

Stratification of Surgical Risk in DIEP Breast Reconstruction Based on Classification of Obesity

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Abstract

Background From both a medical and surgical perspective, obese breast cancer patients are considered to possess higher risk when undergoing autologous breast reconstruction relative to nonobese patients. However, few studies have evaluated the continuum of risk across the full range of obesity. This study sought to compare surgical risk between the three World Health Organization (WHO) classes of obesity in patients undergoing deep inferior epigastric perforator (DIEP) flap breast reconstruction.

Methods A retrospective review of 219 obese patients receiving 306 individual DIEP flaps was performed. Subjects were stratified into WHO obesity classes I (body mass index [BMI]: 30–34), II (BMI: 35–39), and III (BMI: ≥ 40) and assessed for risk factors and postoperative donor and recipient site complications.

Results When examined together, the rate of any complication between the three groups only trended toward significance ($p = 0.07$), and there were no significant differences among rates of specific individual complications. However, logistic regression analysis showed that class III obesity was an independent risk factor for both flap (odds ratio [OR]: 1.71, 95% confidence interval [CI]: 0.91–3.20, $p = 0.03$) and donor site (OR: 2.34, 95% CI: 1.09–5.05, $p = 0.03$) complications.

Conclusion DIEP breast reconstruction in the obese patient is more complex for both the patient and the surgeon. Although not a contraindication to undergoing surgery, obese patients should be diligently counseled regarding potential complications and undergo preoperative optimization of health parameters. Morbidly obese (class III) patients should be approached with additional caution, and perhaps even delay major reconstruction until specific BMI goals are met.

Keywords

- DIEP flap
- obesity
- breast reconstruction

Obesity and its medical complications have been at the forefront of public health research and awareness for several decades. In the United States, the age-adjusted prevalence of obesity in

women between 2017 and 2018 was over 40%, and has demonstrated a linear increase in incidence over time.¹ Furthermore, the estimated cost of obesity-associated healthcare among

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American adults is estimated to be \$149.4 billion annually.² As the obese population continues to grow, plastic surgeons will encounter these patients with increasing regularity for common procedures such as breast reconstruction.

While the surgical plan for breast reconstruction should be tailored to each individual patient's clinical scenario and anatomic needs, numerous studies suggest that abdominal tissue-based autologous breast reconstruction is particularly well-suited and desirable to obese patients. These patients commonly have excessive abdominal subcutaneous fat that provides excellent tissue volume to create a natural-appearing reconstructed breast with the secondary benefit of improved abdominal contour, and it is associated with high patient satisfaction.^{3–7} Likewise, the rise of the obesity epidemic in the United States has contemporaneously paralleled the increasing popularity of abdominal-based perforator flap breast reconstruction—most notably the deep inferior epigastric perforator (DIEP) flap.⁸ In contrast to a muscle-sparing transverse rectus abdominus flap (MS-TRAM), a true DIEP flap avoids taking any amount of rectus abdominus muscle, thereby reducing abdominal morbidity in suitable candidates.⁹

However, concerns have been raised about the safety and efficacy of employing this operative technique in obese patients. Perhaps due to this concern, data have shown that morbidly obese women less frequently undergo DIEP flap reconstruction relative to less obese women.¹⁰ To clarify inconsistencies within the literature regarding the complications potentially associated with obesity and autologous breast reconstruction, multiple high-powered meta-analyses have recently been performed.^{4,11} These studies have found obesity in abdominal based perforator flaps to be correlated with increased rates of both flap-specific and donor site-specific complications,⁴ and linked to significantly more surgical complications, medical complications, and returns to the operating room among patients undergoing breast reconstruction.¹¹ However, included in these analyses were patients that underwent prosthetic reconstruction, as well as autologous reconstruction from non-abdominal sites.

Furthermore, while obesity has been treated in a majority of previous studies as a binary variable—either the patient was obese, or they were not obese—the World Health Organization (WHO) recognizes three distinct classifications of obesity: class I: body mass index (BMI) 30–34.9 (obese), class II: BMI 35–49.9 (severely obese), and class III: BMI 50 and greater (morbidly obese).¹² In doing so, these studies may have missed a significant variance between these patient populations, attributing the higher complication rates of the morbidly obese to all patients above a BMI of 30. The high prevalence of obesity in the authors' region readily facilitates an investigation that allows a more detailed stratification of risk among females between the three distinct classes of obesity undergoing DIEP free flap breast reconstruction.

Methods

Following Institutional Review Board approval, a retrospective review was performed on 219 obese patients undergoing

DIEP breast reconstruction at a single academic medical center in New Orleans, Louisiana by five plastic surgeons between 1993 and 2014. Our group performs over 200 DIEP flaps per year. Per the WHO definition of obesity, only patients with a minimum BMI of 30 kg/m² were included in the study. Patients and individual flaps were then stratified into the three established classes of obesity: BMI 30–34.9 (class I), 35–39.9 (class II) (►Fig. 1), and 40+ (class III) (►Fig. 2) for purposes of statistical analysis. Demographic and outcomes data were collected through chart review for each patient. Two categories of outcomes were observed, flap-related complications (total or partial flap loss, hematoma, seroma, infection, operable fat necrosis, and delayed wound healing) and donor site complications (hematoma, seroma, infection, ventral hernia, and delayed wound healing). Total flap loss was defined as complete removal of the flap due to vascular insufficiency, while partial flap loss was defined as acute vascular insufficiency requiring partial debridement of the flap. Operable fat necrosis was defined

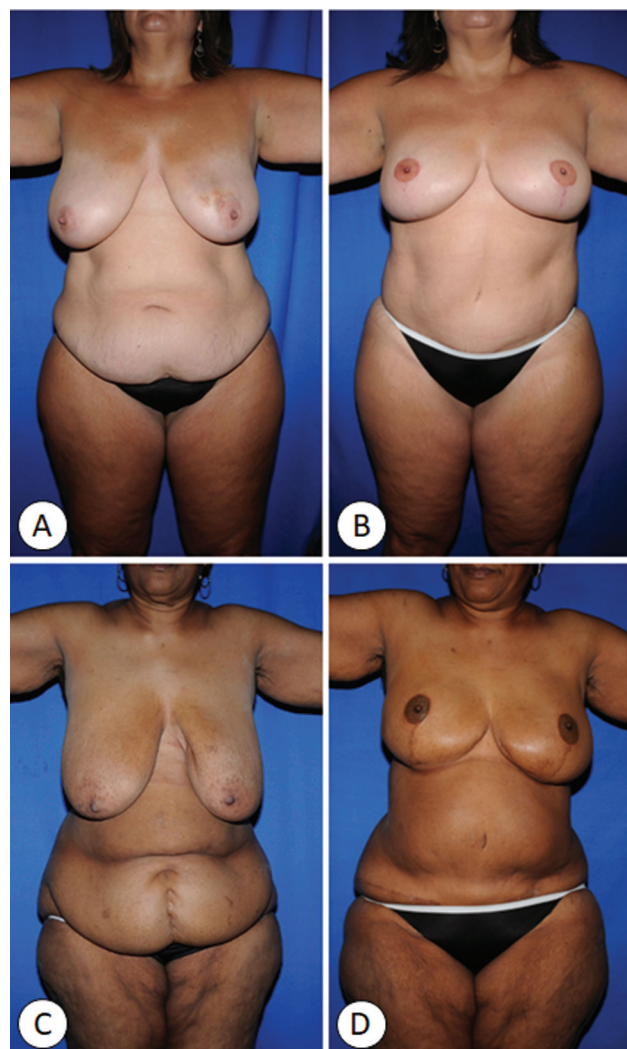


Fig. 1 Pre- (A, C) and post- (C, D) operative photographs of two patients undergoing deep inferior epigastric perforator flap breast reconstruction. The patient in the top row (A, B) has a body mass index of 34 (class I), while the patient in the bottom row (C, D) has a body mass index of 36 (class II).

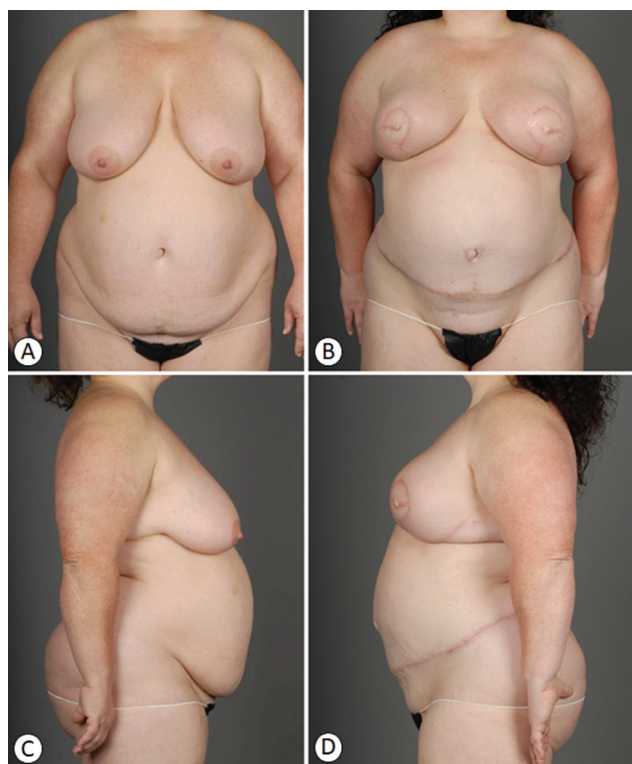


Fig. 2 Pre- and postoperative anterior–posterior (A, B) and sagittal (C, D) views of a single patient with a body mass index of 42 (class III) undergoing deep inferior epigastric perforator flap breast reconstruction.

as symptomatic or palpable necrosis that required excision no earlier than 30 days postoperatively. Risk factors of particular interest were BMI, age, hypertension, diabetes mellitus, hyperlipidemia, cardiovascular disease, chronic obstructive pulmonary disease, asthma, tobacco use, and preoperative radiation.

Statistical analysis was performed using appropriate software (Stata v. 14 StataCorp., College Station TX). Mann–Whitney U or Kruskal–Wallis tests were applied to continuous variables while chi-squared or Fisher's exact tests were used for categorical variables. The three study populations were compared for significant differences in demographics and comorbidities in this fashion. Predictor variables to be used in logistic regression models were chosen by performing univariate analysis with an inclusion threshold of *p*-values less than 0.2. The backward logistic regression analysis using odds ratios (ORs) was then performed utilizing any flap and donor site specific complication as outcomes. Logistic regression could not be performed for each flap-related and donor site-specific complication individually due to a lack of minimum incidence. In this model, age was treated on a continuum. Throughout the analysis, abdominal complications were treated on a per patient basis, while flap complications were considered per reconstructed breast. As such, certain variables such as BMI and comorbidities were “double-counted” for the individual flap analyses.

Results

Demographics and Direct Cohort Comparison

Three hundred and six free DIEP flaps were performed in 219 patients. The average age of the study population was 52 and the average BMI was 35.3 (standard deviation ± 5.2). There were 174 flaps in the class I cohort with mean BMI of 31.7, 69 flaps in class II cohort with mean BMI of 36.7, and 63 flaps in class III cohort with mean BMI of 43.9. Between the cohorts, only tobacco, diabetes, and preoperative radiation demonstrated statistically significant differences (**Table 1**). There were three total flaps lost among the patients included in the study, and no statistically significant differences between rates of partial or complete flap loss; there were also no significant differences between other flap complications, or donor site complications, despite there being a large difference in incidence between class III patients and patients in the other two classes for total complications (**Table 2**).

Logistic Regression Analysis

When variables were examined through backward logistic regression, however, the data demonstrated that patients with class III obesity had significantly increased risk of having any flap complication (OR = 1.71; 95% confidence interval [CI] = 0.91–3.20; *p* = 0.03). Patients with class III obesity also had significantly increased risk of abdominal donor site complications (OR = 2.34, 95% CI = 1.086–5.053; *p* = 0.03) compared with class I. When modeled as a continuous variable, increasing BMI, irrespective of obesity classification, was associated with an increased rate of any flap complication (OR = 1.06, 95% CI = 1.006–1.111, *p* = 0.029) and any abdominal donor site complication (OR = 1.08; 95% CI = 1.02–1.15; *p* = 0.012). Of note, age was also found to be an independent risk factor for incidence of any flap complications (OR = 1.05, 95% CI = 1.015–1.086, *p* = 0.005). None of the other comorbidities included in logistic regression models were significant independent predictors of increased risk for flap or donor site complications (**Table 3**).

Discussion

Obesity is an epidemic in the United States that is a growing burden on the healthcare system.² In the context of plastic surgery and breast reconstruction, this poses an interesting problem: obesity predisposes women to developing breast cancer through the increased aromatization of circulating steroid hormones to estrogens, while at the same time is a cause of significant apprehension for plastic surgeons planning complex reconstructions.^{13–18} Therefore, obesity both increases the chance that a woman will require mastectomy while at the same time potentially reducing her chances of finding a surgeon willing to perform complex reconstructive breast procedures and accept a higher risk of complications.

Through numerous studies, obesity has been established as a risk factor for increased incidence of surgical complications, including those encountered in breast reconstruction procedures. In 2013, Fischer et al published a massive 15,937 patient study advocating for risk stratification and

Table 1 Cohort and flap characteristics by WHO obesity class (N = 219)

Demographics	Total	Class I (BMI 30–34)	Class II (BMI 35–39)	Class III (BMI ≥ 40)	p-Value
No. of patients	219	125	49	45	
No. of flaps	306	174	69	63	
Age, mean (range)	52 (31–70)	53	49.6	51.6	0.08
BMI, mean	35.3	31.7	36.7	43.9	
Comorbidities per flap (%)					
Hypertension	164 (53.6)	91 (52.3)	35 (50.7)	38 (60.3)	0.48
Diabetes mellitus	63 (20.6)	28 (16.1)	14 (20.3)	21 (33.3)	0.02 ^a
Hyperlipidemia	52 (17.0)	30 (17.2)	8 (11.6)	14 (22.2)	0.27
Cardiovascular disease	19 (6.2)	9 (5.2)	3 (4.4)	7 (11.1)	0.23
COPD/asthma	22 (7.2)	14 (8.1)	2 (2.9)	6 (9.5)	0.25
Tobacco use	42 (13.7)	19 (10.9)	16 (23.2)	7 (11.1)	0.03 ^a
Preoperative radiation	74 (24.2)	44 (25.3)	9 (13.0)	21 (33.3)	0.02 ^a
Total DIEP flaps (%)					
Unilateral	132 (43.1)	76 (43.7)	29 (42.0)	27 (42.9)	0.97 ^b
Bilateral	174 (56.9)	9 (56.3)	40 (58.0)	36 (57.1)	
Immediate	213 (69.6)	127 (73.0)	49 (71.0)	37 (58.7)	0.10 ^c
Delayed	93 (30.4)	47 (27.0)	20 (29.0)	26 (41.3)	

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; DIEP, deep inferior epigastric perforator; WHO, World Health Organization.

^a $p < 0.05$ among all three classes per three-way χ^2 .

^bCompares unilateral versus bilateral.

^cCompares immediate versus delayed.

Table 2 Postoperative complications by WHO obesity class (n = 306, N = 219)

Flap complications per flap (%)	Total (%)	Class I (BMI 30–34)	Class II (BMI 35–39)	Class III (BMI ≥ 40)	p-Value
Any complication	96 (31.4)	47 (27.0)	22 (31.9)	27 (42.9)	0.07
Total flap loss	3 (1.0)	1 (0.6)	1 (1.5)	1 (1.6)	0.40
Partial flap loss	10 (3.3)	4 (2.3)	2 (2.0)	4 (6.4)	0.33
Hematoma	13 (4.3)	8 (4.6)	3 (4.4)	2 (3.2)	1.00
Seroma	19 (6.2)	9 (5.2)	4 (5.8)	6 (9.5)	0.85
Infection	32 (10.5)	13 (7.5)	10 (14.5)	9 (14.3)	0.15
Operable fat necrosis	32 (10.5)	13 (7.5)	10 (14.5)	9 (14.3)	0.15
Delayed wound healing	32 (10.5)	20 (11.5)	3 (4.4)	9 (14.3)	0.14
Donor site complications per patient (%)					
Any complication	63 (28.7)	30 (24.0)	14 (28.6)	19 (42.2)	0.07
Hematoma	2 (0.9)	1 (0.8)	0 (0.0)	1 (2.20)	0.52
Seroma	8 (0.9)	4 (3.2)	2 (4.1)	2 (4.4)	0.92
Infection	20 (9.1)	9 (7.2)	5 (10.2)	6 (13.3)	0.45
Ventral hernia	10 (4.5)	5 (4.0)	3 (6.1)	2 (4.4)	0.90
Delayed wound healing	34 (15.5)	17 (13.6)	6 (12.2)	12 (26.7)	0.09

Abbreviations: BMI, body mass index; WHO, World Health Organization.

Table 3 Logistic regression for postoperative complications

Predictor	Any flap complication (n = 306) ^a			Any donor site complication (N = 219) ^b		
	Odds ratio	95% CI	p-Value	Odds ratio	95% CI	p-Value
Age	1.05	1.02–1.09	0.01 ^c	1.04	0.99–1.08	0.09
BMI 30–34	d	d	d	d	d	d
BMI 35–39	1.55	0.84–2.94	0.18	1.36	0.62–3.00	0.44
BMI ≥ 40	1.71	0.91–3.20	0.03 ^e	2.34	1.09–5.01	0.03 ^e
Hypertension	0.85	0.47–1.53	0.59	1.03	0.52–2.04	0.93
Diabetes mellitus	1.8	0.97–3.33	0.06	1.31	0.61–2.77	0.48
Hyperlipidemia	1.64	1.01–3.24	0.16	1.49	0.66–3.37	0.34
Cardiovascular disease	1.68	0.62–4.57	0.31			
Tobacco use				2.01	0.87–4.62	0.10

Abbreviations: BMI, body mass index; CI, confidence interval.

^aand ^b indicate separate regression models with blanks not included.

^cp < 0.01.

^dReference point.

^ep < 0.05.

counseling of obese patients seeking any type of reconstruction—whether it be autologous or prosthetic—due to the correlation of obesity with increased postoperative complications.¹⁰ Hanwright et al demonstrated similar findings that year, noting that obesity increased risks for complications in autologous reconstructions even more so than for prosthetic-based reconstructions.¹⁹ A multicenter, prospective study by Srinivasa et al found that patients with higher obesity class undergoing both prosthetic and autologous reconstruction were at an elevated risk of both any complication and major complications.²⁰ The prevalence of these and other large-scale studies has led to the widespread acknowledgment of a significant association between increasing obesity and surgical complications among patients undergoing breast reconstruction.^{10,11,19–28}

Although several studies have investigated this association specifically in regard to the abdominal donor site, most series commonly include multiple abdominal flap techniques into their cohorts to increase the sample size for statistical analyses.^{5,10,20,24,25,27–30} However, this makes it difficult to delineate specific conclusions about individual surgical techniques. Only a few recent studies of obese patients have focused on true DIEP flaps exclusively,³¹ with only two^{22,26} stratifying their cohort between WHO classes of obesity as in our study. However, these studies refrained from stratifying by class III obesity, instead opting to utilize BMI ≥ 35 as their upper cutoff. Given these limitations, and that the DIEP flap has become the preferred abdominal flap in many practices, an additional high-powered single-focused analysis on this flap and its associated outcomes including the class III obese population should contribute in a meaningful way to the existing literature.

The analysis of the data presented here did indeed demonstrate that obesity is an independent risk factor for both flap and abdominal donor site complications in DIEP breast reconstruction procedures. Upon cohort stratification into individual classes of obesity, it was also demonstrated class

III obesity was independently associated with a significantly higher rate of complications relative to classes I and II, even when accounting for higher rates of diabetes and preoperative radiation. As with our cohort comparison, Ochoa et al found no differences between individual complication rates between the three classes.²⁶ However, they did not assess obesity class as an independent factor influencing these rates as was done with the logistic regression model in this study. In Fischer et al's extensive review of breast reconstruction outcomes, morbidly obese patients were more likely to suffer from comorbidities including diabetes, dyspnea, hypertension, and anemia relative to less obese patients.¹⁰ They also had substantially increased complication rates including wound healing and dehiscence, local and systemic infection, flap loss, and unplanned returns to the operating room compared with the other classes and the nonobese, demonstrating that the distinctions between classes of obesity, and especially class III, are indeed significant in breast reconstruction.

There are multiple proposed and overlapping physiologic mechanisms for poorer outcomes in obese patients. In addition to high rates of medical comorbidities,³² obesity is believed to be associated with a chronic inflammatory state³³ and dysfunctional collagen deposition by myofibroblasts,^{34,35} worsening the body's abilities to heal wounds or fight infection. Given that large flap volumes are often harvested in obese patients, flap edges distal to sites of vascular inflow may be particularly susceptible to hypoxia and necrosis secondary to poor perfusion.³⁶ Additionally, significant adipose mass may increase pedicle tension³⁷ or even compress the lumen of perforator pedicles,³⁸ increasing the risk of thrombosis. Increased dead space adjacent to poorly perfused adipose, increased intraabdominal pressure, and nutritional deficiencies have also been proposed to increase risks of seroma,³⁹ abdominal hernia,⁴⁰ and poor wound healing⁴¹ respectively. While increasing BMI certainly elevates these effects to some degree,²⁵ the successive

impact of these effects at increasingly higher levels remains unclear.

Jandali et al was one of the first studies to investigate the safety and efficacy of abdominal free flaps for breast reconstruction in the morbidly obese population, although they simply compared the morbidly obese group to a non-morbidly obese group with a mean BMI of 27.⁴² In a large series of abdominally based breast reconstructions, Fischer et al found that morbidly obese patients had significantly higher rates of diabetes, partial flap loss, total flap loss, and longer operative times relatively to lower classes of obesity.^{10,43} Momeni et al found high rates of minor surgical complications among patients with BMIs > 40, as well as those with BMIs 35 to 39 with comorbidities; there were no significant differences between these groups.³⁰ Similarly, Spitz et al found donor site complication rates to be equivalent between obesity classes II and III, with more of a difference between classes II and I.⁴⁴ Although these findings contrasted from ours, it is important to reiterate that our sample uniquely focused on DIEP flaps exclusively.

This distinction might suggest that a difference in surgical technique between the DIEP flap and other methods of abdominal-based breast reconstruction may result in higher risk for morbidly obese patients. Due the need for meticulous perforator dissection, a DIEP flap may require longer operative time for the inexperienced surgeon relative to other techniques such as the MS-TRAM.⁹ Given the significantly higher rates of chronic cardiopulmonary comorbidities in morbidly obese patients,^{10,32} it is interesting to speculate on the role of longer anesthesia times on flap and bodily perfusion. Further assessment of intraoperative factors such as flap weight, operative time, and perforator course is warranted to better characterize these differences. Currently, there is no consensus regarding operative guidelines for these patients. Indeed, Sinha et al reported that they do not conduct elective breast reconstruction on class III patients at their center and therefore did not include them in their study of postoperative patient satisfaction.⁵

Given the presumed context of increasing operative complications with increasing obesity, there are several strategies that our group employs to mitigate risk in these patients. These include evaluation of mastectomy flap viability using intraoperative indocyanine green angiography, preferential use of the circumareolar incision pattern to minimize incisions through the mastectomy skin flaps, and deepithelialization of mastectomy flaps instead of full thickness skin excision when reshaping the native skin envelope. Techniques implemented in an attempt to reduce flap-related complications include prioritization of centrally located perforators, supercharging flaps through additional venous anastomosis (particularly the superficial inferior epigastric vein), and augmenting inflow with additional arterial systems (e.g., superficial inferior epigastric artery, superficial and deep circumflex iliac arteries). Attempts at reducing abdominal donor site complications included postponing significant abdominal contouring until the second stage procedure, minimizing abdominal flap undermining, and when native position allowed, incorporation of the umbili-

cus into the abdominal closure and delaying umbilical repositioning until second stage operations. Similarly, for morbidly obese patients, Jandali et al endorsed orienting the flap more superiorly to capture additional periumbilical perforators.⁴² Other surgical specialties have utilized incisional vacuum-assisted closure (VAC) to reduce complication rates in morbidly obese patients.^{45,46} Likewise, we occasionally employ the use of incisional VACs for our DIEP flap patients when abdominal anatomy dictates. Additionally, dietary counseling and referrals to physical therapy should be commonplace at initial consultations to maximize weight loss prior to reconstruction. Preoperative weight loss has been previously shown to facilitate reconstruction, enhance outcomes, and improve satisfaction in obese patients following breast reconstruction.^{24,47} The finding that class III patients had significantly higher complication risk compared with the lower two classes may provide a more specific targeted body weight goal before surgical clearance and potentially provide more effective motivation for morbidly obese patients attempting to lose weight prior to reconstruction. Further study investigating preoperative goals among this higher-risk population would be a worthwhile endeavor.

The demographic profile of many patients undergoing microsurgical breast reconstruction (middle to late aged women) portends to prior abdominal morbidity, with the incidence of prior abdominal surgery reported as high as 51%.^{48–51} Scar tissue introduces additional difficulty in raising flaps by disrupting perforators, altering perfusion across the scar, weakening the abdominal fascia, and directly hindering dissection.^{52,53} Various groups have found rates of higher donor site complication including dehiscence, poor wound healing, wall laxity, and seroma among DIEP flaps harvested from scarred abdomens.^{50,52,54} While muscle-sparing perforator flaps reduce the risk of hernia relative to the rectus abdominus flap,^{4,9,55,56} prior surgeries, in conjunction with the anatomic and physiologic effects of obesity we have previously discussed, may predispose obese patients to increased hernia rates.

Ten (4.6%) patients in our cohort had ventral hernias repaired after their breast reconstruction; this is similar to the 5 to 6% incidence of postoperative hernia among obese patients receiving DIEP flaps reported by other studies.^{57,58} Indeed, reports of hernia among predominantly nonobese DIEP patients have ranged from 0.5 to 3.9%.^{49,57,59,60} One meta-analysis found a pooled postoperative hernia incidence of 4.3% among muscle-conserving abdominal flaps in obese patients relative to an incidence of 2.6% in the nonobese, as well as a 1.72-fold increase in abdominal bulge or hernia risk among obese patients undergoing abdominal-based microsurgical breast reconstruction in general.⁴ Several strategies in the literature have been proposed to mitigate the risk of abdominal hernia: avoiding multiple lateral row perforators, sacrificing the umbilicus, nerve-sparing dissection, and the use of acellular dermal matrix underlay during the initial abdominal wall repair.^{57,58,60} Curiously, one study found the incidence of abdominal bulge and hernia to be significantly decreased among patients with more than two prior abdominal operations, perhaps due to the presence of fibrotic tissue

providing some measure of additional support to the abdominal wall.⁵⁰ Although we did not track the incidence of preexisting ventral hernia, one recent study found concomitant ventral hernia repair to be safe and effective without increased rates of hernia recurrence, flap or donor site complications, or lengthened operative time and length of stay.⁵¹ These can be evaluated during perforator mapping with computed tomography angiography (CTA), which may warrant unique considerations in the obese patient.

Regardless of BMI, we perform preoperative CTA on all patients undergoing DIEP flap-based breast reconstruction with sufficient renal function and without a contraindication. The benefits of CTA imaging are well-documented: the knowledge of perforator course and caliber allows the surgeon to optimize flap design, mitigate dissection difficulty, and theoretically reduce operative time.^{44,61–64} Routine use also ensures that all patients can be evaluated for preexisting abdominal scarring, flap thickness, and alternative options such as the superficial inferior epigastric system. There is evidence that the radiolucency of subcutaneous tissue may make cutaneous perforators easier to visualize in obese patients relative to leaner patients.⁶⁵ Additionally, many studies have documented obesity's role in increasing arterial caliber in response to the increased perfusion and nutrient needs of the larger tissue mass.^{66–70} While imaging studies of deep inferior epigastric artery perforators have not found universal increases in perforator diameter among obese patients,^{70–72} anecdotal intraoperative observations continue to support this in many reports.^{55,59,70} Furthermore, other studies have suggested that obstetric and gynecologic procedures may also increase the quantity of visualized perforators via the surgical delay phenomenon.^{50,53,73} As such, perforator identification on CTA may be improved in obese patients, and we believe that the standard use of CTA in this group is justified despite the drawbacks of financial cost, radiation exposure, vasospasm, and nephrotoxicity in response to intravenous contrast medium.^{64,74,75}

However, it is important to consider that obese patients are generally exposed to higher doses of both radiation and contrast (which are dependent on tissue thickness and weight) to achieve diagnostic image quality.⁷⁶ The latter compounds the risk for kidney injury when also considering the significant impact of obesity in the development of renal disease and metabolic syndrome.^{69,76,77} Patient access and positioning can also constrain imaging protocol if there exists a mismatch between patient size and the specifications of the CT machine.⁷⁶ Additionally, DelMauro and Moon recently observed fewer major deep inferior epigastric artery perforators among patients with higher BMIs. They hypothesized that this was due to perforator collapse secondary to lateral displacement of abdominal adiposity in the supine position during CTA; shearing forces may collapse perforator lumens as they exit the abdominal fascia.⁷⁰ While this potential limitation among obese patients warrants further investigation, we have seldom encountered difficulty identifying suitable perforators in obese patients without a known history of morbidity when high-quality images can be safely obtained.

Our study does suffer from several limitations. As with all retrospective studies, we are only able to identify associations between BMI and outcome measures without the ability to assess causation. Certain variables such as BMI and comorbidities were double counted in analyses on a per flap basis. The low incidence and subsequent quantity of individual complications provided inadequate power for proper statistical comparisons between classes of obesity. Furthermore, as we only focused on obese patients specifically, we did not have a control group of nonobese patients for comparison. Finally, the authors neglected to examine the incidence of several clinically relevant variables, such as rates of venous supercharging and massive weight loss prior to surgery, histories of previous abdominal surgeries and preexisting ventral hernia/bulge, as well as patient-reported quality-of-life outcomes. These factors are all worthwhile of further retrospective and prospective study among morbidly obese patients receiving DIEP flap reconstruction of the breast.

Conclusion

A significant portion of breast cancer diagnoses occur in the obese population. While obesity alone should not prohibit a patient from undergoing breast reconstruction, a surgeon must be diligent in counseling the patient with regard to the potential complications associated with obesity and should put forth a concerted effort to optimize patient health parameters prior to undertaking a complex reconstructive procedure. Given the findings of this study that patients with class III obesity (morbidly obese) are at a significantly elevated risk when undergoing DIEP flap-based reconstructions relative to those patients with class I or II obesity, it is advisable to approach these cases with additional caution, and perhaps even delay major reconstruction until after specific BMI goals have been met.

Conflict of Interest

None declared.

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