

## AbstractID: 2649 Title: The optimization of dose delivery for intraoperative high-dose-rate radiation therapy using curved HAM applicators

**Purpose:** To quantify the effect of the curvature of flexible applicators on the dose distribution in high-dose-rate intraoperative radiation therapy (HDR-IORT).

**Method and Materials:** Treatment planning was performed with flat Harrison-Anderson-Mick applicators using  $^{192}\text{Ir}$  as the radioactive source, and dwell times were optimized using dose-point optimization techniques. These optimized dwell times were then used for the curved applicators, and the dose distributions that would actually be delivered to patients were determined. Shallow, moderate, and steep curvatures were considered. The discrepancies in dose distribution resulting from the applicator's curvature were quantified, and the regions receiving significant underdoses or overdoses were identified.

**Results:** The dose directly below the central catheter was strongly dependent on the curvature of the applicator. Steep parabolic curves caused underdoses as large as 19% at the prescribed depth of 1 cm normal to the convex side of the applicator surface. The rate of dose reduction with increasing distance from the applicator surface was also greatly affected by applicator curvature. The local dose distribution was not greatly affected by the number of catheters. On the concave side of the applicator, curvature pushed the isodose curves from the applicator surface, causing overdosing. Data from these experiments could be used to create a simple library of treatment plans for curved geometries to complement existing libraries for flat applicators.

**Conclusion:** The curvature of the applicator profoundly affects dosimetry and can be exploited to optimize coverage of the target during HDR-IORT procedures. To ensure accurate dose delivery, these dose perturbations must be accounted for in the planning process. We recommend maintaining a dosimetry atlas of various applicator sizes and curvatures in addition to one for flat applicators.