

Right ventricular dysfunction predict limited exercise capacity in heart failure with reduced ejection fraction

Pranvera Ibrahim^{1*}, Gani Bajraktari¹, Afrim Poniku², Violeta Hysenaj², Artan Ahmeti², Fisnik Jashari¹, Edmond Haliti², Michael Y Henein¹

¹Umeå University, Umeå, Sweden

²University Clinical Centre of Kosova, Prishtina, Kosovo

Background and Aim: Compromised exercise capacity is the main symptom in patients with heart failure (HF) and reduced left ventricular (LV) ejection fraction (EF). Six-minute walk test (6-MWT) is popular for objective assessment of exercise capacity in these patients but is confined to heart centres. The aim of this study was to prospectively examine functional parameters that predict 6-MWT in patients with HF and reduced LVEF.

Methods: In 111 HF patients (mean age 60 ±12 years, 56% male), a 6-MWT and an echo-Doppler study were performed on the same day. In addition to conventional ventricular function measurements, global LV dyssynchrony was indirectly assessed by total isovolumic time - t-IVT [in s/min; calculated as: 60 — (total ejection time — total filling time)], and Tei index (t-IVT/ejection time). Also, LV and right ventricular function were assessed by mitral and tricuspid annular plane systolic excursion (MAPSE and TAPSE, respectively). Based on the 6-MWT distance, patients were divided into: Group I: 300 m and Group II: >300 m.

Results: The 6-MWT distance correlated with t-IVT and Tei index ($r=-0.37$, $p<0.001$, for both), lateral and septal e' velocities ($r=0.41$, $p<0.001$, and $r=0.46$, $p<0.001$, respectively), E/e' ratio ($r=-0.37$, $p<0.001$) and TAPSE ($r=0.45$, $p<0.001$), but not with the other clinical or echo parameters. Group I patients had longer t-IVT, lower E/e' ratio, TAPSE and lateral e' ($p<0.001$ for all) compared with Group II. In multivariate analysis, TAPSE [0.076 (0.017-0.335), $p=0.001$], E/e' [1.165 (1.017-1.334), $p=0.027$], t-IVT [1.178 (1.014-1.370), $p=0.033$] independently predicted poor 6-MWT performance (<300 m). Sensitivity and specificity for TAPSE 1.9 cm were 66% and 77%, (AUC 0.78, $p<0.001$); E/e' 10.7 were 66% and 62% (AUC 0.67, $p=0.002$) and t-IVT 13 s/min were 64% and 60% (AUC 0.68, $p=0.002$) in predicting poor 6-MWT. Combined TAPSE and E/e' had a sensitivity of 68% but specificity of 92% in predicting 6-MWT. Respective values for combined TAPSE and t-IVT were 71% and 85%.

Conclusion: In patients with HF, the limited exercise capacity assessed by 6-MWT, is multifactorial being related to severity of right ventricular systolic dysfunction as well as raised LV filling pressures and global dyssynchrony.

KEYWORDS: six-minute walk test, Doppler echocardiography, right ventricular function, heart failure, exercise capacity.

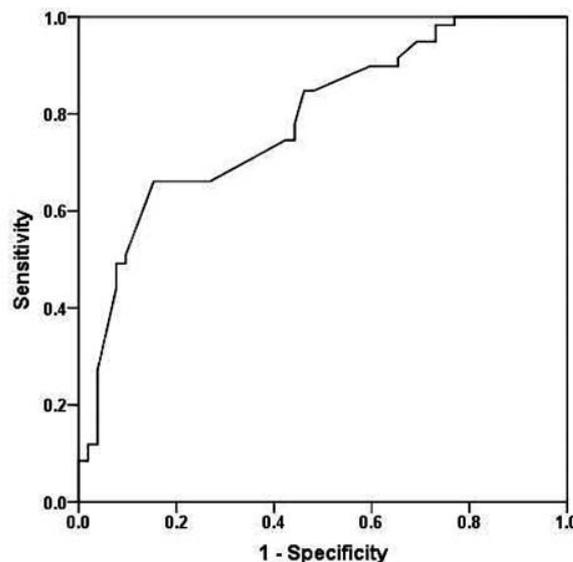


Figure 1. ROC curve of TAPSE in predicting limited exercise capacity in HF patients.

Received: 20th Mar 2013

*Address for correspondence: Department of Public Health and Clinical Medicine, and Heart Centre, Umeå University, SE-901 87 Umeå, Sweden.

Phone: +46-90-785 26 52

E-mail: pranvera.ibrahimi@medicin.umu.se

Literature

- Gardin JM, Leifer ES, Fleg JL, Whellan D, Kokkinos P, Leblanc MH, et al; HF-ACTION Investigators. Relationship of Doppler-Echocardiographic left ventricular diastolic function to exercise performance in systolic heart failure: the HF-ACTION study. *Am Heart J*. 2009;158(4 Suppl):S45-52.
- Ghio S, Temporelli PL, Klersy C, Simioniu A, Girardi B, Scelsi L, et al. Prognostic relevance of a non-invasive evaluation of right ventricular function and pulmonary artery pressure in patients with chronic heart failure. *Eur J Heart Fail*. 2013;15(4):408-14.
- Bajraktari G, Elezi S, Berisha V, Lindqvist P, Rexhepaj N, Henein MY. Left ventricular asynchrony and raised filling pressure predict limited exercise performance assessed by 6 minute walk test. *Int J Cardiol*. 2011;146(3):385-9.
- D'Andrea A, Gravino R, Riegler L, Salerno G, Scarafilo R, Romano M, et al. Right ventricular ejection fraction and left ventricular dyssynchrony by 3D echo correlate with functional impairment in patients with dilated cardiomyopathy. *J Card Fail*. 2011;17(4):309-17.