Abstract: 4936

Cardiac magnetic resonance strain analysis predicts functional recovery following acute ST-segment elevation myocardial infarction

Authors:
F Valente¹, V Bodi², J Gavara³, V Pineda¹, J Monmeneu², A Roque¹, L Gutierrez¹, G Casas¹, L Galian¹, G Teixido¹, MT Gonzalez-Alujas¹, H Cuellar¹, D Garcia-Dorado¹, A Evangelista¹, JF Rodriguez-Palomares¹,
¹University Hospital Vall d'Hebron - Barcelona - Spain, ²UNIVERSITY HOSPITAL CLINIC OF VALENCIA - Valencia - Spain, ³Research Foundation Hospital of Valencia (INCLIVA) - Valencia - Spain,

Topic(s):
Cardiac Magnetic Resonance: Deformation Imaging

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Background: Late gadolinium enhancement (LGE) is the clinical reference standard for estimation of infarct extension and prediction of functional recovery following reperfused acute ST-segment elevation myocardial infarction (STEMI). Nevertheless, myocardial edema, microvascular obstruction and intramyocardial hemorrhage as well as the timing of image acquisition after contrast administration may influence the extent of LGE and underestimate the potential for recovery. Dobutamine stress testing has been recommended to more accurately predict functional recovery when infarct transmurality is between 25 to 75%. We hypothesized that cardiac magnetic resonance (CMR) tissue tracking strain analysis may provide additional value to LGE for the prediction of functional recovery.

Methods: In 370 patients with STEMI who underwent successful primary percutaneous revascularization and were studied with CMR within 3-5 days of the event, peak systolic longitudinal (LS), circumferential (CS) and radial (RS) strain were analyzed with routine SSFP images of 3 long-axis and a stack of short-axis slices (Tissue Tracking, CVI42®, Figure panel A and B). Inversion-recovery echogradient sequences were analyzed 20 minutes after contrast administration for LGE transmurality (Panel C). All per-segment analysis was performed according to the AHA 16-segment model. CMR was repeated at 6 months and functional recovery was defined as persistent normokinesia or improvement of wall motion score from baseline to 6-month CMR.

Results: At baseline CMR, of a total of 5920 segments 70.4% were normokinetic, 7.2% were hypokinetic, 21.9% were akinetic and 0.6% were dyskinetic. All strain parameters decreased significantly with worsening wall motion. At follow-up, 81.5% of the segments showed functional recovery. All strain parameters were significantly associated with functional recovery (p < 0.001) and showed higher predictive value for improvement of wall motion than LGE transmurality (ROC AUC 0.713 LS, 0.710 CS, 0.683 RS and 0.660 LGE). For basal CMR dysfunctional segments, a CS < -10.7% showed the highest accuracy (66%) to predict wall motion improvement, with 58% sensitivity, 76% specificity, 75% positive predictive value (PPV) and 59% negative predictive value (NPV). These results were comparable to LGE transmurality < 50% (65% accuracy, 59% sensitivity, 73% specificity, 74% positive predictive value and 58% negative predictive value). Nevertheless, adding CS analysis to a 50% LGE transmurality cutoff was the best combination for prediction of functional recovery and increased the overall accuracy to 70%, with 76% sensitivity, 64% specificity, 65% PPV and 75% NPV.

Conclusions: Acute CMR tissue tracking strain analysis complements LGE assessment for prediction of functional recovery following an STEMI. The combination of LGE infarct transmurality under 50% and a CS strain higher than -10.7% showed the highest accuracy for prediction of recovery of function.
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1 University Hospital Vall d'Hebron - Barcelona - Spain, 2 Universidad Hospital Clinic de Valencia - Valencia - Spain, 3 Research Foundation Hospital of Valencia (INCLIVA) - Valencia - Spain.

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