

Cardio-Pulmonary Transit-Time by Cardiac Magnetic Resonance Imaging: Associates to infarct severity and adverse events after reperfused STEMI

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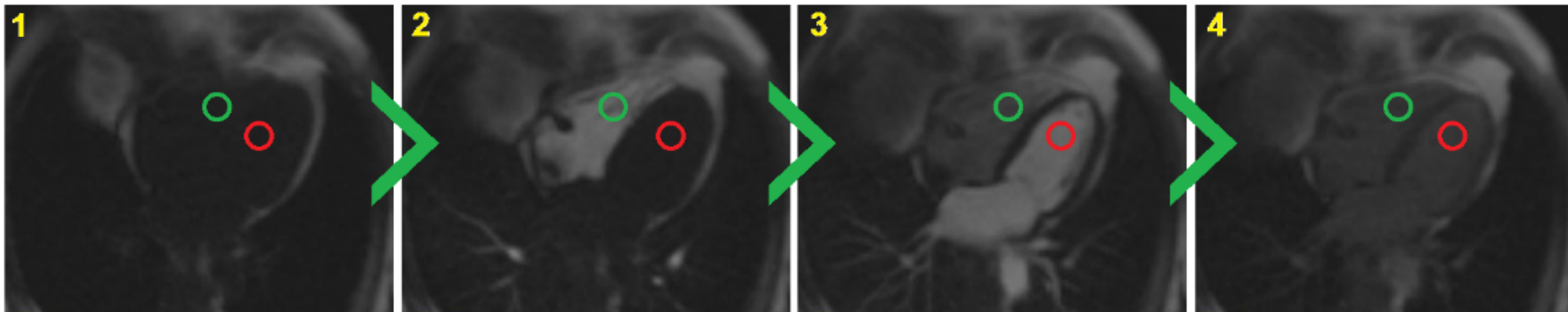
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Purpose

Cardiopulmonary-transit-time (cpTT) may serve as surrogate parameter for integrative cardiac performance and has been linked to heart failure. Cardiac magnetic resonance (CMR) data on cpTT and its associates with infarct characteristics and clinical outcome after reperfused ST-elevation myocardial infarction (STEMI) are lacking so far.

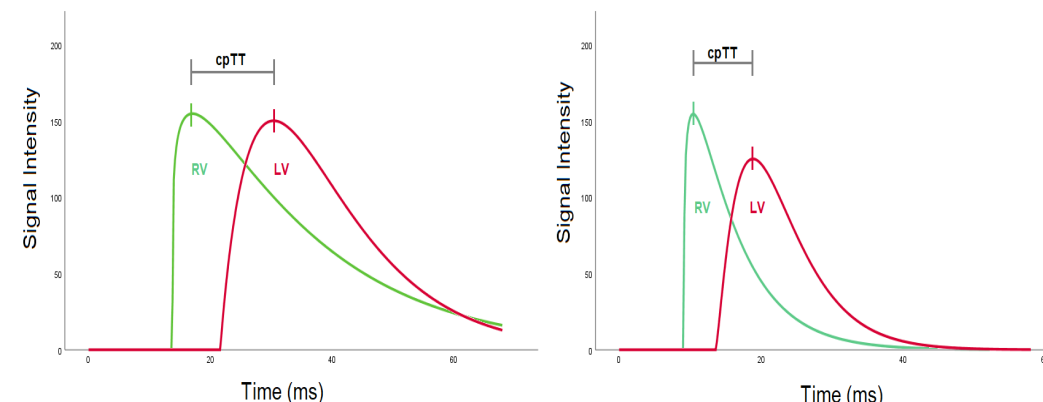
Figure 1. First-pass dynamic of gadolinium-bolus through the RV (green) and LV (red).

Figure 2. Computation of cardio-pulmonary transit time as the time difference between peak signal intensities of RV and LV.



Methods

A total of 207 patients (179 men [87%], median age 55 [interquartile range (IQR) 49-64] with acute STEMI underwent CMR on day 3 [IQR 2-4] and 4 months (m) [IQR 4-5] after primary percutaneous coronary intervention. cpTT was taken as the time between the peaks of time-intensity curves of gadolinium contrast to pass from the right ventricle (RV) to the left ventricle (LV). Infarct size, extent of microvascular obstruction (MVO), RV and LV dimensions and function were assessed at both occasions.



Results

cpTT decreased significantly between baseline and 4m CMR scan (8.6 seconds [IQR 7.5-9.6] to 7.8 sec [IQR 7-8.7], respectively, $p < 0.0001$). Patients with presence of MVO had significantly prolonged cpTT at baseline and 4m follow-up (all $p < 0.022$). According to Cox regression analysis (“functional model”) baseline cpTT (hazard ratio (HR) 1.5, 95% confidence interval (CI) 1.1–2.2; $p = 0.008$) remained significantly associated to the occurrence of major adverse cardiac events (MACE) after adjustment for LV ejection fraction (EF) and cardiac index.

According to Cox regression analysis (“tissue model”) baseline cpTT (HR 1.462, 95% CI 1.02–2.09, $p = 0.039$) as well as extent of MVO (HR 1.196, 95% CI 1.081–1.324, $p = 0.001$) remained significantly associated to MACE after adjustment for infarct size. Baseline cpTT (area under the curve [AUC]: 0.725, 95% confidence interval [CI] 0.57-0.88; $p < 0.009$) was significantly higher for the prediction of MACE compared to LV ejection fraction (AUC: 0.686, 95% CI 0.51-0.87; $p = 0.031$). AUC difference: 0.039, $p < 0.03$). In Kaplan-Meier analysis, cpTT ≥ 9 sec was associated with clinical adverse cardiovascular events ($p = 0.008$).

Conclusion

Following reperfused STEMI, cpTT predicts prognosis independently of infarct size and systolic function. Moreover, cpTT provides significantly higher prognostic implication in comparison with LV ejection fraction.