Three-Year Outcomes Following Five-Fraction SBRT for APBI in Early-Stage Breast Cancer: Cosmesis, Functional Status, and Local Control

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Background

- APBI offers women with early-stage breast cancer a shorter alternative to whole-breast irradiation with comparable tumor control.
- Cosmetic outcomes vary depending on the radiation technique used.
- SBRT provides highly conformal dose delivery with tight margins, potentially improving cosmesis by sparing healthy breast tissue.
- Our prospective study evaluates long-term outcomes after a five-fraction SBRT APBI regimen, focusing on cosmesis, functional status, toxicity, and local-regional control.

Methods

Patients & Treatment

- 23 women with early-stage breast cancer (24 total plans) received SBRT-based APBI: 30 Gy in 5 consecutive daily fractions.
- A bioabsorbable 3D tissue marker (BioZorb™) was placed at lumpectomy to assist surgical cavity visualization.

Target Volumes

- CTV: lumpectomy cavity + 1-cm margin
- PTV: CTV + 3 mm; constrained to ≤124 cc to reduce fat necrosis risk
- Median PTV volume: 76.0 cm³ (range 50.3–211.7 cm³)

Treatment Delivery

- Delivered on Varian Edge using 10-MV flattening-filter-free beams, VMAT planning, and daily CBCT.
- Patients treated supine or prone based on anatomy.
- Two patients had non-clinical treatment delays, completing therapy over 9 and 11 days.

Assessments

- **Cosmesis:** patient- and nurse-reported (4-point scale)
- **Functional status:** Zubrod
- **Toxicity:** CTCAE
- **Imaging:** mammography, ultrasound, and/or MRI with BI-RADS
- Evaluations performed from baseline through 36 months.

Results

Table 1. Baseline Patient and Treatment Characteristics

All patients met ASTRO 'suitable' APBI criteria and were postmenopausal, node-negative, and ER-positive

Characteristic	Value
Age	Median 62 (50–76)
Age ≥50	100 percent
Race/Ethnicity	87 percent White, 12.5 percent African American
ER Status	100 percent ER positive
Nodal Status	All node-negative
Tumor Stage	Nearly all T1N0 (≤2.0 cm)
Tumor Size	3–20 mm (median ~10 mm)
Margins	All ≥2 mm
Histology	IDC predominant; some DCIS, tubular, mixed ductal/lobular
Special note	1 bilateral case (24 treated breasts)

- **Cohort and follow-up:** Twenty-three patients (24 treated breasts) completed SBRT APBI (Table 1); 20 of 23 individuals (21 of 24 treated breasts) remained on protocol at 36 months.
- **Local control:** No in-breast recurrences were observed; two regional nodal events occurred at 6 and 18 months.
- **Functional status:** Zubrod 0 was maintained in 100 percent of patients through 6 months and 90–95 percent thereafter; only 1–2 patients per interval had Zubrod >0.
- **Target volume definition:** Standard SBRT APBI contouring with GTV-to-CTV expansion of +1 cm and CTV-to-PTV expansion of +3 mm produced planning target volumes within clinically acceptable ranges. Most PTVs were below the 124 cc size threshold previously associated with increased fat-necrosis risk in APBI literature (Figure 2).
- **Cosmesis:** Excellent or good cosmesis was reported in 75–85 percent of patients at all timepoints, with poor cosmesis uncommon (≤1–3 patients).
- **Transitions:** Sankey diagrams demonstrated high cosmetic stability with minimal downward shifts (Figures 3–4).
- **Toxicity:** Predominantly Grade 1 events (n = 157); few Grade 2; no irreversible Grade ≥3 acute toxicity.
- **Cosmetic-impacting effects:** Erythema, pigment change, mild retraction, and volume shifts were infrequent and transient.

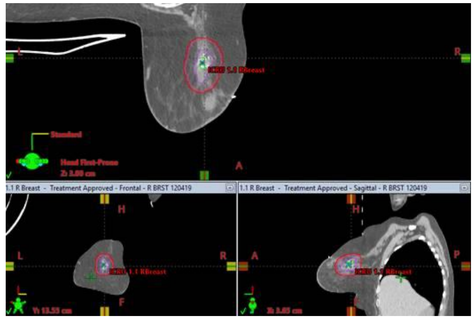


Figure 1. Representative treatment planning images illustrating GTV, CTV, and PTV contours used for SBRT APBI volume generation.

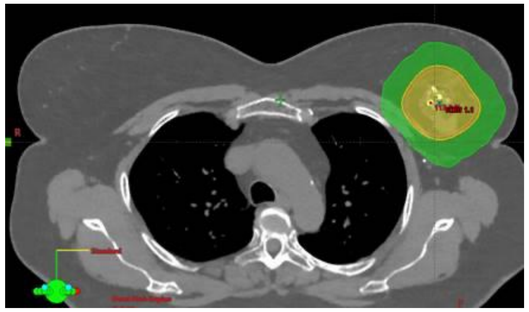


Figure 2. Axial CT demonstrating the lumpectomy cavity with the 100 percent isodose (yellow) and 50 percent isodose (green) dose clouds during SBRT APBI planning.

Patient-Scored Cosmesis Transitions

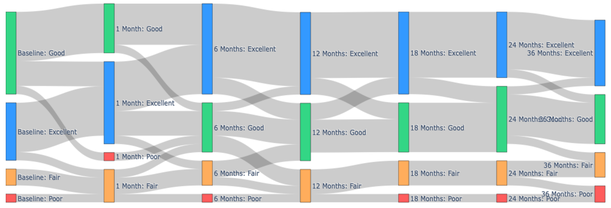


Figure 3. Patient-reported cosmesis transitions from baseline through 36 months, demonstrating high stability with most breasts remaining in excellent or good categories.

Nurse-Scored Cosmesis Transitions

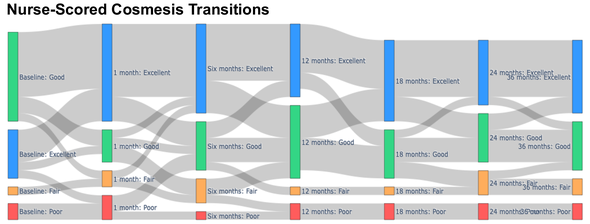


Figure 4. Nurse-reported cosmesis transitions showing similarly stable cosmetic outcomes with minimal shifts into poorer categories over time.

Discussion

- Five-fraction SBRT APBI demonstrated strong 3-year oncologic and functional outcomes, with excellent patient tolerance.
- Cosmesis remained highly favorable, with excellent or good ratings in 75–85 percent of patients and minimal downward transitions across follow-up.
- Patient–nurse concordance further supports cosmetic stability, indicating consistent impressions across subjective and clinician evaluations.
- Standardized GTV–CTV–PTV expansion allowed precise target definition, maintaining PTV volumes within ranges associated with lower fat-necrosis risk in prior APBI literature (e.g., PTV >124 cc).
- Toxicity was predominantly Grade 1, with few Grade 2 events and no irreversible Grade ≥3 acute toxicities, reinforcing the safety of this ultrahypofractionated approach.
- The regimen offers advantages in precision, convenience, and patient-centered care, supporting further evaluation in larger, multi-institutional cohorts.

Conclusion

This five-fraction SBRT approach to APBI was safe, well tolerated, and maintained excellent long-term cosmesis and functional status. No biopsy-confirmed ipsilateral breast tumor recurrences were observed among patients completing 36-month follow-up, and two regional nodal failures occurred during follow-up. These findings support SBRT APBI as a promising, efficient alternative to conventional whole-breast irradiation for carefully selected early-stage breast cancer patients.

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