<3T Neuro MR imaging>

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MR imaging (MRI) at 3.0T is a significant new clinical tool in the imaging of neurological disease. Since approvement by the US Food and Drug Administration (FDA) for human imaging in 1999, high-field MR imaging at 3.0T is becoming available in an increasing number of institutions worldwide. The main advantage of high-field MRI is the improved signal-to-noise ratio, which scales approximately linearly with a field strength from 1.5T to 3.0T. This signal gain can be used to generate more accurate spatial representation or speed up imaging times, depending on the specific application.

Higher field strengths change tissue contrast parameters. T1 relaxation time is increased by approximately 30%, whereas T2 and T2* relaxation times are decreased by around 15 %. Increasing the field-strength from 1.5T to 3.0T also causes chemical shift and susceptibility to double. MR spectroscopy (MRS) benefits considerably from the improved spectral resolution possible with high-field MRI. Images acquired on 3.0T MRI units demonstrate enhanced sensitivity to the blood oxygen level dependent (BOLD) effect as well. Tissue heating, induced by RF power, remains the main challenge for clinical 3.0T MRI as the specific RF absorption rate approximately quadruples when field strength increases from 1.5T to 3.0T. In addition, increased susceptibitliy has both benefits and disadvantages.

Fortunately, solutions such as innovative parallel imaging techniques have been developed to overcome this. High-field MRI has historically been applied primarily to neuro imaging, and the advantage of 3.0T for both morphological and functional neuro MRI is broadly accepted. Current status of 3.0T neuro MR imaging is reviewed and an overview is given on the clinical use of the high-field MRI in our Department of Radiology.