[SY26] Meet the Frontiers

SY26-02

Electromagnetics Meets MRI System

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For early diagnosis through acquisition of high-resolution anatomical image of the human body, Magnetic resonance imaging (MRI) is widely used clinically. Since the necessity of the ultra-high resolution MR image is increasing to find the early-stage tumor or lesion including micro-vessels, the ultra-high field (UHF) MRI over 7 T has been studied and introduced. At the same time, the UHF MRI has the safety problem related to the electromagnetic reaction around a variety of implantable medical devices (IMDs) utilized for therapeutic purposes including prosthetic, Symptom relief, bio-signal monitoring. Therefore, integrated understanding around MRI including IMD system should be required. This abstract introduces some RF coil designs to improve the intensity of the applied B1+ field on the target region, and RF safety result of the IMD patients. Electromagnetic results of the RF coil, and thermal result including specific absorption rate (SAR) around the IMD in the MRI environment from 1.5T to 7T with birdcage and multi-channel RF coil were calculated with the Sim4Life [1] finite difference time domain (FDTD) simulation. Geometrically-adjustable RF coil, and high permittivity material (HPM) pad improves SNR by high applied B1+ field distribution on the body. Simulation results of the Implanted metallic components including IMD and tattoos modeled with MRI system shows that higher SAR was found around the tip of the electrode and conductive part placed closer to the RF coil. In this research, some alleviation techniques are also introduced. Phenomenon and issues of the electromagnetic application related to the MRI system were considered in this research. RF coil design such as adjustable and HPM-applied RF coil to improve SNR for UHF MRI were introduced. In addition, the RF safety issues around several IMD cases were calculated and summarized to make the optimized analysis protocol to design MRI-compatible IMDs.

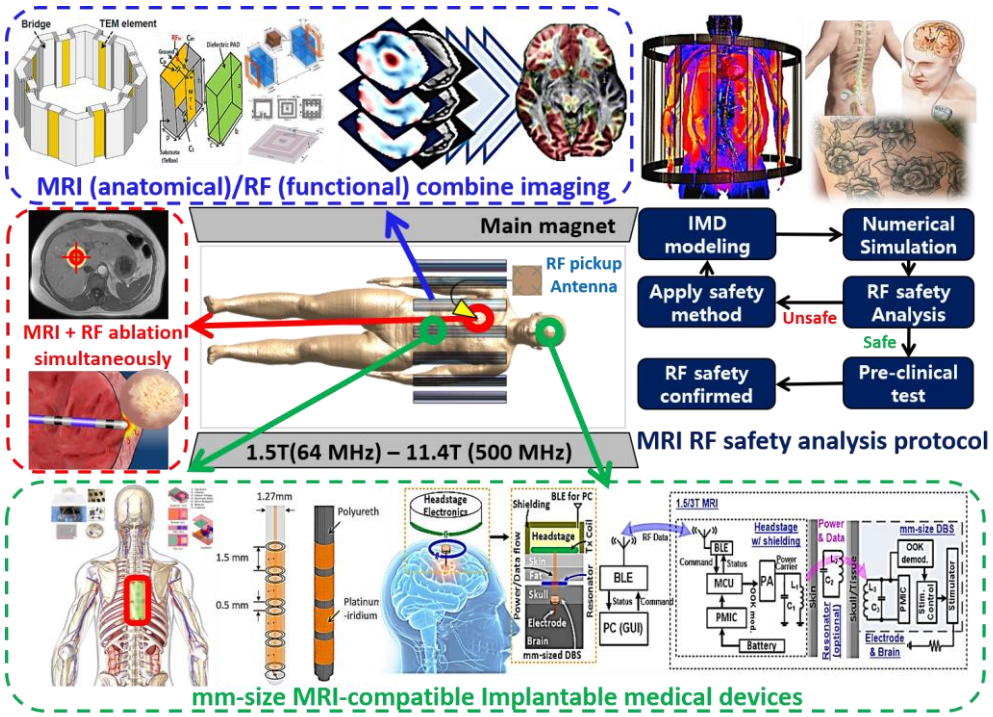

Figure 1. Electromagnetic application and researches related to MRI system

[1] Sim4Life by ZMT, www.zurichmedtech.com

Keywords : MRI, RF Coil, RF safety, Implantable medical devices

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SY26-03

Application of Arterial Spin Labeling in Brain Tumor

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Arterial spin labeling (ASL) is an emerging technique for measuring cerebral blood flow at the tissue level. Due to technical advances in higher magnetic fields with efficient spin labeling, ASL has been incorporated as part of sequences in acquisition of MR imaging which is increasingly used in many neuroimaging applications, including cerebrovascular diseases, neoplasms, epilepsy, and functional MRI. Compared to conventional dynamic susceptibility-contrast perfusion weighted imaging or nuclear medicine imaging including PET or SPECT, ASL for perfusion measurement has the following main advantages: 1) It is completely non-invasive; 2) It provides absolute cerebral blood flow information at brain tissue level without exposing patient to radiation or contrast media.

The purpose of this presentation is to describe our experience with a heterogeneous collection of ASL perfusion images in patients with brain tumors.

Keywords : Arterial spin labeling, Cerebral perfusion, Brain tumor