High Field Imaging of Brain Tumors  
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Overview

3T is the current clinical standard for imaging of the brain, and especially brain tumors. It includes T2-weighted fast spin echo (FSE), fluid attenuated inversion recovery (FLAIR), pre- and post-contrast T1 weighted imaging as well as perfusion- (DCE), diffusion- (DWI) and susceptibility-weighted (SWI) acquisitions as well as magnetic resonance spectroscopy (MRS). However, sensitivity, especially of small, residual tumors or infiltration of normal tissue at the tumor borders, remains limited.

On the other hand, several advantages of higher fields shift the focus of imaging research of brain tumors towards flux densities of 7T and above. These ultra-high field (UHF) systems enable improved disease detection, characterization as well as monitoring of therapeutic interventions or biologic effects of treatment.

The advantages of these systems include higher signal to noise ratio exchangeable into higher spatial resolution, greater coverage or shorter scan times, stronger susceptibility effects and higher spectral resolution.

The goal of this lecture is to describe recent advances in UHF magnetic resonance methods relevant to diagnosis of brain tumors as well as to monitor the effects of treatment. In addition, applications that receive the most benefit from UHF imaging will be outlined.

Objectives

After attending this lecture, attendees should:

- Understand the differences between standard field and ultra-high field (UHF)MRI
- Be familiar with the advantages and disadvantages of UHF MRI in the brain
- Recognize the advantages of UHF in detection of brain tumors
- Be able to describe the differences in the depiction of microvasculature in UHF MRI
- Know the potential of SWI in the characterization of brain tumors at UHF MRI
- Be aware of the capability of USPIO particles in the assessment of brain tumors
- Understand the advantages of UHF MR spectroscopy