Assessment of whole spine vertebral bone marrow fat using chemical shift-encoding based water-fat MRI.

Abstract:
The assessment of bone marrow composition has recently gained significant attention due to its association with bone loss pathophysiology and cancer therapy-induced bone marrow damage. The purpose of our study was to investigate the anatomical variation of the vertebral bone marrow fat using chemical shift-encoding based water-fat MRI and to assess the repeatability of these measurements. Chemical shift-encoding based water-fat MRI of the whole spine was performed in 28 young, healthy subjects (17 males, 11 females, 26 ± 4 years). Six subjects were scanned three times with repositioning to assess the repeatability of these measurements. Proton density fat fraction (PDFF) maps were computed and manually segmented to obtain PDFF of C3-L5. Mean PDFF of all subjects significantly increased from C3 to L5 (P < 0.05) with r = 0.88 (P < 0.05). PDFF averaged over C3-7, T1-6, T7-12, and L1-5 of males and females amounted to 31.7 ± 7.9% and 23.0 ± 7.8% (P = 0.002), 33.8 ± 6.8% and 24.6 ± 8.8% (P = 0.005), 33.8 ± 6.4% and 26.1 ± 6.4% (P = 0.023), and 38.8 ± 7.6% and 31.5 ± 12.4% (P = 0.063), respectively. The repeatability for PDFF measurements expressed as absolute precision error was 1.7% averaged over C3-L5. Whole spine vertebral bone marrow fat could be
reproducibly assessed by using chemical shift-encoding based water-fat MRI and showed anatomical variations.