

MR artifacts: Recognition, Underlying Principles and Remedies in Musculoskeletal and Body Imaging

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Purpose: This educational exhibit aims to familiarize radiologists with a spectrum of MR artifacts that can occur in musculoskeletal and body imaging, discuss underlying scientific principles leading to artifacts and provide remedies to reduce artifacts without significantly increasing scan time or compromising signal-to-noise ratio, contrast-to-noise, resolution and field-of-view. Additional strategies to take advantage of artifacts and improve imaging quality will be discussed.

Outline of content:

- Review of MR artifacts (physiological, inherent physical and mechanical) and underlying scientific and engineering principles
- Remedies to reduce artifacts
- Strategies to exploit artifacts to improve diagnosis

Summary:

Widespread use of magnetic resonance imaging (MRI) has been restricted in the past by limited availability, high cost and technical difficulties. Rapid technological improvements including development of newer imaging sequences, coils and high field scanners have rendered MR as an integral part of musculoskeletal and body imaging.

Now MRI is increasingly utilized in musculoskeletal imaging to evaluate soft tissue structures including meniscus, cartilage, labrum, muscles, tendons and ligaments and has replaced other modalities such as CT or radiographs in evaluating soft tissue pathology. MRI has also become a popular and comprehensive modality for assessing the morphology and pathology of intra-abdominal and pelvic organs.

Due to its complexity and use of radiowaves instead of X-rays, MR imaging produces unique artifacts, different from those radiologists know from x-ray studies. These MR artifacts can depict data erroneously, obscure pertinent anatomy or mimic pathology. For example, chemical shift artifact occurring at the cartilage-bone marrow interface of the wrist may lead to overestimation or underestimation of cartilage thickness. Magic angle effect can result in artifactually increased signal intensity within the tendons being imaged on short echo time images, mimicking degenerative change or partial tear.

Therefore, recognition of MR artifacts and familiarity with them are crucial for proper image interpretation and correct diagnosis. A clear understanding of MR parameters and trade-offs is essential to optimizing image quality.

This educational exhibit aims to familiarize radiologists with a spectrum of MR artifacts (physiological, inherent physical and mechanical) that can occur in musculoskeletal and body imaging, discuss underlying scientific principles leading to artifacts and provide remedies to reduce artifacts without significantly increasing scan time or compromising signal-to-noise ratio, contrast-to-noise, resolution and field-of-view. Additional strategies to take advantage of artifacts and improve imaging quality will be discussed.

Figures:

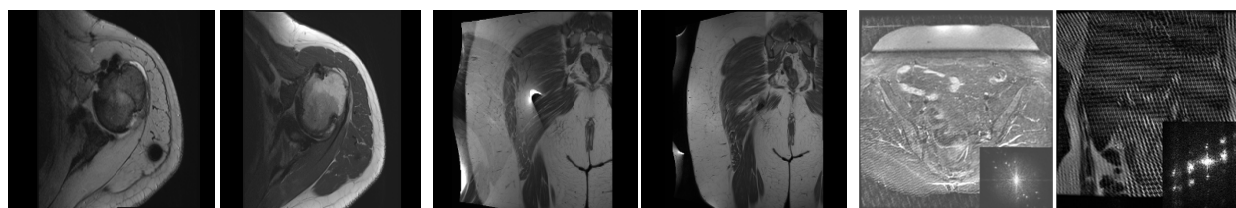


Figure 1. A full-thickness subscapularis tendon tear is obscured by susceptibility artifact (inherent physical artifact) on the gradient-recalled echo (left) but reduced on spin echo (right) due to refocusing pulse

Figure 2. Aliasing or wrap around artifact (inherent physical artifact) can be reduced by increasing FOV (shown on the right), swapping phase and frequency mapping directions, smaller receiving coil, filtering data or employing anti-wrap software

Figure 3. Mechanical artifact from a burnt bulb in the scan room ceiling