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Expanding the Use of Nipple-Sparing Mastectomies in Obese Patients Undergoing Staged Implant-Based Reconstruction

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Abstract

Background: Advantages of various mastectomy techniques include skin reduction and favorable aesthetics in Wise-pattern closures, and less visible scars in nipple-sparing mastectomies (NSM). This study compares postoperative complication profiles between Wise-pattern and nipple-sparing mastectomies in the obese population. **Methods:** A retrospective chart review of obese patients (BMI ≥ 30) who underwent staged breast reconstruction following Wise-pattern and nipple-sparing mastectomies at our institution between February 2016 and January 2020 was conducted. Complications between cohorts were analyzed using the independent samples *t*-test (2-sided) and the χ^2 test. **Results:** A total of 232 breasts (163 Wise-pattern, 69 NSM) were re-constructed in 123 obese female patients (85 Wise-pattern, 38 NSM). Complication rates in both the Wise-pattern and NSM patient cohorts were similar following stage 1 (Wise-pattern: 30.7%, NSM: 39.1%, $p = 0.212$) and stage 2 (Wise-pattern: 16.6%, NSM: 15.9%, $p = 0.907$) of reconstruction. No statistically significant differences in rates of infection, dehiscence, seroma, hematoma or malposition of tissue expander (TE)/implant following stage 1 or stage 2 were found between cohorts. **Conclusions:** There were no significant differences in postoperative complication rates between the Wise-pattern and NSM cohorts of obese patients. NSM can be a viable surgical option in carefully selected obese patients and offer the advantage of concealed scarring.

Keywords

Mastectomy, Breast Reconstruction, Nipple-Sparing

1. Introduction

As the prevalence of obesity among women surpasses 15% and the prevalence of

breast cancer follows closely at 12.5%, the intersection of these two populations warrants further study in the context of post-mastectomy reconstruction [1] [2]. Studies demonstrate that the psychosocial benefits of breast reconstruction manifest for years following mastectomy [3] [4]. While obesity implicates a unique subset of complications in the setting of post-mastectomy reconstruction, it is worth noting that obese women undergoing breast reconstruction report significantly lower satisfaction rates [5]. As the number of post-mastectomy breast reconstructions performed annually continues to rise, it is important to consider how both incision pattern scarring and complication rates impact patient satisfaction [6]-[8]. Both nipple-sparing (NSM) and Wise-pattern closures following mastectomy confer distinct advantages and disadvantages. The Wise-pattern approach is favored in the obese population largely due to its inherent skin reduction, but NSM is also a feasible approach in appropriately selected patients and can have a similar complication profile.

Surgical complications associated with obesity include infection, wound dehiscence, seroma, skin wrinkling and decreased flap survival secondary to limited vascular supply and chronic low-grade inflammation [9]-[11]. The traditional horizontal elliptical mastectomy technique has been criticized in its use among obese patients due to excess skin at the flap and loss of breast contour. The skin reduction inherent in the Wise-pattern technique instead provides a more aesthetically pleasing cosmetic outcome and has been shown to have favorable rates of perioperative complications in obese and/or ptotic patients [12]. However, some studies have reported that skin excision using the Wise-pattern technique can lead to increased complications including skin necrosis and infection after implant placement [11]. While this "reduction-reconstruction" approach offers a more aesthetically pleasing breast shape, it does incur more visible scarring compared to the NSM approach [13].

Patients with large and/or ptotic breasts are often not considered as candidates for NSM due to difficulty in achieving an aesthetically-pleasing cosmetic profile and risk of ischemic complications, especially necrosis of the nipple-areolar complex (NAC) [14] [15]. Additional complications include NAC asymmetry, malposition, and compromised wound healing that may lead to implant extrusion [16]. A number of studies have demonstrated that NSM is associated with high patient satisfaction and psychological benefit [17]. The limited literature on NSM in the obese population suggests that this approach can be successfully used in carefully selected patients with limited comorbidities or used in combination with various skin reduction techniques [18] [19]. Previous studies comparing staged and non-staged approaches in both NSM and Wise-pattern closures advocate for a staged approach in large breast sizes due to significantly lower rates of ischemic complications [20]. However, there is a lack of comparison between incision patterns in a staged approach. To the best of our knowledge this is the first study that demonstrates comparable complication rates between NSM and Wise-pattern approaches in the obese population, thus indicating that NSM can also be an appropriate choice for obese patients when appropriately

selected.

2. Methods

This study retrospectively reviewed the outcomes of 123 female patients who underwent staged breast reconstruction between February 2016 and January 2020 at Upstate University Hospitals. All patients underwent either Wise-pattern closure (85 patients, 163 breasts) or NSM (38 patients, 69 breasts). All reconstructions were performed by the senior author (PKU). The study was approved by the SUNY Upstate Medical University Institutional Review Board (IRB #16184191) and charts were accessed using Epic (Epic Systems Corporation, Verona, WA). All data collection was conducted in a deidentified manner. Using Current Procedural Terminology (CPT) codes for two-staged, implant-based reconstruction and excluding patients with a BMI < 30 based on information collected at initial and follow-up visits prior to stage two, 123 patients met the criteria for the two cohorts.

Basic demographic and comorbidity information collected at the time of stage one included age, ethnicity, BMI, smoking history, and diagnosis of diabetes, hypertension, dyslipidemia, and coronary artery disease. Oncologic data collected included history of chest wall radiation, chemotherapy, neoadjuvant chemotherapy, post-mastectomy radiation therapy, and history of breast surgery.

Perioperative information was also collected for both stages of reconstruction. Mastectomy type (Wise-pattern or NSM), indication for breast surgery, and reconstruction laterality were recorded. Stage one perioperative information collected included mass of the resected breast specimen, whether nipple grafts or axillary lymph node dissections were performed, TE size, use of acellular dermal matrix (ADM), and TE plane (pre- or subpectoral). Stage two perioperative information included size of the final implant placed.

Charts were also evaluated for incidence of postoperative complications up to six months following both stage one and stage two. Complication events included infection, dehiscence, seroma, hematoma, and malposition of either the TE or implant. Infections were further classified as major or minor, with minor infections defined as those requiring no more than oral antibiotics and conservative wound care, and major infections requiring operative intervention such as washout. Washouts were additionally classified by whether or not the TE or implant was salvaged, required replacement, or was removed. Total follow-up time was calculated as the difference between final follow-up visit and date of stage one surgery.

2.1. Statistical Analysis

Data was recorded in a de-identified manner and organized into tables using Microsoft Excel (Microsoft Inc., Seattle, WA). Continuous data was reported using means and standard deviations, while categorial data was described using frequencies. P-values (p) were obtained using the independent samples t-test and χ^2

test for continuous and categorial data, respectively. P-values < 0.05 were considered statistically significant.

2.2. Patient Selection

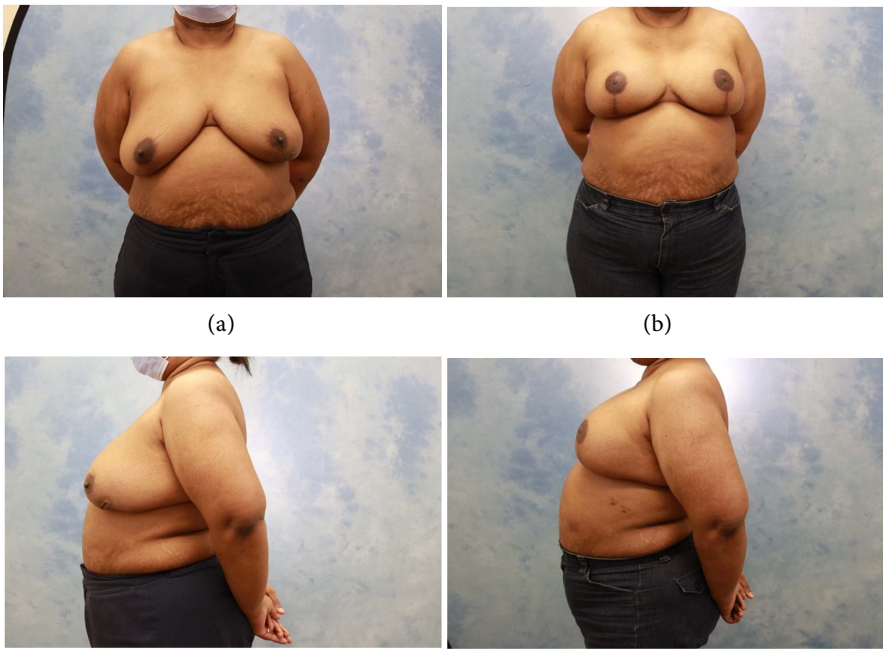
Patients with a BMI ≥ 30 were considered as potential candidates for NSM if they met the following criteria: 1) patient had moderate degree of ptosis, 2) patient was agreeable to possibly have bigger breasts in case a higher volume implant was required to fill up potentially a larger breast pocket following mastectomy, 3) the breast base width was less than 14 to 16 cm, approximately the size of the largest available implant, and 4) the patient understood that a mastopexy might be required in the future for ideal cosmesis (**Figure 1**, **Figure 2**).

3. Results

A total of 232 breasts were reconstructed in 123 female patients. Eighty-five patients (163 breasts) underwent Wise-pattern closure (mean age 52.20 ± 10.06 years, BMI 36.89 ± 5.31) and 38 patients underwent NSM (mean age 46.42 ± 9.24 years, BMI 32.58 ± 1.77). The NSM cohort was significantly younger (p = 0.0031) and had a significantly lower mean BMI (p < 0.0001). Demographics were otherwise relatively comparable between the two cohorts aside from the NSM cohort having a slightly higher proportion of Hispanic patients (10.53% vs 1.18%, p = 0.0438). Comorbidities between the two cohorts were also relatively similar except for diagnoses of diabetes and hypertension, post-mastectomy radiation therapy, and prior history of breast surgery (**Table 1**). The Wise-pattern cohort had a significantly higher prevalence of diabetes (21.18% vs 2.63%, p = 0.0284) and hypertension (49.41% vs 26.32%, p = 0.0186). Patients in the Wise-pattern cohort were also more likely to receive post-mastectomy radiation therapy (13.50% vs 2.90%, p = 0.0281). By contrast, patients in the NSM cohort were most likely to have a history of prior breast surgery (30.43% vs 15.34%, p = 0.0095).

Perioperative information is detailed in **Table 2**. Following the same trend as BMI, average mass of the resected breast specimen trended lower in the NSM cohort (546.16 grams vs 916.29 grams, p < 0.0001). All patients undergoing NSM had acellular dermal matrices (ADM) utilized in reconstruction whereas the majority of Wise-pattern patients did not have ADM placed (63.80% non-ADM). Additionally, the majority of NSM patients had subpectoral TE placement (86.96% vs 64.42%, p = 0.0009) and the NSM cohort had a higher proportion of unilateral reconstructions (18.42% vs 2.35%, p = 0.0069). The Wise-pattern cohort had a higher prevalence of axillary lymph node dissections performed during stage one (13.50% vs 1.45%, p = 0.0222).

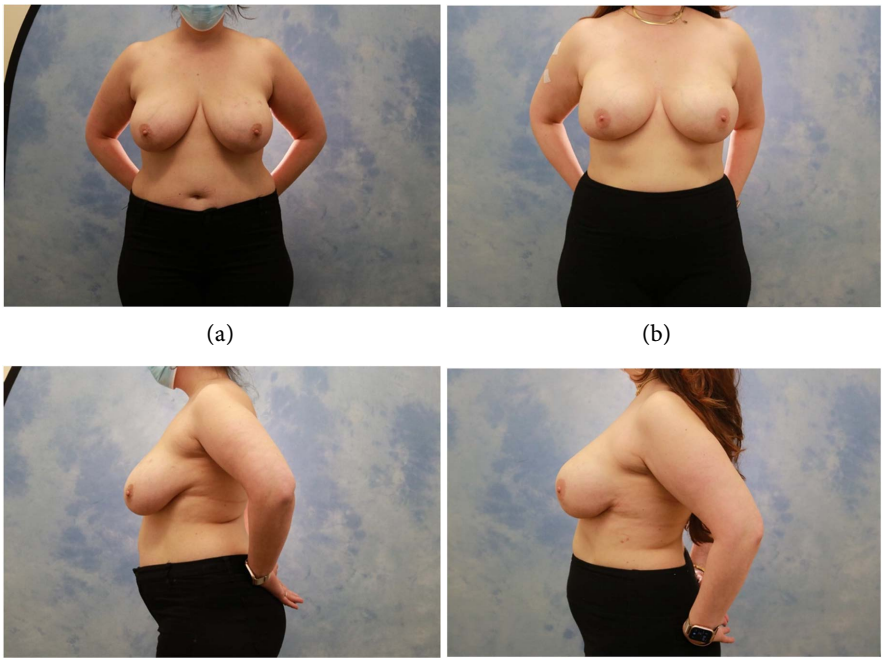
Complication rates following stage 1 (TE placement, **Table 3**) were similar between both the Wise-pattern and NSM cohorts. Of the 232 reconstructed breasts, 77 (33.19%) had a complication incidence > 1 (Wise-pattern: 30.67% vs NSM: 39.13%, p = 0.2123). The most common complication was infection, with higher rates of major infections in the NSM cohort (11.59% vs 4.91%, p = 0.0742).



(a) (b)

(c) (d)

Figure 1. Pre- and six-month post-operative photographs from wise-pattern mastectomy in patient with BMI > 30.



(a) (b)

(c) (d)

Figure 2. Pre- and six-month post-operative photographs from nipple-sparing mastectomy in patient with BMI > 30.

Additional complications in order of decreasing incidence include dehiscence (p = 0.1809), seroma (p = 0.074), hematoma (p = 0.6224), and finally malposition of the TE (p = 0.2298).

Table 1. Patient demographics.

Demographic	Wise-Pattern Patients		NSM Patients		P-value
	N	% or ±SD	N	% or ±SD	
Patients	85		38		
Average Age (years)	52.20 ± 10.06		46.42 ± 9.24		0.0031
Ethnicity					
Asian	1	1.18%	0	0.00%	0.8439
Black	4	4.71%	1	2.63%	0.5955
Other, Hispanic/Latino	1	1.18%	4	10.53%	0.0438
Other, Non-Hispanic	0	0.00%	1	2.63%	0.2424
White	79	92.94%	32	84.21%	0.1412
Mean BMI (Body Mass Index)	36.89 ± 5.31		32.58 ± 1.77		<0.0001
Diabetes	18	21.18%	1	2.63%	0.0284
Hypertension	42	49.42%	10	26.32%	0.0186
Dyslipidemia	22	25.88%	8	21.05%	0.565
Coronary Artery Disease	1	1.18	0	0.00%	0.8493
Smoking History					0.923
Yes	35	41.18%	16	42.11%	
No	50	58.82%	22	57.89%	
History of XRT	10	6.13%	3	4.35%	0.5903
Chemotherapy	16	18.82%	6	15.79%	0.6853
Neoadjuvant Chemotherapy	10	11.76%	6	15.79%	0.5411
Breasts receiving PMRT	22	13.50%	2	2.90%	0.0281
History of Breast Surgery	25	15.34%	21	30.43%	0.0095
Final Follow-Up Time (days)	428.66 ± 227.03		403.78 ± 229.91		0.5769

*Abbreviations: XRT—chest wall radiation history, PMRT—Post mastectomy radiation therapy (by breast).

Table 2. Perioperative information.

Factor	Wise-Pattern Patients		NSM Patients		P-Value
	N	% or ±SD	N	% or ±SD	
Breasts Reconstructed	163		69		
Indication for Breast Surgery (by patient)					0.2066
Breast cancer	71	83.53%	28	73.68%	
Prophylactic	14	11.43%	10	26.32%	
Mean Mass of Resected Specimen (grams)	916.29 ± 326.11		546.16 ± 160.46		<0.0001

Continued

Reconstruction Laterality					0.0069
Unilateral	2	2.35%	7	18.42%	
Bilateral	83	97.65%	31	81.58%	
Nipple Graft	143	87.73%			
Axillary Lymph Node Dissection	22	13.50%	1	1.45%	0.0222
Tissue Expander Plane					0.0009
Prepectoral	58	35.58%	9	13.04%	
Subpectoral	105	64.42%	60	86.96%	
Mean TE Size (in mL)	512.94 ± 49.98		521.01 ± 45.37		0.2494
ADM Use					0.0001
Yes	59	36.20%	69	100.00%	
No	104	63.80%	0	0.00%	
Mean Implant Size	681.53 ± 120.65		705.53 ± 83.37		0.1334

Table 3. Stage 1 complication information.

Complication	Wise-Pattern Patients		NSM Patients		P-Value
	N	%	N	%	
Any complication	50	30.67%	27	39.13%	0.2123
Infection	26	15.95%	13	18.84%	0.591
Major Infection[a]	8	4.91%	8	11.59%	0.0742
Minor Infection[b]	18	11.04%	5	7.25%	0.3799
Washout + Salvaged TE	7	4.29%	5	7.25%	0.3586
Washout + TE Removal	3	1.84%	2	2.90%	0.6149
Dehiscence	19	11.66%	4	5.80%	0.1809
Seroma	17	10.43%	2	2.90%	0.074
Hematoma	2	1.23%	0	0.00%	0.6224
Malposition	0	0.00%	1	1.45%	0.2298

[a]Defined as requiring washout during additional operative procedure. [b]Defined as managed with antibiotics and local wound care.

Complication rates following stage 2 (implant placement) were also relatively similar between the two cohorts (Table 4). Following stage 2 of reconstruction, 38 of the 232 reconstructed breasts (16.38%) experienced ≥ 1 complication (Wise-pattern: 16.56% vs NSM: 15.94%, $p = 0.9068$). Similar to the trend following stage 1 of reconstruction, infection was the most common complication, but higher rates were observed in the Wise-pattern cohort (10.43% vs 2.90%, $p = 0.074$). Dehiscence was the second most observed complication ($p = 0.9213$) followed by malposition of the implant ($p = 0.1606$), hematoma ($p = 0.8346$), and

Table 4. Stage 2 complication information.

Complication	Wise-Pattern Patients		NSM Patients		P-Value
	N	%	N	%	
Any complication	27	16.56%	11	15.94%	0.9068
Infection	17	10.43%	2	2.90%	0.074
Major Infection[a]	6	3.68%	0	0.00%	0.2362
Minor Infection[b]	11	6.75%	2	2.90%	0.2578
Washout + Salvaged Implant	4	2.45%	0	0.00%	0.3615
Washout + Implant Removal	3	1.84%	1	1.45%	0.8346
Dehiscence	10	6.13%	4	5.80%	0.9213
Seroma	1	0.61%	0	0.00%	0.8791
Hematoma	3	1.84%	1	1.45%	0.8346
Malposition	2	1.23%	3	4.35%	0.1606

[a]Defined as requiring washout during additional operative procedure. [b]Defined as managed with antibiotics and local wound care.

finally seroma ($p = 0.8791$). The proportion of breasts undergoing revision after stage 2 were also relatively similar between the two cohorts (Wise-pattern: 35.53%, NSM: 26.10%, $p = 0.0961$).

4. Discussion

Wise-pattern closure is usually favored in the obese patient population mainly due to its inherent skin reduction [12]. The complications that obesity implicates in wound healing following breast reconstruction include—but are not limited to—infection, wound dehiscence, seroma, skin wrinkling with poor cosmesis, and impaired mastectomy flap survival secondary to compromised vascular supply and chronic low-grade inflammation [9]-[11]. Additionally, the proposed complications of a nipple-sparing mastectomy—particularly ischemic complications of the NAC—often preclude surgeons from considering this option in the obese patient cohort [21]-[24]. However, obese women undergoing breast reconstruction report significantly lower satisfaction rates [25]. Studies have demonstrated that retaining the nipple-areolar complex during breast reconstruction is positively correlated with a woman's self-perception and quality of life [26]. Reconstructed nipple-areolar complexes are generally associated with low satisfaction and can flatten over time [27]. Therefore, the use of the NSM in the obese patient population warrants further consideration as it also offers the advantage of more concealed scarring. This study examined post-operative complications following Wise-pattern and nipple-sparing mastectomies within the obese population to better understand whether nipple-sparing mastectomies are a feasible option for appropriately selected patients who desire the aesthetic

outcomes of a native NAC.

Our data demonstrated that complication rates following stage 1 of reconstruction were relatively similar between both the Wise-pattern and nipple-sparing cohorts (Wise-pattern: 30.67% vs NSM: 39.13%, $p = 0.2123$). These reconstruction complication rates are relatively similar to previously reported rates within the population of obese patients undergoing breast reconstruction [11] [26] [28]. Although not statistically significant, major infection rates were higher in the NSM cohort (11.59% vs 4.91%, $p = 0.0742$). Major infections in stage 1 were defined as those requiring surgical intervention consisting of antibiotic washout with or without tissue expander explantation or replacement. Although the average mass of the resected breast trended lower in the NSM cohort (546.16 grams vs 916.29 grams, $p < 0.0001$), it is possible that due to the lack of redundant skin excision, the large skin envelope following stage 1 in NSM patients may serve as a nidus of infection and possible necrosis compared to the Wise-pattern cohort [29]. Studies have demonstrated that the taughtness of skin dictates implant size post-mastectomy [30]. Therefore, larger skin envelopes require larger tissue expanders and implants. As the increased size of the implant may increase the tension on the skin, additional ischemic complications including poor wound healing may occur in the NSM cohort [31]. Additionally, patients in the NSM cohort were more likely to have a history of prior breast surgery (30.43% vs 15.34%, $p = 0.0095$), potentially increasing the risk of post-mastectomy complications.

Complication rates between the Wise-pattern and NSM cohorts were also similar following stage 2 (Wise-pattern: 16.56% vs NSM: 15.94%, $p = 0.9068$). In contrast to stage 1 complications, however, infection rates trended higher in the Wise-pattern cohort (10.43% vs 2.90%, $p = 0.074$) with the majority of these complications being classified as minor, i.e. those that can be resolved with antibiotics and minimal wound care intervention. It is possible that the more extensive scar pattern and tendency for Wise-pattern patients to have larger BMIs and therefore greater vascularity risks are contributing factors to this slightly increased rate of minor infections [32]. In particular, literature demonstrates that patients are more likely to have wound complications at the T-point [33].

Interestingly, all of the NSM patients had ADM utilized in reconstruction while most Wise-pattern patients did not have ADM (63.80%). This is likely because an increasing number of Wise-pattern patients have an autologous de-epithelialized skin flap utilized as a sling for the implant in lieu of ADM. There is evidence to suggest that ADM may increase complications, particularly in ptotic breasts, which may be a factor in the NSM complication rate [34]. Additionally, more NSM patients had a subpectoral implant placement (86.96% vs 64.42%). Literature suggests that this plane may be better suited for NSM mastectomies given that the vascularity of the muscle buffers the already tenuous vascularity of the skin flaps and NAC [32].

Patient selection criteria are particularly important when choosing a reconstruction modality in the obese population. In our study, patients who under-

went Wise-pattern closure tended to be slightly older in age and have a higher BMI (mean age 52.20 ± 10.06 years, BMI 36.89 ± 5.31) compared to the NSM cohort (mean age 46.42 ± 9.24 years, BMI 32.58 ± 1.77). The Wise-pattern cohort also had higher rates of diabetes (21.18% vs 2.63%, $p = 0.0284$) and hypertension (49.41% vs 26.32%, $p = 0.0186$). Given that patients with particularly large and ptotic breasts are more likely to have significant skin redundancy, a Wise-pattern approach may be more appropriate for these patients, particularly those who are candidates for ADM-sparing techniques which utilize the patient's own de-epithelialized skin. Additionally, considering that co-morbidities such as diabetes often negatively impact vascularity and wound healing, more obese patients with these co-morbidities may benefit with a Wise-pattern closure compared to a NSM which requires better perfusion for NAC viability [35]. For obese patients without exceptionally large or ptotic breasts who desire the aesthetic of a native NAC, NSM can be a feasible option without significantly increasing the risk of complication.

We recognize that complication rates are not the only metric that is useful in assessing long-term efficacy when choosing a particular reconstruction modality, however complication rates serve as a strong indicator of safety. As a retrospective study however, this study may be subject to the biases of record keeping. Additionally, follow-up time was limited, therefore studies with longer follow-up may strengthen the use of complication rates as an indicator of safety. Finally, the need for correlative patient-reported outcomes is important to consider as patient satisfaction is a long-term goal. Further studies to assess the long-term impact on both complication outcomes and patient-reported outcomes will be of use in determining whether nipple-sparing mastectomies can be an appropriate choice in select obese patients.

5. Conclusion

While Wise-pattern closure may traditionally be favored in the obese population because it addresses skin redundancy following mastectomy, nipple-sparing mastectomies may also be an appropriate surgical approach in carefully selected obese patients. Our study found that in obese patients with a BMI ≥ 30, complication rates following both stage 1 and stage 2 of reconstruction were similar in both the Wise-pattern and NSM cohorts. Therefore, in obese patients desiring less visible scars, NSM can be an appropriate surgical approach. Further studies will be of use to assess both the long-term impact and overall satisfaction in obese patients undergoing staged Wise-pattern and NSM breast reconstruction.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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