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### **Dose Measurements in the Post-Mastectomy Irradiation Of a Patient With a Gas-Based Tissue Expander**

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#### *Abstract:*

#### Purpose/Objective(s):

Every year, an estimated 90,000 women with breast cancer undergo mastectomy with reconstructions incorporating tissue expanders. Saline-based expanders often require multiple office visits, percutaneous needle injections, and several months for full expansion. A new gas-based tissue expander offers needle free and patient controlled expansion often reaching full size in less time than saline-based technology. This study was designed to investigate the dosimetric consequences of the expander's large, gas-filled compartment within the treatment volume.

#### Materials/Methods:

Skin dose was measured from a patient receiving radiation therapy after mastectomy, placement of a gas-filled tissue expander, and initial expansion. The dosimetry plan was based on CT-simulation-acquired tissue inhomogeneities and consisted of "field-in-field" (MLC-compensated) tangential fields with and without bolus prescribed to 1.8 Gy x 28 treatments. The chest wall target volume, the gas cavity, and the expander's metallic component were contoured. During the treatment course, four measurements were done without bolus and five with bolus. For each measurement, seven 3x3x1 mm<sup>3</sup> TLD chips were placed: one on each of 4 quadrants of the reconstructed breast and 3 along the inframammary (IM) fold. The non-bolus measurements were compared to identically acquired TLD measurements from a cohort of 35 non-mastectomy patients receiving conventional radiotherapy.

#### Results:

Regions of interest volumes: chest wall target volume 1107 cc, gas-filled cavity 406 cc, and metallic component 19.7 cc. For the daily prescribed dose of 1.8 Gy, the Dmax was 118% with the inhomogeneity applied and 116% if assigning tissue equivalence to the gas cavity. The average skin dose with the gas-based tissue expander by TLD location (in Gy): UIQ 1.583 UOQ 1.582, LIQ 1.59, LOQ 1.59, IM lat 1.668, IM center 1.74, IM med 1.68. For the no-gas cohort (in Gy): UIQ 1.41, UOQ 1.73, LIQ 1.48, LOQ 1.81, IM lat 1.73, IM center 1.68 IM med 1.59. The difference for each quadrant expressed as a percentage difference from the non-gas measurements (%): UIQ -12, UOQ +8.5, LIQ +12, LOQ +1, IM lat +4, IM center -4, IM med -6.

#### Conclusions:

Despite the presence of the large, gas-filled compartment within the target volume (37% by volume), measured skin doses varied only from -12 to +12% from measurements in pts comparably treated without a gas-filled expander (p >.6). CT based optimization can reduce dose variation to clinically acceptable limits when treating pts

with the gas-based expanding devices. Further work remains to quantitate and to suggest strategies to optimize dosimetry recognizing the dosimetric properties of the new gas-based reconstructive technologies.

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