MULTIMODAL ASSESSMENT OF MYOCARDIAL INFARCTION IN RATS: COMPARISON OF LATE GADOLINIUM ENHANCED MRI AND PET

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Introduction: Myocardial infarction (MI) size in rats has been assessed using MRI and nuclear imaging, but little information is available on the suitability and assessment of the information provided by each technique. We are running a study to compare results on the infarct size as assessed by each modality 30 days after an induced MI in rats.

Methods: Three out of six rats underwent surgery to permanent occlude by ligature the left anterior descending artery that led to a myocardial infarction (MI) of the anterior wall. The remaining three animals underwent similar surgical procedure with no ligature (sham group). All the animals underwent PET and MRI imaging procedures 30 days after surgery. MRI data were obtained with a 7T Bruker Biospec scanner with a four-element phased array cardiac coil in short axis view. CINE images were obtained with a FLASH sequence: TE=2.1 ms, TR=85.9 ms, α=10º, FOV=50*50 mm2, matrix=128*128, slice thickness=1.5 mm, 11 slices, 16 phases. An ECG-gated gradient echo sequence (FISP) was fine-tuned to visualize late enhancement images (ce-MRI), (FOV=50*50 mm2, matrix=192*192, TE=1.6 ms, TR=4.4 ms, =20º, segments=12, slice thickness =1.5 mm, 11 slices). Inversion time (TI) was critical to achieve a good infarct contrast thus leading to different inversion times for each animal (TI=70-120 ms) selected by means of a test sequence sweeping from 70 to 200ms. The contrast agent used was Gadobutrol (Gadovist 1mmol/mL, Bayer). PET imaging was performed on a small-animal dedicated scanner (ARGUS PET/CT, SUINSA, Madrid). ECG-gated cardiac PET images were obtained 30 min after the intravenous administration of 30-35 MBq of 18FDG. To enhance tracer uptake, the animals were treated via IP with insulin (8 mU/g body weight) and glucose (1 mg/g body weight) 30 minutes before. For all surgical and imaging procedures animals were anaesthetized with inhaled isofluorane/sevofluorane. Co-registration of PET and MRI images was performed by a semiautomatic SVD-based registration algorithm implemented in-house.

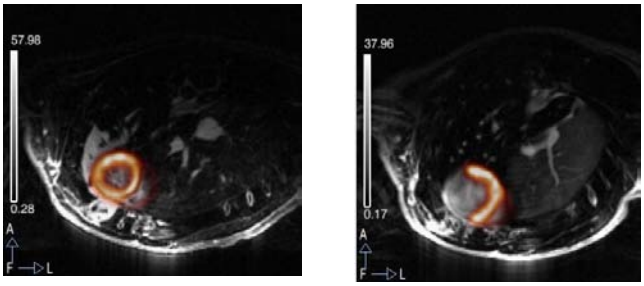

Fig 1. Fusion of ce-MRI and PET images for a sham (a) and an infarcted rat (b)

Results: All the animals survived the surgical procedures. CINE images showed (by visual analysis) a reduced motion area comprising the region enhanced by Gd in the late enhanced images. Although fusion of ce-MRI and PET images demonstrates high accuracy delimitating the infarcted area (fig 1.b) and a very good delineation of the myocardium in control rats (fig 1.a), areas delimited by each modality do not completely match.

Conclusions: It is important to evaluate non-invasive imaging techniques for the study of animal models which recapitulate human disease. MRI and PET imaging for characterization of viability and infarct size offer consistent but non-identical results thus making these modalities a good complement for each other and warranting further investigation of underlying patophysiology.

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