

ERETIC

Absolute quantification of metabolites in [MR spectroscopic imaging \(MRSI\)](#) requires a stable reference signal of known concentration. The Electronic REference To access In vivo Concentrations ([ERETIC](#)) has shown great promise but has not been applied in patients and 3D MRSI. ERETIC hardware has not been integrated with receive arrays due to technical challenges, such as coil combination and unwanted coupling between multiple ERETIC and receive channels, for which we developed mitigation strategies.

Purpose: To develop absolute quantification for whole-brain MRSI in glioma patients.

Study type: Prospective.

Population: Five healthy volunteers and three patients with [isocitrate dehydrogenase](#) mutant [glioma](#) (27% female). Calibration and coil loading phantoms.

Field strength/sequence: A 3 T; Adiabatic spin-echo spiral 3D MRSI with real-time motion correction, Fluid Attenuated Inversion Recovery (FLAIR), Gradient Recalled Echo (GRE), Multi-echo Magnetization Prepared Rapid Acquisition of Gradient Echo (MEMPRAGE).

Assessment: Absolute quantification was performed for five brain metabolites (total N-acetyl-aspartate [NAA]/[creatine/choline](#), [glutamine](#) + [glutamate](#), [Myo-inositol](#)) and the oncometabolite 2-hydroxyglutarate using a custom-built 4x-ERETIC/8x-receive array coil. Metabolite quantification was performed with both EREIC and internal water reference methods. ERETIC signal was transmitted via optical link and used to correct coil loading. Inductive and radiative coupling between ERETIC and receive channels were measured.

Statistical tests: ERETIC and internal water methods for metabolite quantification were compared using Bland-Altman (BA) analysis and the nonparametric Mann-Whitney test. $P < 0.05$ was considered statistically significant.

ERETIC could be integrated in receive arrays and inductive coupling dominated (5-886 times) radiative coupling. Phantoms show proportional scaling of the ERETIC signal with coil loading. The BA analysis demonstrated very good agreement ($3.3\% \pm 1.6\%$) in healthy volunteers, while there was a large difference ($36.1\% \pm 3.8\%$) in glioma tumors between metabolite concentrations by ERETIC and internal water quantification.

The results indicate that ERETIC integrated with receive [arrays](#) and whole-brain MRSI is feasible for brain metabolites quantification. Further validation is required to probe that ERETIC provides more accurate metabolite concentration in [glioma](#) patients ¹⁾.

¹⁾

Thapa B, Mareyam A, Stockmann J, Strasser B, Keil B, Hoecht P, Carp S, Li X, Wang Z, Chang YV, Dietrich J, Uhlmann E, Cahill DP, Batchelor T, Wald L, Andronesi OC. In Vivo Absolute Metabolite Quantification Using a Multiplexed ERETIC-RX Array Coil for Whole-Brain MR Spectroscopic Imaging. J Magn Reson Imaging. 2021 Dec 27. doi: 10.1002/jmri.28028. Epub ahead of print. PMID: 34958166.

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