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Is Tissue Expansion Worth It? Comparative Outcomes of Skin-preserving versus Delayed Autologous Breast Reconstruction

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Background: The requirement for postmastectomy radiation therapy (PMRT) at the time of mastectomy is often unknown. Autologous reconstruction is preferred in the setting of radiotherapy by providing healthy vascularized tissue to the chest. To maximize mastectomy skin preservation, tissue expander (TE) placement maintains the breast pocket until definitive reconstruction. This study aims to compare outcomes of skin-preserving delayed versus standard delayed autologous breast reconstruction in the setting of PMRT.
Methods: A retrospective review of a prospective database was performed of two patient cohorts at a single center between 2006 and 2016. Inclusion criteria were locally advanced breast cancer patients who completed PMRT and free autologous reconstruction. Primary outcomes were major intraoperative and postoperative TE and flap complications.
Results: Over 10 years, 241 patients underwent mastectomy and PMRT. Standard delayed autologous breast reconstruction was performed in 131 breasts (non-TE group). Skin-preserving delayed autologous reconstruction was performed in 113 breasts (TE group). The TE group was associated with a higher incidence of intraoperative complications during flap reconstruction ($P = 0.002$) and had a higher venous thrombosis incidence than the non-TE cohort ($P = 0.007$). Other major postoperative complications were not significantly different between the two groups. TE patients had 7.5 times higher risk of intraoperative complications and an 18.6% TE loss rate.
Conclusions: We identified higher intraoperative flap complications and a high rate of TE loss in patients who underwent skin-preserving delayed autologous breast reconstruction. The benefit of mastectomy skin preservation needs to be weighed against the increased risk of TE loss and higher rates of flap thrombosis. *(Plast Reconstr Surg Glob Open 2020;8:e3217; doi: 10.1097/GOX.0000000000003217; Published online 23 November 2020.)*

INTRODUCTION

Radiotherapy is a key component of locally advanced breast cancer treatment and has been proven to increase both local control and survival.[1–5] Despite technical advances, breast reconstruction in the setting of postmastectomy radiation therapy (PMRT) remain a difficult problem for the reconstructive surgeon. The reconstructive type and timing remains controversial,[1,3,4,6] as multiple studies have shown that definitive breast reconstruction after PMRT is associated with a significantly higher rate of postoperative complications compared to patients who do not require PMRT.[1,3,4,6–13] To further confound the problem, the clinical need for PMRT is often not known at the time of the initial mastectomy. The multidisciplinary decision for adjuvant chemoradiation is usually determined by pathologic findings finalized over the weeks following the

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ablative procedures. Preoperatively, reconstructive surgeons must base their immediate reconstruction decision on the estimated potential for PMRT. This decision can be challenging in patients who receive immediate autologous reconstruction since PMRT can cause fat necrosis, flap volume loss and contraction.[6,7,14–22]

In 2004, the MD Anderson group published a 2-stage approach to manage patients where PMRT plans were unknown at the time of mastectomy.[23] This introduced the concept of "delayed-immediate" breast reconstruction, which consisted of placement of a sub-pectoral tissue expander (TE) at the time of the initial mastectomy to maintain the soft-tissue envelope. If PMRT was not required, patients were taken back to the operating room for essentially "staged-immediate" definitive reconstruction. These patients are considered to receive the same aesthetic and surgical results of immediate reconstruction. Patients who required PMRT had their TE in place during radiation treatment and were reconstructed in a delayed manner. Since its advent, this concept and technique have become increasingly popular, and have been reported throughout the recent literature.[24–26] In a follow-up study, 10-year follow-up data were published, which demonstrated an overall 84.6% success rate in 384 delayed-immediate breast reconstructions all of which involved PMRT.[27]

The term "delayed-immediate" has continued to be used for all 2-stage delayed autologous breast reconstructions in which a TE was placed at the time of mastectomy. Ayoub et al reported that patients in this cohort who underwent PMRT waited on average 7 months from the completion of radiation and 12 months after placement of their TE for their autologous reconstruction.[27] With this in mind, "Skin-preserving delayed autologous reconstruction" has become a better description of these patients who may wait a year or more after PMRT for reconstructive completion.

Although this algorithm has been adopted by many surgeons with relative success, skin-preserving delayed autologous reconstruction can be associated with TE removal in up to one third of cases secondary to postoperative and radiation-related complications.[23] In addition, there is evidence that TE placement before PMRT may interfere with the delivery of radiation and could negatively impact cancer treatment.[22,23,27–38] Reconstructive surgeons and patients must weigh the benefit of maintaining the mastectomy skin envelope against the risks associated with radiating a TE. Clinical outcomes must be compared with the benefit of preservation of the temporary breast mound during adjuvant therapy when counseling patients on delayed breast reconstruction. This enables the patient to choose the sequence of procedures that meets their oncologic and reconstructive goals. In this study, our objective was to assess reconstructive outcomes comparing skin-preserving and standard delayed autologous reconstruction in setting of PMRT.

METHODS

After institutional review board approval, a single-center retrospective review of a prospective maintained

database was conducted from January 2006 to January 2016. We evaluated consecutive locally advanced breast cancer patients treated with mastectomy, with or without immediate TE placement, followed by PMRT and free autologous abdominal-based breast reconstruction. The decision to place a TE was surgeon dependent. All patients in these two cohorts received all their surgical and oncologic care at the MD Anderson Cancer Center. Exclusion criteria included any immediate implant or autologous flap reconstruction and any pedicled or non-abdominal based autologous reconstruction.

Electronic medical record chart review was conducted to include patient characteristics (including age, body mass index (BMI), and comorbid conditions), tobacco use, cancer characteristics/medical treatment (tumor type, TNM staging, and chemotherapy), PMRT therapy details (dosing, duration, and complications), and surgical management details (mastectomy type, reconstructive detail of the tissue expander, and free flap along with and postoperative outcomes). We assessed the timing from mastectomy to initiation of PMRT, and completion of final reconstruction. Patients from all the plastic surgery faculty at the MD Anderson Cancer Center during this time were included. Standard global postoperative follow-up includes several visits after TE placement (TE group) in addition to preoperative and postoperative follow-up after autologous reconstruction in both groups. Comprehensive cancer care at our institution provided additional long-term follow-up by a detailed chart review, which was performed before final analysis.

Placement of the TE was done in the subpectoral position as total submuscular coverage or with an inferior acellular dermal matrix (ADM) sling. Type of TE or ADM was surgeon specific. There were no patients who received prepectoral tissue expanders in our patient cohort. Definitive reconstructive surgery included abdominal-based flaps (transverse rectus abdominis muscle, muscle-sparing transverse rectus abdominis muscle flaps, deep inferior epigastric artery perforator, and superficial inferior epigastric artery flaps). Timing of delayed free flap reconstruction was also surgeon dependent. Surgeon-dependent factors inherently contribute to selection bias, which is unavoidable in our study design. The single center nature of our study was used to control bias as much as possible.

Radiation-related complications were assessed per acute radiation dermatitis grading as delineated by the National Cancer Institute Common Terminology Criteria for Adverse Events, specifically detailing degree of skin breakdown. Severe radiation complications (including moist desquamation or higher on the grading scale) were documented as skin-related radiation complication. The MD Anderson Cancer Center radiation therapy routinely targets the undissected internal mammary chain using a 3D conformal approach. Majority of patients received 50Gy in 25 fractions, often boosted to 60Gy to the chest wall.

Due to this approach, TEs were deflated before and re-inflated after PMRT. In our practice, TEs were filled to as close to target volume as possible and then deflated to a maximum of 150 ml normal saline before

PMRT simulation. Following completion of radiation, the expanders are then rapidly expanded to re-establish the mastectomy pocket.

Primary outcome measures were major free-flap–related complications and major TE complications. Major complications were defined as complications that required re-operation or hospitalization. Secondary outcomes were minor complications, including free-flap related complications, TE complications, and radiation associated complications all of which did not require re-operation or hospitalization. We also examined time intervals between different treatment regimens. Both recipient and donor site surgical complications were studied and described as major or minor similar to the above descriptions. Special focus was placed on intraoperative anastomotic revisions, thrombectomy, venous supercharging, perioperative reoperation for flap salvage and flap loss.

For analysis, patients were placed into two groups. Those who underwent immediate placement of TE at the time of mastectomy before initiation of PMRT were placed into the "TE group." These patients were the "Skin-preserving delayed breast reconstruction" patients. Those who did not undergo TE placement were grouped into the "non-TE group." These patients are the "Standard delayed breast reconstruction" patients.

STATISTICAL METHODS

Descriptive statistics such as means, SDs, median and interquartiles (IQRs) were used for specific demographic and surgical continuous variables. Frequencies and percentages were used to present categorical variables and outcomes. Chi-squared test or Fisher's exact test was used to determine the association between the categorical variables and study groups. Wilcoxon rank sum test is used to compare the ordinal variables between patients with and without TE. Univariate analyses revealed the association between use of TE and the complications. Univariate and multivariable generalized estimating equations models were used to estimate the adjusted odds ratios (ORs) for clinical factors associated with the TE-related surgical reoperations. All tests were two sided. $P < 0.05$ was considered significant. The analyses were performed in SAS 9.3 (SAS Institute Inc, Cary, N.C.) with the assistance of a departmental biostatistician (JL).

RESULTS

A total of 241 patients were included in our study, with 244 reconstructions (3 bilateral cancer patients). Of these patients, 113 underwent skin preserving delayed reconstruction (TE group), and 131 underwent standard delayed reconstruction (non-TE group). Table 1 summarizes patient demographics. Mean patient age was 50.4 years and mean BMI was 28.7 kg/m². Mean follow-up time was 44.4 and 54.1 months for the non-TE and TE group respectively ($p = 0.041$). The non-TE group had significantly more patients with tobacco use (13.7% versus 3.5%, $P = 0.006$), advanced stage (stage III/IV) breast cancer (72.5% versus 46.9%, $P = 0.001$) and neoadjuvant chemotherapy (98.5% versus 88.5%, $P = 0.002$).

All patients underwent PMRT (mean: 60Gy, 42 days) to the chest wall and regional lymphatics (Table 2). The duration of radiotherapy was significantly longer in the TE group (45.7 versus 43.6 days, $P = 0.041$) although the radiotherapy dose was not significantly different. Skin-related radiation complications were significantly higher in TE patients (14.2% versus 5.3%, $P = 0.019$). The univariate generalized estimating equation model estimated that the risk of skin-related radiation complications in TE

Table 1. Patient Demographics

Characteristic	All, N (%)	Non-TE, N (%)	TE, N (%)	P*
No. patients	244	131	113	
Age of patients (years)				0.140
Mean ± SD	50.5 ± 10.2	51.5 ± 10.8	49.3 ± 9.4	
Median (range)	51 (28–85)	51 (28–85)	50 (29–70)	
Follow-up (mo)				0.140
Mean ± STD	48.9 ± 29.0	44.4 ± 25.5	54.1 ± 32.0	
Median (range)	41.0 (5.8–154.5)	38.7 (9–154.5)	42.6 (5.8–130.2)	
BMI, kg/m²				0.068
Mean ± SD	28.7 ± 4.6	29.1 ± 4.4	28.2 ± 4.7	
Median (range)	28 (20–39)	29 (20–39)	28 (21–39)	
Active smoker	22 (9.0)	18 (13.7)	4 (3.5)	0.006
Diabetes	5 (2.1)	3 (2.3)	2 (1.8)	0.999
Peripheral vascular disease	3 (1.2)	1 (0.8)	2 (1.8)	0.598
Coronary artery disease	1 (0.4)	0 (0)	1 (0.9)	0.463
Arrhythmias	5 (2.1)	3 (2.3)	2 (1.8)	0.999
Cerebrovascular disease	4 (1.6)	2 (1.5)	2 (1.8)	0.999
Immunological disease	3 (1.2)	1 (0.8)	2 (1.8)	0.598
Psychiatric disorder	34 (13.9)	15 (11.5)	19 (16.8)	0.228
Renal disease	5 (2.1)	2 (1.5)	3 (2.7)	0.665
Rheumatologic disease	6 (2.5)	5 (3.8)	1 (0.9)	0.221
Pulmonary disease	8 (3.3)	3 (2.3)	5 (4.4)	0.477
Hypertension	47 (19.3)	24 (18.3)	23 (20.4)	0.688
Gastrointestinal disease	41 (16.8)	21 (16)	20 (17.7)	0.728
Stages				0.001
I/II	96 (39.3)	36 (27.5)	60 (53.1)	
III/VI	148 (60.7)	95 (72.5)	53 (46.9)	
Neoadjuvant chemotherapy	229 (93.9)	129 (98.5)	100 (88.5)	0.002

*P values were calculated by using Wilcoxon rank sum test for age, BMI, and length of follow-up, and Chi-squared test and Fisher's exact test for categorical variables.

Table 2. Radiation Duration, Dosing, and Skin-related Complications

	Non-TE	TE	P*
Duration, d mean (SD)	43.6 (23.4)	45.7 (34.6)	0.041
Median (range)	42 (10–266)	42 (26–407)	
Dose mean (SD)	60 (3.6)	60 (2.1)	0.765
Median (range)	60 (45–66)	60 (50–70)	
Skin-related radiation complications (N, %)			0.019
No	124 (94.7)	97 (85.8)	
Yes	7 (5.3)	16 (14.2)	

*P values were calculated by using Wilcoxon rank sum test and Chi-Squared test.

Table 3. Surgical Procedure Demographics

	Non-TE (N, %)	TE (N, %)	P*
Mastectomy type			<0.001
Skin sparing	30 (22.9)	112 (99.1)	
Nipple sparing	2 (1.5)	0 (0)	
Modified radical	99 (75.6)	1 (0.9)	
Flap type			0.306
Deep inferior epigastric artery perforator flap	92 (70.2)	78 (69)	
Muscle-sparing transverse rectus abdominis muscle flap	34 (26)	34 (30.1)	
Transverse rectus abdominis muscle flap and superficial inferior epigastric artery perforator flap	5 (3.8)	1 (0.9)	

*P values was calculated by using Fisher's exact test.

patient is nearly 3-fold than in non-TE patients (OR = 2.98, 95% CI = 1.18–7.55, P = 0.021).

Table 3 summarizes the surgical procedure demographics. The majority of TE group patients underwent skin-sparing mastectomy (99.1%), while the majority of non-TE group patients underwent modified radical mastectomy (75.6%). There was no significant difference between type of abdominal free flap reconstructions between the two groups, with deep inferior epigastric artery perforator flaps as the most common in the non-TE and TE groups.

The TE group had a higher incidence of intraoperative complications (11.5% versus 1.5%, P = 0.002), and venous thrombosis (8.0% versus 0.8%, P = 0.007) (Table 4). There were no significant differences in overall major post-operative complications, arterial thrombosis, total/partial flap loss, or overall minor complications between the two groups.

TE patients had a shorter interval from the time of mastectomy to final reconstruction (11 months versus 16 months, P < 0.001) (Table 5). However, the time interval between mastectomy and initiation of PMRT was significantly longer in the TE group (1.9 months versus 1.6 months, P = 0.001).

In the TE group (Table 6), there were 21 patients that had major complications, which resulted in 19 TE removals (18.6%). The most common surgical complications in the TE patients were infection and mastectomy skin flap necrosis (15.9% and 9.7%, respectively). Seven TEs were removed before initiation of PMRT and 10 expanders were removed after its completion (6.2% versus 8.8%), respectively. Univariate and multivariable analyses evaluating

Table 4. Intra-operative and Post-operative Free Flap Reconstruction Complications

Complications	All (N, %)	Non-TE (N, %)	TE (N, %)	P*
Intra-operative complications	15 (6.1)	2 (1.5)	13 (11.5)	0.002
Postoperative complications				
Minor	59 (24.2)	31 (23.7)	28 (24.8)	0.839
Major	39 (16.0)	19 (14.5)	20 (17.7)	0.497
Breast surgical site occurrence				
Arterial thrombosis	5 (2.0)	3 (2.3)	2 (1.8)	1.000
Venous thrombosis	10 (4.1)	1 (0.8)	9 (8)	0.007
Partial flap loss	4 (1.6)	1 (0.8)	3 (2.7)	0.339
Total flap loss	8 (3.2)	5 (3.8)	3 (2.7)	0.728
Hematoma	6 (2.5)	1 (0.8)	5 (4.4)	0.099
Seroma	11 (4.5)	7 (5.3)	4 (3.5)	0.498
Infection	15 (6.2)	9 (6.9)	6 (5.3)	0.613
Dehiscence	7 (2.9)	3 (2.3)	4 (3.5)	0.707
Mastectomy skin flap loss	5 (2.0)	1 (0.8)	4 (3.5)	0.185
Fat necrosis	21 (8.6)	12 (9.2)	9 (8)	0.740
Donor site				
Return to operating room for donor site complications	11 (4.5)	6 (4.6)	5 (4.4)	0.953

*P values were calculated by using Chi-squared test or Fisher's exact test for complications.

Table 5. Treatment Time Intervals

Variable	Non-TE (N, %)	TE (N, %)	P*
Time between mastectomy and final flap reconstruction (mo), median (IQR)	16 (12–20)	11 (8–15)	<0.001
Time between mastectomy and PMRT beginning (mo), median (IQR)	1.6 (1.2–2.3)	1.9 (1.5–6)	0.001
Time between mastectomy and PMRT completion (mo), median (IQR)	2.9 (2.5–3.9)	3.3 (2.8–7.8)	<0.001

*P values were calculated by using Wilcoxon rank sum test.

Table 6. TE Complications

Complication	N (%)
No. breasts	113
Hematoma	3 (2.7)
Seroma	7 (6.2)
Implant exposure	4 (3.5)
Infection	18 (15.9)
Dehiscence	6 (5.3)
Mastectomy skin flap necrosis	10 (8.8)
Surgical reoperation	21 (18.6)
Major complication	21 (18.6)
Minor complication	35 (40.0)
TE removal	19 (16.8)
Before PMRT	7 (6.2)
During PMRT	2 (1.8)
After PMRT	10 (8.8)

effect of age, BMI, tumor stage and radiation skin complications, failed to demonstrate significant correlation with occurrence of TE related surgical operations (Table 7). When we performed a similar analysis modeling for intraoperative complications, we found a significant correlation with the use of TE and younger age (Table 8). Tissue expander patients had approximately 7.5-fold higher odds of intraoperative complications compared with patients without tissue expanders.

Table 7. Univariate and Multivariable Model for Probability of TE Surgical Reoperation

	Univariate Model		Multivariable Model	
	OR (95% CI)	P	OR (95% CI)	P
Age of patients (y)	0.99 (0.95–1.04)	0.773	0.99 (0.94–1.04)	0.602
BMI (kg/m^2)	1.02 (0.94–1.11)	0.590	1.03 (0.94–1.12)	0.573
Stages (III/IV versus I/II)	2.08 (0.82–5.22)	0.121	2.17 (0.81–5.80)	0.121
PMRT complication	0.57 (0.12–2.71)	0.477	0.50 (0.09–2.62)	0.412

Table 8. Univariate and Multivariable Model for Intraoperative Complications

	Univariate Model		Multivariable Model	
	OR (95% CI)	P	OR	P
Use of TE	8.53 (1.88–38.7)	**0.005**	7.46 (1.27–43.82)	0.026
Age of patients, year	0.95 (0.90–0.99)	0.027	0.94 (0.89–0.99)	0.023
BMI, kg/m^2	0.98 (0.89–1.08)	0.706	1.03 (0.94–1.13)	0.493
Tobacco use	1.60 (0.34–7.60)	0.554	2.92 (0.54–15.75)	0.213
Stages (III/IV versus I/II)	0.41 (0.14–1.18)	0.099	0.63 (0.21–1.89)	0.407
Neoadjuvant chemotherapy	0.22 (0.06–0.89)	**0.034**	0.35 (0.10–1.29)	0.114
PMRT complication	2.60 (0.68–9.99)	0.164	1.25 (0.35—4.42)	0.729

DISCUSSION

In this study we found that TE patients have a 3-times higher skin complication rate following PMRT and a 7.5 times higher intraoperative complication rate when compare to standard delayed patients. In addition, this series had a 19% TE explantation rate due to major complications in the postop and post radiation periods. Although immediate TEs may help patients cope better with their initial post-surgical quality of life,[39] they come with significant risk especially in the setting of radiotherapy.[40,41] The patient and reconstructive surgeon then must weigh the risks and benefits to determine the best timing and surgical approach.

In the TE group there were significantly fewer active smokers, less patients received neoadjuvant chemotherapy and cancer staging was lower when compared to the standard delayed reconstruction patients. Standard delayed patients were more likely to undergo modified radical mastectomy due to their high cancer staging and axillary dissections. Despite these adverse factors, the standard delayed patients had better outcomes when looking at surgical complications. This is an important finding because healthier, better surgical candidates are experiencing higher complications in the setting of TE placement. We did identify a longer time interval between mastectomy and completion of PMRT for the TE group which could represent a potential delay in PMRT due to TE related complications.

The increased risk of radiation related skin complications in the TE group was likely caused by thinner skin flaps after expansion and an underlying foreign body. When examining TE complications, there was an overall 21.6% major complication rate that resulted in reoperation. Of these 21 breasts, 19 lost their TE (16.8%). The most common complications associated with TE loss was infection and mastectomy skin flap necrosis (15.9% and 9.7%, respectively). Our complications were not mutually exclusive and therefore patients could have had multiple postoperative complications that ultimately led to the loss of their TE. We found that most patients lost their TE after completion of radiation (53%) although two patients had TE loss during radiation negatively impacting their radiotherapy. This could be correlated to increased radiation skin complications that occurred in these patients leading to wound healing difficulties, infection and exposure. Rates of TE loss in the literature can be highly variable but reported to be as high as 40% in two stage implant reconstruction with chemoradiation.[42] Majority of the loss in these patients occur during first stage of reconstruction. This is consistent with our reported rate especially in the setting of PMRT.

The intended purpose of the delayed-immediate breast reconstruction with TE placement was to keep the skin pocket intact during radiation treatment to create a temporary breast mound for the patient and facilitate the final reconstruction. Patients may have a difficult time waking up after their mastectomy without any breast mound despite potential risks associated with a temporary TE. Patient reported outcome measures may help answer the question of whether the identified increased complications are worth this facilitation? When we examine the benefits of the "skin-preserving" delayed reconstruction, Albino et. al. reported that usage of mastectomy skin flap improved skin quality, breast contour and overall aesthetic outcomes following a delayed-immediate breast reconstruction.[43] Although these are subjective determinations, oftentimes the inferior mastectomy skin is too tight or fibrotic, regardless of tissue expander use, to be preserved in the final breast reconstruction. This portion of mastectomy skin can be discarded, and the soft, non-radiated flap tissue can be used for a more rounded lower breast pole with a more defined inframammary fold (IMF). Furthermore, the IMF often migrates cranially in patients with irradiated tissue expanders and the IMF needs to be lowered during the autologous reconstruction which is challenging. In this study we were unable to define exactly how much inferior skin was removed during the final reconstruction; that remains a limitation of our paper.

In addition to one-fifth of our TEs being removed in the setting of PMRT, we found that TEs were associated with increased intraoperative complications. These vascular complications included venous and arterial anastomotic revisions, vein grafting and supercharged veins. In the setting of PMRT reconstruction, we often find the arterial walls to be more friable and the veins more fibrotic with decreased caliber. We hypothesize that TE placement in the setting of PMRT increases the radiation fibrosis of the internal mammary vessels. Additional compression and scarring of the chest wall from the TE likely increases the negative tissue effects of our standard IM node radiation boost that is performed at MD Anderson Cancer Center. The increase in internal mammary and supraclavicular nodal boosts have been shown to improve disease free survival and breast cancer mortality.[44] Although we identified more venous complications than arterial issues in our TE patients, the retrospective nature of our case may have limited the true number of intraoperative revisions.

There are several limitations to this study, which result largely from its retrospective design. We acknowledge the fact that a single center study may not have the generalizability that a multi-institutional study would provide. Although our study is a single-center patient cohort, we included patients from all of the plastic surgery faculty at the MD Anderson, which can add to variability in surgical technique and outcomes. We appreciate a potential selection bias by reconstructive surgeons who may have chosen the standard delay technique in active tobacco users or patients with advanced cancer staging or aggressive disease. All patients in our TE cohort had a subpectoral TE placement. The lack of prepectoral TE placement in our breast reconstruction patients may also decrease the generalizability of our results, especially with the recent increase in prepectoral reconstruction and associated PMRT.[45] The overall events of TE surgical reoperation and intraoperative complication were relatively low for our multivariable analyses which could make them unreliable. However, we felt it would be better to control for confounding variables in this retrospective study which is why we chose this methodology. Future research directions may include assessment of patient-reported outcome measures and prepectoral expander placement in the setting of PMRT. Recent implementation of patient-reported outcome measures at our institution will be incredibly helpful in the future to determine if overall patient satisfaction is higher in radiated patients who undergo skin-preserving versus delayed autologous breast reconstruction. In addition, future matched prospective cohort analysis of these two groups of patients may display even higher surgical complication differences, which is important to acknowledge when counseling patients.

CONCLUSIONS

In this study, we identified a higher rate of TE complications and high rates of intraoperative flap complications requiring anastomotic revision in patients who underwent TE placement for skin preserving delayed autologous breast reconstruction. In the setting of PMRT, the use of TEs may increase radiation fibrosis and scarring of the chest wall leading to higher intraoperative autologous flap complications. The benefit of mastectomy skin preservation needs to be weighed against the increased risk of TE loss and higher rates of flap thrombosis. Prospective randomized studies are needed to determine if there is a benefit or detriment of "delayed-immediate" breast reconstruction in the setting of PMRT. Based on our data, we recommend that tissue expanders be carefully considered in patients with significant comorbidities who plan to receive PMRT.

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