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Case Report

Long-term outcome of accelerated partial breast irradiation using a multilumen balloon applicator in a patient with existing breast implants

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ABSTRACT

PURPOSE: Accelerated partial breast irradiation is now an accepted component of breast-conserving therapy. However, data regarding long-term outcomes of patients treated with multilumen catheter systems who have existing breast implants are limited.

METHODS AND MATERIALS: We report the treatment and outcome of our patient who had existing bilateral silicone subpectoral implants at the time of presentation. Ultrasound-guided core needle biopsy of the right breast showed infiltrating mucinous carcinoma. Right breast lumpectomy revealed an 8 mm area of infiltrating ductal carcinoma with mucinous features and nuclear grade 1. A 4–5 cm Contura (Bard Biopsy Systems, Tempe, AZ) device was placed, and she was treated over the course of 5 days twice daily to a dose of 34 Gy using a high-dose-rate iridium-192 source.

RESULTS: The planning target volume for evaluation was 73.9 cc. The percentage of the planning target volume for evaluation receiving 90%, 95%, and 100% of the prescribed dose was 99.9%, 99.3%, and 97.8%, respectively. The total implant volume was 234.5 cc and received a mean dose of 15.4 Gy and a maximum dose of 72.8 Gy. The percentage of implant volume receiving 50%, 75%, 100%, and 200% of the prescribed dose was 31.1%, 16.5%, 8.6%, 2.0%, and 0%, respectively. Maximum skin dose was 97% of the prescribed dose. With a followup of nearly 5 years, she continues to be cancer free with minimal late toxicities and good to excellent cosmetic outcome.

CONCLUSIONS: Accelerated partial breast irradiation using a multilumen balloon applicator in patients with existing breast implants can safely be performed with excellent long-term cosmetic outcome. Further studies are needed to establish the absolute dosimetric tolerance of breast implants.

Keywords: APBI; Contura; Breast augmentation; Capsular contracture

Introduction

Accelerated partial breast irradiation (APBI) has quickly become an acceptable route for delivering radiation therapy as part of breast-conserving therapy over the past decade. The initial advent of brachytherapy-based APBI (B-APBI) was based on the use of multicatheter interstitial systems used to deliver a boost to the lumpectomy cavity. Over time, this evolved to limited-field radiation therapy using such methods as interstitial low-dose-rate multiplanar catheter systems using iodine-125 or high-dose-rate approaches using iridium-192 (1) as the sole mode of radiation after breast-conserving surgery. With the approval of the single-entry balloon applicator MammoSite (Hologic, Bedford, MA) in 2002 (2), followed by development of multilumen balloon devices such as Contura (Bard Biopsy Systems, Tempe, AZ) and nonballoon-based SAVI (Cianna Medical, Aliso Viejo, CA) has become more widely accessible and is used in about 10% of early stage breast cancer patients (3). Because to date, randomized Phase III data available comparing B-APBI to whole breast radiation therapy are limited (4), the exact eligible patient population remains unknown. Based on retrospective and nonrandomized prospective results, multiple

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consensus guidelines have been developed (5–7) to better direct use of B-APBI based on certain clinical characteristics of the patients. However, none of the guidelines comment on the appropriateness or feasibility of B-APBI in patients with existing breast implants. To our knowledge, there is only one published case of B-APBI in an augmented breast, and this study only focused on dosimetric evaluation and did not report any long-term outcomes (7). Here, we report the case of our patient with existing breast implants who was treated with B-APBI along with her long-term clinical outcomes.

Case report

The patient was a 68-year-old woman with bilateral silicone breast implants placed in early 1990s who was referred to our clinic in May 2009. A mammogram performed the previous month had shown a suspicious mass measuring 10 mm in size at the 12 o'clock position in the right breast. An ultrasound-guided core needle biopsy of the lesion in April 2009 had shown infiltrating mucinous carcinoma with apocrinoid features, with no evidence of lymphovascular invasion, positive for estrogen and progesterone receptors and negative for human epidermal growth factor receptor 2 (HER2-neu), and methylation-inhibited binding protein 1 (MIB-1) proliferation, and rate of 10%. MRI of the bilateral breasts revealed no lesions in the left breast and enhancement in the area of biopsy in the right breast with no evidence of axillary lymphadenopathy. She then underwent right breast lumpectomy with the final pathology revealing an 8 mm area of infiltrating ductal carcinoma, mucinous type with focal apocrine differentiation, well differentiated with nuclear grade 1. The surgical margins were negative, and three sentinel lymph nodes did not show any evidence of malignancy.

On July 15, a 4–5 cm Contura device was placed, and 2 days later, she underwent CT simulation (Brilliance Big Bore; Philips Healthcare, Andover, MA) in the supine position. About 0.5 cc of contrast was added to the saline mixture of the balloon for delineation purposes before her simulation. The planning CT was taken around the Contura device using 2 mm slices for a total of 202 slices. The implant had remained intact with no signs of leakage or puncture, and the Contura device conformed to the cavity appropriately. The distance from the balloon to the skin surface was 8 mm and to the breast implant 2 mm. CT images were then transferred to BrachyVision (Varian, Palo Alto, CA) for treatment planning. A total dose of 34 Gy with twice-daily treatments of 3.4 Gy for a total of 10 fractions were prescribed using a high-dose-rate iridium-192 source. The dose was prescribed to the planning target volume for evaluation (PTV_EVAL), which consisted of the 1 cm of tissue surrounding the balloon volume but limited to 5 mm from the skin surface (Fig. 1). Figure 1 shows the balloon position as well as the prescription coverage for one fraction (3.4 Gy) of the PTV_EVAL. CT-based. CT-based image guidance was used daily before each treatment to evaluate the device position, tissue–balloon conformance, balloon symmetry, and minimal balloon surface–skin distance.

Results

The initial balloon diameter was 4.3 cm, balloon fill volume 41.0 cc, PTV_EVAL volume 73.9 cc, and an air/seroma volume of 0 cc. V_{90}, V_{95}, and V_{100} PTV_EVAL (percent volume of PTV_EVAL receiving 90%, 95%, and 100% of the prescribed dose, respectively) was 99.9%, 99.3%, and 97.8%, respectively. Maximum skin dose was 97% of the prescribed dose, where skin dose was defined at the surface of the patient, and the maximum rib dose was 72.8% of the prescribed dose. V_{150} of normal tissue was 35.7 cc and V_{200} was 11.5 cc, where V_{150} and V_{200} are the percent volume of normal tissue not including the balloon receiving 150% and 200% of the prescribed dose.

No specific parameters have been defined to date for dosimetrical evaluation of breast implants because their tolerance dose is unknown. However, we based some of our reported parameters here according to the previous case report by Bloom *et al.* (8). The total implant volume was 234.5 cc with a mean dose of 15.4 Gy, maximum dose of 72.8 Gy, and minimum dose of 0.4 Gy. V_{50}, V_{75}, V_{100}, V_{150}, and V_{200} (percent volume of the implant receiving percentage of prescribed dose) were 31.1% (72.9 cc), 16.5% (38.7 cc), 8.6% (20.1 cc), 1.98% (4.7 cc), and 0% (0.1 cc), respectively.

She was last seen for followup in May 2014, approximately 5 years after B-APBI. Her most recent diagnostic mammograms in February 2014 showed no concerning lesions in the right breast and a stable area of calcifications in the left breast. She is in excellent health otherwise and has no evidence of disease elsewhere. The patient herself was happy with her cosmetic outcome and rated it as excellent (Fig. 2). On physical examination, no masses, fibrosis, or seroma were palpated. Her right breast had a small area of telangiectasia superior to her areolar region. Overall, based on the European Organization for Research and Treatment of Cancer (EORTC) and Radiation Therapy Oncology Group (RTOG) late radiation morbidity scoring schema, we assessed her as Grade 1 for skin given her area of telangiectasia and Grade 0 for her subcutaneous tissue. Based on the Harvard, National Surgical Adjuvant Breast and Bowel Project, (NSABP) RTOG breast cosmesis grading scale, we assessed her as "good" for overall cosmesis given the small difference in size between both breasts, which had in fact been present even before the start of her B-APBI.

Discussion

Over the past decade, B-APBI has become an important part of breast-conserving therapy and has even been incorporated into the National Comprehensive Cancer Network (NCCN) guidelines (9). To this date, only one randomized controlled trial has been completed, which compares