National Trends for Intra-operative Radiation Therapy in Favorable, Early-stage Breast Cancer: A Propensity Scoring Analysis of the National Cancer Database

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Background/Objective: Adjuvant whole breast irradiation (WBI) is recommended after breast-conserving surgery for most patients with early-stage breast cancer. Recently, partial breast intra-operative radiotherapy (TARGIT-IORT), supported by randomised evidence, has emerged as a potential alternative treatment modality for suitable patients. IORT involves a single treatment at the time of lumpectomy, which is more convenient for the patient compared with 3-5 weeks of daily fractionated external beam WBI. We examined national trends regarding the use of IORT for breast cancer.

Methods: We retrospectively reviewed the National Cancer Database (NCDB) and identified patients with clinical Stage I-III breast cancer who received breast-conserving surgery with either adjuvant WBI or IORT without adjuvant WBI between 2004-2014. Patient demographics, tumor characteristics, and survival were compared between the 2 groups. Univariate, multivariate, and stage-stratified propensity score weighted analyses were performed to compare study groups and survival.

Results: We identified 2,871 (0.42%) eligible patients treated with TARGIT-IORT delivered at the time of the initial lumpectomy (“immediate”) and 675,429 (99.58%) patients treated with WBI. We excluded 141 patients treated with IORT during a procedure after the initial lumpectomy (“delayed”). Median follow-up was 54 months. The use of IORT significantly increased 16-fold in the 10 years from 0.07% in 2004 to 1.09% in 2014 (p<0.001). In comparison to WBI, IORT patients were more likely to have ER+/PR+/HER2- tumors, to be slightly older (median age (y): 66 [IQR: 59,72] vs. 61 [IQR:52, 69]), have more comorbidities, be of Asian, White, or non-Hispanic ethnicity, have insurance, have higher education and income levels, live in a metropolitan county, and be treated at an academic hospital (all with p<0.001). Performing TARGIT-IORT vs. WBI was significantly more likely to be done in patients with Stage 0 or 1 disease: 412 (0.27%) vs. 150,566 (99.73%) for Stage 0, 2,257 (0.59%) vs. 383,143 (99.41%) for Stage I, 196 (0.15%) vs. 128,432 (99.85%) for Stage II, and 6 (0.05%) vs. 13,288 (99.95%), for Stage III, respectively (p<0.001). In the adjusted stage-stratified propensity score weighted analysis, TARGIT-IORT patients had statistically similar survival compared to WBI in all stages combined (HR:0.89, p=0.59), as well as for stage 0 (HR:0.47, p=0.19), Stage I (HR:1.56, P=0.054), and Stage II (HR:0.42, p=0.15). Analysis was not performed on patients with Stage III disease due to the small number of patients in this group.

Conclusions: Utilization of partial breast TARGIT-IORT as an alternative to fractionated WBI is rising, and it is more commonly used for favorable early-stage breast cancer in better-educated patients in metropolitan academic hospitals. These real-world data suggest that survival after treatment with single dose TARGIT-IORT was similar to survival after adjuvant WBI given over several weeks in favorable early-stage breast cancer while greatly improving patient’s cancer journey.