AbstractID: 13373 Title: Study On MRI Image Distortions Caused By Leksell Gamma Knife Stereotactic Localization Box

Purpose: Study if the Gamma-Knife stereotactic frame can cause image distortions due to chemical shifts at material interfaces and magnetic susceptibility differences of the fiducials and the studied objects as observed with BANG gel dosimeter studies.

Method and Materials:

A phantom was constructed using one side of the Gamma-Knife localization box. Several representative materials were fixed to the frame; these include fish oil, grapes and a potato wedge. The phantom was put inside a head coil and adjusted so the diagonal fiducial sat in the horizontal plane.

The MRI was done using Philips 1.5T Intera system. Five overlapped slices with thickness of 5 mm and spacing of 3 mm were obtained using the T1-weighted spin echo (SE) with TR=100 ms, TE=15 ms, Nex=2. FOV was 140 mm x 140 mm and acquisition matrix was 512 (frequency encoding steps) x 435 (phase encoding steps) using the SENSE-head coil, which was later reconstructed into a 512x512 grids with in-plane resolution of 0.273 mm x 0.273 mm. The receiver bandwidth per pixel was set to 93.9 Hz, which corresponds to 0.631 mm for the fat-water chemical shift of 3.4 ppm. The frequency encoding direction was alternated in opposite directions for a pair of scans so that the pixel displacement caused by chemical shift and susceptibly difference, if any, can be doubled when subtracted.

Results:

The chemical shifts of fat-water (fish oil) were clearly observed in the image while there were no shifts in grapes or potato wedge. The fiducial markers showed about one pixel size shift in the plane, which is ~ 0.27 mm. Considering the FE direction was switched in two images, the fiducial marker shifts in one image was ~0.13 mm from its true position.

Conclusion:

The fiducials in Gamma-knife localization box did no have any significant shifts in MRI image.