Magnetic Resonance Imaging Artifacts

Gross artefact is often apparent with ferromagnetic metallic total disc arthroplasty (TDA) devices on conventional high field-strength MRI scanners. Such artefact completely obliterates MRI assessment at the operated level, and usually obscures visualization of adjacent segments. Because adjacent segment preservation is a raison d'être of spinal TDA, clarity of imaging at this latter level is imperative. A failure to image adjacent segments may presage investigations, which are either invasive (e.g., myelography) or associated with significant radiation hazard (e.g., computed tomography), both with significantly less diagnostic sensitivity. This could negatively direct TDA choice with certain TDAs.

The CHARITE artificial disc and the PRODISC-L artificial disc do not present an additional hazard or risk to a patient undergoing an MRI procedure using a scanner operating with a static magnetic field of 1.5 T or lower. Image artefacts from the implants may present problems if the anatomical region of interest is in or near the area where these implants are located (e.g., vertebral canal at affected segment) [1].

Progressive modifications to specific imaging parameter settings were sought on a conventional high field-strength (1.5T) closed-bore scanner to match the minimal artefact previously observed on a lower field-strength (0.3T) open scanner. Direct comparisons were made between each modified protocol image obtained initially using a phantom; however, routine postoperative MRIs were subsequently obtained in n = 40 patients following lumbar TDA insertion.

Key parameter modifications were required in the receive bandwidth, the strength of the frequency encoding gradient, as well as in the echo train length. The use of higher specification “focused gradients” was also avoided. The overall effect was to reduce the slew rate of the gradients, which limited artefact due to a decrease in phase dispersion. Such appearances effectively matched with those previously obtained on the low field-strength (0.3T) open scanner in n = 40 patients.

Relatively simple modifications to MRI parameter settings can be made on conventional high field-strength (1.5T) closed-bore scanners, which minimize metal artefact and enhance imaging of adjacent segments with ferromagnetic TDA devices. Such modifications effectively match appearances to those obtained with outmoded low field-strength (0.3T) open-bore scanners [2].

Magnetic Resonance Imaging Artifacts in Adjustable differential pressure valves

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2)
Marshman LA, Strong G, Trewhella M, Kasis A, Friesem T. Minimizing ferromagnetic artefact with metallic lumbar total disc arthroplasty devices at adjacent segments: technical note. Spine (Phila Pa 1976). 2010 Jan 15;35(2):252-6. doi: 10.1097/BRS.0b013e3181c838cc. PubMed PMID: 20081522.