

Significant disagreements between conventional functional metrics and 3D echocardiography-derived ejection fraction in the detection of right ventricular systolic dysfunction

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Background. The conventional echocardiographic parameters of the right ventricular (RV) systolic function (e.g., tricuspid annular plane systolic excursion - TAPSE, fractional area change – FAC, free wall longitudinal strain – FWLS) only partially portray the complex functional characteristics of the RV; therefore, they may fail to capture the full spectrum of RV dysfunction and associated adverse clinical outcomes. 3D echocardiography-derived RV ejection fraction (RVEF) is a well-validated and reproducible parameter that overcomes these limitations.

Purpose. We aimed to investigate the discordance between TAPSE, FAC, FWLS and RVEF in RV systolic function grading and associated outcomes.

Methods. Two retrospective databases from different centers including consecutive patients with various cardiac diseases who underwent clinically indicated 2D and 3D echocardiography (n=750) were analysed. Patients were followed up for the occurrence of all-cause mortality. RVEF was measured by a single, commercially available 3D software package. Guideline-recommended cut-off values were used to indicate RV systolic dysfunction (TAPSE<17 mm, FAC<35%, FWLS<-20%). RVEF <45% served as the “ground truth” of RV dysfunction.

Results. Among patients with normal RVEF (n=511), 109 (21%) had reduced TAPSE, 168 (33%) had reduced FAC, and 42 (8%) had reduced FWLS. Among patients with reduced RVEF (n=239), 109 (46%) had normal TAPSE, 61 (26%) had normal FAC, and 98 (41%) had normal FWLS. Correspondingly, sensitivity and specificity for discrimination of RV systolic dysfunction (RVEF<45%) were 66% and 70% for TAPSE, 71% and 76% for FAC, and 89% and 69% for FWLS on ROC analysis, respectively (Figure 1). During the median follow-up time of 3.5 years, 112 patients (15%) died. Using univariable Cox regression, TAPSE (HR [95% CI]: 0.911 [0.881 - 0.942]), FAC (0.940 [0.924 - 0.957]), FWLS (1.101 [1.071 - 1.133], and RVEF (0.928 [0.913 - 0.944]) were all significant predictors of mortality (p<0.001).

Interestingly, combining the conventional functional measures based on how many of them indicate dysfunction shows that outcomes are the worst if at least two parameters are impaired and gradually better if only one or none of them (Kaplan-Meier curves, Figure 2, log-rank $p < 0.001$).

Conclusion. Guideline-recommended cut-off values of conventional echocardiographic parameters of RV systolic function are only modestly associated with RVEF-based assessment. Impaired values of FWLS show the closest association with the RVEF cut-off. Our results emphasize a multiparametric approach in the assessment of RV function, especially, if 3D echocardiography is not available.

Figure 1.

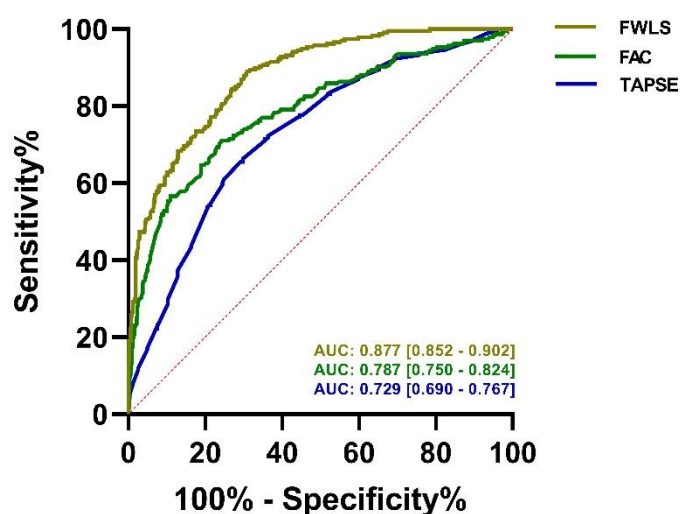


Figure 2.

