ADC Quantification of the Vertebral Bone Marrow Water Component: Removing the Confounding Effect of Residual Fat.

Abstract:
To remove the confounding effect of unsuppressed fat on the imaging-based apparent diffusion coefficient (ADC) of the vertebral bone marrow water component when using spectrally selective fat suppression and to compare and validate the proposed quantification strategy against diffusion-weighted magnetic resonance spectroscopy (DW-MRS). Twelve subjects underwent diffusion-weighted imaging (DWI) and DW-MRS of the vertebral bone marrow. A theoretical model was developed to take into account and correct the effects of residual fat on ADC, incorporating additional measurements for proton density fat fraction (PDFF) and water T2 (T2w). Uncorrected and corrected DWI-based ADC was compared with DW-MRS-based ADC using the Bland-Altman method. There was a systematic bias equal to 0.118 ± 0.116 x 10(-3) mm(2)/s between DWI and DW-MRS when no correction was performed. Taking into account measured PDFF and constant T2w reduced the bias to 0.006 ± 0.128 x 10(-3) mm(2)/s. Using the proposed approach with both individually measured PDFF and T2w reduced both the bias and the limits of agreement between DWI and DW-MRS (0.018 ± 0.065 x 10(-3) mm(2)/s). By taking into account the presence of residual fat in a modified
signal model that incorporates additional individual measurements of PDFF and T2w, good agreement of imaging-based ADC with MRS-based ADC can be achieved in vertebral bone marrow. Magn Reson Med 78:1432-1441, 2017. © 2016 International Society for Magnetic Resonance in Medicine.