Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3600** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) A PoC study of in-vivo Simultaneous Hyperpolarized 129Xe MRI and [15O]-water PET Measurements

Monday 19 June 2023 14:45 (15 minutes)

INTRODUCTION: A non-invasive imaging technique inhaled hyperpolarized (HP) 129Xe magnetic resonance imaging (MRI) is presently employed to assess lung structure and function1. It is possible to quantify the ventilation/perfusion (V/P) of the lungs simultaneously using this MRI technique because the solubility of xenon in lung tissues is higher compared to other imaging gases. This measurement is possible owing to the distinct and broad range of chemical shift frequencies (˜200 ppm) of 129Xe when residing in lung tissue, brain tissue, and red blood cells as opposed to the gas phase.
[15O]-water positron emission tomography (PET) is the gold standard imaging method for determining cerebral perfusion2,3. In this study, simultaneous in-vivo 129Xe-based MRI and [15O]-water PET images were collected and compared.

METHODS: [15O]-water solution (30mL) contained in a 60mL plastic syringe was used to dissolve 30mL of the hyperpolarized 129Xe gas. Anesthesia was induced in rats with 5% isoflurane and oxygen and maintained at 2%. A 24g tail vein catheter was inserted for delivery of the [15O]-water / 129Xe mixture. Hyperpolarized 129Xe gas was obtained from a turn-key, spin-exchange polarizer system (Polarean 9800 129Xe polarizer). In-vivo PET imaging was obtained using a small animal MRI compatible PET insert (Cubresa Inc.) [15O]-water PET data was acquired simultaneously with 129Xe MRI using the integrated PET system in the 3T PET/MRI.

RESULTS: 2D axial 129Xe MRI images and [15O]-water PET images were acquired simultaneously indicating that the diameter of the phantom from both PET and MRI images were similar. The 129Xe image demonstrates a sufficient SNR level (80). The anatomical-proton and [15O]-water-PET-perfusion images of rat-brain were also produced.

CONCLUSIONS: The results of this study clearly indicate the feasibility of simultaneous hyperpolarized 129Xe MRI and [15O]-water PET measurements. This demonstration proves that 129Xe could be used as a potential non-radioactive and high-resolution imaging tool.

References:
1. Kaushik, S. S. et al. MRM (2016); 2. Fan, A., et. al. JCBFM (2016); 3. Ssali. T., et. al. JNM (2018).

Keyword-1

hyperpolarized gas MRI

Keyword-2

129Xe

Keyword-3

[15O]-water/gas

Authors: SEMBHI, Ramanpreet (The University of Western Ontario); FOX, Matthew (The University of Western Ontario, Lawson Health Research Institute); LIM, Heeseung (Lawson Health research institute); HICKS, Justin (Lawson Health Research Institute, The University of Western Ontario); WHITEHEAD, Shawn (The University of Western Ontario); THIESSEN, Jonathan (Lawson Health Research Institute, The University of Western Ontario); PARRAGA, Grace (The University of Western Ontario, Robarts Research Institute); Prof. OURIADOV, Alexei (The University of Western Ontario, Lawson Health Research Institute)

Presenter: SEMBHI, Ramanpreet (The University of Western Ontario)

Session Classification: (DPMB) M2-3 MRI I | MRI I (DPMB)

Track Classification: Technical Sessions / Sessions techniques: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)