A PARSE-MRI BASED TECHNIQUE TO MEASURE CEREBRAL OXYGEN EXTRACTION FRACTION (OEF)

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TARGET AUDIENCE: Physicians, Researchers, and Scientists interested in stroke and cardiac imaging

PURPOSE: OEF is shown to be an independent predictor of stroke [1]. There is an unmet clinical need for a robust MRI technique to quantify oxygen extraction fraction (OEF) in the brain. A novel, fast, and non-invasive MRI technique to measure OEF is being reported here.

METHODS: We implemented the PARSE (Parameter Assessment by Retrieval from Signal Encoding) [2] sequence on a clinical 3T MR scanner. PARSE uses a more accurate MR signal model and allows the simultaneous estimation of $M_0$, $R_2^*$ and OEF related frequency changes (Figure 1). We performed sensitivity analysis and numerical simulations and concluded that the technique is sensitive to frequency changes of 4Hz and higher [3]. In a series of 5 normal volunteers (M/F 3/2, <age> = 26 ±10 years) and 1 Arterio-Venous Malformation (AVM) patient we acquired single slice, 5.0 mm thick, 220 mm x 220 mm FOV, 64 x 64 matrix, resolution = 3 x 3 x 5.0 mm³) 2D PARSE data. The frequency change maps calculated from the PARSE reconstruction were processed using ICA analysis to separate static components from the dynamic OEF components.

RESULTS: The mean frequency change for normal subjects was in the range of 15.49 Hz ±2.77. The mean calculated OEF for the 5 normal subjects was 36.87 ± 6.60%. The AVM patient exhibited an area of elevated OEF (84.05 ± 4.54%). Figure 2 shows the plot of OEF for normal subjects and the AVM patient, compared to published Positron Emission Tomography (PET) literature.

DISCUSSION/CONCLUSION: The mean OEF for the normal subjects are in close agreement to literature values of PET-OEF studies of normative values from Carpenter (35±7%), Yamauchi (42±5%), Diringer (41±6%) and Raichle(40±9%) [4]. The AVM patient exhibits elevated OEF proximal to the AVM and “steal” in the distal part of the slice, suggesting that the surrounding tissue may be in distress due to the AVM. The data from PARSE based studies on our cohort suggests a potential MRI-OEF measurement technique. Further patient studies are required to validate the efficacy of this technique as related assessing the risk in stroke patients.

REFERENCES

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