Impact of the dynamics of ejection fraction on risk stratification in a large multicenter registry of STEMI patients using sequential CMR

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Background: Left ventricular ejection fraction (LVEF) has traditionally been used as the cornerstone for risk stratification after ST-segment elevation myocardial infarction (STEMI) and it can be accurately quantified by cine cardiovascular magnetic resonance (CMR). In recent years, the additional prognostic value of contrast CMR-derived infarct size (IS) and microvascular obstruction (MVO) has been demonstrated.

Purpose: We explored the impact of sequential assessment of CMR-derived LVEF on dynamic risk stratification after STEMI.

Methods: Data were obtained from three prospective registries of reperfused STEMI patients (n=1036) in whom LVEF, IS and MVO were sequentially quantified by CMR (at least at 1 week and at 6 months). Major adverse cardiac events (MACE) were defined as a combined clinical end-point: death or re-admission for acute heart failure (HF), whichever occurred first. Late events were regarded as those occurring after the 6-month CMR.

Results: During a mean and median follow-up of 5 years, 105 first MACE (10%, 36 deaths and 69 HF) and 82 late MACE (8%, 35 deaths and 47 HF) were registered. From 1-week to 6-month CMR, LVEF improved (49±12 vs. 53±12%), IS decreased (21±14 vs 17±12% of LV mass) and MVO vanished (1.3±1.9 vs. 0.1±0.7% of LV mass), $p<0.001$ for all comparisons. At 1-week CMR, 207 patients (20%) displayed reduced LVEF (r-LVEF, <40%), 328 (32%) mid-range LVEF (mr-LVEF, 40–50%) and 501 (48%) preserved LVEF (p-LVEF, >50%). At 6-month CMR, 144 patients (14%) displayed r-LVEF, 247 (24%) mr-LVEF and 645 (62%) p-LVEF. The total MACE rate was higher ($p<0.001$) only in patients with r-LVEF at 1 week (22%) vs. 7% in those with mr-LVEF and 7% in those with p-LVEF. Similarly, the late MACE rate was higher ($p<0.001$) only in patients with r-LVEF at 6 months (20%) vs. 7% in those with mr-LVEF and 5% in those with p-LVEF. The late MACE rate was very low in patients with sustained mr- or p-LVEF (41/794, 5%), intermediate in those with improved LVEF from r-LVEF at 1 week to mr- or p-LVEF at 6 months (12/98, 12%) and high in patients with sustained r-LVEF (22/109, 20%) or worsened LVEF from mr- or p-LVEF at 1 week to r-LVEF at 6 months (7/35, 20%), $p<0.001$ for the trend. Using a Markov approach, only r-LVEF (at any time assessed) significantly related to a higher MACE rate.

Conclusions: Of available CMR parameters, LVEF persists as the pivotal index for simple post-STEMI risk stratification. Mid-range or preserved LVEF in acute phase associates with excellent long-term outcome. Changes in LVEF provide valuable dynamic prognostic information. Maintenance of mid-range or preserved LVEF in chronic phase occurs in the majority of patients and associates with a very low risk of late clinical events. Whereas late improvement reaching at least mid-range LVEF exerts salutary effects, detection of reduced LVEF at this point identifies the small subset of patients at high risk in the long term.

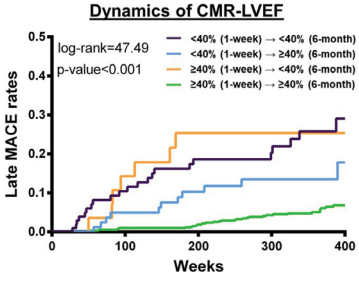

Figure 1