

AbstractID: 13421 Title: On-line CT verification of needle applicator positions in HDR prostate brachytherapy

Purpose: Needle applicators have shown displacement between fractions during HDR prostate brachytherapy, which will degrade plan quality. Typically, displacement is determined by analyzing catheters on a verification CT (vCT) or port films obtained before treatment relative to fiducials or bony landmarks. We present a procedure to verify applicator positions to achieve planned dose distributions by registering vCT directly to planning CTs (pCT).

Method and Materials: Patients received a vCT prior to each fraction. This was imported to BrachyVision (Varian Medical Systems) and fused to the pCT by rigid-body registration based on matching urethra and three prostate-implanted gold fiducials. Then, applicators in the vCT were compared to applicators in the pCT in a reconstructed plane through each catheter and any difference larger than 3mm was manually adjusted by a radiation oncologist before treatment. To assess treatment quality, the prostate volume was copied from pCT to vCT and the planned dwell positions/time was applied to the vCT applicators.

Results: Two consecutive patients were treated using our CT registration needle verification method. Both patients required applicator adjustments in the first two fractions. Patient one had an average 7mm cranial-to-caudal applicator displacement, corresponding to 23% and 12% fractional drop in $V100_{\text{prostate}}$ respectively; Patient two had displacement in both cranial-to-caudal and caudal-to-cranial directions up to 9mm, but due to minimum loading of affected applicators, no significant decrease in $V100_{\text{prostate}}$ was seen. Neither patient required applicator adjustment at the 3rd/last fraction. Despite differences in applicator displacement, post-adjustment, the achieved $V100_{\text{prostate}}$ at each fraction deviated from planned value by less than 4% for both patients. The distances between fiducials in vCTs were consistent with those in pCTs within 3mm, confirming that fiducials are appropriate landmarks for registration.

Conclusion: We have successfully treated two patients using this method. This technique ensures the treatment quality closely matches plan quality.