



Cardiac Electrical Biomarker Improves ECG Prediction of Left Ventricular Scar

Fabrizio Ricci, MD, PhD, Cesare Mantini, MD, PhD, Melissa De Maio, MD, Carla Pietrangelo, MD, Anna Laura Caterino, MD, Luca Procaccini, MD, Marzia Olivieri, MD, Antonella Benedetto, MD, Marco Zimarino, MD, PhD, Giulia Renda, MD, PhD, Antonio Raffaele Cotroneo, MD, Sabina Gallina, MD, FACC, FESC

Background: Myocardial scar detected by cardiovascular myocardial resonance (CMR) with late gadolinium enhancement (LGE) imaging is associated with increased risk of major adverse cardiovascular events and all-cause mortality. The cardiac electrical biomarker (CEB) is an emerging ECG marker reflecting the multipolar versus dipolar activity of the heart and its use as predictor of irreversible myocardial fibrosis has not yet been explored.

Purpose: To test the diagnostic accuracy of CEB for the detection of myocardial fibrosis by LGE in unselected patients referred to CMR imaging.

Methods: We prospectively enrolled 102 consecutive patients (mean age 47 ± 19 ; men 78%) undergoing CMR imaging. Digital 12-lead ECGs were recorded at presentation and the CEB values were calculated in a blinded fashion. From the individual ECG changes a score was calculated, assigning 5 points for ST-depression and 2 points for T-wave inversion to quantify conventional ECG changes. The final diagnosis was adjudicated by two independent cardiologists. Poor-quality ECGs ($n=8$) were excluded. We tested the incremental diagnostic value of CEB over conventional ECG criteria for the detection of myocardial LGE by receiver operating characteristics (ROC) curve analysis.

Results: Overall, 71 (75%) patients had myocardial LGE (13% subendocardial, 9% transmural, 49% midwall or subepicardial) and were presenting more often with pathological Q waves (17% vs 0%, $P=0.045$) compared with LGE- individuals ($n=23$). Transmural LGE was significantly more frequent in subjects with top quartile levels of CEB (Q4 67% vs Q1-Q3 20%, $P=0.02$), while signs of myocardial edema were significantly more frequent in subjects with bottom quartile levels of CEB (Q1 71% vs Q2-Q4 21%, $P<0.001$). The use of the CEB in addition to conventional ECG criteria significantly improved prediction of ischemic LGE as quantified by the area under the ROC curve (AUROC) from 0.66 to 0.72 ($p < 0.001$). CEB showed only modest prediction accuracy for prediction of non-ischemic LGE (AUROC 0.57). There was no significant relationship between CEB and T1/T2 parametric mapping indices.

Conclusion: Non-invasive ECG quantitative assessment of multipolar activity of the heart improves accuracy of conventional 12-lead ECG criteria for prediction of left ventricular ischemic scar. Further research is needed to test whether CEB might serve as a screening tool for the detection of silent myocardial infarction in asymptomatic patients.

