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Abdomen

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Latest developments for improved Body Diffusion Weighted Imaging

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The discovery of MR imaging weighted by the diffusion characteristics of the water molecules by Le Bihan et al., and the subsequent finding that diffusion weighted imaging showed early signal change in stroke (Moseley et al.) is one of the main breakthroughs in the development of MR imaging as a clinical tool. Ever since, diffusion weighted MRI has found many more applications, e.g. related to the possibility to encode the anisotropy of the diffusion phenomenon, giving information on the directionality of while matter fibre tracts. The use of DWI outside of the brain remained limited for some time though, mainly due to issues related to motion and fat suppression.

DWIBS was introduced in 2004 by this author and Takahara et al. in a paper demonstrating that it was indeed possible to acquire diffusion weighted data throughout the body, and illustrating the principle with visualisation of lesions throughout the body without the need for administration of contrast agents (and radiation of course). These results came as quite a surprise to many, as it was the common belief that it was impossible to visualise diffusion effects (on the micrometre scale) within bodies moving over centimetres (mainly due to respiration). One of the solutions to this problem was to oversample and add the signal in the image space rather than in the k-space.

The images were clinically useful, but remained affected by inhomogeneity induced artefacts since we were using an EPI read out. The total acquisition time was also relatively long. In this presentation we will introduce recent techniques that address these shortcomings. We will talk about acquisition techniques that overcome the B0 inhomogeneity issue by sampling the data as spin echoes, rather than EPI gradient echoes. We will discuss a technique to correct for motion induced artefacts through adapting the diffusion weighting gradient waveforms. Finally, two approaches will be discussed to speed up the acquisition.

All these new techniques result in a whole body acquisition that is remarkably faster than before, with better fidelity. These technical improvements, together with the various clinical reports establishing the clinical usefulness of the approach especially in oncology, should help with the further penetration of this technique in the clinical environment.

Keywords: Diffusion weighted imaging, Body, Abdomen