

# Prepectoral Breast Reconstruction in Morbidly Obese Patients

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**Background:** Prosthetic breast reconstruction via the subpectoral approach in morbidly obese patients (body mass index:  $\geq 40$  kg/m<sup>2</sup>) has been reported to be associated with an increased risk of perioperative complications and poor outcomes. Further, immediate reconstruction appears to carry a higher risk of poor outcomes than delayed reconstruction in this population. The impact of morbid obesity on outcomes after prepectoral breast reconstruction has not yet been evaluated, and such was the purpose of this study.

**Methods:** This retrospective study included all consecutive patients with morbid obesity who underwent prepectoral expander/implant reconstruction between July 2009 and April 2020 in the first author's practice. Patient records were reviewed, and data on demographics, comorbidities, radiotherapy use, type of mastectomy, mastectomy specimen weight, and postoperative complications following reconstruction were retrieved. Complications were stratified and compared by timing of reconstruction (immediate versus delayed).

**Results:** Eighty-five breasts in 45 morbidly obese patients were reconstructed. Postoperative complications occurred in 11 breasts (12.9%) and included major skin necrosis (3.5%), seroma (4.7%), wound dehiscence (5.9%), and reconstructive failure (1.2%). Timing of reconstruction had little impact on postoperative complications other than major skin necrosis, which was significantly higher in the delayed group (11.1% versus 1.5%).

**Conclusions:** Prosthetic breast reconstruction via the prepectoral approach can be successfully performed in morbidly obese patients, with outcomes approaching those seen in nonobese patients when performed by experienced surgeons. Patients with morbid obesity should not be denied this reconstructive approach because of their body mass index. (*Plast Reconstr Surg Glob Open* 2022;10:e4261; doi: 10.1097/GOX.0000000000004261; Published online 13 April 2022.)

## INTRODUCTION

Morbid obesity (also referred to as severe, extreme, or class III obesity) is defined by a body mass index of greater than or equal to 40 kg per m<sup>2</sup>. Morbid obesity, or obesity in general, is a major public health concern. Obesity increases the risk of medical conditions and surgical morbidity, and morbid obesity further increases these risks.<sup>1</sup>

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Currently in the United States, approximately 42 percent of women are obese and 12 percent are morbidly obese.<sup>2</sup> With a 12 percent lifetime risk of breast cancer,<sup>3</sup> and the growing trend of more women opting for mastectomy and reconstruction as a treatment for breast cancer,<sup>4</sup> reconstructive surgeons are likely to encounter an increasing number of obese and morbidly obese patients.

Prosthetic breast reconstruction, mostly via the dual-plane or subpectoral approach, is currently the most frequently performed method of breast reconstructive surgery in women undergoing mastectomy<sup>4</sup> due to its shorter operative time, hospital stay, and recovery; absence of donor site morbidity<sup>5</sup>; and lower risk of postoperative complications<sup>6-8</sup> compared with autologous approaches. However, morbid obesity poses significant challenges in prosthetic, as it does in autologous breast reconstruction. Analyses of 30-day complications after

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breast reconstruction in morbidly obese patients from the National Surgical Quality Improvement Program found that regardless of reconstructive modality (autologous or implant-based), morbidly obese patients had a significantly increased risk of perioperative complications, including major surgical complications, medical complications, respiratory complications, venous thromboembolism, and wound complications, compared with nonobese patients.<sup>1</sup> They were also more likely to return to the operating room for any reason and specifically for reconstructive failure. Further, morbid obesity was found to be an independent predictor of wound complications, surgical complications, medical complications, and return to the operating room, increasing the odds of these complications by about 1.5- to two-fold.

The authors have previously reported acceptable-to-good outcomes with prepectoral reconstruction in obese patients.<sup>9</sup> The purpose of this study was to assess postoperative complications and outcomes after prepectoral breast reconstruction in morbidly obese patients.

## PATIENTS AND METHODS

### Study Criteria

This is a retrospective study of all consecutive patients with morbid obesity (body mass index:  $\geq 40$  kg/m<sup>2</sup>) who underwent prepectoral expander/implant reconstruction between July 2009 and April 2020 in the first author's practice (A.G.). Patients who underwent immediate or delayed reconstruction were included; those who had hybrid procedures (implant and latissimus flap), revision reconstruction, or direct-to-implant reconstruction were excluded. The study was approved by PeaceHealth Southwest Medical Center's institutional review board (Vancouver, Wash.).

### Preoperative Considerations

Preoperatively, patient comorbidities and tumor characteristics in oncologic patients were reviewed to determine suitability for immediate reconstruction. Initially, a conservative approach was adopted whereby patients with a body mass index greater than 40 kg per m<sup>2</sup> with diabetes, hypertension, hemoglobin A1c value greater than 7.5 percent, and/or active smoking; with a prior history of irradiation; who were immunocompromised; and with tumors greater than 5 cm, deep tumors, late-stage cancer, chest wall involvement, and/or grossly positive axillary involvement were excluded.<sup>10</sup> The reconstructive and oncologic criteria were gradually relaxed with experience and more patients were offered immediate prepectoral reconstruction. Eventually, reconstructive exclusions were restricted to a hemoglobin A1c value greater than 7.5 percent, active smoking, and uncontrolled hypertension, and oncologic exclusions were restricted to inability to obtain a clear margin, extensive skin involvement, chest wall involvement, and inflammatory breast cancer. Ultimately, the decision to proceed with immediate reconstruction was made intraoperatively and was based on the availability of adequately perfused mastectomy flaps. Adequately

### Takeaways

**Question:** The purpose of this study was to assess postoperative complications and outcomes after prepectoral breast reconstruction in morbidly obese patients.

**Findings:** Critical elements for successful outcomes in this population include the appropriate management of thicker flaps, flap redundancy, and extensive dead space, which require an in-depth understanding of the relevant breast anatomy. Morbid obesity is not a contraindication for immediate prepectoral reconstruction. Patients with morbid obesity should not be denied this reconstructive approach because of their body mass index.

**Meaning:** Prosthetic breast reconstruction via the prepectoral approach can be successfully performed in morbidly obese patients, with outcomes approaching those seen in nonobese patients when performed by experienced breast and reconstructive surgeons.

perfused flaps are an absolute requirement for immediate prepectoral reconstruction. Mastectomy flap perfusion was accessed routinely in all patients intraoperatively with a perfusion assessment device or clinically in earlier patients. Patients who had malperfused flaps or who did not meet criteria for immediate reconstruction for other reasons were offered delayed reconstruction.

### Reconstructive Details

Prepectoral reconstruction was performed per the authors' protocol, which was published in 2017, paying particular attention to the management of skin redundancy and dead space.<sup>11</sup> The tissue expanders were either wrapped or tented with one or two pieces of acellular dermal matrix before placement in the prepectoral space. Expanders were filled intraoperatively with air, as tolerability permitted to 70–80 percent of their capacity, which was guided by flap perfusion assessment. Two drains were placed before incision closure. Negative-pressure therapy or Steri-Strips were used for incisional wound management. Tissue expansion was commenced after wound healing, usually 14–21 days postoperatively. Saline was exchanged for air, and the expander was filled to 80–90 percent of capacity. Second-stage implant exchange was typically performed 3 months postoperatively in nonirradiated patients or 3 to 6 months after completion of irradiation in irradiated patients. Autologous fat grafting was performed as a third stage when indicated.

### Data Collection and Analyses

Patient records were reviewed and data on demographics (ie, age and body mass index), comorbidities (ie, smoking status, diabetes, and hypertension), neoadjuvant/adjuvant radiotherapy/chemotherapy use, type of mastectomy (ie, skin-sparing, nipple-sparing, or skin-reducing), mastectomy specimen weight, and postoperative complications following reconstruction (ie, skin necrosis, seroma, surgical-site infection, wound dehiscence, prosthesis exposure or loss, return to operating

room, and capsular contracture) were retrieved. Surgical-site infection was defined as any sign of cellulitis. Major surgical-site infection required a return to the operating room for expander or implant removal, lavage, followed by intravenous antibiotic treatment. Complications were stratified and compared by timing of reconstruction (ie, immediate or delayed). Differences in the rate of complications between the groups were assessed using the chi-square test.

## RESULTS

### Study Participants

A total of 401 patients underwent prepectoral reconstruction during the study period. Forty-five of these patients were morbidly obese and were included in this study. Table 1 lists the baseline demographic, comorbid, and mastectomy characteristics of these morbidly obese patients. At the time of surgery, their mean age was 53 years, and their mean body mass index was 44 kg per m<sup>2</sup>. Almost 85 percent were diabetic and three-quarters were hypertensive. Smoking was uncommon, with only one patient with a smoking history.

A total of 85 breasts were reconstructed following skin-sparing mastectomy in 51 percent, skin-reducing mastectomy in 46 percent, or nipple-sparing mastectomy in about 4 percent of the breasts. The mean mastectomy specimen weight was 1156 g. Seventy-nine percent of reconstructions were immediate and 21 percent were delayed. Approximately 11 percent of the breasts were irradiated: 7 percent preoperatively and 4 percent postoperatively. Forty percent of patients received chemotherapy, predominantly preoperatively (38 percent versus 2 percent postoperatively).

**Table 1. Demographic, Comorbidity, Neoadjuvant/Adjuvant Therapy, and Mastectomy and Reconstructive Variables**

Characteristic/Variable	Morbidly Obese Cohort
Patients, n	45
Breasts, n	85
Age, y, mean ± SD (range)	53.1 ± 10.5 (33–76)
Body mass index, mean ± SD, kg/m <sup>2</sup> (range)	43.9 ± 4.0 (40–64)
Smoking (prior), no. patients (%)	1 (2.2)
Diabetes, no. patients (%)	38 (84.4)
Hypertension, no. patients (%)	34 (75.6)
Radiation, no. breasts (%)	9 (10.5)
Preoperative	6 (7.1)
Postoperative	3 (3.5)
Chemotherapy, no. patients (%)	18 (40)
Preoperative	17 (37.8)
Postoperative	1 (2.2)
Type of mastectomy, no. breasts (%)	
Skin-sparing	43 (50.6)
Skin-reducing	39 (45.9)
Nipple-sparing	3 (3.5)
Mastectomy specimen weight, mean ± SD, g	1156.2 ± 443.3
Reconstruction, no. breasts (%)	
Immediate	67 (78.8)
Delayed	18 (21.2)

### Early Postoperative Complications and Outcomes

Patients were followed for an average of 39.9 (± 18.0) months. Postoperative complications occurred in 11 breasts, at a complication rate of 12.9 percent (Table 2). Complications included any skin necrosis at 8.2 percent, seroma at 4.7 percent, wound dehiscence at 5.9 percent, return to the operating room at 7.1 percent, expander/implant exposure at 1.2 percent, and expander/implant loss (reconstructive failure) at 1.2 percent. The rate of major skin necrosis was 3.5 percent. There were no incidences of surgical-site infection or capsular contracture. All documented postoperative complications occurred within the first 18 months following completion of reconstruction.

When postoperative complications were stratified by timing of reconstruction, patients who had their reconstructions delayed were found to have a significantly higher rate of any skin necrosis (33.3 percent versus 1.5 percent, delayed versus immediate), major skin necrosis (11.1 percent versus 1.5 percent), and minor skin necrosis (16.7 percent versus 0 percent) (Table 2). Rates of seroma, wound dehiscence, expander/implant exposure or loss, and return to the operating room did not differ statistically between the two groups. Representative outcomes of morbidly obese patients who underwent prepectoral expander/implant breast reconstruction are depicted in Figures 1–3.

## DISCUSSION

Historically, and even more recently, breast reconstruction in the morbidly obese has been shown to be fraught with complications, poor outcomes, and poor patient satisfaction, all of which are worse with prosthetic versus autologous approaches.<sup>1,12,13</sup> In fact, body mass index is considered to be a continuous predictor of complications in prosthetic reconstruction,<sup>14,15</sup> with each point increase in body mass index increasing the odds of complications and device explantation by 3.4 percent and 8.6 percent with prepectoral and subpectoral reconstruction, respectively.<sup>15</sup> Further, a body mass index of 34 kg per m<sup>2</sup> appears to be the optimal cutoff for prosthetic reconstruction, beyond which complications and explantation rates are elevated. With respect to the timing of reconstruction, immediate reconstruction appears to carry a higher risk of poor outcomes than delayed reconstruction.<sup>12</sup>

The authors have been performing prepectoral reconstructions since 2009. Recently, they published their findings on the effect of body mass index on outcomes after prepectoral reconstruction.<sup>16</sup> Based on their data, they concluded that body mass index in itself is not a continuous predictor of postoperative complications and outcomes rather other patient factors, such as diabetes and smoking, as well as surgical factors may be contributing to the increased risk of complications with higher body mass index.

The results from the present study corroborate the authors' hypothesis. With a major skin necrosis rate of 3.5 percent, a wound dehiscence rate of 5.9 percent, a



**Table 2. Postoperative Complications**

Complication Type	Total (n = 85) n (%)	Immediate (n = 67) n (%)	Delayed (n = 18) n (%)	Immediate versus Delayed <i>P</i>
Skin necrosis	7 (8.2)	1 (1.5)	6 (33.3)	<b>&lt;0.001</b>
Minor	3 (3.5)	0	3 (16.7)	<b>0.001</b>
Intermediate	1 (1.2)	0	1 (5.6)	0.052
Major	3 (3.5)	1 (1.5)	2 (11.1)	<b>0.050</b>
Seroma	4 (4.7)	3 (4.5)	1 (5.6)	0.848
Surgical-site infection	0	0	0	—
Wound dehiscence	5 (5.9)	3 (4.5)	2 (11.1)	0.288
Expander/implant exposure	1 (1.2)	1 (1.5)	0	0.602
Return to OR	6 (7.1)	4 (6.0)	2 (11.1)	0.450
Expander/implant loss	1 (1.2)	1 (1.5)	0	0.602
Capsular contracture	0	0	0	—
Any complication	11 (12.9)	7 (10.4)	4 (22.2)	0.186

Values in boldface indicate statistical significance.

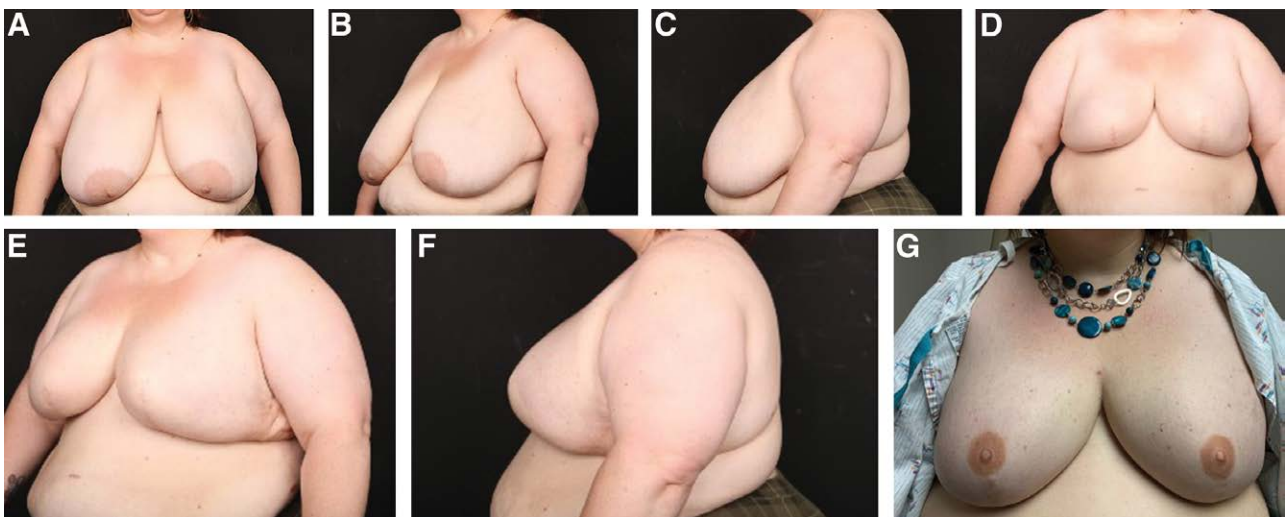
seroma rate of 4.7 percent, and a failure rate of 1.2 percent, the authors' complication rates in morbidly obese patients after prepectoral reconstruction approach those reported in the literature for normal-weight/nonobese patients.<sup>1,15,16</sup> These data suggest that prosthetic breast reconstruction can be successfully performed in morbidly obese patients, and morbid obesity per se may not necessarily be associated with an increased risk of complications.

Successful immediate prepectoral reconstruction in the morbidly obese population, however, hinges on proper mastectomy and reconstructive technique principles, particularly as they relate to the management of thicker flaps, flap redundancy, and extensive dead space. In the authors' opinion, poor management of these three factors are the key drivers of poor outcomes in morbidly obese patients.

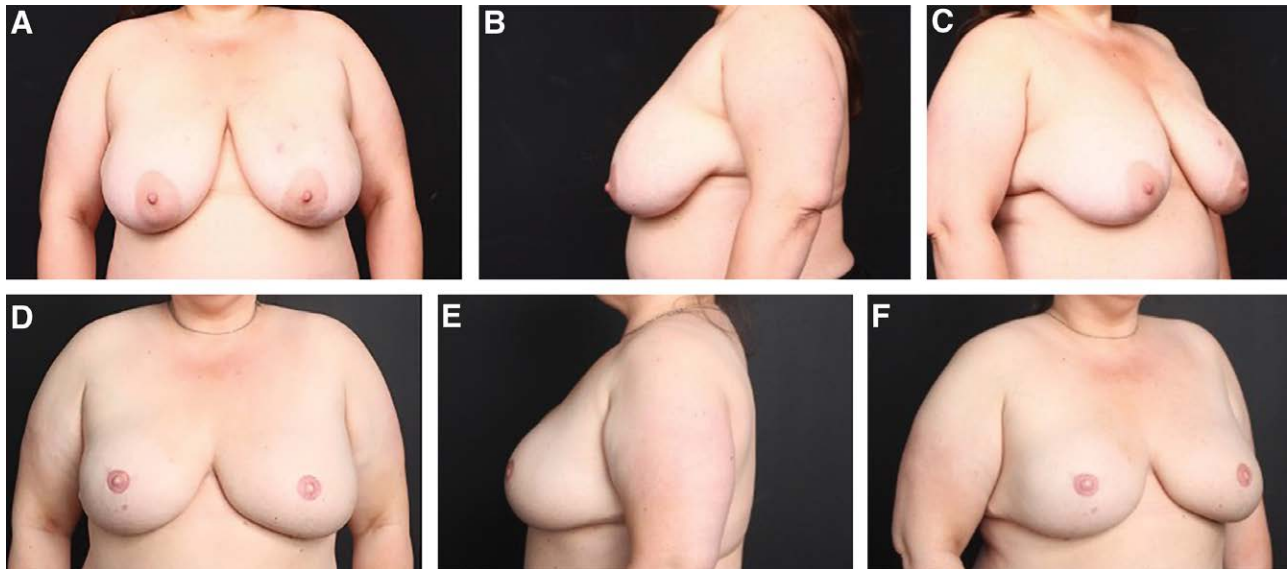
Compared with nonobese patients, morbidly obese patients have a greater number of adipocytes and larger fat globules within the hypodermis and as a result have thicker mastectomy flaps. Breast surgeons need to be cognizant of this difference in flap morphology between

morbidly obese and nonobese patients when performing oncologic resection of the tumor. As the blood supply to the mastectomy skin lies within the hypodermis, preserving the hypodermis is crucial for flap fusion and viability. Thus, oncologically appropriate dissection should be performed at the junction between the hypodermis and the mammary glands with maximal removal of breast tissue to minimize the risk of local recurrence but at the same time preserving the hypodermis. Flap thickness should not be used to guide oncologic resection as this would violate the integrity of the hypodermal layer and compromise flap viability. If available, the use of a perfusion assessment device for real-time perfusion monitoring during mastectomy is strongly recommended, as it helps in ensuring the preservation of the hypodermis and flap viability.

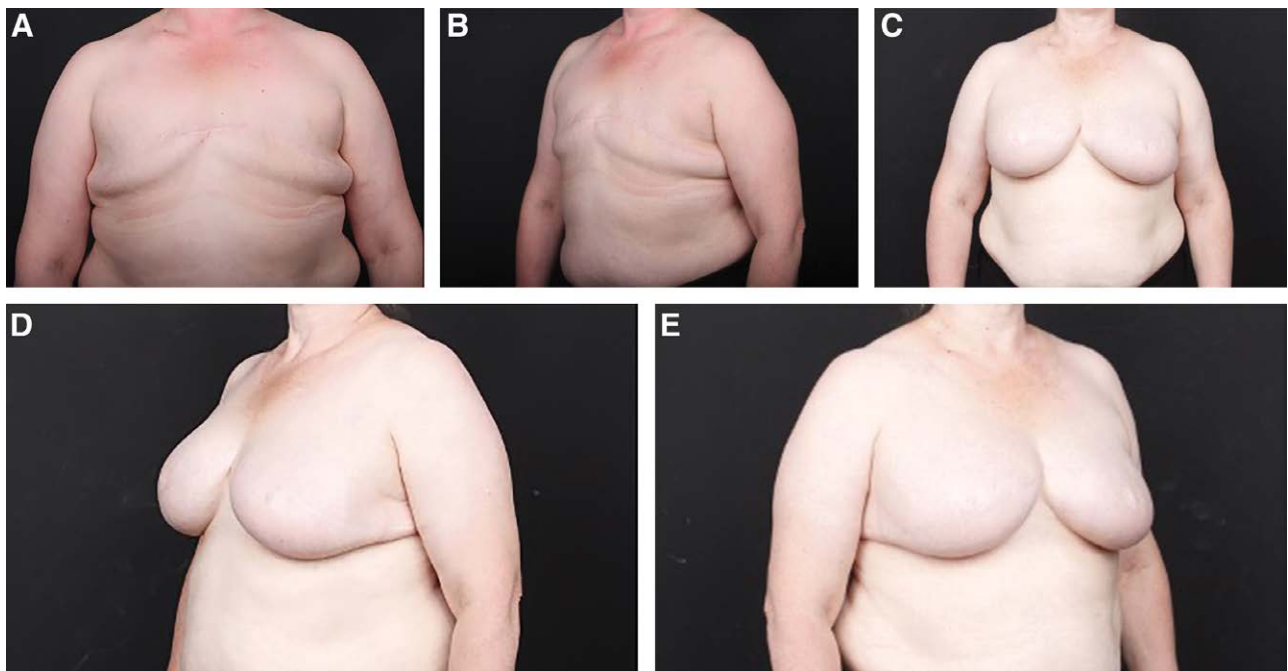
Flap redundancy due to mammary hypertrophy is very common in morbidly obese patients. Flap redundancy can be managed in two ways: skin-reducing mastectomy and/or utilizing redundant flaps in recreating the breast. Skin-reducing mastectomy is undertaken as for a mastopexy



**Fig. 1.** A 39-year-old woman with a body mass index of 62.1 kg per m<sup>2</sup> and left breast cancer. She underwent bilateral mastectomy with immediate prepectoral reconstruction with 600 cm<sup>3</sup> tissue expanders (133FV Natrelle, Allergan, Madison, N.J.). She did not require radiotherapy. At second-stage reconstruction, 750 cm<sup>3</sup> smooth, round, extra-full profile, gel implants (SRX, Inspira, Allergan, Madison, N.J.) were placed. At third stage, she underwent nipple bilateral fat grafting to the lateral chest wall. A–C: Preoperative view. D– F: At two years following second-stage reconstruction. G: At 3 years follow-up.



**Fig. 2.** A 37-year-old woman with a body mass index of 42.8 kg per m<sup>2</sup> and left breast cancer. She underwent bilateral mastectomy with immediate prepectoral reconstruction with 600 cm<sup>3</sup> tissue expanders (133FV Natrelle). She did not require radiotherapy. She underwent second-stage reconstruction with 800 cm<sup>3</sup> smooth, round, extra-full profile, gel implants (SRX, Inspira) followed by bilateral fat grafting to the lateral chest wall. A–C: Preoperative view. D–F: At 4 years follow-up.



**Fig. 3.** A 50-year-old woman with a body mass index of 41.2 kg per m<sup>2</sup> and a history of right breast cancer. She underwent bilateral skin-sparing mastectomy and adjuvant chemotherapy with no radiation followed by delayed prepectoral expander/implant reconstruction with 800 cm<sup>3</sup> smooth, extra-high profile, responsive silicone gel implants (Style 45, Natrelle). A, B: Pre-reconstruction view. C–E: At 6 years follow-up after implant reconstruction.

via an inverted T incision or extended transverse/oblique skin excision. If utilizing redundant flaps for breast reconstruction, the medial and lateral redundant flaps are deepithelialized and arranged over the acellular dermal matrix-covered expander placed in the prepectoral space. The deepithelialized flaps provide an extra layer of soft-tissue coverage to the expander (and implant subsequently)

and protects against device exposure in the event of incisional dehiscence. A critical element for successful flap redundancy management is objective flap perfusion assessment. Only well-perfused, viable flaps are used for reconstruction and malperfused flaps are excised to mitigate the risk of necrosis, dehiscence, and reconstructive failure.

Presence of extensive dead space in the prepectoral plane following mastectomy is also highly common in morbidly obese patients. The management of this dead space can be technically challenging, requiring meticulous pocketwork. The void created by the removal of breast tissue causes the lateral subcutaneous tissue to descend to the posterior axillary line and the cephalad-subcutaneous tissue to retract. To collapse the prepectoral space, the descended lateral subcutaneous tissue is repositioned and secured to the anterior axillary line while the retracted cephalad-subcutaneous tissue is displaced more caudally. The cephalad area is less of a concern in subpectoral reconstructions, but needs to be addressed in prepectoral reconstructions. The appropriate reduction of the dead space in morbidly obese patients to achieve a snug fit of the expander is critical to reducing the risk of seroma formation postreconstruction as well as for improving the overall breast aesthetics.

In addition to the above-discussed technique principles, the authors believe that the continued evolution of prosthetic breast reconstruction culminating in modern techniques and devices, in general, are also likely to have played a contributory role to the observed outcomes in this study. Mastectomies, for example, have become less aggressive, with radical mastectomies being phased out and replaced by skin- and nipple-sparing mastectomies. The latter mastectomies were conceived to preserve mastectomy flap perfusion and viability that are critical for the prepectoral approach. The availability of tissue perfusion devices that allow perfusion assessment in real-time provide an objective means of evaluating flap viability. The incorporation of acellular dermal matrices into the reconstructive algorithm allows for additional soft-tissue coverage that is often lacking in prosthetic reconstructions, especially in prepectoral reconstruction. Acellular dermal matrices may also reduce the risk of capsular contracture<sup>17,18</sup> by thwarting the foreign body inflammatory response.<sup>19,20</sup> Improvements in implant designs, such as the newer highly cohesive gel implants, are associated with less rippling and wrinkling. Advances in autologous fat grafting techniques have simplified and made fat grafting more efficient; consequently, there is a wider uptake of this adjunctive treatment that provides additional soft-tissue coverage. Finally, the prepectoral approach has eliminated the need to elevate the pectoralis major muscle, thus simplifying the prosthetic reconstructive approach as well as eliminating the associated morbidities and complications of muscle elevation.

As mentioned above, patient factors such as current smoking, diabetes, and hypertension may also contribute to poor outcomes in morbidly obese patients. The authors recommend delaying reconstruction in these cases until after the comorbidities are controlled. In the case of smoking, reconstruction is offered only after at least 3 months of smoking cessation. Patients who underwent delayed reconstruction in this study fared just as well as those who underwent immediate reconstruction other than with a higher rate of skin necrosis. As the majority of the delayed reconstructions were

performed earlier on when selection criteria for immediate reconstruction were more restrictive and when the authors had less experience with patients with morbid obesity, these may partly explain the higher rate of skin necrosis. Over time and with greater experience, morbidly obese patients were increasingly offered immediate reconstruction, which could explain the smaller patient numbers in the delayed group. Although both immediate and delayed reconstructions can be successfully performed in morbidly obese patients, in the authors' opinion, immediate reconstruction may have the advantage of better aesthetic outcomes as surgeons are better able to control the mastectomy skin envelope and scar location. In delayed reconstruction, the mastectomy scar is often located across the breast, which is aesthetically displeasing.

The limitations of this study include its retrospective nature and the small patient numbers in the delayed reconstructive group. Future studies will explore the aesthetic benefits and patient satisfaction with prepectoral reconstruction.

## CONCLUSIONS

Prosthetic breast reconstruction via the prepectoral approach can be successfully performed in morbidly obese patients with outcomes approaching those seen in nonobese patients when performed by experienced breast and reconstructive surgeons. Critical elements for successful outcomes in this population include the appropriate management of thicker flaps, flap redundancy, and extensive dead space, which require an in-depth understanding of the relevant breast anatomy. Morbid obesity is not a contraindication for immediate prepectoral reconstruction. Patients with morbid obesity should not be denied this reconstructive approach because of their body mass index.

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