Conclusions: SBT for localized recurrent adenocarcinoma is a successful treatment option. Accounting for volume reduction between the prostate size at t_0 and SBT is important. VCF and the imaging deformation tool assist in acquiring the needed information for evaluation of treatment options for patients presenting without initial imaging studies.

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2337 Intraoperative Dosimetry using Registered Ultrasound and Fluoroscopy during Prostate Brachytherapy: Comparison with Real-time Method using CT as a Standard

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Purpose/Objective(s): The ability to more accurately determine dosimetry intraoperatively during permanent prostate brachytherapy may assist clinicians in improving dosimetric and clinical results. Our purpose was to compare a novel system of registered ultrasound and fluoroscopy (RUF) with the current method of ultrasound (US) based seed localization (a.k.a. real time) for intraoperatively predicting dosimetry, using post-implant CT as a standard.

Materials/Methods: Six patients underwent implantation using real time method where seed positions are identified by visualizing needle tip or seed on US during placement. In addition, seed positions were separately determined using RUF. RUF requires modest alterations to a standard brachytherapy setup, utilizing a non-invasive, radio-opaque fiducial for registration to US coordinate system as well as 3D reconstruction of seeds relative to prostate using non-isocentric C-arm fluoroscopy. Four non-coplanar X-rays are acquired for reconstruction; 3D coordinates of segmented seeds are calculated upon resolving correspondence of seeds in images, by formalizing seed-matching as a network-flow problem. Calculated seed positions are imported into the treatment planning software, allowing visualization of dose intraoperatively. Post-implant CT was performed on day of implantation, with indwelling catheter for identification of urethra. Comparisons of dosimetry among the 3 methods were performed using generalized estimating equation approach, where correlated measurements within same subject were accounted for by assuming an exchangeable correlation structure. Prostate V200, V150, V100, D90, D80 and urethra D5, D30 were assessed. The squared difference between dosimetric parameters for real time vs. CT and RUF vs. CT was calculated for each patient, and mean squared differences and 95% confidence intervals evaluated. A paired t test was used to evaluate which method (real or RUF) was more closely aligned with CT dosimetry.

Results: For 41 of 42 measurements, RUF values were either equally or more closely correlated with CT than real time values. Real-time method showed statistically significant variation from CT for 6/7 parameters (mean ratios 1.0-1.5 for all 7 parameters), whereas RUF showed statistically significant variation from CT for 1/7 parameters (mean ratios 1.0-1.1 for all 7 parameters). Mean squared differences between RUF vs. CT and real-time vs. CT were significantly greater for real-time in 5/7 parameters (prostate V150, V200, D80, D90, and urethra D30).

Conclusions: RUF-based intraoperative dosimetric predictions were more closely correlated with post-implant CT dosimetric values than those derived using a real-time US-based method.

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2338 How Soon after Fiducial Marker Implantation Should Patients Have Their Planning CT Scan Done for Prostate Cancer Radiotherapy?

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Purpose/Objective(s): To assess the impact of intraprostatic fiducial marker (FM) migration in patients with planning computed tomography (CT) scan scheduled the same day as FM implantation versus several days later.

Materials/Methods: A total of 31 patients with localized prostate adenocarcinoma were considered for this study. Twenty-three patients had their planning CT done the same day as FM implantation and the remainder between 1 and 34 days after implantation (median of 5 days). On each treatment day, the FM positions are identified with two orthogonal 2-D projections using kV on-board imaging (OBI, Varian Medical Systems). For this study, the 3-D position of each FM was established using an in-house reconstruction algorithm on the projection images. To carry out the match, the positions were overlaid on the digitally-reconstructed radiographs (DRR) generated from the planning CT. The distance between each FM and the centre of mass (COM) of the 3-4 implanted FMs was calculated for the first five treatments as well as for the middle and last treatments. In addition, four radiation therapists were asked to independently perform the match from OBI to DRR in all seven evaluated treatments and retrospectively rate the match from very easy to very difficult. Mann-Whitney and Fisher's Exact Test was used to compare the match between patients where planning CT was on the same day as or several days later than FM implantation. Spearman's coefficients were computed to assess for each patient the correlation between the rating of the match by all 4 radiotherapists and FM migration.

Results: We did not observe a significantly larger FM migration among patients where planning CT was the same day as FM implantation versus those done later ($p = 0.024$). Twenty-three % of patients who had their planning CT the same day as FM implantation were found to have at least one difficult match by at least two radiation therapists. However, none of the matches were found to be difficult in patients who had their planning CT later than the day of FM implantation (Fisher's Exact Test, $p = 0.093$). The difficulty of the match was correlated to the extent of FM migration ($p<0.001$). The match was easier for patients weighing less than the median weight of 78 kg ($p = 0.049$) or with prostates smaller than the median volume of 44.5cc ($p = 0.124$).