Imaging Now and Next

Addressing the health and safety concerns of MRI technology

Magnetic resonance imaging ("MRI") is a non-invasive imaging technology used widely in clinical settings for the detection, diagnosis and monitoring of disease. MRI uses strong magnetic fields, field gradients and radio waves to generate high quality contrast images of a variety of tissues – particularly soft tissues – without the use of ionizing radiation. However, the electromagnetic fields used for MRI can be problematic for patients with metallic implants. So how can patient safety be optimised in MRI, and what are the key considerations for safe screening of patients with implants?

Prioritising patient safety: the importance of pre-MRI screening

In today's ageing population, the incidence of major joint replacements and cardiac implants is on the rise. This overlaps with an increasing prevalence of neurodegenerative, musculoskeletal and malignant conditions requiring MRI scans. The strong magnetic forces within a MRI scanner act on ferromagnetic and metallic objects, including certain implants. This can lead to the potentially dangerous movement or displacement of implants, as well as excessive heating of conductive materials. Therefore, thorough and efficient screening procedures are necessary to ensure the safety of patients with metallic implants preparing to undergo MR procedures.

MRI-related dangers for patients with implants

Implants can be categorised into two categories: passive implants with no electronic or magnetic components, including valves, filters, stents and orthopaedic prosthetics; and active implants that contain a power source, like pacemakers, internal defibrillators, cochlear implants and neurostimulators. In a MR environment, passive implants are subject to several issues resulting from the magnetic field, including displacement, heating and magnetisation. Active implants pose additional risks, like disruptions to functional or operational components, as well as reset or permanent damage to the electronic elements of the device.

A valuable resource

Dr Frank G Shellock – Adjunct Clinical Professor of Radiology and Medicine at the University of Southern California's Keck School of Medicine, and Director of MRI Safety at the Stevens Neuroimaging and Informatics Institute – specializes in assessing implants and devices for MRI-related issues. Through his work, he has established an online universal MRI safety resource that includes guidelines for thousands of implants, devices and materials (www.mrisafety.com). This site also provides standardised screening forms and interview formats – intended to be performed by MRI safety-trained healthcare professionals – to identify any devices that need to be considered prior to conducting a MRI.

MRI testing and labelling to reduce injury risk

Manufacturers of medical implants are required to assess their products for MR safety and label them according to standardised terminology. 'MR safe' devices are non-conductive, non-metallic and non-ferromagnetic; 'MR conditional' devices require highly specific conditions to ensure safety; and 'MR unsafe' devices are absolutely contraindicated for MRI scanning. A lack of labelling information can result in patients being denied access to MRI technology unnecessarily, so it is crucial that standardised labels be used worldwide to ensure access to scanning. Dr Shellock advises: "Taking into account all safety recommendations provided by the American College of Radiography, the final determination of whether to scan a patient should be made by a qualified, supervising physician, who understands all MRI-related issues that can impact patients with implants, and is able to weigh up the MR safety risks with the potential benefits of MRI for disease diagnosis and monitoring." There are a variety of training resources available online where radiologists can gain the competency to make informed decisions on MRI safety.

MRI procedures for all

There are multiple advantages of using vertical field MRI scanners. Their open architecture accommodates claustrophobic and obese patients, and allows key anatomy to be selectively placed within the scanner for imaging. In addition, the vertical direction of the magnetic field results in fewer motion artifacts, allows the use of solenoid coils to clearly image the musculoskeletal system, and enables MRI to be used to guide interventional procedures, such as breast biopsies and neurological investigations.

FUJIFILM Healthcare Europe is driving the performance of vertical field MRI scanners by pioneering technologies that prioritise both image quality and a positive patient experience. Open-bore vertical field MRI systems have already enabled a more comfortable scanning experience for innumerable bariatric and claustrophobic patients, and these benefits are now being extended to many patients with medical implants. The availability of up-to-date patient screening procedures and online training resources for radiologists assessing patient eligibility for MRI, together with accurate labelling of all implants and devices, is helping to ensure safety can be maintained when considering MRI procedures for patients with medical implants, increasing access to this valuable imaging resource.

For more information on MRI safety, visit www.mrisafety.com.

FUJIFILM
Value from Innovation