

COMPARING THE EFFECTS OF ACUTE HOMOGENEOUS MYOCARDIAL INFARCT WITH HETEROGENOUS MICROINFARCT ON LEFT VENTRICULAR FUNCTION USING MRI

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Hypothesis

Clinical studies have demonstrated the deleterious effects of acute homogeneous myocardial infarct (AMI) after revascularization on left ventricular (LV) function using MRI. In most of these cases percutaneous coronary catheters have been used to reperfused ischemic myocardium, which may result in microembolization. The purpose of this study was to differentiate the deleterious effects of these two ischemic insults (major-vessel and micro-vessel occlusion) on left ventricular function using MRI.

Methods

Twenty four farm pigs (30-32 kg) were divided into 3 groups (n=8 per group): 1) control (no-infarct), 2) animals subjected to 90min of the LAD coronary artery occlusion/reperfusion and 3) animals subjected to coronary microembolization by delivering 16mm³ volume of 40-120 μ m microemboli into the LAD coronary artery. Percutaneous coronary catheterization was used for LAD occlusion/reperfusion and delivering microemboli under X-ray guidance. At 3 days after coronary intervention, MR images were acquired using a 1.5T MRI. The cine imaging parameters were: TR/TE/flip angle=3.5ms/1.75ms/70°, slice thickness=8mm, no slice gap, FOV=25x25cm, matrix size=160x152 and heart phases=16. These images were used to measure LV volumes, ejection fraction and radial strain. DE-MR images were acquired 5-10min after injection of 0.15mmol/kg Gd-based MR contrast media to measure homogeneous and heterogeneous myocardial infarcts. DE-MR imaging parameters were: TR/TE/flip angle=5ms/2ms/15°, TI=230-250ms, interval=2RR-intervals, slice thickness=8mm, no slice gap, FOV=26x26cm, matrix size=256x162. At the conclusion of the imaging session, triphenyltetrazolium chloride stain (TTC) was used to confirm the presence of infarcted myocardium. The semi-automatic threshold method was used to measure myocardial infarcts in all animals.

Results

At 3 days after coronary intervention, there was significant difference in radial strain between large homogeneous infarct (-1±1% systolic wall thickening), heterogeneous microinfarct (-2±1%) and control (40±6%, P<0.01) animals in the territory subtended by the LAD coronary artery. In remote myocardium there was also significant difference in wall strain between the groups (homogeneous infarct=28±4%, heterogeneous microinfarct= 26±4% and control=43±6%.P<0.01). The table summarizes the effects of 90min LAD coronary occlusion/reperfusion and 16mm³ volume of 40-120 μ m microemboli on global LV function compared with control animals. The sizes of homogeneous myocardial infarct and microinfarct measured on DE-MRI were 17±1% and 6.2±0.6% of left ventricular mass (P<0.01). Surprisingly, the effect on LV ejection fraction was identical in both interventional procedures, suggesting that different mechanisms govern the decline in LV function. TTC stain confirmed/denied the presence of myocardial damage in all animals.

N=8/group	LV diastolic volume (ml)	LV systolic volume (ml)	Ejection fraction (%)
Control (no infarct)	77±3	35±2	52±1
Large homogeneous infarct	75±2	44±1 (P<0.05)	41±1 (P<0.01)
Heterogeneous microinfarct	76±2	47±1 (P<0.05)	39±1 (P<0.01)

Discussion/Conclusions

MR imaging provides important information on the severity of acute large homogeneous and heterogeneous myocardial infarct. The LV dysfunction in microembolized animals, however, was disproportionately large compared with those subjected to the coronary occlusion/reperfusion, suggesting that the infarct size is not the sole factor for LV dysfunction in acute microinfarct. Precautionary measures should be taken prior to coronary intervention to prevent additional source of cardiac instability.