

Introduction

There has been an increasing use of postmastectomy radiation therapy (PMRT) in breast cancer patients, especially in cases of large tumors (T3 or greater) or node-positive disease (N1 or greater).¹ When radiation for the treatment of breast cancer is expected, tissue-based breast reconstruction is generally preferred to implant-based reconstruction. This distinction is attributed to the high rate of complications with postoperative radiation after implant-based reconstruction, ranging from 20% to 70%.²

In cases when the need for radiation is likely, breast reconstruction with autologous tissue is typically deferred until the completion of the radiation therapy. Reasons for deferring include avoiding additional morbidity that may delay adjuvant therapy, avoiding irradiating the flap, and maintaining a planar field to optimize radiation delivery.³⁻⁹ Additionally, radiation is known to cause tissue fibrosis, edema, and vasculitis, all of which can interfere with wound healing.³ These reasons must be balanced against the increased psychological discomfort of delayed breast reconstruction, as defect of the breast can affect a woman's self-esteem.¹⁰ Few studies have examined the effects of prior radiotherapy on autologous breast reconstruction.^{11,12} The purpose of this study is to delineate the effects of postmastectomy radiation therapy on outcomes of lower abdominal free flap breast reconstruction by a single surgeon.

Methods

A retrospective chart review of all patients from 2011 to 2016 undergoing a lower abdominal free flap breast reconstruction by the senior author (PJG) was conducted. Prior to free flap breast reconstruction, patients obtain preoperative imaging of the abdominal vasculature via CT angiogram to determine the presence of adequate perforators. The results are used to determine the amount of muscle that may need to be taken from the donor site.

Flaps were grouped into two cohorts based on whether they had received radiation to the ipsilateral side preoperatively. For example, if a patient received preoperative radiation to only the left side and received bilateral reconstruction, the flap on the left side was included in the radiation group, while the flap on the right side was included in the no-radiation group. Specific variables examined included age, body mass index, and presence of comorbid factors such as smoking, hypertension, coronary artery disease, hyperlipidemia, diabetes, and current medications. Rates of total flap loss, microvascular thrombosis, hematoma, seroma, fat necrosis, wound dehiscence, pulmonary embolism, hernia and abdominal laxity were recorded. Subjects were excluded from the study if the time of completion of radiation was unknown. Groups were compared using a Fisher's exact test, with statistical significance defined as a p-value of less than 0.05. SAS 9.4 (SAS Institute, Inc., Cary, NC) software was used for analysis.

Results

Among a total of 113 patients (174 flaps), 81 flaps were included in the radiation group, and 93 flaps were included in the no-radiation group. Based on preoperative imaging, 51 DIEP reconstructions were performed (Figure 1). One instance of total flap loss occurred in the radiation group (Table 1). Additionally, the radiation group had four instances of microvascular thrombosis compared to zero instances in the no-radiation group (p = 0.0451). All other metrics, including wound healing, infection, hematoma and seroma were not statistically different between the groups. Within the radiation group, 95.1% of flaps had at least a 3 month interval from the end of radiation to the free flap procedure. The mean interval was 39.6 months. The mean BMI of the radiation group was 29.5, and the mean BMI of the no-radiation group was 31.6, which resulted in an overall BMI of 30.3.

Overall, there were three instances of hernia. Moreover, 19 patients had abdominal wound healing issues, nine of which necessitated VAC therapy (Table 2). The other ten patients were managed solely with Santyl® (Smith and Nephew, Inc., Fort Worth, Texas).

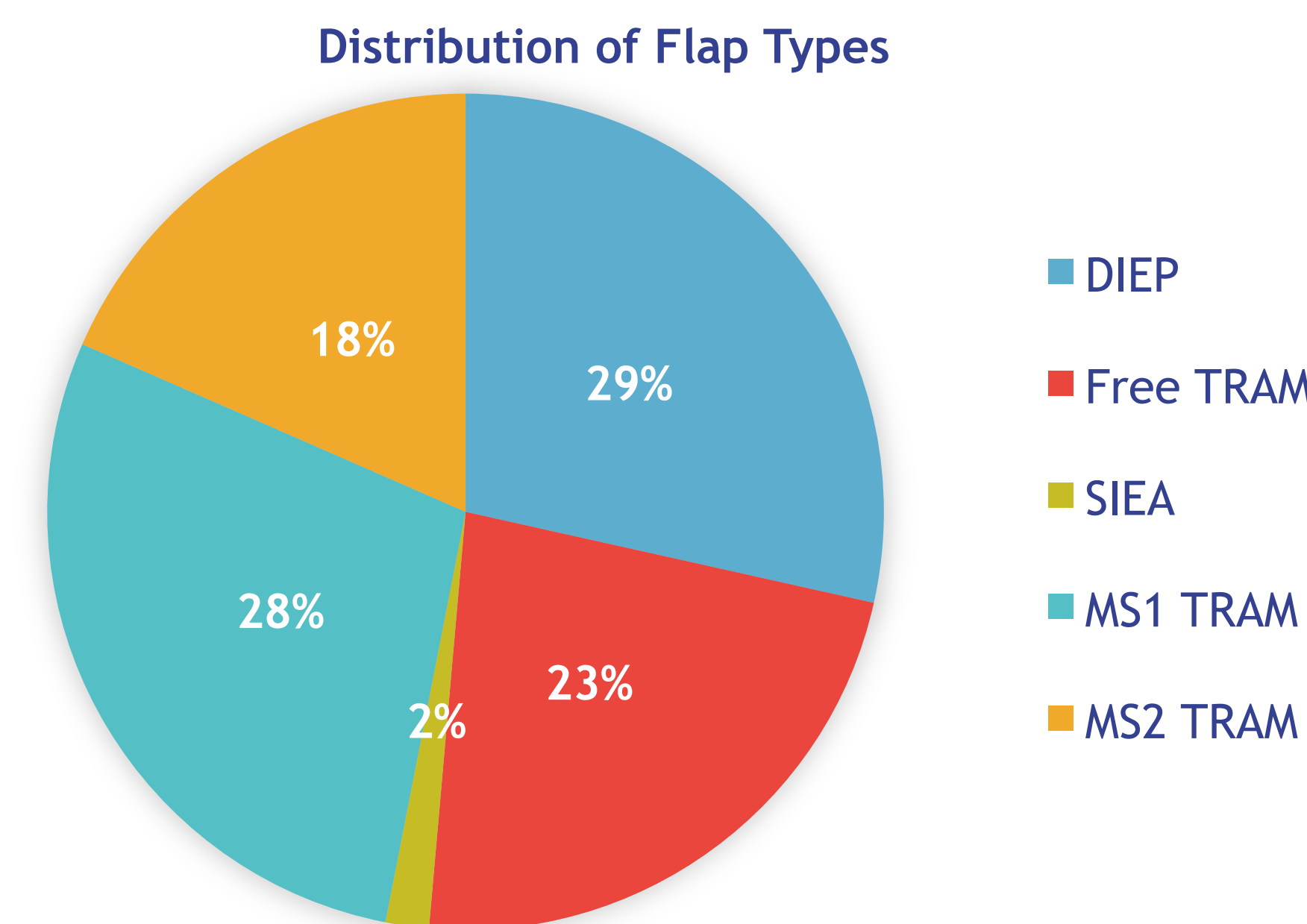


Figure 1: Distribution of Flap Types

Complication	Radiation (%)	No-radiation (%)
Flap Loss	1 (1.2%)	0 (0%)
Microvascular thrombosis	4 (4.9%)	0 (0%)
Hematoma	3 (3.7%)	5 (5.4%)
Seroma	1 (1.2%)	2 (2.2%)
Fat Necrosis	6 (7.4%)	6 (6.5%)
Infection	1 (1.2%)	1 (1.1%)
Major wound healing	2 (2.5%)	0 (0%)
Minor wound healing	5 (6.2%)	2 (2.2%)
Total	23 (28.4%)	16 (17.2%)

Table 1: Breast complications in radiated and non-irradiated breasts

Abdominal Wound Complication	Percentage	BMI
Major Wound Healing Issue (Needing VAC)	7.7% (9/117)	33.2
Minor Wound Healing Issue (Needing Santyl)	8.5% (10/117)	31.8
Infection	1.7% (2/117)	31.1
Seroma	3.4% (4/117)	34.2
Hematoma	0.9% (1/117)	20.4
	22.20%	Average BMI = 32.1

Table 2: Overall abdominal wound complications

Discussion

The increased rate of microvascular complications during free flap reconstruction in the setting of radiation therapy is well-known. In a comparison of 226 radiated to 799 non-irradiated flaps, Fosnot et al reported that prior radiation therapy resulted in an increased rate of intraoperative vascular complications (14.2% vs 7.6%, p < 0.003) and an increased rate of total vascular complications (17.3% vs 9.6%, p < 0.001).¹¹ The authors found the rates of total flap loss, fat necrosis and delayed wound healing in the radiation group to be 3.1%, 8%, and 30.5%, respectively. These rates are consistent with the rates in our cohort of 1.2%, 7.4%, 8.7%.

The optimal timing of breast reconstruction in patients requiring PMRT is still unclear. Baumann et al examined delayed free flap reconstruction in the setting of PMRT and separated patients based on completion of radiation at less than or more than 12 months prior to reconstruction. Patients who completed radiation less than 12 months prior to reconstruction had a higher rate of total flap loss (p = 0.014) and reoperation (p = 0.022).³ In contrast, Momoh et al found no statistically significant differences when using a similar study design with 100 patients. An alternate analysis found no significant differences when using 6 months as the cutoff point.^{13,14} In our series, the average time from the completion of radiation therapy to reconstruction was 39.6 months, and the minimal complication rates reported further support a delayed reconstruction. It is important to note that in our series, a minority of flaps were performed less than 3 months after the end of radiotherapy in patients who demonstrated minimal skin and soft tissue changes.

When the patients in this series were separated based on completion of radiation at less than or more than 12 months prior to reconstruction, the data failed to reach statistical significance, most likely due to the small sample size. Performing this subgroup analysis with more patients is a potential area of further study. Another area of future study would be to investigate the complication rates in patients having completed radiation 2 years or more before reconstruction.

Conclusion

Given the increased use of radiotherapy for the treatment of breast cancer, plastic surgeons must better delineate the effects of radiation therapy on reconstructive outcomes. In the setting of PMRT, delayed reconstruction of the breast can result in a low complication rate. While the optimal timing is unknown, this review calls attention to the further study needed to be able to appropriately counsel patients to achieve the best possible results.

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