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Magnetic resonance microscopy at 14 tesla and correlative histopathology of human brain tumor tissue.

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Abstract

Magnetic Resonance Microscopy (MRM) can provide high microstructural detail in excised human lesions. Previous MRM images on some experimental models and a few human samples suggest the large potential of the technique. The aim of this study was the characterization of specific morphological features of human brain tumor samples by MRM and correlative histopathology. We performed MRM imaging and correlative histopathology in 19 meningioma and 11 glioma human brain tumor samples obtained at surgery. To our knowledge, this is the first MRM direct structural characterization of human brain tumor samples. MRM of brain tumor tissue provided images with 35 to 40 µm spatial resolution. The use of MRM to study human brain tumor samples provides new microstructural information on brain tumors for better classification and characterization. The correlation between MRM and histopathology images allowed the determination of image parameters for critical microstructures of the tumor, like collagen patterns, necrotic foci, calcifications and/or psammoma bodies, vascular distribution and hemorrhage among others. Therefore, MRM may help in interpreting the Clinical Magnetic Resonance images in terms of cell biology processes and tissue patterns. Finally, and most importantly for clinical diagnosis purposes, it provides three-dimensional information in intact samples which may help in selecting a preferential orientation for the histopathology slicing which contains most of the informative elements of the biopsy. Overall, the findings reported here provide a new and unique microstructural view of intact human brain tumor tissue. At this point, our approach and results allow the identification of specific tissue types and pathological features in unprocessed tumor samples.

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