AbstractID: 8796 Title: Design of Magnetic Resonance Imaging protocol for Accelerated Partial Breast Irradiation in prone position

Purpose: Accurate delineation of tumor bed is prerequisite for an effective treatment of breast cancer with accelerated partial breast irradiation (APBI) technique. Magnetic resonance imaging (MRI) has high contrast mechanisms that could enable precise contouring of the lumpectomy cavity. We investigated practical issues pertinent to MR-guided breast radiation therapy using customized pulse sequences. **Method and Materials:** Unilateral breast MR images were obtained from two healthy volunteers in prone position on a dedicated coil. Radiation therapists positioned the volunteers in reproducible setup using a waterproof marker. We acquired 6-min 3D MR images to analyze setup uncertainty and fast 2D MR images of 0.5-s temporal resolution to detect respiratory motion. An accurate 3D warping-correction algorithm was evaluated and used to restore spatial fidelity from geometric distortions due to MR gradient non-linearities. MR images of surgical clips as fiducial were obtained using pulse sequences designed to provide high signal from lumpectomy cavity. **Results:** Average breathing motion in the breast was found to be less than 0.5 mm in prone position. Setup deviations of 1 cm were observed between series of intended prone positioning. Rigid image registration based on local anatomy structure resulted in a residual error which was up to 5 mm at the peripheral region of the breast. Gradient-induced non-linearity led to 1 cm distortion in the uncorrected phantom image at the region 15 cm away from the main magnet axis. The 3D correction algorithm reduced the deviation to < 1 mm. We observed 4 mm signal void artifacts of surgical clips. **Conclusion:** We obtained MR images of suitable quality from volunteers using pulse sequences customized for lumpectomy site identification. MR-guided APBI in prone position would require 5 mm uniform expansion of clinical target volume with the employment of an appropriate on-board imaging technique.