INTRODUCTION

- Diffuse MRI pattern of marrow involvement correlates with poor prognosis in patients with multiple myeloma (MM) both in the conventional chemotherapy and novel agent era.
- Sometimes the differentiation of diffuse from normal MRI marrow involvement in MM patients is difficult, particularly in cases of anemia and low plasma cell marrow infiltration.
- Diffusion-Weighted Imaging (DWI) is an MRI technique based on differences in the diffusivity of water molecules in different tissues. Quantitative analysis of DWI can be achieved by calculating the Apparent Diffusion Coefficient (ADC) values from images with two or more different diffusion weightings.
- There are very limited data in the literature regarding ADC values in MM patients and almost no data regarding ADC values in patients with different MRI patterns of marrow involvement.
- The aim of this study was to calculate and compare ADC values in newly diagnosed patients with MM, in order to identify possible differences among diffuse, focal, and normal MM MRI patterns and to identify a threshold which may distinguish diffuse from normal MRI patterns.

PATIENTS – METHODS

- We evaluated 44 patients with newly diagnosed, untreated, MM and 16 healthy, gender and age-matched controls, with MRI of the lumbar sacral spine, using a 1.5 Tesla unit.
- In MM patients with a normal or a diffuse pattern, as well as in healthy controls, region of interest (ROI) measurements were obtained from each of the five lumbar vertebral bodies avoiding the region of the bavasvertebral vessels and any focal non-myelomatous lesion and the mean ADC value was calculated (figures 1, 2, 3).
- In MM patients with a focal pattern, ROIs were placed on several focal lesions and the highest ADC value was recorded; additionally, ROI was placed on a normal appearing vertebra to record the ADC value of apparently normal marrow (figure 4).

RESULTS

- We performed 1-way analysis of variance (ANOVA) showed a significant difference in ADC values among the study groups (p<0.0001).
- Further analysis using t-test revealed significant differences of ADC values between diffuse and focal MM patterns (p=0.0001), diffuse and normal MM patterns (p=0.0001), focal and normal MM pattern (p=0.0001), diffuse MM pattern and healthy volunteers (p=0.0001), focal MM pattern and healthy volunteers (p=0.0001), diffuse MM pattern and apparently normal marrow in focal MM pattern (p=0.0001) and finally between focal MM pattern and apparently normal marrow in focal MM pattern (p<0.0001).

CONCLUSION

- Normal, focal and diffuse MRI patterns of marrow involvement in multiple myeloma patients have distinct ranges of Apparent Diffusion Coefficient (ADC) values on Diffusion-Weighted Imaging.
- An ADC value above 0.593 x 10^-3 mm²/sec is diagnostic of diffuse myelomatous infiltration of the bone marrow with extremely high accuracy and can be used when a diffuse pattern cannot be readily differentiated from a normal pattern on conventional MRI images.

The authors declare no conflicts of interest for this paper.