^{17}O MRI of Rat Head at 21.1 T

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Introduction

The importance and potential of ultra-high magnetic field MRI for humans (up to 20 T) is under investigation across-the-board [1]. Detecting ^{17}O is an attractive and promising goal of utilizing MRI at ultra-high magnetic fields and is expanding our capability to conduct non-invasive *in vivo* MR imaging. The power of the ultra-high magnetic field of 21.1 T is demonstrated below by performing 3D ^{17}O MRI at natural abundance of oxygen (0.037%) in 25 min. Thus, a variety of labeled ^{17}O substances can be monitored with high resolution 3D MR imaging.

Experimental

The MR experiments were performed using the 21.1 T magnet and Bruker MRI Avance III console. The *in vivo* RF probe has a double tuned ^{17}O/^{1}H volume RF coil with an internal diameter of 33 mm, covering a rat head. The MR frequency for ^{17}O was 121.65 MHz. 3D MR imaging of a rat head was accomplished using a modified Bruker UTE pulse sequence with radial sampling having a matrix size =80x112x56, using FOV=64x64x64 mm, TR = 15 ms, TE = 0.2 ms, NA= 16, Scan time = 25 min. The effect of labeled ^{17}O-water was observed using an injection of PBS solution with a final ^{17}O enrichment of 17%. All animal experiments were conducted according to the protocol approved by the Florida State University ACUC.

Results and Discussion

The ultra-short echo time MR images of rat head using ^{17}O demonstrate many anatomical features and the background level of MR signal intensity, which can be successfully used for calibration of ^{17}O MR signals (**Fig. 1**). The ^{17}O labeling expands our capability to perform *in vivo* research using non-invasive MR imaging.

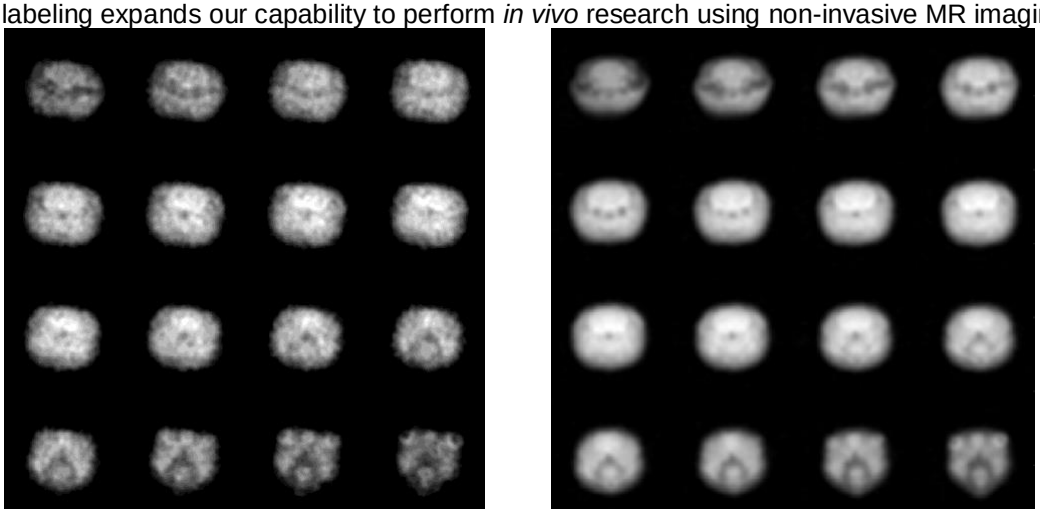

Fig.1 ^{17}O 3D MRI of rat head (left, natural abundance) and 1.5 hours after 1 mL bolus injection of ^{17}O-water (right). Scan time was 25 min in both cases and resolution of 1x1x1 mm.

Conclusions

The ^{17}O MR 3D imaging with resolution of 1x1x1 mm is feasible in a rat head for natural abundance of oxygen and labeled ^{17}O compounds. The higher voltage capability of the RF probe allowed for minimizing the loss of ^{17}O MR signal during *in vivo* experiments by achieving a 90 º RF pulse of 120 µs for ^{17}O.

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References

[1] Budinger, T.F., *et al*., MAGMA, **29(3),** 617-639 (2016), Review.