Purpose:

To present clinical implementation and quality assurance for a new HDR applicator of Strut-Adjusted Volume Implant (SAVI) for partial breast irradiation and the higher-order DVH examined.

Methods:

The SAVI applicator with multi-peripheral struts can be differentially loaded with the HDR source for a conformal dose distribution to the lumpectomy cavity. The treatment plan is evaluated by a dose volume histogram (DVH) as follows: V90 > 90%, V150 < 50 cc, and V200 < 20 cc. A higher-order DVH which may reflect radiation-induced toxicity, such as V300, was studied. The SAVI device status was verified by the 3D CT images and image fusion. Tissue invagination was investigated using an ion chamber and film with the cavity filled with air and water merged into a water phantom.

Results:

Twenty-nine patients to date at Mercy Medical Center, Baltimore, Maryland were treated with SAVI device. The dosimetric data demonstrated the achievements of greater than 90% coverage for V90 at 96.8% and 94.1% for V95 while keeping a low V150 at 33.9 cc and V200 at 16.5 cc. V300 was found to be 2.7 cc in average. Potential uncertainties introduced by the SAVI applicator motion were a 3% variation in dose caused either by a 3-mm translation or a rotation of 3 degree.

Conclusions:

Multiple catheters of the SAVI applicator allows for optimal and conformal dose distribution around a lumpectomy cavity while minimizing the dose to adjacent normal structures such as skin and ribcage. Multiple imaging techniques are capable to verify cavity variation, strut collapse or relative motion, and device shift. A nearly fully loaded dwell source position produced the discrepancy of less than 3% and allow for optimal and conformal dose distribution to a lumpectomy cavity. Advantages of the SAVI applicator have been shown in treating breast cancer with the shallower, elliptical, and asymmetric cavity.