HEAD TO HEAD COMPARISON OF MAGNETIC RESONANCE IMAGING AND MULTIDETECTOR COMPUTED TOMOGRAPHY IN ASSESSING LONG-TERM EFFECTS OF MICROEMBOLIZATION ON MYOCARDIAL VIABILITY, PERFUSION AND FUNCTION,

M. Saeed[1], A. Martin[1], and M. Carlsson[1,2]

[1]UCSF, Dep of Radiology and Biomedical Imaging, San Francisco, CA, United States, [2]Lund University Hospital, Dep of Clinical Physiology, Lund, Sweden

INTRODUCTION: Microinfarction resulting from microembolized plaques is common in patients following percutaneous coronary intervention (PCI) and acute coronary syndrome. MRI has shown to be able to demonstrate the acute and subacute effects of microembolization. The ability of MRI and multidetector compute tomography (MDCT) to quantify the chronic effects of microembolization on left ventricular (LV) infarction, perfusion and function. MDCT is not known.

PURPOSE: To compare head-to-head the potential of MRI and MDCT in quantifying left ventricular (LV) function, perfusion and viability at 7-8 weeks after microembolization using a swine model.

MATERIALS AND METHODS: Approval was obtained from the Institutional Committee on Animal Research and the study was performed in concordance with the Guide for the Care and Use of Laboratory Animals. Pigs (n=6, 33±1 kg) underwent microembolization of the LAD-territory using a hybrid XMR-system (Philips Medical Systems). A 3F-catheter was placed distal to the first diagonal and the perfusion territory was determined on first pass perfusion MR-imaging during injection of 10ml 10% Gd-DOTA (Dotarem®, Guerbet, France) through the catheter. Microembolization was created injection of microspheres, (Embosphere®, n=250 000, 40-120 µm) through the 3F-coronary catheter. 7-8 weeks after microembolization the pigs were imaged on MRI and MDCT (64-slice LightSpeed Ultra, GE Healthcare) within 3 days. Histochemical and histopathological stains were used to confirm and quantify microinfarction postmortem. MRI was aquired using cine imaging with an ssfp sequence (TR/TE/α=3.5ms/1.75ms/70°), first-pass perfusion during 0.1 mmol/kg Gd-DOTA with an SR-GRE sequence (TR/TE/α=4.5/2.2ms/20°) and delayed enhancement (DE) 5-10 minutes after 0.15 mmol/kg Gd-DOTA administration with a IR-GRE sequence (TR/TE/α=5ms/2ms/15°). First-pass MDCT was acquired during the administration of 1 ml/kg of iodinated contrast media (tube voltage/tube current: 120kV/100mAs), cine MDCT was acquired during 2 ml/kg of iodinated contrast media (tube voltage/tube current: 120kV/650mAs) and 3-5 minutes after contrast administration for viability.

RESULTS: The embolized territory was 32±4% of the LV. MRI and MDCT gave similar functional data (Figure 1 and Table 1). Semiquantitative measures of perfusion during first-pass could identify microinfarction on MRI but not on MDCT (Table 2). DE-MRI and MDCT detected chronic microinfarction and the microinfarction size on TTC (7.0±0.6%) did not significantly differ from MDCT (6.3±0.8%, *P*=0.31) or MRI (6.6±0.5%, *P*=0.69). The attenuation of the DE-MDCT images of remote myocardium (107±6 HU) was 60±4% (*P*=0.03) higher compared to the microinfarcted territory (172±9 HU). Thus DE-MR images had 15±3 times higher relative contrast between microinfarction and remote myocardium compared to MDCT (*P*=0.03).

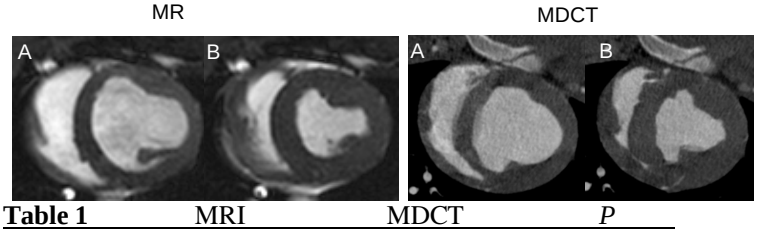

Figure 1. Cine MR and MDCT images during end-diastole (A) and end-systole (B).

Table 1	MRI	MDCT	*P*
EF (%)	47.5±3.2	50.0±3.1	0.16
EDV(ml)	91.8±8.2	92.6±8.0	1.00
ESV (ml)	48.0±4.9	46.0±4.1	0.69
CO (l/min)	3.8±0.3	3.9±0.4	0.69
LVM (g)	108.5±4.8	101.8±4.2	0.06

Table 2	MRI		MDCT	
	Remote	Microinf	Remote	Microinf
Max upslope (s^{-1})	166±26	52±15	14±3	13±1
Max signal	1627±203	1314±122	74±3	75±2
Time to peak	13±1	17±1	12±1	17±0

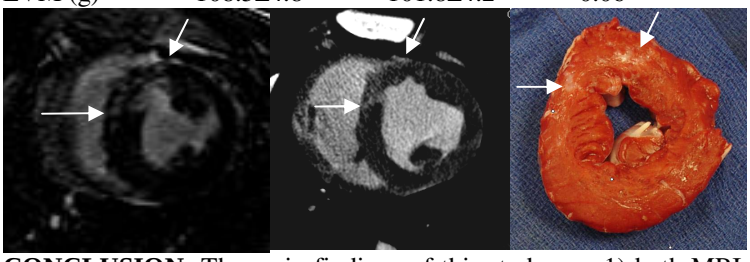

Figure 2. MR (right) and MDCT (middle) delayed enhancement images and corresponding TTC slice (right) from a representative animal show good correspondence between the modalities in defining the territories of patchy microinfarction (indicated by arrows).

CONCLUSION: The main findings of this study are: 1) both MRI and 64-slice MDCT have the ability to visualize and quantified chronic microinfarction and the extent of microinfarction is comparable to histochemical staining, 2) there is an excellent agreement between MDCT and MRI in measuring regional and global LV function and 3) MRI has higher sensitivity to detect perfusion deficit in chronic microinfarction compared to MDCT.

Acknowledgment. This study was supported by a grant from NIH (RO1HL072956).