Intra-Aortic Balloon Counterpulsation Improves Regional Systolic Function After Acute Myocardial Infarction: Randomized Experimental Magnetic Resonance Imaging Study

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Background: We investigated whether the favorable shift in the myocardial oxygen supply/demand ratio afforded by intraaortic balloon counterpulsation (IABP) translates into improved regional systolic function after acute myocardial infarction (AMI).

Methods: Fourteen dogs underwent 90-min coronary artery occlusion and reperfusion. Seven were randomized to IABP immediately after reperfusion. Five short-axis slices were acquired for each dog at 1h, 6h and 24h following reperfusion using both delayed-enhancement (DE) and tagged MRI. IABP was paused during image acquisition. The risk region was defined as regional blood flow <50% of remote by radiopaque microspheres. Each slice was divided into 6 segments that were classified in 4 categories: transmural AMI (DE>50% area), subendocardial AMI (DE<50% area), risk region and remote area. Peak systolic circumferential strain (Ecc) was calculated for each segment.

Results: Among segments with no difference in Ecc between the IABP group and controls (1.3±1 vs 1.3±1 at 1h, 0±4% vs 0±4% at 6h and 0±3% vs 0±3% at 24h, NS for all) and no Ecc improvement over time. Among subendocardial AMI segments, at 24h after reperfusion, the IABP group exhibited higher Ecc values than controls (1.3±1 vs 1.3±1 at 1h, 0±4% vs 0±4% at 6h, and 0±3% vs 0±3% at 24h, NS for all). Steady-state free precession (SSFP) sequences with visual assessment of perfusion defects allow a reliable detection of relevant myocardial ischemia from reperfused AMI.

Steady State Free Precession Perfusion Allows Visual Assessment for the Clinical Diagnosis of Ischemia

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Cardiac magnetic resonance imaging (MRI) is a powerful tool for the non-invasive examination of myocardial perfusion. Apart from the determination of wall motion the assessment of coronary stents at rest and during pharmacological stress is a very reliable method for the detection of myocardial ischemia. Semi-quantitative analysis (assessment of the myocardial signal up-slope and the response of blood supply to stress) is too elaborate for the use in clinical routine. However, conventional techniques are hampered by artifacts and the calculation of pharmacological stress is not part of the standard. In 6/8 patients CMR both observers found Gd-enhanced lesions with/without complementation of stunned myocardium after reperfused AMI.

Gadolinium-Enhanced Magnetic Resonance Imaging in Patients With Left Ventricular Apical Ballooning Syndrome Identifies Acute Myocarditis as a Potential Etiology of This Syndrome

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Background: Gadolinium-enhanced cardiac MRI (Gd-MRI) is a new non-invasive diagnostic tool to identify patients with acute myocarditis in coronary artery territories. Left ventricular apical ballooning syndrome (LVABS) is a clinical condition of unknown etiology characterized by acute onset of abnormal apical wall motion in the presence of angiographically normal coronary arteries. To test the hypothesis that acute myocarditis may be the etiology of this syndrome, Gd-MRI was performed as described by Friedrich et al. (Circulation 1998;97:1802) in 11 consecutive patients who presented to Massachusetts General Hospital between January 2000 and January 2002 with LVABS. Methods: The ratio of global enhancement of myocardium relative to skeletal muscle was calculated from T1-weighted spin-echo images acquired before and after administration of 0.1 mmol/kg of Gd intravenously. The Gd-MRI study was considered positive for myocarditis when this ratio was ≥1.1 because myocarditis can be focal disease, we also calculated a regional relative enhancement ratio (RRER) within the area of abnormal wall motion. Results: All patients were female (mean age of 72 ± 11 years) who presented with acute onset of chest pain, ST segment elevation, extensive anterior and apical wall motion abnormalities, elevated cardiac enzymes and angiographically normal coronary arteries. Global MRI analysis was positive for myocarditis in 5/11 patients (45.5%), mean value of 4.8 ± 1.4 at 5 ± 2 days after admission). Regional MRI analysis identified 4 additional patients with myocarditis (mean RRER 4.1 ± 0.6). The mean left ventricular ejection fraction was 41 ± 5% at the time of admission, 52 ± 14% at the time of hospital discharge, and 70 ± 8% at 39 ± 43 days of follow-up. Conclusion: 1) LVABS is characterized by acute onset of chest pain associated with abnormal apical wall motion and myocardinosis in the presence of normal coronary arteries, followed by rapid improvement in LV systolic function. 2) Gd-MRI suggests that acute myocarditis is a possible underlying mechanism for the LVABS. 3) Because myocarditis can be a focal disease, regional Gd-MRI analysis adds sensitivity to global Gd-MRI analysis in this cohort of patients.

Usefulness of Myocardial Delayed Enhancement Magnetic Resonance Imaging in the Diagnosis and Surgical Treatment of Endomyocardial Fibrosis

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Background: Endomyocardial fibrosis (EMF) is a rare restrictive cardiomyopathy, whose differential diagnosis includes cardiac diseases with apical obliteration. The treatment is tissue (FT) resection in symptomatic patients (pts). Myocardial delayed enhancement images (MDE) are frequently used to identify the fibrous tissue (FT) accumulation. However, MDE images are not specific for FT tissue. Our aim was to evaluate the utility of MDE in patients with EMF.

Methods: We studied prospectively 24 pts (19 females, 58±11 years) with EMF, 4 (17%) with prominent right ventricular (RV) involvement, 12 (50%) with prominent left ventricular (LV) involvement and 8 (33%) with biventricular involvement. Six (25%) of these pts were submitted to resection of LV fibrosis and were analyzed by MDE pre- and postoperatively. MDE were performed in a 1.5 T GE CV1.5 magnetic. Images were acquired after a 290 minutes of 0.2 mmol/kg of Gd bolus. We analyzed LV FT (%FT)= LV FT/LV FT LV T1 FT mass. Results: All surgical cases were confirmed as EMF during surgery and by pathology. Data are shown in Table 1. Post-surgical LV fibrosis decreased significantly (Table 1 P<0.05, pre vs. post-surgical).

Conclusions: MDE is useful to confirm the diagnosis of EMF by differentiating from apical thrombus, hypertrophy and tumor. MDE was able to detect and quantify the fibrous tissue in both ventricles pre- and postoperatively. Moreover, this technique provides the precise location of fibrous tissue crucial for surgical planning.

Table 1