

Global longitudinal strain predicts outcome in chronic heart failure across American Heart Association stages: results from the MyoVasc study

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Background: Global longitudinal strain (GLS) demonstrated a superior prognostic value over left ventricular ejection fraction (LVEF) in acute heart failure (HF). Its prognostic value across American Heart Association (AHA) stages of HF – especially under considering of conventional echocardiographic measures of systolic and diastolic function – has not yet been comprehensively evaluated.

Purpose: To evaluate the prognostic value of GLS for HF-specific outcome across AHA HF stages A to D.

Methods: Data from the MyoVasc-Study (n=3,289) were analysed. Comprehensive clinical phenotyping was performed during a five-hour investigation in a dedicated study centre. GLS was measured offline utilizing QLab 9.0.1 (PHILIPS, Germany) in participants presenting with sinus rhythm during echocardiography. Worsening of HF (comprising transition from asymptomatic to symptomatic HF, HF hospitalization, and cardiac death) was assessed during a structured follow-up with subsequent validation and adjudication of endpoints. AHA stages were defined according to current guidelines.

Results: Complete information on GLS was available in 2,400 participants of whom 2,186 categorized to AHA stage A to D were available for analysis. Overall, 434 individuals were classified as AHA stage A, 629 as stage B and 1,123 as stage C/D. Mean GLS increased across AHA stages of HF: it was lowest in stage A ($-19.44 \pm 3.15\%$), $-18.01 \pm 3.46\%$ in stage B

and highest in AHA stage C/D ($-15.52 \pm 4.64\%$, P for trend <0.0001). During a follow-up period of 3.0 [1.3/4.0] years, GLS denoted an increased risk for worsening of HF after adjustment for age and sex (hazard ratio, HRGLS [per standard deviation (SD)] 1.97 [95% confidence interval 1.73/2.23], $P < 0.0001$) in multivariable Cox regression analysis. After additional adjustment for cardiovascular risk factors, clinical profile, LVEF and E/E' ratio, GLS was the strongest echocardiographic predictor of worsening of HF (HRGLS [per SD] 1.47 [1.20/1.80], $P=0.0002$) in comparison to LVEF (HRLVEF [per SD] 1.23 [1.02/1.48], $P=0.031$) and E/E' ratio (HRE/E' [per SD] 1.12 [0.99/1.26], $P=0.083$). Interestingly, when stratifying for AHA stages, GLS denoted a similar increased risk for worsening of HF in individuals classified as AHA stage A/B (HRGLS [per SD] 1.63 [1.02/2.61], $P=0.039$) and in those classified as AHA stage C/D (HRGLS [per SD] 1.95 [1.65/2.29], $P < 0.0001$) after adjustment for age and sex. For further evaluation, Cox regression models with interaction analysis indicated no significant interaction for (i) AHA stage A/B vs C/D ($P=0.83$) and (ii) NYHA functional class $<II$ vs $\geq II$ in individuals classified as AHA stage C/D ($P=0.12$).

Conclusions: GLS demonstrated a higher predictive value for worsening of HF than conventional echocardiographic measures of systolic and diastolic function. Interestingly, GLS indicated an increased risk for worsening of HF across AHA stages highlighting its potential value to advance risk prediction in chronic HF.