Globally Applicable MR Safety Program for Medical Students

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Purpose

This educational electronic poster outlines the design of a globally applicable educational MR safety module with a concise multiple choice exam for instructing medical students about basic MR and patient related safety. The MR safety course can be implemented as a traditional didactic lecture, interactive, or self-administered online. The goal of the course is to make sure that medical students worldwide get a basic understanding of MR principles and safety considerations. It prepares the medical students for optimal ordering of MR studies while emphasizing patient screening and safety. A standardized multiple-choice exam, accessible through the internet and the program ExamWeb (Exam Web, LLC; Newport Beach, CA) at the end of the course documents the proficiency of the medical students. The course covers low field MRI systems in developing countries as well as state-of-the-art ultra high field MRI systems. It can be used universally by all medical school programs and will help to ensure consistent quality of teaching materials and MR safety standards.

Outline of Content

1.) Course description and examples of implementation
2.) Importance of MR safety for physicians
3.) MR principles and magnetic fields
   - Static magnetic fields (B_0)
   - Radiofrequency field (B_1)
   - Gradient fields (G_x, G_y, G_z)
4.) Effects of magnetic fields in an MR suite
   - Attractive forces on ferromagnetic objects
   - Projectile effects
   - Thermal effects
   - Peripheral nerve stimulation
5.) Types of MR systems
6.) Fringe fields and 5 Gauss line
7.) MR screening procedures
   - Implanted devices (e.g. pacemakers, hearing aids, surgical implants)
   - Pregnancy
   - MR contrast agent reactions and renal insufficiency
8.) Emergency procedures in an MR suite

Summary

This educational electronic poster will provide a comprehensive overview on the implementation of an internationally applicable MR safety course for medical students. Education in MR safety for medical students will enable these future physicians to optimize requests for MR studies by increasing their understanding of patient screening and safety procedures.

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a) Sample slide of the MR safety module

Dangers of the Static Magnetic Field:

- Ferromagnetic substances such as iron have a large magnetic susceptibility and are easily magnetized permanently.
- All magnets have a fringe magnetic field, the magnetic field which exists in the vicinity surrounding the magnet. This field may extend many meters from the magnet itself.

b) Sample multiple choice test question

Which magnetic field interacts with the patient in an MRI scanner?

A) Static magnetic field
B) Gradient field
C) Radiofrequency field
D) A and B
E) A, B and C

Fig. 1 a) Sample slide and **b)** sample multiple choice test question of a comprehensive MR safety module for medical students.