WBRT vs. APBI: an interim report of patient satisfaction and outcomes

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Abstract

Purpose: To determine differences in patient’s reported quality of life and self-reported breast cosmesis between whole breast radiation therapy (WBRT) and accelerated partial breast irradiation (APBI) via single and multi-lumen high-dose-rate (HDR) brachytherapy for women with early stage breast cancer.

Material and methods: Patient information was retrospectively reviewed and survey data were prospectively collected for women treated between 2004 to 2014 (APBI) and 2012 to 2014 (WBRT). Criteria for APBI treatments were ER+ (after 2010), N0 (after 2010), T < 3 cm, and post-menopausal. All patients were given a survey with modified FACIT (Functional Assessment of Chronic Illness Therapy) breast quality of life questions to rate their amount of pain, self-consciousness, low energy, presence of lymphedema, and breast cosmesis.

Results: 242 APBI patients and 59 WBRT patients were identified. In the WBRT cohort, 34 women met departmental criteria for APBI treatment (WBRT who were APBI eligible). The FACIT survey was completed by 80 women treated with APBI (33%; mean follow-up time of 14 months), and 26 women treated with WBRT who were APBI eligible (76%; mean follow-up time of 26 months). During the first year post-treatment, low energy ($p = 0.009$), self-consciousness ($p = 0.0004$), and lymphedema ($p = 0.0002$) scores were significantly lower in the APBI cohort when compared to women treated with WBRT who were APBI eligible. During the second year post-treatment, women treated with APBI reported significantly better breast cosmesis ($p = 0.04$). The single-lumen balloon (score = 6.3/10) was found to be associated with worse cosmesis compared to the multi-lumen balloons (Mammosite ML and Contura; score = 8.2/10; $p = 0.002$). There were no significant differences in rates of recurrence between balloons or treatments ($p > 0.05$).

Conclusions: APBI treated patients reported higher cosmetic satisfaction than patients in the matched WBRT cohort. Quality of life scores tended to improve over time. Multi-lumen catheters provided superior cosmetic results compared to single-lumen catheters.

Key words: APBI, breast cancer, Contura, Mammosite, quality, SAVI.
lagen vascular, genetic or other metabolic diseases with hypersensitivity to radiation [8].

For patients who meet the inclusion criteria, multiple APBI techniques are available. These include interstitial brachytherapy (high-dose-rate – HDR, pulsed-dose-rate – PDR, and permanent implants), brachytherapy using single-lumen balloons (MammoSite [Hologic Inc., Bedford, MA, USA]); brachytherapy using multi-lumen balloons (MammoSite ML, Contura [SenoRx, Inc., Aliso Viejo, CA, USA]), and hybrid/strut-based brachytherapy devices (SAVI applicator [SAVI; Cianna Medical, Aliso Viejo, CA, USA]) (Figure 1). The first option, interstitial brachytherapy, requires the implantation of interstitial applicators through the lumpectomy site, which is not practiced at our hospital. The single-lumen balloon brachytherapy technique is a simpler approach that utilizes a balloon applicator consisting of a silicone balloon catheter that contains a channel for filling the balloon and a channel for introducing the radioisotope. Multi-lumen balloons permit greater dosimetric optimization. Strut-based devices (SAVI) forgo an inflatable barrier between catheters and tissue allowing tissue to settle between the struts, after placement. Given the anatomic differences between struts and balloon-based devices, different dosimetric guidelines are used in determining acceptability of treatment plans. Previously published results suggest a satisfactory treatment outcome and good cosmetic results with all of these applicators [9,10,11,12,13,14,15,16,17,18]. However, patient assessed quality of life and cosmesis have not been compared between these different brachytherapy options.

With these considerations in mind, the aim of our study was to compare patient’s reported quality of life and self-reported breast cosmesis after being treated with WBRT versus APBI. Furthermore, the differences in quality of life and cosmesis between those women treated with single-lumen, multi-lumen, and hybrid brachytherapy devices were reviewed as well.

Material and methods

Subjects

The charts of women, ages 40-87 years, who received partial breast radiation treatment for breast cancer at our hospital were retrospectively reviewed per an Institutional Review Board (IRB) approved protocol. Following an initial analysis of the data, the protocol was amended to include additional prospective data collection of women receiving both APBI and WBRT. Women treated with APBI between the years of 2002 to 2014 and women treated with WBRT between the years of 2012 to 2014 were included in this analysis. Women were treated with WBRT after completion of breast conservation surgery with lumpectomy, per the standard of care. Women who received WBRT who were APBI eligible were compared to those women who received APBI therapy for all primary and post-hoc analyses. Departmental criteria to qualify for APBI treatment was in agreement with ASTRO’s Suitability Guidelines and included: post-menopausal women with estrogen receptor positive status (ER; after 2010), negative sentinel nodes, per the standard of care. Women who were APBI eligible were compared to those women who received APBI therapy for all primary and post-hoc analyses.

Fig. 1. Accelerated partial breast irradiation techniques. A) Interstitial brachytherapy (high-dose-rate [HDR], pulsed-dose-rate [PDR], and permanent implants) [28]. B) Brachytherapy using single-lumen balloons (MammoSite, Contura) [29]. C) Brachytherapy using multi-lumen balloons (MammoSite ML) [29]. D) Hybrid brachytherapy devices (SAVI applicator) [30].
as Stage I or II [1]. Demographic, tumor, and treatment information on the included patients can be found in Table 1.

Radiotherapy details

Whole breast radiation therapy was defined as irradiating the whole breast with a radiation boost to the region of the tumor bed. Accelerated partial breast irradiation was defined as irradiating the region of the tumor bed alone using one of the commercially available catheter devices. After completing a CT-simulation, the patients in the WBRT group received therapy with 6-25 MV X-rays using three-dimensional conformal radiotherapy (3DCRT) to a total dose of 45-50.4 Gy. This therapy was delivered in 25-28 fractions over a five- to six-week period, followed by a tumor bed boost with either electrons or mini-tangents for an additional 10-14.4 Gy to the tumor bed. This boost was delivered in 1.8-2 Gy fractions over five to eight days. Patients in the APBI group received 34 Gy in ten treatments (twice a day) for five days using an HDR afterloader.

FACIT quality of life survey

A prospective analysis of validated FACIT (Functional Assessment of Chronic Illness Therapy) breast cancer quality of life questions was performed. The survey allowed patients to rate their amount of pain, self-consciousness, low energy, and presence of lymphedema on a scale from 0 to 4 (0 = not at all, 1 = a little bit, 2 = somewhat, 3 = quite a bit, 4 = very much) and their breast cosmesis on a scale of 1-10 with a score of 10 being the best [19].

Data analysis

Statistical analyses were performed using the Statistical Analysis System (SAS Institute, Cary, NC, USA, 2002-2008). Student’s t-tests and \( \chi^2 \) /Fisher’s Exact Test were used to evaluate demographic characteristics between groups. Student’s t-tests were used to compare survey scores and cosmesis scores between those women treated with APBI and women treated with WBRT who were APBI eligible for the primary analysis. Post-hoc analyses using analyses of variance (ANOVA) tests were used to examine the influence of APBI balloon type on self-reported scores. Finally, Pearson correlations were used to examine the relationship of age with self-reported scores.

Results

Clinical characteristics

From the retrospective chart analysis, 242 APBI patients and 59 WBRT patients were identified. In the WBRT...
cohort, 34 women met departmental criteria for APBI treatment. Significant differences in age were observed, with the APBI treatment group being the eldest \( (p = 0.007) \). The FACIT survey was completed by 80 women (33%) treated with APBI (mean follow-up time of 14 months), and 26 women (76%) treated with WBRT who were APBI eligible (mean follow-up time of 26 months). Within the APBI cohort, 35 women (44%) were treated with single-lumen devices, and 42 (53%) women were treated with multi-lumen devices. There were no significant differences in rates of cancer recurrence between radiation techniques used \( (p = 0.1) \).

**Survey results**

During the first year post-radiation treatment, women treated with APBI reported significantly higher energy level scores \( (p = 0.009) \), and significantly lower self-consciousness \( (p = 0.0004) \) and lymphedema scores \( (p = 0.0002) \) when compared to patients treated with WBRT who were APBI eligible (Figure 2). In the second year following treatment, women treated with APBI reported significantly higher breast cosmesis \( (p = 0.04) \) when compared to patients treated with WBRT who were APBI eligible (Figure 2). Furthermore, in the APBI cohort, older patients reported significantly less pain \( (p = 0.0008, R = -0.4) \) and self-consciousness \( (p = 0.02, R = -0.3) \).

**Accelerated partial breast irradiation balloon comparison**

The single-lumen balloon (LSmean score = 6.3/10) was found to be associated with worse patient-graded...
breast cosmesis compared to the multi-lumen balloons (Mammosite ML and Contura; LS mean score = 8.2/10; 
*p = 0.002; Figure 3). There were no significant differences in rates of cancer recurrence between the types of devices 
used in treatment (p = 0.7).

Discussion

This study suggests, in agreement with prior research, that women treated with APBI for breast cancer report 
better quality of life outcomes when compared to women 
treated with WBRT who meet ASTRO Suitability Guide-
lines for APBI treatment [20,21]. Specifically, women 
treated with multi-lumen catheter-based APBI are signifi-
cantly happier with their breast appearance one year after 
treatment when compared to women treated with WBRT.

In addition to the initial difference in quality of life 
scores following radiation treatment with APBI, quality 
of life scores tended to improve over time. This phenom-
enon has been previously reported, and suggests overall 
decreased toxicity with APBI treatment, following the 
resolution of acute toxicity to the tumor bed [22,23,24].

Furthermore, younger patients had worse self-re-
ported cosmetic outcomes in the APBI cohort. A possible 
reason for this finding is initial higher scores of breast 
cosmesis in this group, prior to their breast surgery and 
radiation allowing for a greater potential difference in 
their breast appearance following treatment, thus pre-
senting as lower self-rated cosmesis scores.

Finally, multi-lumen devices were found to provide 
superior patient rated cosmetic outcomes when com-
pared to single-lumen catheters. The multi-lumen devices 
include the MammoSite ML balloon, the Contura bal-
loon, and the SAVI device. Consistent with findings from 
other studies, these devices allow for dosimetric optimi-
zation to minimize toxicity to the surrounding chest wall, 
skin, and breast tissue [25,26,27].

There are several limitations that should be consid-
ered when interpreting the results of our study. First, 
the sample size was small due to the limited number of patients treated at our community hospital and their 
charts were retrospectively reviewed. This also affected 
our ability to match our participants for demographic characteristics. Second, the short follow-up time for the 
WBRT cohort limited the number of long term compar-
isons that could be made between the groups, and as 
a result of the APBI guidelines, the WBRT cohort includ-
ed a greater number of patients with advanced disease. 
Third, we did not treat any patients with Linac or inter-
stitial catheter brachytherapy based APBI. Next, patients 
were selected for radiation therapy largely before initial 
consult with radiation oncology. Additionally, differ-
ces in patient perceptions of survey options may have 
limited their later satisfaction. Likewise, differences in 
surgical approach taken with WBRT and APBI groups 
cannot be quantified. Furthermore, there may have been a surgeon or patient selection bias with treatment deci-
sion regarding WBRT vs. APBI. Lastly, multi-lumen 
devices replaced single-lumen devices in our practice in 
entirety; therefore, differences in those approaches should 
be without bias. However, patient selection for strut ver-
sus balloon-based APBI is dependent upon lumpectomy 
cavity geometry and skin distance, therefore there may 
be confounding affecting outcomes. If this were the case, 
however, it would have been expected that the strut-

Based on these limitations, to our knowledge, this is 
the first non-industry funded study to examine the self-
reported cosmesis and quality of life ratings of women 
treated with single-lumen versus multi-lumen catheter 
devices and whole breast radiation therapy. Future pro-
spective studies, including larger sample sizes are needed 
to further characterize the differences between modalities 
of delivering APBI.

Conclusions

In conclusion, APBI is a safe and efficacious alterna-
tive to WBRT in women with early stage breast cancer 
following lumpectomy. Multi-lumen catheter APBI may 
also offer women superior breast cosmesis and decreased 
toxicity with increased time following their treatment.

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Disclosure

Authors report no conflict of interest.

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Fig. 3. Influence of balloon type on self-reported cosmesis 
scores and quality of life measures

Cosmesis/Apperance

*p < 0.05
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