

AbstractID: 3043 Title: Investigation of MR Image Distortion for Radiotherapy Treatment Planning of Prostate Cancer

Purpose:

To implement MRI based treatment planning clinically for prostate cancer, the machine generated geometrical distortions on MR images must be investigated to ensure the accuracy of dose calculation and treatment delivery.

Method and Materials:

The MR system used for this study was a 0.23 Tesla open scanner (Philips Medical System, Cleveland, OH) operating clinically as an MR simulator. Based on the fact that there was no observable patient induced MR image artifact with 0.2 T low magnetic fields, the patient induced geometrical distortions were negligible for our MR unit and the machine induced geometrical distortions could be detected, studied and corrected accurately. A distortion evaluation phantom (F18) was employed to measure the distortions after a gradient distortion correction (GDC) software was installed to post-process the images and a point-by-point correction method was then developed to remove the residual distortion based on precise measurements.

Results:

With our routine clinical 3-dimensional fast spin echo sequences, our work shows that there are no patient induced distortions detected and the machine specific geometrical distortions can be quantified and corrected first by the GDC post-processing software and then by the point by point correction technique. The residual distortions after the corrections are reduced from the original > 2 cm to < 3 mm in the external contour determination for patients with large lateral dimensions. An effective FOV has been established, which can be used clinically to set up patient selection criteria for MR based treatment planning.

Conclusion:

MR geometrical distortions on MR scanners can be corrected and, with the GDC post-processing and our point by point correction technique, 2% to 5% improvement in dose accuracy can be expected in the treatment planning for prostate cancer.