Clinical experience with a miniature strut-based APBI device: a retrospective 5year single-institution comprehensive study

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PURPOSE

Accelerated partial breast irradiation (APBI) is a popular treatment option for early stage breast cancer, and was increasingly favored at our practice for patients with reduced breast size and/or where higher adaptability to anatomical constraints was anticipated. The applicator studied (Cianna Medical, Aliso Viejo, CA), is the smallest of the strut-based type applicators (SAVI6-1mini), with six peripheral struts that can expand around a central lumen (Fig.1).

RESULTS

An example of the 3-D dose distribution, demonstrating both the PTV_EVAL coverage and the skin or the chestwall sparing, is displayed below, for the SAVI 6-1mini device (Fig.2).

METHODOLOGY

Patients included in this study: n=121

Dosimetric coverage criteria: V0=94%, V10=50cc, V20=20 cc.

Additional constraints are placed to try limiting the chestwall and skin doses to 100%. The dosimetric parameters studied for each applicator size include:
- cavity, PTV (1.0 cm expansion from SAVI cavity) and PTV_EVAL (PTV limited by CW and 5 mm inside skin surface) volumes;
- V90, V95, V100, V105, V120 (cc);
- skin bridge (SB) (minimum distance from the lumpectomy cavity wall to the skin);
- chest wall bridge (CWB) (minimum distance of the chest-wall from the lumpectomy cavity wall);
- maximum doses to skin and chest wall;

All implants were planned and dosimetrically evaluated using BrachyVision (Varian Medical Systems) using conventional TG43 homogenous dose calculation formalism.

SUMMARY of RESULTS across the entire cohort of patients:

Lumpectomy cavity volumes averaged 8.4 ± 3.6cc.

PTV_EVAL and PTV volumes averaged 44.7±7.9cc and 49.9±3.4cc, respectively.

V90 values averaged 98.8±1.7% of the PTV_EVAL volume.

V95 averaged 97.8±2.2% and V100 averaged 95.3±4.8%.

V150 averaged 25.0±4.3cc while V200 averaged 14.7±2.4cc.

PTV reduction mounted up to 36.0±12.0% for the cases where the skin bridge was < 5mm, especially where combined with reduced CW bridges. This can result in dramatic drops of the CI (conformity index) values for PTV_EVAL, where air/seroma are present, down to 61.1%. Though, across the entire cohort, CI (conformity index) values averaged 96.6±5.7%.

Skin and CW sculpting of PTV is always employed when creating PTV_EVAL structures (see Fig.3). The PTV volume reduction (PTV-VR) averaged 11.0±14.0%, with min and max values of 0.0% (no reduction) and 59.0% (when both SB and CWB were < 5mm) respectively.

All patients were included in the study: 16 patients had a skin bridge of less than 5 mm (see above table). For these patients, the maximum skin dose (n=16) was 96.3%. Mean ± standard deviation 49.9±2.5 Gy.

CONCLUSIONS

The SAVI6-1mini strut-based device proves to be a highly adaptable and versatile APBI solution for patients with reduced breast and lumpectomy cavity volumes, and skin and/or rib bridges. Inside the framework of a detailed and clear QA program, when it is appropriately elected as the APBI device of choice, optimally implanted, and comprehensively monitored during the course of treatment, this device indeed offers a very effective and highly reproducible tool for the treatment of complex breast cancer cases.

Fig. 1 – SAVI 6-1mini applicator

Fig. 2 – The dose cloud for a SAVI 6-1mini strut-based device (the smallest)

Fig. 3 – PTV to PTV_EVAL reduction, when Min CWB was < 5mm.