understand the predicted performance in the program.

Table 1 – Patient's characteristics

Parameter	Value
Age (years)	69.3±9.5
Days of hospitalization	19±9
Diabetes	18 (36%)
Ventricular function and NYHA class	
HFpEF	6 (12%)
HFmEF	8 (16%)
HFrEF	36 (72%)
NYHA III	41 (82%)
NYHA IV	9 (18%)
Ethiology	
Valvular disease	16 (32%)
Isquemic disease	18 (36%)
Other	16 (32%)
Devices	
ICD	16 (61,5%)
PM	4 (15,4%)
CRT	6 (23%)
Gender	
Male	35±9.5
Female	15±9.5

CRT – cardiac resynchronization therapy, ICD – implantable cardiac defibrillator, HFpEF – Heart failure with preserved ejection fraction, HFmEF – Heart failure with mid-range ejection fraction, HFrEF – Heart failure with reduced ejection fraction PM – pacemaker.

Table 2 – Functional performance of the patients (Paired sample T test)

	Nº days hospitalization	CVRF	$LCADL_{ad}$	$LCADL_{dis}$	BI_{ad}	BI_{dis}	$6MWT_{ad}$	$6MWT_{dis}$	Dif LCADL	Dif Barthel	Dif 6MWT
N	50	50	50	50	50	50	50	50	50	50	50
Mean	19	3.74	32.08	12.34	73.22	95.70	199.90	287.60	-19.74	22.48	87.70
Median	18.5	4	32	10.50	76	100	205	290.50	-21	18.50	74.50
Sd.Deviation	8.0	1.37	8.50	3.96	19.80	6.39	115.92	128.97	7.12	16.21	170.66
Minimum	5	1	10	9	8	75	0	75	-31	0	-316
Maximum	41	6	45	24	100	100	480	600	-1	78	565
P value	-	-	0.000		0.000		0.001		-	-	-

Table 3 – Functional class and ventricular function regarding predictive variables

	NYHA III	NYHA IV	HFrEF	Other
6MWT	p = 0.633		p = 0.03	
BI	p = 0.463		p = 0.199	
LCADL	p = 0.950		p = 0.016	
Age	p = 0.721		p = 0.318	
Days of hospitalization	p = 0.008		p = 0.052	

LIMITATIONS

1) absence of other similar studies to compare results;
2) not all patients performed the same volume of exercise, due to the duration of inhospital stay and functional differences;
3) the relatively small study sample does not allow to perform subgroup analysis for important characteristics, particularly left ventricular ejection fraction and compare patients with preserved ejection fraction;
4) the study population is very heterogeneous; patients were enrolled regardless of left systolic ventricular ejection. A larger sample of patients will allow to create homogenous groups;
5) absence of follow-up.

CONCLUSIONS

Patients with the worst results in the initial 6MWT, higher initial Barthel and younger ages, will get the most gains in terms of difference walked between the initial and final 6MWT and have the most benefit from the intervention program.

Predictive equation:

6MWT distance =
454,694-1*6MWTinitial+2,981*Barthelinitial-5,554*age

HOT TOPICS

- ERIC-HF program is more effective in younger and more functional decompensated HF patients than it is in older ones.
- NYHA functional class and left ventricular systolic function apparently do not interfere in the performance of the patients during the program – exercise should be delivered for all patients, even for those who have worst prognosis and more comorbidities.
- Other programs must be developed for older and more impaired patients in order to promote their functional capacity.

REFERENCES

1 – Haykowsky, M. J., Daniel, K. M., Bhella, P. S., Sarma, S., & Kitzman, D. W. (2016). Heart Failure: Exercise-Based Cardiac Rehabilitation: Who, When, and How Intense? Can J Cardiol, 32(10 Suppl 2), S382-S387. doi:10.1016/j.cjca.2016.06.001
2 – Piepoli, M. F., Conraads, V., Corrà, U., Dickstein, K., Francis, D. P., Jaarsma, T., . . . Ponikowski, P. P. (2011). Exercise training in heart failure: from theory to practice. A consensus document of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation. Eur J Heart Fail, 13(4), 347-357. doi:10.1093/eurjhf/hfr017
3 – Ponikowski, P., Voors, A. A., Anker, S. D., Bueno, H., Cleland, J. G., Coats, A. J., . . . van der Meer, P. (2016). 2016 ESC Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure. Rev Esp Cardiol (Engl Ed), 69(12), 1167. doi:10.1016/j.rec.2016.11.005
4 – Cattadori, G., Segurini, C., Picozzi, A., Padeletti, L., & Anzà, C. (2018). Exercise and heart failure: an update. ESC Heart Fail, 5(2), 222-232. doi:10.1002/ehf2.12225
5 – Morris, J. H., & Chen, L. (2019). Exercise Training and Heart Failure: A Review of the Literature. Card Fail Rev, 5(1), 57-61. doi:10.15420/cfr.2018.31.1