Phenotyping right heart function for prognosticating heart failure

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Background: Right heart failure has been shown to portend poor prognosis. The pathophysiology of right heart function is complex, as right ventricular (RV) function is easily affected by preload and afterload.

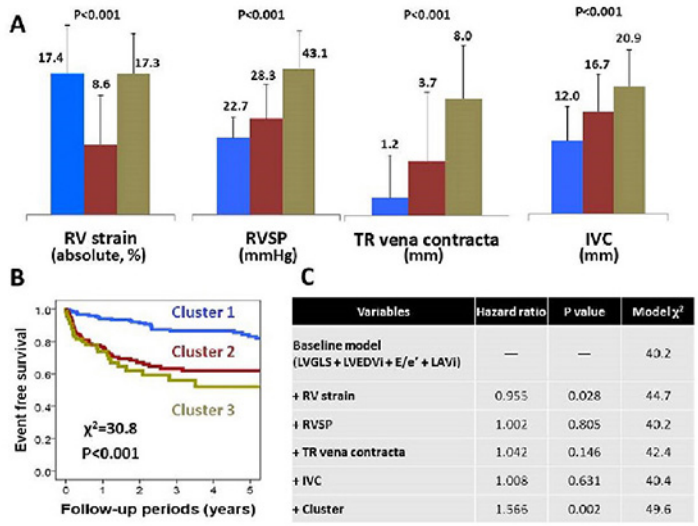
Purpose: To test the hypothesis that machine learning would detect heterogeneity in right heart function and improve risk stratifications in a heart failure population

Methods: This study included 403 heart failure patients who had a history of hospitalization for decompensation. Patients were excluded if they had primary heart valve disease or pericardial disease or a previous cardiac surgery. Hierarchical clustering was undertaken on right heart variables (RV strain, right ventricular systolic pressure (RVSP), vena contracta of tricuspid regurgitation (TR) and diameter of inferior vena cava) to identify homogenous groups of patients with similar profiles of the variables. Cox hazard analysis was used to elucidate the benefit of clustering over each variable for prognosticating heart failure. Endpoint was hospitalization for worsening heart failure.

Results: Cluster analysis identified three groups with distinct right heart function. Cluster 1 (n = 191) represented patients with preserved RV function and low RVSP (figure A). On the other hand, cluster 2 (n = 144) had reduced RV function and low RVSP, while cluster 3 (n = 68) had preserved RV function and high RVSP, associated with severe TR and high central venous pressure. The latter 2 clusters carried worse outcome than cluster 1 ($p < 0.001$, figure B). Cox hazard analysis demonstrated that, although the addition of each right heart variable to baseline model constructed from left heart variables did not improve predictive power, clusters predicted events with a hazard ratio of 1.566, independent from and incremental to the left heart variables (Figure C).

Conclusion: Cluster analysis identified two distinct phenotypes of right heart failure that were associated with adverse outcomes. This data-driven phenotyping can help in categorizing right heart failure and better prognosticating heart failure.

Abstract Figure.



C

Variables	Hazard ratio	P value	Model χ^2
Baseline model (LVGLS + LVEDVI + E/e' + LAVI)	—	—	40.2
+ RV strain	0.955	0.028	44.7
+ RVSP	1.002	0.805	40.2
+ TR vena contracta	1.042	0.146	42.4
+ IVC	1.008	0.631	40.4
+ Cluster	1.566	0.002	49.6