The Utility of Magnetic Resonance Fingerprinting in Differentiating Between Cerebral Gliomas and Metastases: A Pilot Study

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Introduction

Conventional MRI imaging is susceptible to changes in technique making interpretation subjective. Technical characteristics of the magnet and software vary even between MRI units in the same institution. MRI can often reliably distinguish tumors from other intracranial pathologies, but classification of the tumor type is typically less reliable. MR Fingerprinting (MRF) is a new approach yielding rapid, non-invasive, precisely quantifiable imaging which is, highly reproducible between platforms. . This pilot study is the first in vivo attempt to differentiate between two important intra-axial malignant brain tumor types (gliomas and metastases) using MRF.

Learning Objectives

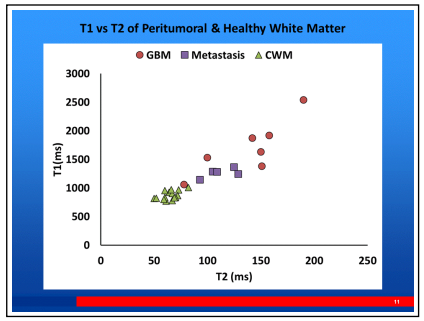
By the conclusion of this session, participants should be able to: 1) Define the challenges of image analysis of tumors using conventional MRI, 2) Define MRI Fingerprinting 3) Explain the characteristic imaging findings differentiating GBM vs oligodendrogliom vs brain mets

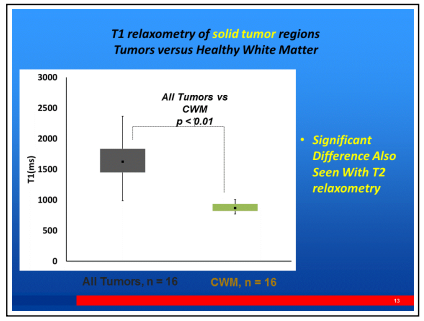
Methods

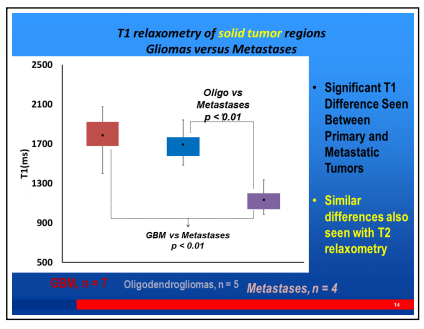
A total of 27 patients with newly diagnosed intra-axial brain tumors were studied: 7 metastases (METs), 6 oligodendrogliomas (OGDs) and 14 glioblastomas (GBMs) were included. Axial imaging was acquired through representative areas of tumor region and quantitative T1 and T2 maps were generated. T1 and T2 quantification of solid tumor component (ST), immediate perilesional white matter (PWM) within 1 cm from enhancing margin, and contralateral white matter (CWM) was performed using ROI analysis. Student's t-test was used for statistical analysis and comparison between various tumor regions across different tumor types was performed.

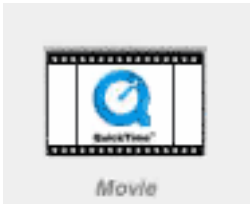
Results

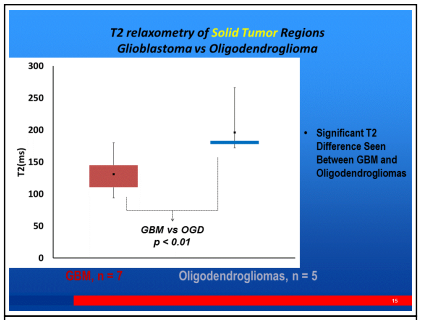
T1, T2 measurements from ST and PWM were different than those of CWM (all p-values < 0.01). Similarly solid tumor T1 and T2 values of METs were different from those of GBMs and OGDs (all p-values < 0.01). The ST region of GBMs and OGs showed a significant difference in T2 ($p < 0.01$). Also, there was significant difference between PWM T2 of GBMs and METS (< 0.05).

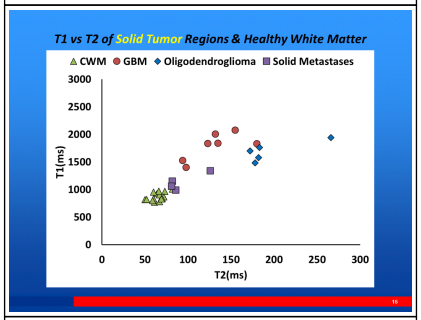


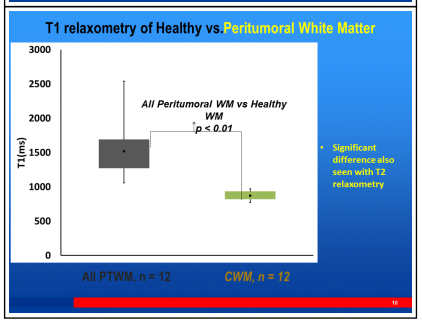


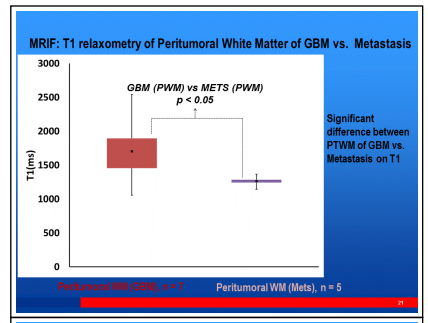


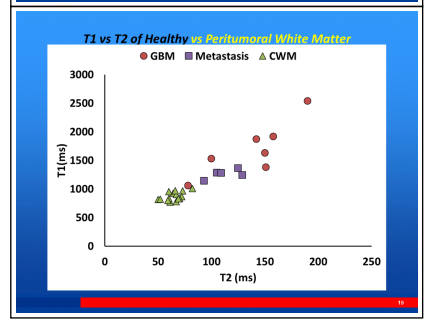












SUMMARY:

- MRF enables quantitative, multiparametric measures in < 7-10 min
- Can accurately and precisely determine diagnosis
- Additional preliminary results suggest potential applications:
- Differentiation of Tumor Types
- Identification of Radiation Necrosis
- Larger sample studies are underway to establish the validity of these findings

Conclusions

MRF is able to rapidly and simultaneously measure T1 and T2 values of brain tumors and surrounding tissues. It can reliably distinguish between solid tumor types and the perilesional white matter changes surrounding brain metastasis and the two most common gliomas.