
Abstract:

The aim of this study was to differentiate normal, hypercellular, and neoplastic bone marrow based on its MR enhancement after intravenous administration of superparamagnetic iron oxides in patients with cancer of the hematopoietic system. Eighteen patients with cancer of the hematopoietic system underwent MRI of the spine before and after infusion of ferumoxides (n=9) and ferumoxtran (n=9) using T1- and T2-weighted turbo spin-echo (TSE) and short tau inversion recovery sequences (STIR). In all patients diffuse or multifocal bone marrow infiltration was suspected, based on iliac crest biopsy and imaging such as conventional radiographs, MRI, and positron emission tomography. In addition, all patients had a therapy-induced normocellular (n=7) or hypercellular (n=11) reconversion of the normal non-neoplastic bone marrow. The MRI data were analyzed by measuring pre- and post-contrast signal intensities (SI) of hematopoietic and neoplastic marrow and by calculating the enhancement as deltaSI(%) data and the tumor-to-bone-marrow contrast as contrast-to-noise ratios (CNR). Changes in bone marrow signal intensity after iron oxide administration were more pronounced on STIR images as compared with T1- and T2-weighted TSE images. The STIR images showed a strong signal decline of normal and hypercellular
marrow 45-60 min after iron oxide infusion, but no or only a minor signal decline of neoplastic bone marrow lesions; thus, deltaSI% data were significantly higher in normal and hypercellular reconverted marrow compared with neoplastic bone marrow lesions (p<0.05). Additionally, the contrast between focal or multifocal neoplastic bone marrow infiltration and normal bone marrow, quantified by CNR data, increased significantly on post-contrast STIR images compared with precontrast images (p<0.05). Superparamagnetic iron oxides are taken up by normal and hypercellular reconverted bone marrow, but not by neoplastic bone marrow lesions, thereby providing significantly different enhancement patterns on T2-weighted MR images; thus, superparamagnetic iron oxides are useful to differentiate normal and neoplastic bone marrow and to increase the bone marrow-to-tumor contrast.