

## Visualization of beta-cells in a diabetic mouse model by Manganese enhanced MRI

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### Introduction:

Loss of beta-cells in type 1 and type 2 diabetes leads to metabolic dysregulation and inability to maintain normoglycemia. Noninvasive imaging of beta-cells *in vivo* would therefore provide a valuable diagnostic and research tool for follow-up the progression of diabetes and evaluation of the effects of therapeutic intervention. Manganese (Mn(2+)) is a T1-shortening contrast agent that enters cells such as pancreatic beta-cells through voltage-gated calcium channels. Mn(2+)-enhanced MRI of the pancreas after glucose infusion would allow for noninvasive detection of beta-cells *in vivo*. Diabetic and islet transplant animal models were developed for the purpose of aggressive intervention and histology proof in the current project. MRI was used to monitor pancreatic endogenous islets and the final cell destination *in vivo* after islet transplantation.

### Methods and Materials:

Both nondiabetic mouse (C57BL/6, 24 g) and diabetic mouse (C57BL/6, 10 g) were fasted for 8 hours and anesthetized with 1.25% isoflurane before imaging. 20 minutes prior to MR acquisition, glucose (1.56 mg/g) was injected intravenously via tail vein followed by intraperitoneal MnCl<sub>2</sub> (0.1 mol/g) administration. MR images were acquired using a 7 Tesla MR scanner (ClinScan, Bruker, Germany) using a gradient echo sequence with the following parameters: TR/TE/Flip angle=2.31/0.76 ms/20 degree, FOV= 34×26 mm<sup>2</sup>, slice thickness = 0.5 mm. Signal enhancement ratio was calculated by  $(SI_{Mn} - SI_0) / SI_0$ , where  $SI_{Mn}$  and  $SI_0$  are signal intensity before and after Mn infusion, respectively.

### Results:

Figure 1 shows the T1 weighted image before (a) and after MnCl<sub>2</sub> infusion(b) in a normal mouse, the arrowhead indicates the pancreas, which was enhanced after the MnCl<sub>2</sub> infusion. Figure 2 shows the signal enhancement ratio of the normal control and the diabetic animal after MnCl<sub>2</sub> infusion. The enhancement after MnCl<sub>2</sub> infusion is significantly reduced in the diseased animal.

### Conclusion

Mn(2+)-enhanced MRI of the pancreas after glucose infusion would allow for noninvasive detection of beta-cells *in vivo*.

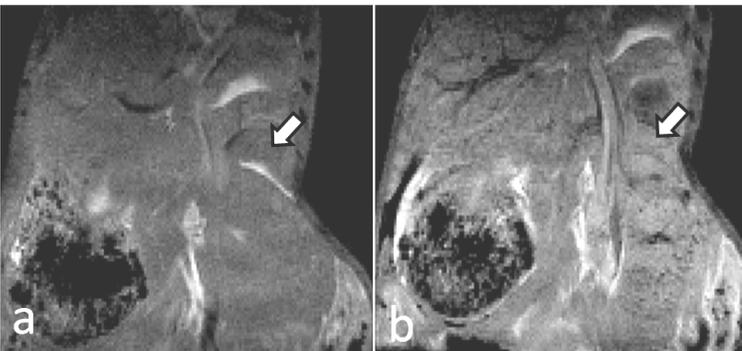


Fig. 1 enhancement from MnCl<sub>2</sub> in the pancreas of the nondiabetic mouse.

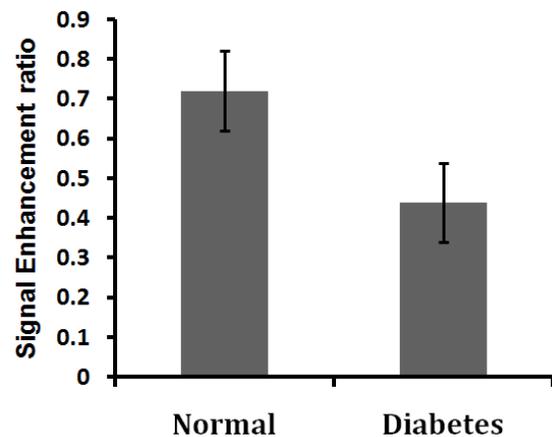


Fig. 2 reduced enhancement in the diabetes mouse when compared to the normal