Results: The median follow-up was 98 months. Patients with IMNI had more advanced pN stages and more medial/central-located primary tumors. The 8-year overall survival rate of IMNI group and no-IMNI group was 81.7% and 77.8% ($p=0.1274$), and the 8-year disease free survival rate of IMNI group and no-IMNI group was 75.9% and 64.9% ($p<0.0001$). After propensity score match, IMNI significantly improved OS and DFS in matched patients (HR = 0.643 (95%CI, 0.444-0.933) for OS, HR = 0.477 (95%CI, 0.352-0.648) for DFS). IMNI was an independent prognostic factor for DFS in all patients and matched patients.
Conclusion: IMNI significantly improved survival outcome in breast cancer patients in the context of modern systemic treatment. Further prospective randomized trials are warranted to confirm the role of IMNI in modern systemic treatment settings.
Author Disclosure: **X. Wang**: None.

2019

Outcome of Radiotherapy in Patients with Internal Mammary Lymph Node Metastasis from Breast Cancer

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Purpose/Objective(s): This study was performed to evaluate the outcome of radiotherapy (RT) in breast cancer patients with clinically positive internal mammary lymph nodes (cIMN+).
Materials/Methods: We retrospectively reviewed the medical records of 85 patients with cIMN+ breast cancer treated with curative surgery, taxane-based chemotherapy, and RT at our hospital during the period of January 2009 through December 2014. All cIMN+ was diagnosed by imaging studies and confirmed from biopsy ($n = 40$). Seven patients had IMN only metastasis, 57 had metastasis in IMN in conjunction with axillary lymph nodes (ALN), and 21 showed metastasis in IMN and supraclavicular lymph nodes with or without ALN metastasis. Forty-two patients had IMN greater than 1.0cm in long axis diameter. Immunohistochemistry-based breast cancer subtypes of the patients were as follows; 32 patients had luminal, 23 had HER2 enriched and 30 patients had triple-negative. Patients received breast-conserving surgery ($n = 40$) or mastectomy ($n = 45$) without IMN dissection. In 66 patients (77.6%), neoadjuvant chemotherapy with or without adjuvant chemotherapy was performed. Postoperative RT with a median dose of 50 Gy at a 2 Gy per fraction was given to the chest wall or whole breast and boost dose was added as surgical bed and gross nodes if needed. Median radiation dose to IMN was 62.5 Gy. By calculating the biologically equivalent dose in 2 Gy fractions (EQD2), we categorized the IMN dose into three groups; low (50 − 56 Gy), intermediate (56.1 − 63.5 Gy), and high (63.6 − 70.5 Gy).
Results: After median follow-up period 58 months (range, 12 − 111), there were 15 death and 26 recurrent events. Of the recurrent cases, loco-regional recurrence and distant metastasis were 11 (12.9%), and 24 (28.2%), respectively. IMN recurrence was found in two patients (2.4%) and the recurrences developed simultaneously with distant metastases. Among the two patients, one had IMN failure 6 months after completion of 66 Gy IMN RT. Another patient showed IMN recurrence 16 months after 50 Gy IMN RT. The 5-year loco-regional recurrence-free survival, disease-free survival (DFS), and overall survival (OS) rates were 95.2%, 72.3%, and 84.1%, respectively. Triple-negative type, IMN long diameter ≥ 1.0 cm, mastectomy, and intermediate RT dose was significantly associated with poor DFS. Higher pathologic grade was significantly related to inferior OS. Among the patients with IMN ≥ 1.0 cm, patients with high dose IMN RT had higher 5-year DFS rate than those with low to intermediated dose (33.3% vs. 69.3%, $p = 0.019$). There were 5 patients who developed grade 2 toxicity. Four patients showed Grade 2 dermatitis at the end of RT. One patient with left breast cancer developed symptomatic cardiac diastolic dysfunction 5 years after RT.
Conclusion: Patients with cIMN+ breast cancer could achieve favorable outcome after IMN radiotherapy without IMN dissection. Size of IMN, RT dose to IMN, subtypes was closely associated with patient's DFS. Higher IMN dose is necessary for the patients with large IMN.
Author Disclosure: **K. Yang**: None.

2020

FDG/PET-CT-Based Supraclavicular Lymph Nodes Atlas in Breast Cancer Patients from Two Central China Cancer Centers

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Purpose/Objective(s): The aim of this study was to map the location of metastatic supraclavicular (SCV) lymph nodes in breast cancer patients with SCV node involvement by using positron emission tomography with fluorine 18 fluorodeoxyglucose/computed tomography (FDG-PET/CT).
Materials/Methods: 107 patients with 370 FDG/PET-CT positive SCV lymph nodes metastases were included in our analysis. SCV lymph nodes areas were defined based on the main anatomical route of metastasis. All imaging data were imported into the planning system and each lymph node was manually contoured. A patient with "standard anatomy" was chosen as a template, and all contoured structures were registered rigidly and non-rigidly to this patient. A comprehensive atlas was delineated including all identified lymph node metastases. Further, the incidences of lymph node metastases were analyzed and are presented with color-coding in the atlas. A modified SCV CTV was proposed with better involved-node coverage.
Results: Of the 370 nodal metastases, 292(78.92%) were within the RTOG consensus volume, and 78(21.08%) in 33 patients were outside the volume. The highest rate of SCV lymph node metastasis was area II, and the lowest was area I. Supraclavicular disease outside the RTOG consensus volume was mostly located in area IV.
Conclusion: The location of supraclavicular lymph nodes metastasis surpasses the range defined by the RTOG guidelines. We suggest the adjuvant irradiation target volume should be extended to cover area IV, particularly the posterior edge.
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2021

Use of Chemotherapy in Patients Receiving Hypofractionated Whole-Breast Irradiation: An Analysis within a State-Wide Quality Consortium

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Purpose/Objective(s): Randomized clinical trials support the use of hypofractionated whole breast irradiation (H-WBI) in select patients with

early stage breast cancer following breast conserving surgery. Patients who received chemotherapy (CHT) are not well represented on these trials. This study investigates whether receiving CHT prior to WBI is associated with increased toxicity or worse cosmetic outcomes.

Materials/Methods: We identified 7,014 women in a state-wide radiation oncology quality consortium database who received WBI with a surgical cavity boost between 11/2011 and 8/2018. Toxicity data were available for 6,870 patients. Significant acute toxicity was defined as patient-reported moderate/severe breast pain (≥4/10), physician-reported CTCAE ≥grade 2 breast pain, or the development of moist desquamation between 7 days prior to and 42 days following the completion of radiotherapy. We determined rates of physician-reported fair/poor cosmetic outcome per the Harvard criteria in 2,012 patients who had ≥1 year of follow-up. Rates of significant acute toxicity and fair/poor cosmetic outcome were compared among patients receiving conventionally fractionated treatment (C-WBI) or H-WBI. Multivariable modeling, adjusting for age, race, BMI, breast volume, separation along the central axis, comorbidity index, smoking status, radiation planning technique, breast D50, triple negative breast cancer, pTis disease, treatment at an academic institution, and receipt of CHT, were used to quantify the strength of association, given as an odds ratio [95%CI], between patient or treatment related factors and clinical endpoints.

Results: C-WBI and H-WBI most commonly comprised 45-50.4 Gy in 25-28 fractions and 40-42.72 Gy in 15-16 fractions, respectively. A boost of 10-16 Gy in 5-8 fractions and 10 in 4 fractions was most common for C-WBI and H-WBI, respectively. CHT was administered prior to radiation therapy in 1266 (35%) of the 3,628 patients who received C-WBI and in 558 (17%) of the 3,242 patients who received H-WBI. Crude rates of significant acute toxicity were 43% and 40% for patients receiving CHT followed by C-WBI and C-WBI without CHT, respectively, and 29% and 27% for patients receiving CHT followed by H-WBI and H-WBI without CHT, respectively. CHT was not associated with worse acute toxicity for patients receiving C-WBI (OR = 0.94 [0.79-1.12], p = 0.50) or H-WBI (OR = 0.79 [0.63-1.00], p = 0.054). CHT was not associated with increased rates of fair/poor cosmetic outcomes at 1 year (OR = 1.21 [0.82-1.78], p = 0.33), independent of fractionation.

Conclusion: In this large, multi-center cohort, rates of significant acute toxicity and fair/poor cosmetic outcomes were not worse in patients receiving chemotherapy prior to whole breast irradiation, compared to patients who did not receive chemotherapy, regardless of fraction size.

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2022

Analysis of the Financial Impact of the 2018 ASTRO Breast Dose-Fractionation Guidelines on Radiation Oncology Departmental Reimbursement

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Purpose/Objective(s): The recent 2018 update to the 2011 ASTRO clinical practice guidelines for whole breast radiation therapy increased the number of patients with early stage breast cancer eligible for hypofractionated whole-breast irradiation (HF-WBI). While these guidelines provide evidence-based rationale for treating patients with a shorter course of radiation therapy, the financial implications of such reductions in number of fractions in the fee-for-service environment are poorly understood. The goal of this study is to estimate the financial impact of this treatment paradigm shift on radiation oncology departmental reimbursement.

Materials/Methods: A process map was created to model each phase of treatment, from consultation through first follow up, for conventionally fractionated WBI (CF-WBI, 50 Gy + 10 Gy boost, 30 fractions) and HF-WBI (42.6 Gy + 10 Gy boost, 20 fractions). Reimbursement for each step was obtained from the 2019 Centers for Medicare and Medicaid Services Medicare Physician Fee Schedule (MPFS) database. Review of patient characteristics among a previously published cohort of 1477 women treated with lumpectomy and post-operative WBI for T1-2 N0 breast cancer from 2011-2013 was used to determine the relative proportion of women with early stage disease eligible for HF-WBI under both 2011 and 2018 ASTRO guidelines. Under 2011 guidelines, 404 (44%) were eligible for HF-WBI. Under 2018 guidelines, all patients were eligible for hypofractionation. Based on this, reimbursement per breast case was calculated using a weighted average of reimbursement for HF-WBI and CF-WBI.

Results: Reimbursement for CF-WBI and HF-WBI are approximately $12,406 and $9,162 per treatment course, respectively. Average departmental reimbursements per breast case under 2011 and 2018 guidelines, are therefore $10,978 and $9,162 respectively. This corresponds to a 16.5% decrease in reimbursement per case.

Conclusion: Adherence to the new ASTRO guidelines for breast fractionation may result in a decrease in average reimbursement of up to 16% per case of WBI. While some practitioners may be hesitant to prescribe hypofractionated treatment due to dosimetric inhomogeneity or after particular chemotherapy regimens, the vast majority of patients previously ineligible under 2011 guidelines now receive consensus recommendations for hypofractionated treatment. Although hypofractionation will ultimately increase the value of radiation therapy for early stage breast cancer patients, the drop in reimbursement per case may impact departmental finances given the high proportion of early stage breast cancer patients seen in radiation oncology departments. An alternative payment model that better reflects the value provided by hypofractionation may ultimately bring financial incentives in line with the standard of care.

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2023

Robotic Stereotactic Accelerated Partial-Breast Irradiation for Early-Stage Breast Cancer: 5-Year Results of a Single-Institution Pilot Study

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Purpose/Objective(s): Outcomes following adjuvant accelerated partial breast irradiation (APBI) in select women with early stage breast cancer are comparable to whole breast irradiation. Robotic stereotactic accelerated partial breast irradiation (SAPBI) with fiducial tracking is an attractive treatment option, but limited data are available regarding the feasibility of this approach and 5 year outcomes have not yet been published. We report our institutional experience treating select women with SAPBI.

Materials/Methods: Women with DCIS and early stage breast cancer treated from November 2008 to September 2015 were evaluated.