

AbstractID: 13826 Title: On the Dosimetric Impact of Dose Sculpting Optimization in High Resolution (3.0 Tesla) MRI-Guided HDR Brachytherapy for GYN Cancer: When are the Benefits Maximized?

Purpose: To quantify the impact of volume optimization (OPT), when utilizing tandem and ovoid applicators in high resolution (3.0 Tesla) MRI for different high risk (HR)-CTV sizes.

Materials and Methods: The IR (intermediate)- and, HR-CTV and organs-at-risk (OAR; rectum, bladder, and sigmoid) were delineated for 25 HDR plans of six patients with FIGO stage Ib1-IV cervical cancer. A conventional plan was re-optimized using Dose-Sculpting OPT where the D90 (HR-CTV) was optimized to receive the prescription dose (Rx). Three subgroups were categorized according to HR-CTV volumes; Non-Bulky (< 20 cc), Low-Bulky, and Bulky (≥ 40 cc). The differences in D90 (HR-CTV), normalized to Rx, were quantified, while D2cc of the OAR, normalized to the dose limits. The values of D100 (HR-CTV), and D90 (IR-CTV), normalized to Rx, were quantified while the values of ICRU rectum and bladder point doses, normalized to their D2cc values.

Results: For the Non-Bulky group, Dose-Sculpting OPT maximized the sparing without compromising the D90 (HR-CTV). The D2cc were reduced on average $-21 \pm 20\%$, $-17 \pm 8\%$, and $-20 \pm 11\%$ for rectum, the bladder, and the sigmoid while the difference in D90 (HR-CTV) was on average $-0.3 \pm 1\%$. The differences of D90 were improved on average $+13 \pm 11\%$ in the Bulky group, but only from 64% to 77%, showing that even Dose-Sculpting OPT is limited in improving tumor coverage in the Bulky group. In the Low-Bulky group, on average $+6 \pm 4\%$ were found in D90, from 89% to 95%. However, the sigmoid sparing was improved on average $-18 \pm 14\%$ for all. The doses at Point A were 78% (Non-Bulky), 105% (Low-Bulky), and 120% (Bulky) of Rx.

Conclusion: Utilizing Dose-Sculpting OPT, OAR sparing was significantly improved for small HR-CTV without compromising HR-CTV coverage. The sigmoid sparing was significantly improved for all HR-CTV sizes.