Planning Treatment Volumes Irradiated in Accelerated Partial Breast Irradiation (APBI): Comparison Among Devices.

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INTRODUCTION

Single entry brachytherapy catheters target 1 cm of tissue surrounding the surgical tumorbed. Published studies claim that with tissue stretching, an equivalent of ≥ 1.5 cm of tissue is actually treated by the MammoSite device, more closely approximating the gold standard interstitial brachytherapy. Newer brachytherapy catheters have been introduced, and it is unclear if the treated tissue is identical to the tissue in the MammoSite studies. This study evaluated the ideal and published irradiation treatment volumes of the three most commonly used intracavitary devices; the Strut Adjusted Volume Implant (SAVI), the Contura, and the MammoSite. If the treated volumes of the devices match the volumes of the MammoSite, it stands to reason that an equivalent amount of tissue is irradiated.

Figure 1. Expanded SAVI Device

Device	Ideal Volume	Treated Volume (range)
SAVI 6-1	60 cc	56.15 cc (23.2-97.9 cc)
SAVI 8-1	75 cc	78.25 cc (33.7-138.9 cc)
SAVI 10-1	110 cc	113.83 cc (62-212.9 cc)
MammoSite balloon 4 cm, 5 cm	80 cc, 114 cc	95 cc (74-120 cc)
Contura balloon 4 cm, 5 cm	80 cc, 114 cc	83.8 cc (40.2-143.7 cc)

Table 1. Treatment Volume Comparisons

Methods

The ideal treatment volumes were calculated mathematically from the geometry of the devices by mathematical expansion 1 cm from the edge of the expanded catheters. The PTV-EVAL of the device is the clinical PTV. It is a 1 cm expansion from the cavity edge minus the chest wall, and a 5mm skin bridge (so is often smaller than the geometric expansion). The PTV-EVAL represents the tissue targeted to receive at least 90% of the target dose. The treatment volumes (PTV-EVAL) of the first 121 patients treated with the SAVI were cataloged by device size and compared to the published treatment volumes of the MammoSite and Contura.

Results

Ideal volumes for each device (PTV-EVAL not trimmed to avoid normal tissue) are approximately 60, 75, 110 cc each for the 6-1, 8-1, and 10-1 SAVI. Ideal volumes for the Contura and MammoSite are 80 and 114 cc for the 4 cm and 5 cm balloons, respectively. A total of 60 6-1 devices, 40 8-1 devices and 21 10-1 devices had data available for analysis. PTV-EVAL volume treated medians and ranges are presented in Table 1 with published treatment volumes for the Contura and MammoSite balloons.

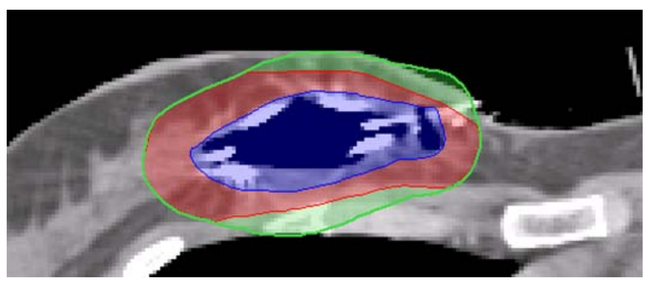

Figure 2. SAVI with initial PTV (green) and PTV-Eval (red) trimmed for skin and chestwall

Conclusion

The SAVI 8-1 and 10-1 device treat an equivalent tissue volume to the Contura and MammoSite, and by the same tissue stretching logic, should treat more than the 1 cm targeted during planning. The 6-1 device treats smaller tissue volumes, but is generally used when avoidance of normal tissue is the most critical. At one of the participating institutions, 86% of the patients implanted with the smaller devices had substantial trimming of the PTV-EVALs for normal tissue avoidance. Maximizing the size of the implanted SAVI increases the treated volume of tissue.

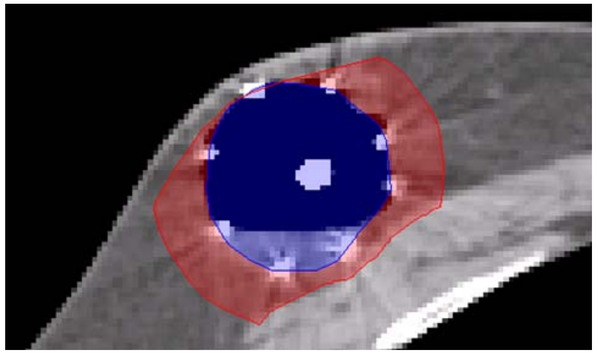

Figure 3. SAVI 8-1 with PTV-EVAL trimmed for normal tissue avoidance.

References

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