AbstractID: 7238 Title: MRI and MRS Assessment of Bone Marrow Cellularity

Purpose:
Bone marrow cellularity is an important parameter in the diagnosis and treatment of bone marrow disease, as disease affects marrow cellularity and marrow adipocyte concentration significantly alters beta- or alpha-particle energy deposition from radiopharmaceuticals to radiosensitive hematopoietic cells. The current "gold standard" for the assessment of cellularity is the histological analysis of painful bone marrow biopsies of the iliac crest. There have been a few limited attempts to quantify cellularity non-invasively by MR Chemical Shift Imaging (CSI), but the accuracy of this technique has never been validated. Here we demonstrate a method to correlate *ex-vivo* CSI cellularity values to the results obtained by standard histological methods, using stereotactic image co-registration.

Method and Materials:
Cellularity phantoms were created by preparing a series of lipid/water emulsions in which the water fractions (WFs) ranged from 0% to 100%, and were precisely known *a priori.* WFs were then measured in each phantom by CSI using a Phillips 3T horizontal bore scanner. Following this, tubular Silicon fiducials were inserted into the spongiosa of an excised canine limb using a Teflon template guide. *Ex-vivo* cellularity measurements were obtained by 3T-CSI within the fiducial region, and then bone cores were extracted with the fiducial systems intact for subsequent histological analysis and digital microscopy imaging using standard protocols. The accuracy of the CSI cellularity was then evaluated by co-registration of the MR spectroscopy to the histological 'gold-standard'.

Results and Conclusions:
Here we demonstrate a novel technique to co-register NMR Spectroscopy with standard digital imaging methods, in phantoms and histological specimens in which the lipid to water fraction is precisely quantifiable. Further studies are suggested, but these results imply that it may be possible to accurately sample bone marrow cellularity in both healthy and diseased individuals, for improved prognostic outcome in the treatment of metastatic bone disease.