

Diffusion-Weighted Imaging: Artifacts and Remedies in Body MRI

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Target Audience: Clinicians, physicists and technologists who are interested in gaining an understanding of methods for artifact recognition and resolution in body MRI.

Objective: At the completion of this session, learners should be able to recognize common DWI artifacts for applications in the body and be familiar with approaches to remedy them based on an understanding of the trade-offs and considerations of DWI sequence design.

The signal in Diffusion Weighted Imaging (DWI) reflects the difference between the diffusion of excited spins in different tissues. The distinguishing characteristic of diffusion-weighted sequences is the application of gradients that provide sensitivity to the microscopic motion of the excited spins. In body MRI, DWI is utilized for a number of applications including in the liver, kidney, breast, and prostate. However, DWI in the body can be particularly challenging due to motion as well as magnetic field inhomogeneities. The necessity for diffusion-weighted sequences to be sensitive to the microscopic motion of excited spins also renders them highly susceptible to artifacts from other sources of motion. Sequences can be designed to compensate for this susceptibility to bulk motion but there are consequent trade-offs. For example, most common DWI sequences utilize echo planar imaging (EPI) based methods to reduce bulk motion artifacts but these sequences also introduce a greater susceptibility to other artifacts like distortions due to field inhomogeneities. While many DWI artifacts result from utilization of EPI readouts there are other factors that can lead to artifacts as well. Effects like T2 shine-through or the contribution of perfusion with small diffusion gradients can alter DWI signal levels and contrast. Ultimately, the optimal balance of these considerations in sequence design will depend on the specific anatomy being scanned.

An understanding of these trade-offs in DWI can help to form a framework for recognizing artifacts in body DWI as well as for developing remedies for the artifacts. In this session, we will briefly describe the sequence design considerations for DWI in the body. We will also review and practice recognizing common DWI artifacts across a number of body MRI applications. Finally we will present remedies for these artifacts drawing on an understanding of the inherent trade-offs in DWI acquisitions.

References

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