Results: Between 2010 and 2014, 532 eligible patients (65 DCIS and 467 invasive breast cancer) underwent whole breast irradiation with intensity modulated radiotherapy and simultaneously integrated boost (IMRT-SIB) following BCS. The median age was 46 years old (range, 22-74 years), and the median follow-up period was 5.06 years. The most common grade 1 or 2 acute toxicities were breast pain, radiation dermatitis, and fatigue. There was only one patient presenting a grade 3 event (0.18%). Ipsilateral breast tumor recurrence developed in a total of two patients (0.3%), one in conjunction with widespread metastatic disease. Distant metastatic disease developed in eight patients (1.5%), and the five-year disease-free survival and overall survival rates were 98.1% and 99.2%, respectively.

Conclusion: Five-year disease-specific outcomes for adjuvant breast radiotherapy using a simultaneous integrated boost are favorable in early-stage breast cancer.

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How Does 0.35T Magnetic Resonance Imaging Compare with Computed Tomography for Post-Lumpectomy Tumor Bed Delineation in Breast Cancer?

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Purpose/Objective(s): Accelerated partial breast irradiation (APBI) delivers higher doses of radiation in fewer fractions to tumor bed (TB), targeting the area at highest risk of local recurrence while sparing normal breast tissue. Many ongoing APBI studies segment TB on computed tomography (CT) scans. Although surgical clips can improve consistency in TB delineation, their accuracy in representing the original tumor site is still debatable. Role of multimodal imaging including 3.0T magnetic resonance imaging (MRI) in TB delineation remains investigational. Novel radiotherapy platforms with integrated 0.35T MR imaging have provided us with a unique opportunity to image patients in the treatment position. Accurate definition of TB is central to online-adaptive therapy that is now being executed on MR-guided platforms. The purpose of this study is to compare CT and 0.35T MR generated TB contours.

Materials/Methods: Fifteen breast cancer patients were selected. Non-contrast, free breathing CT scans, and true fast imaging with steady-state free precession (TRUFI) MRI scans acquired on a MR imaging system in supine position were used for TB segmentation. An experienced breast radiologist was asked to allocate individual cavity visualization scores (CVS) for CT and MR TB. TB was contoured on both datasets using standardized contouring guidelines. CT contours were designated as reference contours. Volume of contours and conformity indices including Dice coefficient (DC-degree of agreement between two contours), Geographical Miss Index (GMI-volume of CT contour not included in the MR contour) and Discordant index (DI-volume of MR contour not included in the CT contour) were calculated. Chi-squared test and Wilcoxon signed-rank test were used to assess difference between CT and MR contours.

Results: The proportion of patients having optimal CVS (3-5) was higher for the CT dataset than for the MR dataset (73% vs. 47%, p=0.1). Median TB volume was marginally lower in the MR contours (MR 13.8cc (IQR5.8-22.9) vs. CT 15.5cc (10.6-34.0), p=0.19). Lower TB volumes could be due to combined T1/T2 imaging (TRUFI) of the 0.35T system possibly negating any potential advantage of MR tissue discrimination. Median DC was 0.38 (IQR 0.02-0.57), indicating that there was only 38% overlap between MR and CT contours. Median DI was 0.48(IQR 0.3-0.94) indicating that CT contours did not encompass all the information present in MR scans and a high median GMI of 0.72 (IQR 0.49-0.99 indicated the same for MR contours.

Conclusion: Cavity visualization scores and tumor bed volumes were lower on 0.35T MR scans when compared to CT scans. This was found to be consistent with the data published for 3.0T diagnostic MR scans. While information derived from 0.35T MRI is useful in the treatment planning process, CT images obtained in the treatment position remain critical for accurate delineation of tumor bed at this time.

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Dosimetric Comparison of Simultaneous-Integrated BOOST and Sequential BOOST with VMAT or Helical Tomotherapy in Breast Cancer Patients after Breast-Conserving Surgery

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Purpose/Objective(s): To perform dosimetric analysis of different breast simultaneous-integrated-boost (SIB) irradiation with respect to target coverage and organs at risk (OARs) doses, using volumetric-arc radiotherapy (VMAT) and helical tomotherapy (HT).

Materials/Methods: The dosimetric analysis was performed in 30 early-stage breast cancer patients (15 patents right sided, 15 patients left sided breast) having breast conserving surgery. In SIB plan, the prescribed dose was 64.4 Gy to the PTV_{boost} and 50.4 Gy to the PTV_{breast} in 28 fractions, and in sequential boost technique (SB) the prescribed dose was 50 Gy to PTV_{breast} and 16 Gy to PTV_{breast} delivered in 33 fractions. The target volume and OARs doses, conformity (CI) and homogeneity indices (HI) were compared between SIB and SB plans for both VMAT and HT plans.

Results: For SB and SIB plans, the average maximum doses of PTV were significantly higher in VMAT plans than in HT (56.46±2.24 Gy vs. 53.21±0.92; $p < 0.001$ and 54.24±0.77 Gy vs. 51.80±0.71 Gy; $p < 0.001$, respectively). The maximum PTV doses were significantly higher in SB plan compared to SIB plan in both VMAT and HT plans. The CI was significantly higher in HT for SB plan (0.67±0.08 vs. 0.63±0.07; $p < 0.001$), however no significant difference was observed in SIB plan between VMAT and HT (0.67±0.09 vs. 0.65±0.08; $p = 0.15$). The CI in VMAT plan was better SIB plan compared to SB plan, however no significant difference was observed in HT. The HI was significantly higher in HT compared to VMAT for both SB and SIB plans (0.36±0.03 vs. 0.33±0.02; $p = 0.001$ and 0.32±0.04 vs. 0.30±0.02; $p = 0.006$, respectively). Lung V5 was significantly higher in VMAT compared to HT for SB plan (53.67±7.93 Gy vs. 43.73±7.25 Gy; $p = 0.02$). However, other dosimetric parameters for ipsilateral lung and heart did not differ significantly between each plan for VMAT and HT. The significant dosimetric advantage of contralateral lung V5 was found in HT compared to VMAT for SB plan (1.98±0.73 Gy vs. 3.52±1.40; $p = 0.03$). Although contralateral lung V5 was significantly lower in SIB plan compared to SB plan for HT (1.98±0.73 Gy vs. 1.61±1.06 Gy; $p = 0.003$), contralateral lung V5 was significantly higher in SIB plan for VMAT (4.04±3.22 Gy vs. 3.52±1.40 Gy; $p = 0.04$). Contralateral breast V5 was significantly lower in HT compared to VMAT for SB plan (1.48±1.19 Gy vs. 4.61±3.55 Gy; $p = 0.03$), however no significant difference was found for SIB plan between HT and VMAT (1.33±0.46 Gy vs. 1.82±0.77; $p = 0.64$).

Conclusion: For breast irradiation after breast conserving surgery, HT is advantageous for lower maximum PTV doses, better conformity, and homogeneity in target volume doses compared to VMAT. Additionally, contralateral breast and lung doses were significantly lower in HT compared to VMAT. With SIB technique the target dose homogeneity and conformity was better, contralateral lung and breast doses were lower compared to SB technique. Our study demonstrated the dosimetric feasibility of SIB using HT for breast cancer patients.

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Are We Choosing Wisely? - Pattern of Hypofractionated Radiation Therapy Use for Early Breast Cancer in Victoria, Australia from 2012 to 2017

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Purpose/Objective(s): Level 1 evidence show non-inferiority of hypofractionated radiation therapy (RT) compared to conventionally fractionated RT as part of breast conservation therapy in women with early breast cancer (BC). One of the Choosing Wisely recommendations in the US, Canada and Australia is: to not initiate breast RT without considering hypofractionation in this group of patients. However, remuneration for RT in the Australian healthcare setting is largely determined by fractions delivered. We aim to evaluate the adoption of hypofractionated RT for early BC and factors associated with that in Australia.

Materials/Methods: This is a population-based cohort of patients with early BC who had breast RT (excluding patients who had nodal irradiation) as captured in the Victorian Radiotherapy Minimum Data Set (VRMDS) between January 2012 and December 2017. The Cochrane-Armitage test for trend was used to evaluate use of hypofractionation over time. Multivariable logistic regression was used to identify patient-, sociodemographic-, and institutional factors associated with use of hypofractionation.

Results: A total of 11,477 patients were included in the study. Overall, 6,490 (57%) patients had hypofractionated RT. There was significant increase in the use of hypofractionation from 36% in 2012 to 76% in 2017 (P<0.001). Older patients were more likely to have hypofractionation (mean age 64 vs. 56, P<0.001). Patients treated in private institutions were less likely to have hypofractionation compared to those treated in public institutions (50% vs. 62%, P<0.001). Patients treated in regional centers were also less likely to have hypofractionation, compared to those treated in metropolitan centers (50% vs. 58%, P<0.001). In multivariable analyses, increase in uptake of hypofractionation over time was independent of other covariates, with patients treated in 2017 8.2 times (95%CI=6.9-9.8, P<0.001) more likely to have hypofractionation compared to patients treated in 2012. Every year increase in age was associated with 8% (95%CI=7.3-8.2%, P<0.001) increased in likelihood of hypofractionation. Patients treated in private and regional institutions were less likely to have hypofractionation compared to patients treated in public (OR=36, 95% CI=0.33-0.40, P<0.001) and metropolitan institutions (OR=0.34, 95% CI=0.29-0.39, P<0.001) respectively.

Conclusion: This is the largest population-based study on breast RT for early BC in Australia. We observed significant increase in uptake of hypofractionation over a 6-year period. There is, however, large geographical and institutional variation in uptake of hypofractionated breast RT, and further work is needed to reduce unwarranted variation in care for patients with early BC in line with the Choosing Wisely recommendation.

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The Effect of Post-Mastectomy Radiation Therapy on Survival in Breast Cancer Patients with N1mic Disease

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Purpose/Objective(s): The role of post mastectomy radiation therapy (PMRT) in patients with N1mic breast cancer has not been well defined. A retrospective analysis was performed using the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) database to evaluate the impact of PMRT on survival in patients with pN1mic breast cancer.

Materials/Methods: Patients with T1-T2, N1mic, M0 breast invasive ductal carcinoma (IDC) who had undergone mastectomy and were diagnosed from January 1, 2004 to December 31, 2014 were extracted from SEER. Only patients who underwent either no radiation or radiation after surgery were included in the final analysis. Descriptive statistics were calculated for all variables. Univariate analysis to assess for differences in survival with respect to covariates was performed using the log rank test. Multivariate analysis was performed with Cox proportional hazards regression models to determine the predictive performance of covariates with respect to OS and DSS, reported as hazard ratio [HR] with 95% CIs. Sub-cohort analysis with propensity score matching was used to assess differences in survival among patients undergoing PMRT vs no PMRT. Comparisons were considered statistically significant at P <0.05.

Results: A total of 6011 patients met inclusion criteria. Mean age ± SD was 55.8 ± 13.9 years. There were 1222 (20.3%) patients who underwent PMRT and 4789 (79.6%) who did not undergo PMRT. Women undergoing PMRT were more likely to be younger, present with T2 tumors, grade III disease, have ER/PR/HER2 − (triple negative) status, >1 involved lymph node, undergo systemic therapy, and have a higher level of education (p<0.05). On univariate analysis; there was no difference in OS between women undergoing PMRT vs no PMRT. DSS was worse among those undergoing PMRT (p=0.0053). However, there was no difference in either OS or DSS between the PMRT vs no PMRT groups on multivariate Cox regression analysis (HR, 1.09; 95% CI [0.90; 1.33] and HR, 1.05; 95% CI [0.83; 1.33], respectively). Similarly, no difference in either OS or DSS was demonstrated after propensity score matching between those undergoing PMRT vs no PMRT.

Conclusion: In this large national, retrospective analysis of patients with T1-T2, N1mic, M0 breast IDC from the SEER database, there was no difference in either OS or DSS among patients who underwent PMRT vs no PMRT on multivariate analysis. These results suggest that PMRT does not impact survival among breast cancer patients with N1mic disease. However, additional prospective studies with longer follow up are necessary for further evaluation of the role of PMRT in this cohort of breast cancer patients.

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The Impact of Physician Productivity Metrics and Patient Tumor Biology on Receipt of RT in Elderly Patients with ER+ T1N0 Breast Cancer in a Tertiary Cancer Center

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Purpose/Objective(s): Among elderly patients with early-stage invasive ER+ breast cancer, multiple randomized clinical trials show adjuvant radiation (RT) after lumpectomy does not reduce rates of survival or mastectomy (CALGB 9343, PRIME II). However, in the US, rates of adjuvant