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Scientific Article

Predictors of radiation-induced acute skin toxicity in breast cancer at a single institution: Role of fractionation and treatment volume

Arti Parekh MD [a], Avani D. Dholakia MD [a], Daniel J. Zabranksy MD, PhD [a], Fariba Asrari MD [a], Melissa Camp MD, MPH [b], Mehran Habibi MD [b], Richard Zellars MD [c], Jean L. Wright MD [a,*]

[a] *Department of Radiation Oncology, Johns Hopkins Hospital, Baltimore, Maryland*
[b] *Department of Surgical Oncology, Johns Hopkins Hospital, Baltimore, Maryland*
[c] *Department of Radiation Oncology, University of Indiana, Bloomington, Indiana*

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Abstract

Purpose: The associations among radiation fractionation, body mass index (BMI), and acute skin toxicity with adjuvant radiation for breast cancer is of increasing interest. This study evaluated the rate of grade ≥2 dermatitis and moist desquamation (MD) in patients with a high BMI who were treated to the breast or chest wall to understand the role of radiation target, fractionation regimen, and BMI.

Methods and materials: We retrospectively evaluated 280 patients treated with adjuvant radiation for breast cancer after up-front surgery. We collected information on patient demographics, disease and treatment characteristics, and acute skin toxicities. Multiple logistic regression models were used to evaluate for predictors of grade ≥2 dermatitis and MD.

Results: Patients undergoing post-mastectomy radiation therapy (PMRT) had the highest rate of MD (24%). The rate was lower (8.7%) among lumpectomy patients, but those receiving conventional fractionation had a higher rate of MD (10.9%) compared with hypofractionated therapy (1.8%; $P = .05$). Among lumpectomy patients, chemotherapy use (odds ratio, 3.74; $P = .04$) and regional nodal irradiation (odds ratio, 3.29; $P = .03$) were also significant predictors of MD. Despite an elevated average BMI among lumpectomy patients, hypofractionated therapy resulted in lower rates of skin toxicity.

Conclusions: We identified multiple risk factors for acute skin toxicity, including the use of PMRT and conventionally fractionated regimens. Elevated BMI, regional nodal irradiation, and chemotherapy use were associated with an increased risk of MD. Our findings highlight the need to explore the use of less toxic hypofractionated regimens in patients who are at the highest risk of acute skin toxicity, including those with a higher BMI and those receiving PMRT.

Conflicts of interest: The authors have no conflicts of interest to report.

* Corresponding author. Department of Radiation Oncology and Molecular Radiation Sciences, Johns Hopkins Hospital, 401 N. Broadway, Baltimore, MD 21231.

E-mail address: jeanwright@jhmi.edu (J.L. Wright).

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Introduction

Adjuvant radiation to the breast or chest wall after surgery for breast cancer is generally well tolerated, but acute skin toxicity is a common side effect that affects quality of life. Symptoms such as irritation, pain, itching, and peeling are common, but the most uncomfortable and disruptive to treatment is progression to moist desquamation (MD). The risk of MD is highly variable depending on the radiation target (breast vs chest wall) as well as multiple patient and treatment factors. Rates can reach as high as 71% in the setting of post-mastectomy radiation therapy (PMRT) and range from 11% to 47% in the setting of breast conservation.[1-7]

The severity of acute skin toxicity and the risk of MD are well established as being greater in the setting of PMRT compared with radiation therapy (RT) to the intact breast due to the more superficial target and often the use of tissue-equivalent bolus. In the setting of PMRT, conventional regimens remain standard due to a lack of data with regard to the toxicity and outcomes using hypofractionated regimens, although data to support hypofractionated regimens in this setting are beginning to emerge.[8] In contrast, there is clear evidence supporting the use of hypofractionated regimens in the setting of adjuvant RT to the intact breast in a majority of cases. Three large, randomized trials comparing conventionally fractionated and hypofractionated adjuvant breast RT regimens have reported equivalent long-term outcomes, with improved late toxicities in the hypofractionated arms.[7,9]

More recent analyses have also reported decreased acute toxicities with hypofractionated regimens. A randomized trial from MD Anderson reported less acute dermatitis, hyperpigmentation, and fatigue among patients who were randomized to hypofractionated RT but did not report on MD specifically.[5] A report from the Michigan Radiation Oncology Quality Consortium (MROQC) also reported lower rates of acute skin toxicity with hypofractionation, with a lower rate for both MD (28.5% vs 6.6%; $P < .001$) and grade ≥2 dermatitis (62.6% vs 27.4%; $P < .001$).[6]

Despite these robust data, hypofractionated regimens have only been adopted slowly across the United States.[10,11] Large breast separation, high body mass index (BMI), and large breast size are commonly cited contraindications to the use of hypofractionation in favor of conventionally fractionated regimens because of concerns for greater toxicity in these patients.[5,12] However, in the MROQC study, the mean BMI was 30.3, which is above the threshold of 30 for obesity, and the rates of both dry desquamation and MD were significantly lower in the hypofractionated group on multivariable analysis accounting for BMI. Similarly, in the randomized trial from MD Anderson in which favorable skin toxicity was seen with the hypofractionated regimen, 66% of patients who were randomized to hypofractionation had a BMI >29.[5,6]

Similar to the MROQC and MD Anderson cohorts, the patient population at our institution has a high average BMI, and we have increasingly offered hypofractionated regimens to these patients unless they are being treated to the chest wall and/or regional lymph nodes. Therefore, we sought to evaluate the rate of grade ≥2 dermatitis and MD at our own institution. We chose to include patients who were treated both to the chest wall (PMRT) and the intact breast to understand the spectrum of skin toxicities experienced by patients at our institution and to identify risk factors for more severe toxicities, with a focus on the influence of radiation target, fractionation regimen, and BMI.

Methods and materials

In this study, we retrospectively evaluated 280 patients with breast cancer who were treated with up-front surgery followed by adjuvant RT with or without adjuvant chemotherapy from 2008 to 2015. The study was approved by the institutional review board. Information with regard to patient demographics, disease characteristics and treatment details, and comorbidities were collected through a review of electronic medical records. Information on skin toxicity was extracted from on-treatment visits and end-of-treatment notes. Acute toxicity was defined as toxicity observed during treatment or within 90 days of completion of treatment. Our practice is to see patients for first follow-up 1 month after treatment completion. Grading followed the Common Terminology Criteria for Adverse Events (CTCAE) criteria and notation of presence or absence of MD in weekly on-treatment visits and end-of-treatment notes.

Hypofractionated RT was defined as any treatment regimen with a daily fraction size greater than 2.6 Gy. At our institution, 3-dimensional, conformal radiation techniques are used for breast radiation with field-in-field techniques. Coverage goals included a maximum dose (d_{max}) ≤ 107% and 50 cc of breast <105% of the prescription dose. Treatment volumes are standard across our sites and are modelled after the Radiation Therapy Oncology Group contouring atlas. In patients receiving PMRT, our institutional practice is to use brass bolus on the chest wall in a majority of cases; bolus is occasionally omitted in patients with low-risk features or those who have tissue expanders in place. Bolus is discontinued at the onset of brisk erythema. Moist desquamation was noted if it occurred anywhere within the treatment field, and regional nodal irradiation (RNI) was noted as radiation to the level III axilla, supraclavicular nodes, and/or internal mammary nodes.

The χ^2 test was used for univariate analysis to compare differences in the distribution of rates of grade ≥2 dermatitis and MD by patient characteristics, including race, age, menopause status, comorbidities, and BMI; by disease characteristics, including disease stage, hormone receptor, and human epidermal growth factor receptor 2 (HER2) status; and by treatment details including RNI and chemotherapy use. Logistic regression analysis was used to test for mul-

tivariate relationships between the aforementioned variables and skin toxicity. A *P*-value of ≤.05 was considered significant. Statistical analyses were performed with SPSS Statistics software Version 22.0 (IBM Corporation, Chicago, IL).

Results

Patient, disease, and treatment characteristics

Table 1 presents the characteristics of the 280 patients in the study cohort, overall and separated by radiation target (post-mastectomy [n = 50] vs post-lumpectomy [n = 230]). In the overall cohort, the median age was 60 years, 29.3% were black, and the mean BMI was 28.5. Additionally, 47% of patients had one or more of the following comorbidities: diabetes mellitus, hypertension, and coronary artery disease. In addition, 87.5% of patients had estrogen receptor positive disease, and 7.9% had HER2 positive disease. The majority of patients had pathologic stage I or II disease (72%), and 31% received chemotherapy. The cohorts were similar with respect to race, presence of comorbidities, BMI, and estrogen receptor and HER2 status. However, patients who were treated with PMRT versus RT to the intact breast were younger and more likely to be premenopausal (78.3% vs 50%; $P < .001$), more likely to be treated for stage ≥III disease, and more likely to be treated more aggressively with RNI (84% vs 10%; $P < .001$) and chemotherapy (74% vs 21.7%; $P = .007$). The median RT dose was 50.40 Gy in the post-mastectomy cohort, 51.30 Gy in the conventionally fractionated post-lumpectomy cohort, and 42.56 Gy in the hypofractionated cohort.

Table 2 presents the subset of 230 patients who were treated with post-lumpectomy RT, separated by fractionation schedule (conventional fractionation, n = 174, 75.7%

Table 1 Patient, disease, treatment, and toxicity characteristics

	All patients n (%)	PMRT n (%)	Lumpectomy n (%)	*P*-value
Total	280	50 (17.9)	230 (82.1)	
Patient characteristics				
Median age (y)	60	50.5	61	
Age >60 y	144 (51.4)	15 (30)	129 (56.1)	.001
Race				
Black	82 (29.3)	14 (28)	68 (29.6)	.866
Non-black	198 (70.7)	36 (72)	162 (70.4)	
Postmenopausal	205 (73.2)	25 (50)	180 (78.3)	< .001
Diabetes mellitus	32 (11.4)	3 (6)	29 (12.6)	.226
Hypertension	104 (37.1)	13 (26)	91 (39.6)	.078
Coronary artery disease	8 (2.9)	0 (0)	8 (3.5)	.358
Body mass index				
Mean	28.5	27.5	28.7	.363
≤25	86 (30.7)	20 (40)	66 (28.7)	
25.1-30.0	86 (30.7)	15 (30)	71 (30.9)	
30.1-35	52 (18.6)	7 (14)	45 (19.6)	
>35	40 (14.3)	5 (10)	35 (15.2)	
Not reported	16 (5.7)	3 (6)	13 (5.7)	
Disease characteristics				
ER+	245 (87.5)	42 (84)	203 (88.3)	.478
PR+	211 (75.3)	40 (80)	171 (74.3)	.472
HER2+	22 (7.9)	7 (14)	15 (6.5)	.06
Stage				
Tis	55 (19.6)	1 (2)	54 (23.5)	< .001
I-II	202 (72.1)	34 (68)	168 (73)	
≥III	23 (8.2)	15 (30)	8 (3.5)	
Treatment characteristics				
RNI	74 (26.4)	42 (84)	32 (10)	< .001
Chemotherapy	87 (31.1)	37 (74)	50 (21.7)	< .001
Toxicity				
Grade ≥2 dermatitis	88 (31.4)	24 (48)	64 (27.8)	.007
Moist desquamation	32 (11.4)	12 (24)	20 (8.7)	.005

ER+, estrogen receptor positive; HER2+, human epidermal growth factor receptor 2 positive; PMRT, post-mastectomy radiation therapy; PR+, progesterone receptor positive; RNI, regional nodal irradiation.

Table 2 Patient, disease, treatment, and toxicity characteristics: Lumpectomy

	All lumpectomy n (%)	Lumpectomy hypofractionation n (%)	Lumpectomy conventional fractionation n (%)	*P*-value
Total (from 280 patients)	230	56 (24.3)	174 (75.7)	
Patient characteristics				
Median age (y)	61	63	61	
Age >60 y	129 (56)	33 (58.9)	96 (55.2)	.65
Race				.03
Black	68 (29.6)	10 (17.9)	58 (33.3)	
Non-black	162 (70.4)	46 (82.1)	116 (66.7)	
Postmenopausal	180 (78.3)	43 (76.8)	137 (78.7)	.85
Diabetes mellitus	29 (12.6)	6 (10.7)	23 (13.2)	.82
Hypertension	91 (39.6)	21 (37.5)	70 (40.2)	.76
Coronary artery disease	8 (3.6)	1 (1.8)	7 (4)	.68
Body mass index				
Mean	28.7	27.4	29.2	
≤25	66 (28.7)	21 (37.5)	45 (25.9)	.18
25.1-30.0	71 (30.9)	14 (25)	57 (32.8)	
30.1-35	45 (19.6)	12 (21.4)	33 (19)	
>35	35 (15.2)	5 (8.9)	30 (17.2)	
Not reported	13 (5.7)	4 (7.1)	9 (5.2)	
Disease characteristics				
ER+	203 (88.2)	50 (89.3)	153 (87.9)	1.00
PR+	171 (74.3)	44 (78.6)	127 (73)	.48
HER2+	15 (6.5)	5 (8.9)	10 (5.7)	.33
Stage				
Tis	54 (23.5)	13 (23.2)	41 (23.6)	.257
I-II	168 (73)	43 (76.8)	125 (71.8)	
≥III	8 (3.5)	0 (0)	8 (4.6)	
Treatment characteristics				
RNI	32 (13.9)	0 (0)	32 (18.4)	.001
Chemotherapy	50 (21.7)	5 (8.9)	45 (25.9)	.008
Toxicity				
Grade ≥2 dermatitis	64 (27.8)	4 (7.1)	60 (30.4)	< .001
Moist desquamation	20 (8.7)	1 (1.8)	19 (10.9)	.05

ER+, estrogen receptor positive; HER2+, human epidermal growth factor receptor 2 positive; PR+, progesterone receptor positive; RNI, regional nodal irradiation.

vs hypofractionation, n = 56, 24.3%). Patients treated with conventionally fractionated regimens were similar with respect to median age, menopausal status, presence of comorbidities, BMI, stage of presentation, and ER and HER2 status. Compared with the hypofractionated regimens, those receiving conventional regimens were more likely to be of black race (33.3% vs 17.9%; $P = .03$) and more likely to be treated more aggressively with RNI (18.4% vs 0%; $P = .001$) and chemotherapy (25.9% vs 8.9%; $P = .007$).

Acute skin toxicity

As shown in Table 1, the overall rate of MD was 11.4% and CTCAE grade ≥2 dermatitis was 31.4% among the entire cohort, including both PMRT and intact breast targets. When broken down by PMRT versus intact breast, as expected, patients treated with PMRT had greater skin toxicity, with higher rates of MD (24% vs 8.7%; $P = .005$) and CTCAE grade ≥2 dermatitis (48% vs 27.8%; $P = .007$) compared with those treated to the intact breast. When the intact breast cohort is broken down by conventional versus hypofractionated regimens, those treated with conventional regimens were more likely to have both MD (10.9% vs 1.8%; $P = .05$) and grade ≥2 dermatitis (30.4% vs 7.1%; $P < .001$).

Among the 50 patients receiving PMRT in this cohort, 52% received bolus during treatment and 48% did not. Among those treated with bolus, 38.5% developed MD; only 8.3% of patients treated without bolus developed MD ($P = .02$). On multivariate analysis of the PMRT cohort, only bolus use was found to significantly predict for MD (odds ratio [OR], 8.71; $P = .04$).

Table 3 Predictors of moist desquamation in lumpectomy patients: Univariate analysis

Variable	Moist desquamation	*P*-value	Grade ≥2 dermatitis	*P*-value
Age >60 y				
Yes	7%		22.5%	.054
No	10.9%	.35	34.7%	
Black race				
Yes	7.4%		27.9%	1.00
No	9.3%	.80	27.8%	
Postmenopausal				
Yes	10%		30%	.21
No	4.0%	.26	20%	
Body mass index ≥30				
Yes	13.6%		30.9%	.54
No	6.4%	.09	26.2%	
Diabetes mellitus				
Yes	10.3		27.6%	1.00
No	8.5	.73	27.9%	
Hypertension				
Yes	9.9%		31.9%	.30
No	7.9%	.64	25.2%	
Coronary artery disease				
Yes	0%		37.5%	.69
No	9.0%	1.00	27.5%	
ER+				
Yes	8.9%		27.6%	.82
No	7.4%	1.00	29.6%	
PR+				
Yes	9.4%		26.9%	.62
No	6.8%	.79	30.5%	
Hypofractionated RT				
Yes	1.8%		7.1%	<.001
No	10.9%	.05	34.5%	
Chemotherapy				
Yes	18%		34%	.29
No	6.1%	.02	26.1%	
RNI				
Yes	21.2%		48.5%	.006
No	6.6%	.01	24.4%	

ER+, estrogen receptor positive; PR+, progesterone receptor positive; RNI, regional nodal irradiation; RT, radiation therapy.

Table 3 presents univariate analysis of factors that are potentially associated with grade ≥2 dermatitis and MD in the subset of patients treated to the intact breast. Predictors of grade ≥2 dermatitis included conventionally fractionated RT (34.5% vs 7.1%; $P < .001$) and use of RNI (48.5% vs 24.4%; $P = .006$). The average rate of MD was quite low at 8.7%. Predictors for MD also included conventionally fractionated RT (10.9% vs 1.8%; $P = .05$) and use of RNI (21.2% vs 6.6%; $P = .01$), as well as use of chemotherapy (18% vs 6.1%; $P = .02$).

On multivariate analysis, we included factors found to be associated with skin toxicity on univariate analysis, as well as other factors that have been associated with skin toxicity, including race, menopausal status, receptor status, and BMI. Predictors of grade ≥2 dermatitis were the same as those identified on univariate analysis, including conventionally fractionated RT (OR, 5.88; $P = .001$) and use of RNI (OR, 2.4; $P = .06$). With respect to MD specifically, use of chemotherapy (OR, 3.74; $P = .04$) and use of RNI (OR, 3.29; $P = .03$) retained significance, but fractionation scheme lost significance (OR, 5; $P = .13$) and BMI ≥30 emerged as a predictive factor (OR, 3.29; $P = .03$).

Discussion

In this retrospective analysis of patients treated with postoperative radiation for breast cancer, including RT to the intact breast and chest wall (PMRT), we identified a spectrum of skin toxicities depending on the radiation target, radiation fractionation scheme, and other predictive factors including BMI, use of chemotherapy, and use of RNI. As

expected, the rate of both grade ≥2 dermatitis and MD were highest in those patients treated with PMRT (48% and 24%, respectively). Among those treated to the intact breast, the overall rate of both grade ≥2 dermatitis and MD were higher in those treated with conventional fractionation compared with hypofractionated regimens (30.4% vs 7.1% for grade ≥2 dermatitis and 10.9% vs 1.8% for MD). As expected, among those who received PMRT, the rate of MD was higher in those treated with bolus (38.5% vs 8.3%).

Our findings support the existing literature with regard to risks of acute skin toxicity and highlight the need to explore the use of hypofractionation in patients who are at the highest risk of acute skin toxicity, including those with elevated BMI and those being treated with PMRT. Our findings align with those in the recently published MROQC analysis, particularly with respect to the finding that hypofractionated regimens do not result in increased acute toxicity in patients with elevated BMI. Our study provides information on the risk factors for grade ≥2 dermatitis as well as MD, an endpoint that is less commonly reported because the CTCAE toxicity scale groups MD with grade 2 dermatitis, which makes it more difficult to capture this toxicity. Our study is unique in directly comparing acute skin toxicities in a population of patients treated at the same institution with the same general treatment planning approaches; it highlights the starkly elevated risk of acute toxicity in patients receiving PMRT.

As summarized in the introduction, multiple randomized trials comparing conventionally fractionated versus hypofractionated regimens in patients being treated with adjuvant RT to the intact breast have demonstrated equivalent long-term outcomes, with improved acute and late toxicities in the hypofractionated arms.[5-7,9] In 2013, the ASTRO Choosing Wisely Campaign issued a strong statement in support of hypofractionation with the following statement: "Don't initiate whole breast radiotherapy as a part of breast conservation therapy in women age ≥ 50 with early stage invasive breast cancer without considering shorter treatment schedules."[13] Despite this, hypofractionated regimens have been adopted slowly in the United States compared with other countries.[10,11]

The known association of large breast separation and elevated BMI with acute skin toxicities is a commonly cited reason for the selection of conventionally fractionated regimens. This association relates at least in part to the greater challenge in creating dose homogeneity in patients with larger breasts.[14] However, our results, as well as those from the larger MROQC analysis, call into question the validity of this concern in the era of modern RT. In both studies, the mean BMI was above the threshold for overweight, and 38.6% in our study had BMI >30, which meets the threshold for obesity. Elevated BMI was not associated with a greater risk of grade ≥2 dermatitis in our study, but it was associated with a greater risk of MD, likely due to the increased area of skin folds in these patients among other reasons. Despite this, acute toxicities were not worse in patients with an elevated BMI who were treated with hypofractionated regimens.

The rationale for hypofractionated regimens in breast cancer stems from the hypothesis that the majority of breast tumors have a relatively low α/β ratio of 3 Gy and are therefore more sensitive to fraction size than to total dose. To correlate with the use of higher dose per fraction, total radiation doses are lowered with hypofractionated regimens, and it is total dose that is expected to correlate with acute toxicities. Although an analysis of dose homogeneity was not available for all patients in this cohort, dose homogeneity in general will be inferior in patients with a higher BMI, regardless of fractionation. Radiobiologic modeling suggests that the impact of dose inhomogeneity should not significantly vary with fraction size.[15] Taken together, these data strongly suggest that higher BMI should not be used as an exclusion criterion for patients who are being considered for hypofractionated radiation, regardless of the homogeneity parameters.[5]

Of note, the use of chemotherapy was associated with higher rates of MD but not grade ≥2 dermatitis, among lumpectomy patients on our multivariable analysis (Table 4). The significance of this finding is unclear given the small percentage of patients receiving chemotherapy in the hypofractionated arm and the low incidence of MD in the lumpectomy cohort; therefore, this may be a statistical

Table 4 Predictors of moist desquamation in lumpectomy patients: Multivariate analysis

Variable	Moist desquamation		Grade ≥2 dermatitis	
	Odds ratio	*P*-value	Odds ratio	*P*-value
Black race	0.42	.15	0.75	.42
Postmenopausal	4.73	.07	1.61	.27
Body mass index ≥30	3.29	.03	1.35	.38
ER+	1.23	.85	1.09	.88
PR+	2.53	.27	0.97	.95
Hypofractionated RT	0.20	.13	0.17	.001
Chemotherapy	3.74	.04	0.97	.94
Regional nodal irradiation	3.29	.03	2.4	.06

ER+, estrogen receptor positive; PR+, progesterone receptor positive; RT, radiation therapy.

anomaly due to the small number of events. A meta-analysis of the UK START trials did not show an increased toxicity rate in patients treated with chemotherapy, but this study did not report on acute toxicity.[7] We continue to offer hypofractionated regimens to patients who have received chemotherapy at our institution and will continue to evaluate this finding over time.

With respect to the cohort of patients receiving PMRT, these patients were found to be at a substantially elevated risk of grade ≥2 dermatitis (48% vs 27.8%) and MD (24% vs 8.7%). This finding is expected because of the difference in radiation target, which generally does not include the skin in the setting of RT to the intact breast but does include the skin in the setting of PMRT. Tissue-equivalent bolus to increase the skin dose is commonly used at our and other institutions; thus, the development of dermatitis is intended in this subset of patients and was indeed observed to be higher in those treated with bolus. Although the use of tissue-equivalent bolus is clearly one risk factor for acute toxicity in PMRT patients, the fact that PMRT is generally delivered using conventional fractionation may also contribute to this risk. The finding that hypofractionation results in equivalent outcomes and a decreased risk of both acute and late toxicity in the intact breast population suggest that perhaps a study of hypofractionation in the setting of PMRT, especially with use of bolus and regional nodal RT, may yield less toxicity.

Some data have begun to emerge in support of this approach. A small retrospective study from Thailand compared hypofractionated with conventionally fractionated PMRT regimens and showed no significant differences in locoregional control or late toxicity, such as skin fibrosis. Acute toxicity was not reported.[16] In a recent prospective study, Ahlawaht et al reported results using hypofractionated treatment in higher risk and node-positive patients, including RNI.[7,9,17] In this study, 9.6% of patients received RNI, and grade 3 dermatitis was only observed in 1 patient who underwent reirradiation. Although PMRT patients were not included in this cohort, the tolerability of hypofractionation in patients with N1-N2 disease treated with RNI lends support to the use of hypofractionation in higher-risk populations.

In a recent publication by Bellefqih et al, patients who underwent either mastectomy or breast conservation with node-positive disease all received adjuvant hypofractionated RNI. Although acute toxicity was not detailed, late toxicity was limited to grade ≥2 hyperpigmentation (<1%) and grade 3 fibrosis (1%).[18] Finally, a randomized trial is underway in China (A Phase III Randomized Clinical Trial of Postmastectomy Hypofractionation Radiotherapy in High-risk Breast Cancer; NCT00793962, clinicaltrials.gov) and is expected to report soon.[19] The available data strongly support further investigation into hypofractionated treatments in the setting of PMRT.

There are several limitations to this study, most importantly its reliance on retrospective data. As such, our measurement of MD was reliant on toxicity documented during weekly on-treatment checks as well as follow-up visits. Given that our practice is to see patients for first follow-up 1 month after treatment completion, we are likely missing MD that is not captured in routine assessments. The low rate of MD observed in our hypofractionated lumpectomy cohort (1.8%) could be explained by this because skin toxicity tends to peak immediately post-RT and has perhaps resolved before the 1-month assessment.

Of note, the use of hypofractionated regimens for whole breast RT after lumpectomy was low in the study's overall cohort (24.3%). This is largely explained by the range of treatment years included, which spanned from 2008 to 2015. Hypofractionation is increasingly adopted at our institution on the basis of the published literature, the Choosing Wisely Campaign, and our own findings as reviewed here and is now the preferred modality for all patients who are not receiving PMRT or RNI.

Conclusions

In this retrospective analysis of patients with postoperative radiation treatment for breast cancer, including RT to the intact breast and chest wall, we identified multiple risk factors for acute skin toxicity, including radiation target (with greater toxicity in the PMRT cohort) and fractionation scheme (with greater toxicity in the conventionally fractionated cohort). Elevated BMI was associated with an increased risk of MD but not grade ≥2 dermatitis, but this was independent of fractionation scheme. Our findings support the existing literature with regard to the risks of acute skin toxicity and highlight the need to implement and explore the use of hypofractionation in those patients at highest risk of acute skin toxicity, including those with a higher BMI, and to further investigate those being treated with PMRT.

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