AbstractID: 13690 Title: The Impact of Source Dwell Position Uncertainty on CT-based Brachytherapy Plan for Cervical Cancer

Purpose:
In CT based high dose rate (HDR) brachytherapy, the longitudinal catheter tip position can be easily mis-localized because of several reasons. These include the coarse image scanning thickness, artifact of applicators, use of ovoids shield and digitizing uncertainty during planning. With the use of anatomic structures of planning CT, this project investigates the 3D dosimetric impact when source dwell positions deviate from the true positions.

Method and Materials:
Five cervical cancer patients treated with intracavity HDR brachytherapy using tandem and ovoids applicators were included in this study. For each patient, we acquired CT and made clinic plan based on ICRU 38 protocol. Retrospectively, we contoured the bladder and rectum wall and replaned patients considering the scenarios of source positions shifted 5mm. For each patient we compared five plans: original clinical plan, seed positions of all three applicators shifted forward or backward and seed positions of two ovoids shifted forward or backward. Seven dosimetric endpoints are used in comparisons and they are total treatment time, ICRU bladder/rectum point dose, and 1cc/5cc bladder/rectum maximal dose.

Results:
The DVHs of two forward plans, all shifted or only ovoids shifted, show similar trends. Similar result was observed from two backward shifted plans. Forward shifted and backward shifted plans deviate from the original plan, but in opposite way, and the direction of deviation is structure dependent. For 1cc bladder wall maximum dose, the mean of forward plans is -3.9±3.0% and backward plans is 5.7±4.6% different from the original plan. For 1cc rectum wall maximum dose, the mean of forward plans is 14.6±6.3% and backward plans is -6.3±3.2% different from the original plan.

Conclusion:
Source position accuracy is a critical factor for the high quality of brachytherapy treatment planning. A 5mm discrepancy could have great impact on the dosimetric endpoints of normal structures.