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Advanced Imaging Digest

Magnetic resonance imaging advances: Functional coils and portable units

As medical imaging technology evolves, magnetic resonance imaging (MRI) is becoming more precise and accessible, as well as increasingly clinician and patient friendly. Advances in functional MRI coils and portable MRI are also improving clinician performance and efficiency, while ensuring the safety of both the clinician and patient.

Functional MRI coils

Not every MR exam is the same. Each is specialized to the scan the patient is having and the type of coil being used. Coils are made for and help the MR machine gather high-quality images of specific body parts, such as the spine, hand, wrist, shoulder, abdomen, pelvis and head, and are essential in generating images.

MRI is the gold standard for diagnosing soft tissue injuries and various soft tissue pathologies. Coils currently used in MR are rigid, can be uncomfortable and do not allow for patient positioning. With recent technological advancements, several institutions are now constructing more wearable and less awkward and rigid coils.

Supported by the National Institutes of Health's National Institute of Biomedical Imaging and Bioengineering, NYU Langone Health has developed a coil prototype that allows for real-time movable, functional scanning with an MRI glove to dynamically image the extremity. The technology used in the MRI glove has many potential applications, including all extremities where functional imaging and competency of ligaments and tendons would be needed to determine management.

Magellan Healthcare clinical leaders continually review imaging trends and needs in light of current medical concerns, available literature, and society and Centers for Disease Control and Prevention recommendations and guidelines. This document is a summary of our latest findings. Please consult references for detailed information.

Similarly, Perdue University has recently developed technology utilizing stretchable fabric with attachable MRI coils. Other researchers have been exploring liquid metal (eutectic gallium indium (eGaIn)) contained in flexible silicone tubes attached to a stretchable textile-type wrap. These flexible coils will allow use regardless of positioning, which is a vast advantage over traditional rigid coils. Additionally, the detachable coils and washable fabrics will help make maintaining hygienic precautions easier. The flexibility of these coils will also allow for a wide range of applications in evaluating joint disease and their related injuries, as well as expanded imaging of curved body regions, such as breast MRI.

Portable MRI units

Typically, MRI needs to be performed in specially engineered rooms with appropriate shielding. Recently, the Food and Drug Administration approved Hyperfine Research's portable MRI machine for imaging of the brain for patients who are young toddlers, infants and neonates to older adults. The portable machine will cost approximately $50,000, which is 20 times cheaper than traditional systems, runs on 35 times less power and weighs 10 times less than normal 1.5T MRI machines.

Currently, these machines are 0.064T (ultralow field MRI) compared with the standard 1.5T or 3.0T magnets. The lower magnetic field is obtainable as the technology uses artificial intelligence (AI) to convert the signals detected by the MRI into detailed pictures of the brain.

Most likely, this technology will be primarily utilized in the hospital/ICU setting. However, it has the potential to be incorporated in subspecialty offices, such as neurology offices, given the lack of special construction needed to house the units. As this technology continues to evolve, clinicians may be able to use these units to conduct studies in patients' homes. These units are also safe to use without having to remove magnetic objects and do not interfere with ICU room monitoring devices. Additionally, these portable scanners have a permanent magnet that negates the need for any cooling, and the low-power consumption allows the scanner to operate using standard electrical power.

Some recent studies have evaluated low-field MRI in comparison to traditional MRI units in the detection and diagnosis of multiple sclerosis (MS). One study by Arnold et al. noted that portable low-field MRI showed 94% sensitivity for detecting lesions in established MS cases. Using portable MRI units for musculoskeletal MRI exams is also being explored. Magellan Healthcare will continue to monitor this technology as it emerges and as it possibly incorporates itself in outpatient imaging.

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Dr. Khalid joined Magellan in 2014. As a board-certified diagnostic radiologist with a career spanning more than twenty years, he has a thorough understanding of the complexities of the U.S. healthcare system and current standards of care. In his current role, Dr. Khalid is involved in training new physicians, auditing, continuing education and policy development.

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