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Off label Disclosure: I will not discuss or describe during my presentation at the above CME program a use of a medical device or pharmaceutical that is classified by the Food and Drug Administration (FDA) as investigational for the intended use. I will not discuss or describe during my presentation at the above CME program use of a medical device or pharmaceutical that is "off-label", e.g., a use not described on the product's label. I will specifically disclose that the FDA has not cleared the device or pharmaceutical for the specific "off-label" use.

Award: I would not like to be considered for a resident travel award.

Title: BREAST BRACHYTHERAPY USING THE ACCUBOOST SYSTEM: DOSIMETRY CONSIDERATIONS FOR TANGENTIAL IRRADIATION USING HDR 192Ir

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Purpose: The AccuBoost peripheral breast brachytherapy system has dedicated imaging equipment providing IGRT capability not available in other treatment modalities. Assessment of realistic patient setup situations was performed to quantify dosimetric differences with conventional treatment planning systems. Two major areas related to breast dosimetry were analyzed: a) instances where the applicator inside edge did not entirely cover the breast surface (i.e., flash); and b) practical dose calculation and delivery.

M&M: The HDR 192Ir source and the AccuBoost applicators (4-8 cm inner diameters) were simulated using Monte Carlo (MC) methods (MCNP5). Dose was calculated in three dimensions using 1 mm resolution. Compressed breasts (3-8 cm thick) were simulated with complete applicator coverage or with flash. Further, a polystyrene phantom was simulated for direct comparison to experimental measurements performed using a parallel plate (Markus, PTW N23343) and Farmer (PTW N23333) ionization chambers. The AAPM TG-21 methodology was used to convert integrated charge to absorbed dose in either breast or polystyrene. MC results were normalized to measurements for complementary applicator:phantom geometries to determine MC dose distributions in compressed breast. MC results for varying breast thickness were readily approximated as the dose distribution for the largest breast thickness. These results were fitted to polynomial functions and reduced to a simple spreadsheet for clinical treatment planning. Unlike conventional brachytherapy treatment planning systems, this approach accounts for material heterogeneities and applicator collimation.

Results: Compared to the uniform slab model of a compressed breast, simulations of the applicator having substantial flash generally perturbed the breast dose by < 5%, with slight underdosing near the chest wall for a 6 cm applicator and 8 cm thick breast. This effect became less significant as applicator diameter and breast thickness decreased, and was not deemed clinically significant given dose uncertainties in breast brachytherapy. Comparison of predicted dose using the spreadsheet to measured dose for different HDR 192Ir sources and geometries showed agreement typically within 2%.

Conclusion: Conformity and dose distributions for the AccuBoost applicators did not significantly change upon inclusion of flash in the treatment field. A spreadsheet-based means of calculating treatment parameters for AccuBoost delivery has been validated using measurements and MC simulations.