

## Characteristic Breast MRI findings following Accelerated Partial Breast Irradiation either by Intra-Operative Radiotherapy or Three-Dimensional Conformal External Beam Radiotherapy

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**BACKGROUND:** Accelerated partial breast irradiation (APBI) is an emerging treatment option for selected women with limited early stage breast cancer after breast conserving surgery. APBI using Intra-Operative Radiotherapy (IORT) or Three-Dimensional Conformal External Beam Radiation (3D-CRT) limits the radiation field to the breast cancer tumor bed. In contrast to whole breast irradiation (WBI) which takes 6 to 7 weeks, IORT or 3D-CRT occurs over a short period of time (15 intra-operative minutes or 5 days, respectively), potentially offering increased use of BCS and reduced treatment-related morbidity. APBI leaves untreated breast tissue outside the irradiated field. The high sensitivity of MRI for cancer could be harnessed to detect early in breast tumor recurrence (IBTR) or new primary carcinoma in the non-irradiated tissue. It is important, therefore, to characterize the typical appearance of the breast on MRI after APBI.

**PURPOSE:** To characterize and describe typical or unique breast MRI appearances after APBI (IORT or 3D-CRT).

**METHODS:** We reviewed records of 9 patients with Stage 0 or 1 breast cancer enrolled on an IRB-approved protocol evaluating lumpectomy or re-excision lumpectomy and APBI who also underwent pre- and post-APBI MRIs. APBI was performed with 17 Gy IORT using a 200 kV intra-operative orthovoltage unit (IORT, 5/9 patients, 55%) or post-operative external-beam irradiation delivering 385 cGy twice daily for 5 days (3D-CRT, 4/9 patients, 44%) delivered to the tumor bed and margin. MRIs and post-biopsy/APBI mammograms were reviewed by two MQSA-certified radiologists experienced in breast MRI who evaluated skin thickening, breast edema, post-surgical changes, pectoralis muscle enhancement and susceptibility artifacts (MRI only).

**RESULTS:** Between 1/14/04 and 8/22/06, 9 women (median age= 52, range 43-62 years old) qualified for the study, and had MRIs 3-100 days (mean, 39 days) before APBI and 168-483 days (mean, 271 days) after APBI. Post-APBI MRIs showed striking, characteristic parenchymal changes which extended from the skin to the chest wall in every case. The post-surgical changes ranged from cylindrical distortion or cavity, sometimes containing fluid, to a thin linear scar. There was relative absence of generalized skin thickening often seen after whole breast irradiation. In addition, 77% (7/9 patients) had susceptibility artifacts in either the tumor bed or surgical tract without metallic artifacts on the mammograms (4 IORT, 3 3D-CRT), 56% (5/9 patients, 3 IORT and 2 3D-CRT) had focal skin thickening, and 44% (4/9 patients, 2 IORT and 2 3D-CRT) had focal pectoralis muscle enhancement.

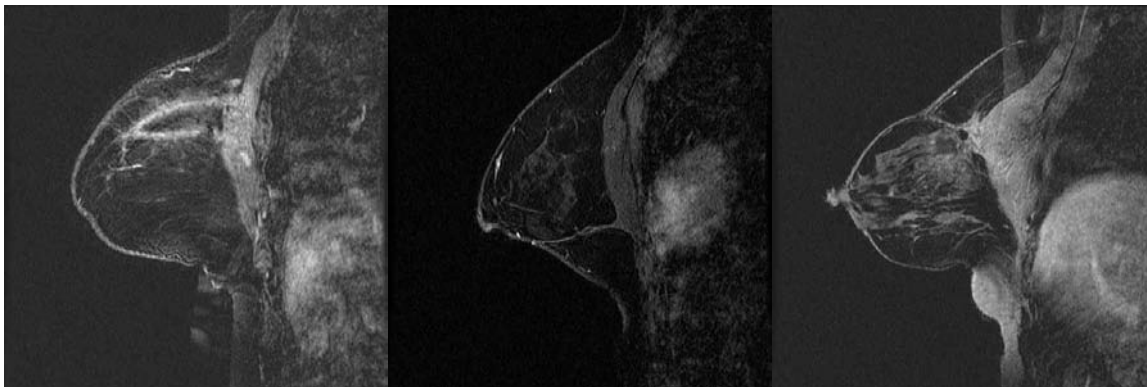


Figure 1

Figure 2

Figure 3

Figures 1-3: Note the absence of generalized skin thickening and breast edema typically seen in whole breast irradiation.

Figure 1 - Sagittal post-contrast 3DSSMT after 3D-CRT showing a cylindrical fluid-containing post-surgical cavity extending to the chest wall with susceptibility artifact in the surgical tract. Other slices showed post-surgical changes extending to the skin.

Figure 2 - Sagittal post-contrast 3DSSMT after IORT showing a thin linear scar extending from the skin to the chest wall.

Figure 3 - Sagittal post-contrast 3DSSMT after 3D-CRT showing a thin linear scar extending from the skin to the chest wall with susceptibility artifact at the posterior aspect of the surgery tract and enhancing post-surgical changes on the pectoralis muscle.

**CONCLUSION:** MRI after IORT or 3D-CRT results in characteristic post-treatment changes which extend from the skin to the chest wall. Radiologists should be aware of this novel treatment approach and recognize the characteristic MRI appearance of the APBI field in order to accurately detect treatment field recurrences, as well as the development of new primary carcinoma elsewhere in the breast.