

Acute Toxicity Outcomes in Breast Cancer Patients Treated with Adjuvant Proton Therapy

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Purpose: Adjuvant radiotherapy (RT) requiring regional nodal irradiation (RNI) for breast cancer (BCa) is associated with high risks of long-term complications, such as cardiovascular morbidity and mortality. Proton Therapy (PT) allows for improvement in the therapeutic ratio by reducing dose to non-targeted organs, such as the heart and lung, which could reduce morbidity. This retrospective review assesses the acute toxicity outcomes of BCa patients treated with PT.

Methods and Materials: From 2011 to 2014, 41 females and 1 male with BCa received adjuvant PT. Patients were included if targeting required RNI including the internal mammary lymph nodes plus the intact breast or post-mastectomy chest wall. Patients including those with recurrent disease were staged according to the American Joint Committee on Cancer 7th edition at the time of PT consultation.

Acute toxicity was prospectively assessed and recorded using Common Terminology Criteria for Adverse Events v. 4.0 weekly during PT, 2 weeks and 4 weeks following PT completion, and then every 6 months. Charts were retrospectively reviewed to record dosimetric variables and correlated to acute toxicity using Pearson's r Correlation. Statistics were performed using Microsoft Excel.

Results: Median follow-up was 4 months. Median age at PT initiation was 52.5 (25-68) years. 8 patients had stage II BCa and 34 had stage III BCa. 7 patients received PT in the setting of re-irradiation for either recurrent disease or new BCa primary. PT was targeted to the left side (N=21), right side (N=16), and bilaterally (N=5). 22 patients received neoadjuvant chemotherapy and 19 received adjuvant chemotherapy; 1 patient received both neoadjuvant and adjuvant chemotherapy for interval local recurrence between surgery and radiotherapy. 11 patients had breast conserving surgery and 31 underwent mastectomy, of which 16 had reconstruction prior to initiation of PT. Median PT dose was 50.51 cobalt gray equivalent.

Assessment of acute dermatitis demonstrated 29 patients with grade 2 and 5 with grade 3 toxicity. 5 patients experienced grade 2 esophagitis. 2 patients had grade 2 chest wall pain, and 3 patients had grade 3 chest wall pain. Pearson's r Correlation was performed to assess relationship between grade 2 or higher acute dermatitis and grade 2 esophagitis for the following variables measuring greater than the cohort median: planning target volume (PTV) V105 and V110, skin dmax, esophagus mean dose, and esophagus dmax. PTV V105 $\geq 37.43\%$, PTV V110 $\geq 2.9\%$, skin dmax ≥ 55.52 , esophagus mean dose ≥ 6.09 , and esophagus max dose ≥ 50.985 did not demonstrate a strong positive correlation to acute skin or esophageal toxicity, respectively.

Conclusions: PT for BCa patients requiring RNI appears well tolerated with acceptable acute toxicity. Longer follow-up is needed.