Accuracy of a Fully Automated Deep Learning Based Contouring Method for the Assessment of Global Longitudinal Strain

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Background

- Given the widespread availability and low cost of transthoracic echocardiography (TTE), it plays a key role in the diagnosis of cardiac amyloidosis (CA).
- Although impairment in left ventricular (LV) global longitudinal strain (GLS) typically predates reductions in LV ejection fraction (EF), manual GLS measurements are time consuming and prone to variability.

Aims

- To assess whether a deep-learning (DL) based fully automated contouring method (FACM) and manual assessment of GLS provide similar estimates and to determine the agreement identifying abnormal GLS in patients with pre-clinical (pre-CA) and clinical CA.

Methods

- We identified 48 patients (age 80±10 yrs, 52% male) with confirmed CA according to guidelines (AL 23%, ATTR 63%) who underwent TTE pre-CA and/or at the time of CA diagnosis (median time between studies 3.76 yrs).
- GLS was quantified from the apical 2- and 4-chamber views using both manual tracing of endocardial borders and fully automated contouring method (FACM) (EchoGo Core 2.0, Ultromics).
- Inter-technique agreement was assessed using Pearson's correlation coefficients (r).
- The diagnostic accuracy of FACM for detecting abnormal GLS (defined as ≥-15.1%) was also assessed.
- Kaplan-Meier (KM) curves for time to abnormal GLS were obtained for each method.

Results

- There were no significant differences in manual and FACM values in either pre-CA (-17.7 ± 5.0% vs -16.9 ± 4.6%, respectively; p=0.105), or at diagnosis (-12.7 ± 4.5% vs -12.9 ± 4.7%, respectively; p=0.722).
- The GLS values provided by both methods showed strong correlation on both the pre-CA (r=0.83) and CA echoes (r=0.80) (**Figure 1**).
- The sensitivity and specificity of FACM for detecting abnormal strain were 82% and 86%, respectively, in the pre-CA echo, and 100% and 67% at the time of CA diagnosis.
- In KM analysis, there was no significant difference in the relationship between GLS and time to abnormal strain between the two methods (log-rank p-value=0.83) (**Figure 2**).

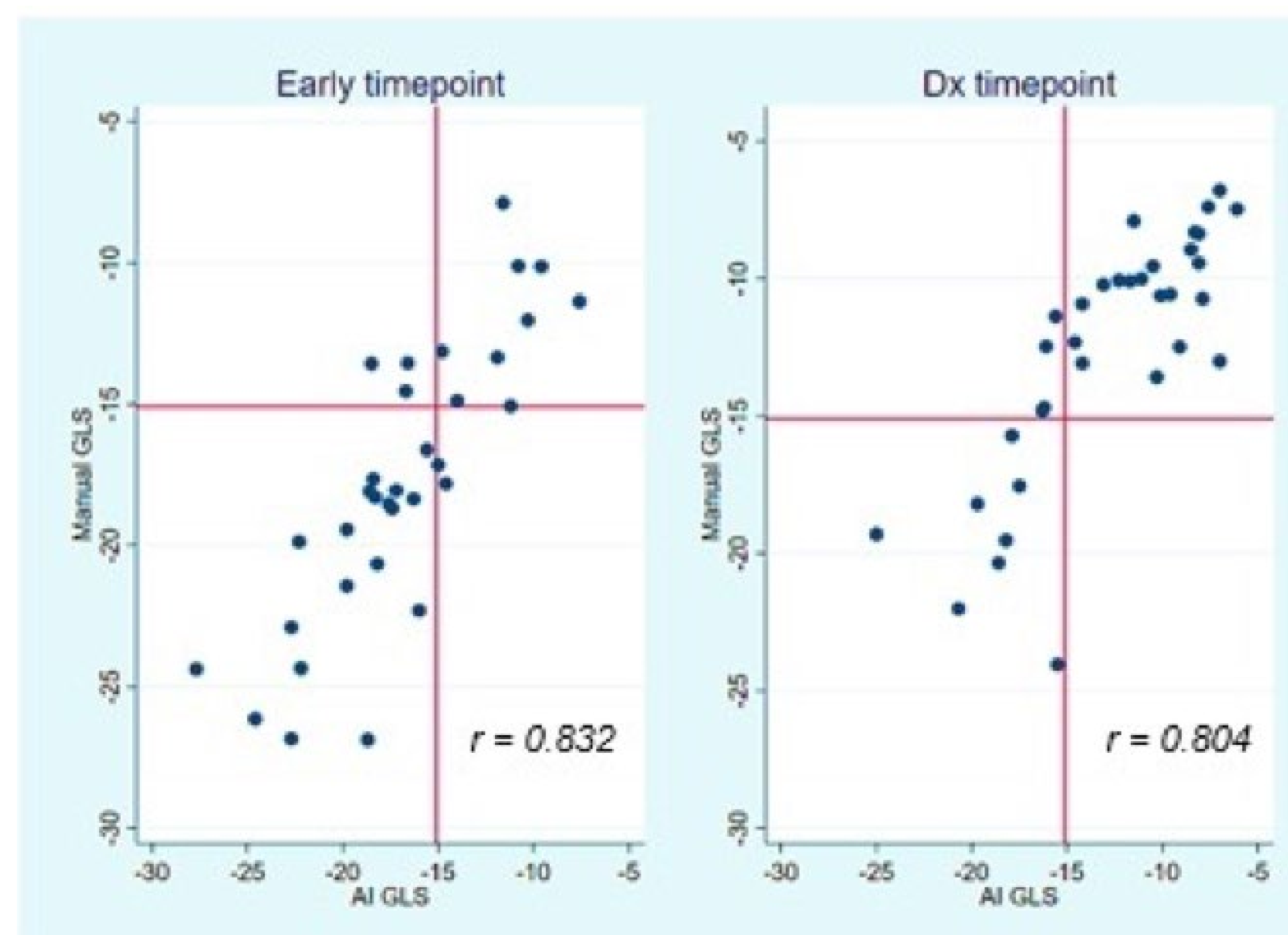

Figure 1. Correlation between conventional and FACM-based GLS measurements from early TTE (left) and at the time of CA diagnosis data (right).

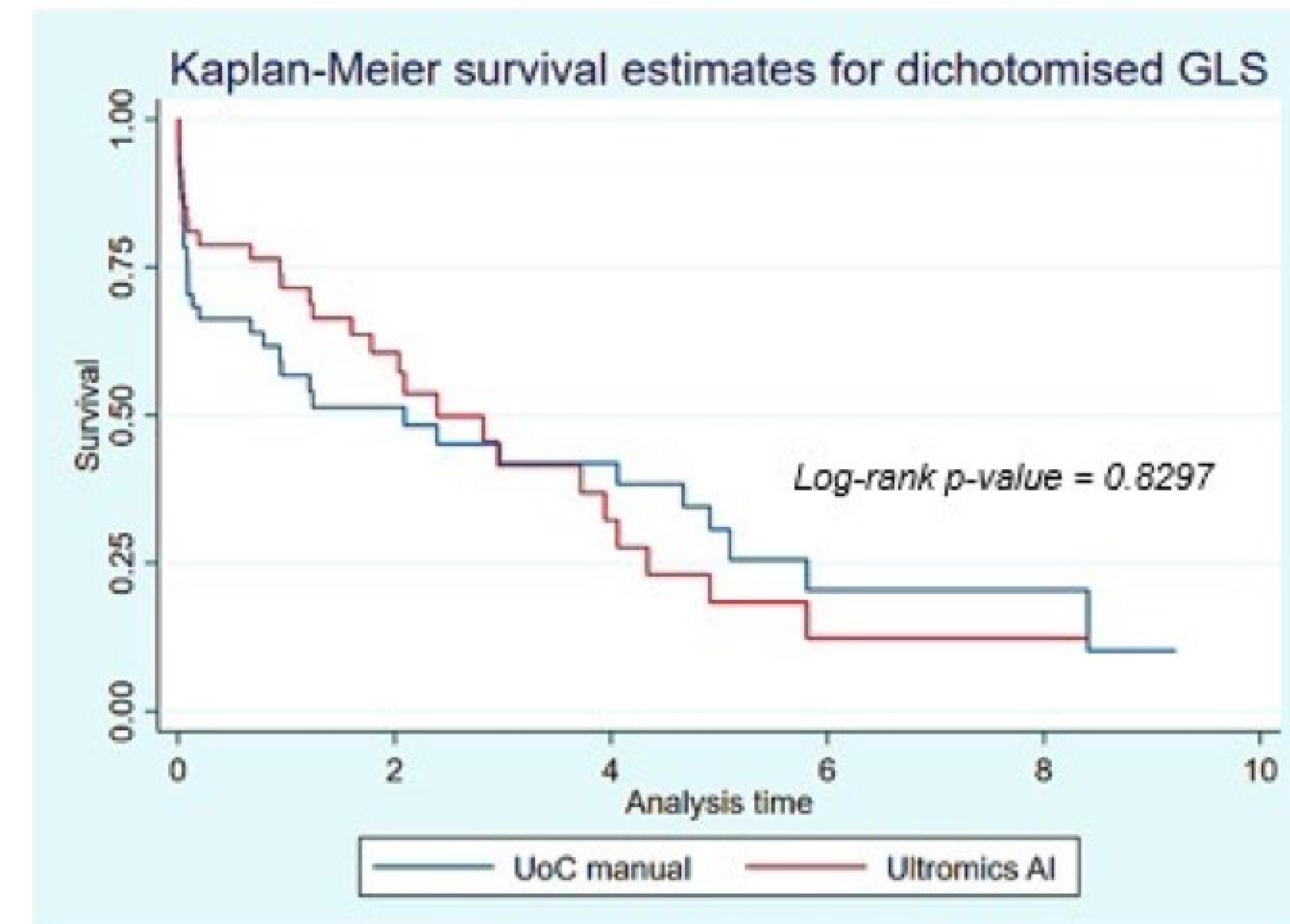

Figure 2. Kaplan-Meyer survival curves for GLS measured using conventional analysis and using FACM software.

Conclusions

- FACM provides accurate LV-GLS assessment in both pre-clinical CA and at the time of diagnosis.
- The widespread implementation of automated GLS quantification using DL may allow for more rapid assessment of GLS in different disease states with comparable accuracy and reproducibility to manual methods.

Conflicts of interest: ES and JO are employees of Ultromics