

ISMRM Annual Meeting 2015

Weekend Educational Course: MRI Safety

MRI Safety: Interaction of Fields with Human Body
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TARGET AUDIENCE :

All patients, volunteers, and individuals who will use MRI for diagnostic or research purposes including, physicians, scientists, technologists, and research staff.

OBJECTIVES :

Upon completion of this course, participants will learn the safety implications of various components of MRI scanners. This will be achieved by presenting a summary of principles of operation of the major components of these scanners and how they interact with human body structure and affect function.

The main objective of this course is to help participant to understand the mechanism of interaction of various fields produced by (1) strong magnets, (2) gradients and (3) RF coils with human body. The knowledge acquired in this course is critical for safe exposure of humans to MRI scanners and will, in addition, provide an insight to the users to design appropriate techniques for the best outcome from the use of this exotic tool in unraveling mysteries of human body.

- (1) Understanding the effect of static magnetic fields (B_0) on the human body requires a knowledge of interaction of B_0 with the body from molecular to cell, tissue, and organ level [1,2]. Furthermore, interactions of B_0 with metallic objects and the consequence of imposition of forces and torques will be discussed the requirements for MR safe implants and devices.
- (2) Both B_0 -gradients and time-varying magnetic field (dB/dt) produced by gradients can interact with biological tissues. Interaction of dB/dt with biological tissues are unique enough that warrants their independent analysis [3,4]. Ability of dB/dt to produce eddy currents in the human body as well as in the magnet housing causes heating whose magnitude and distribution in the body must be well understood to prevent harm to human subjects. These aspects of gradient use as well as the spurious magnetic fields that they produce in the large metallic components of the scanners will also be discussed.
- (3) Another component of MRI scanners that produce a unique electromagnetic field is the radiofrequency (RF) coil. These coils produce pulsed magnetic field (B_1) that interacts with human body. Once inside the human body, B_1 fields can produce thermal energy and heat the body part that is placed inside these coils [5-7]. These fields can also heat metallic components of cloths and objects such as implants that need to be addressed. For special populations such as children and pregnant women also there are special recommended limits that will be

discussed as well as the exposure of patients, volunteers, MRI staff, researchers, manufacturers' staff, and general public.

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