Cardiac Magnetic Resonance (CMR) evaluation of Patients with ST-elevated Acute Myocardial Infarction (STEMI): influence of Time-to-Reperfusion on the Extent of the Area at Risk, Infarct Size and Microvascular Damage

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PURPOSE: Myocardial salvage and limitation of infarct size (IS) expansion are the principal mechanisms by which patients (pts) with STEMI benefit from reperfusion; current strategies aim to recanalize infarct-related artery as quickly as possible, in order to reduce ischemic window and to save viable myocardium within the risk area. Present study was designed to determine influence of time-to-treatment on the extent of IS, area at risk (RA) and microvascular obstruction (MVO) in pts with STEMI using CMR as reference diagnostic tool.

MATERIALS AND METHODS: 70 pts with STEMI targeted for primary or rescue PTCA were enrolled. Pts were divided in 4 groups according to different time-to-reperfusion intervals: Group A (< 60 min; n=19); Group B (60-150 min; n=17); Group C (>150 to 360 min; n=17); Group D (>360 min; n=17). In all cases a CMR protocol including TSE T2w-STIR, 1st-pass and delayed enhancement (DE) sequences after Gd-BOPTA (Bracco) administration was performed within 1 week after the acute event. IS and RA were quantified from DE and T2w MRI using a threshold-based manual contouring method; peri-infarction zone was also determined as the difference between RA and IS. MVO was defined as the hypointense zone within the infarcted segments from DE images. Measurements were normalized to LV mass.

RESULTS: Median time-to-reperfusion was 197±120 min. Shorter time-to-reperfusion (group A) was associated with smaller IS and MVO and larger salvaged myocardium. A progressive increase overtime in IS (8%, 11.7%, 12.7%, 17.9%, p=0.005, respectively), and MVO (0.5%, 1.5%, 3.7%, 6.6%, p=0.039, respectively) was observed, whereas salvaged myocardium suddenly decreases after 60 minutes (8.5%, 3.2%, 2.4%, 2.1%, p =0.003, respectively). Lately reperfused patients (group D) had significantly larger areas of IS and MVO compared to group A, with an almost complete disappearance of salvaged myocardium.

CONCLUSIONS: Our study suggest that early reperfusion with PTCA is associated with smaller IS and has a much greater impact within the first 90 minutes, whereas lately reperfused STEMI (7-12 hrs) have significantly larger areas of MVO. Peri-infarct zone is also larger in early reperfused STEMI reflecting presence of dysfunctional but salvageable myocardium within the RA.

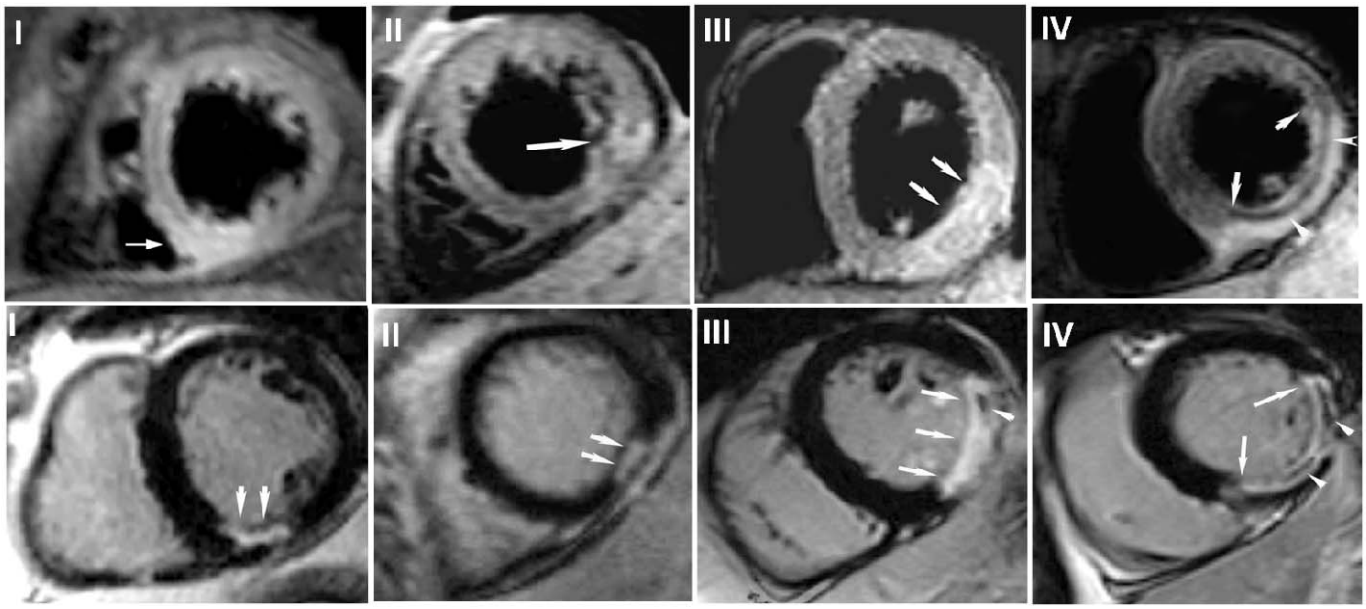

Figure1: Top row includes T2w STIR images from the four groups examined (I: group A; II: group B; III: group C; IV: group D); bottom row images are the corresponding DE sequences. A significant IS increase over time was found. The extent of myocardial edema did not change significantly as time-to-reperfusion progressed; conversely, salvaged area at risk (edematous but not yet necrotic area that exceeded scar tissue) significantly reduced with a consistently larger extent of edema compared to IS in early reperfused patients and a sudden reduction in salvaged area after 60 minutes of coronary occlusion. In lately reperfused patients an almost complete disappearance of salvaged myocardium at risk was observed**.** The incidence and extent of MVO progressively increased as time-to-reperfusion increased; in particular the larger MVO area was observed in the latest reperfused group (group D).

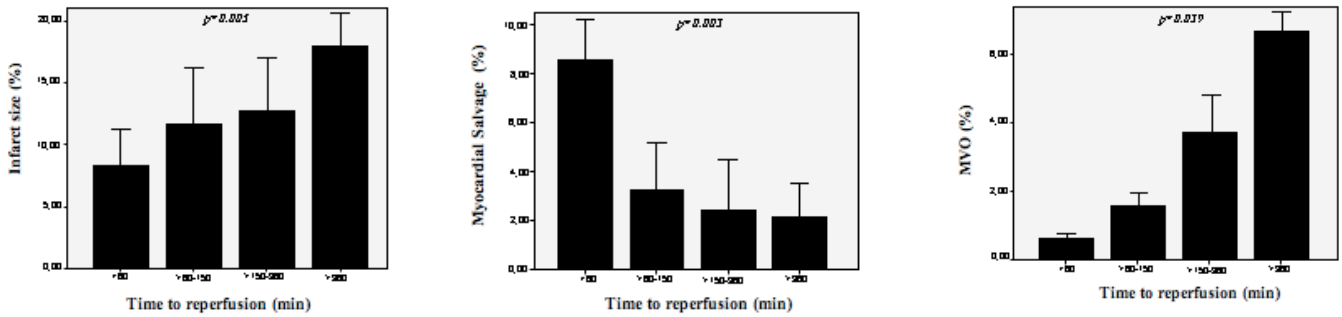

Figure 2: Bar graphs showing infarct size (left), myocardial salvage (middle) and microvascular obstruction-MVO- (right) by time to reperfusion.