Association between body mass index and adverse surgical outcomes of implant-based breast reconstruction: a prospective cohort study of 5,545 breast reconstructions

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Background: Breast cancer is the highest incident cancer amongst women globally, with the exception of skin cancer. Approximately 15% of women globally are overweight, equating to an economic burden of $11 billion per year. To date, few studies have focused on the effects of obesity specifically in patients undergoing implant-based breast reconstruction for breast cancer.

Methods: We reviewed the 2007 to 2012 American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) databases identifying encounters for implant-based reconstruction (immediate, delayed, and tissue expander), as a prospective cohort study. Patients were classified and compared based on World Health Organisation (WHO) obesity criteria: body mass index (BMI) ≤25 kg/m^2—'not overweight', BMI 25 to ≤30 kg/m^2—'overweight', BMI 30 to ≤40 kg/m^2—'obese to severely obese' and BMI >40 kg/m^2—'morbidly obese'.

Results: During the study period 5,545 implant-based breast reconstructions were performed post mastectomy. Morbidly obese patients had a markedly greater likelihood of wound complications [odds ratio (OR) 2.47, 95% confidence interval (CI): 1.20–4.38, P=0.008] compared to their non-overweight counterparts. Morbidly obese patients also had 2.91 (95% CI: 1.21–5.94) times the likelihood of wound infection (P=0.009) and 8.54 (95% CI: 2.80–21.41) times the likelihood of wound dehiscence (P<0.001) compared with non-overweight patients. Those that were obese to severely obese also had an increased likelihood of wound infection compared to non-obese patients (OR 1.64, 95% CI: 1.0–2.7, P=0.048).

Conclusions: This study characterized the effect of progressive obesity using a prospective, multicentre dataset. Increasing obesity is associated with increased perioperative morbidity. The negative consequences of obesity on operative outcomes can be used to counsel patients on the importance optimizing preoperative BMI, particularly considering lifestyle factors in the context of oncological management.

Keywords: Body mass index (BMI); breast reconstruction; breast cancer; obesity

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Introduction

Breast cancer is the highest incident cancer amongst women globally, with the exception of skin cancer (1). Breast cancer remains the leading cause of cancer related death amongst women and is also a substantial cause of cancer related death amongst men worldwide (1). Although the survival rate of breast cancer has improved with increasing population size and increasing longevity there is still a higher incidence and more people dying of the disease in both developing and developed countries (2). In America and Australia, it is estimated that breast cancer accounts for approximately 30% of all new cancer cases among women in 2019 (3,4). The more widespread adoption of a westernized lifestyle with all of its risk factors, and increased life expectancy have thought to be major contributing factor to the global burden of breast cancer doubling between 1975 and 2000 (5). While the recent COVID-19 pandemic has occupied the focus of the medical community with its wide-ranging implications on human health, there is a growing body of evidence around the long-term implications of other epidemics, such as the obesity epidemic. The rise of the obesity epidemic has been somewhat less dramatic and has involved a longer time course than the COVID-19 pandemic. However, its enduring and inter-generational effects on our health are at least as significant. The obesity epidemic is thought to be a factor contributing to the rising prevalence of breast cancers in most Western countries (5).

Obesity is defined as a body mass index (BMI) greater than 30 kg/m^2 (6) and is associated with a range of peri- and post-operative complications (7-9). In recent decades, obesity has become a major public health issue, affecting around 13% of the global population (6,9). The prevalence of obesity is higher among women, with approximately 15% of women globally being overweight (6). In the USA, approximately 30% of adults are obese, and this contributes to an estimated economic burden of $11 billion (10,11).

Oncological managements and drug therapy regimens of breast cancer have contributed to causing obesity by making patients more prone to weight gain (12). Consequently, surgical services are increasingly being challenged by a rising prevalence of obese patients requiring mastectomy and subsequent breast reconstruction procedures. In many centers obesity is often a relative contraindication to immediate breast reconstruction with various centers citing body mass indexes (BMIs) of 30 or 35 kg/m^2 as an exclusion criterion (13,14). Obesity makes surgery more challenging; procedures in obese patients take longer and there are also higher rates of anaesthetic complications (15,16).

To date, research has shown that obese patients are more likely to experience complications with both autologous and implant-based breast reconstruction procedures (9,17,18). The higher risk of complications among these patients creates unique challenges for their surgical management, especially in the context of the current trend toward immediate implant-based reconstruction, and declines in autologous reconstructions (9,19). The current study specifically focuses on the association between obesity and outcomes of both immediate and delayed implant-based breast reconstructions for breast cancer. We present the following article in accordance with the STROBE reporting checklist (available at https://abs.amegroups.com/article/view/10.21037/abs-21-2/rc).

Methods

American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) data

Data for the ACS-NSQIP datasets were collected by trained research nurses employed by participating institutions. Approximately 240 variables relating to patient demographic characteristics, intraoperative variables, comorbidities, and outcomes affecting morbidity and mortality are collected for each patient. Patients are contacted post-operatively to obtain information on relevant outcomes up to that period. A complete list of the variables collected as part of ACS-NSQIP is available elsewhere (http://www.acsnsqip.org/).

These analyses utilized data from all plastic and reconstructive, and breast oncology surgical procedures identified in the 2007–2012 ACS-NSQIP datasets, identified using the 2012 Current Procedural Terminology (CPT) codes. The study was conducted with the Declaration of Helsinki (as revised in 2013).

Dependent variables

Surgical complications were examined as the dependent variables, including: superficial wound infection, deep wound infection, organ space infections, wound dehiscence, reintubation, pneumonia, postoperative bleeding/transfusion, deep venous thrombosis, pulmonary embolism, urinary tract infection, sepsis, and return to operating room.

Three composite outcome variables were created from these complications: "Medical complications', 'Major surgical complications', and 'Wound complications'.

Medical complications included: pneumonia, pulmonary embolism, postoperative renal insufficiency (creatinine >2 mg/dL), urinary tract infection, stroke, myocardial infarction, symptomatic deep vein thrombosis or sepsis. Major surgical complications comprised of: deep wound infection, a graft/prosthetic loss, or an unplanned return to the operating room. Wound complications comprised superficial surgical-site infections, deep incisional wound infections, organ space infections, and wound dehiscence. Wound infections were looked at as a sub-category of "wound complications" and included superficial surgical-site infections and deep incisional wound infections.

Independent variables

The principal independent variable was BMI which was calculated from measured height and weight at the time of surgery, and calculated using the Quetelet Index [BMI = (weight in kilograms)/(height in meters)^2] (6). Patients were grouped based on their BMI's and the WHO classifications for obesity (6). Patients with a BMI ≤25 kg/m^2 were categorized as being 'not overweight', those with a BMI between 25 to ≤30 kg/m^2 were grouped as 'overweight', 'obese to severely obese' was a BMI between 30 to ≤40 kg/m^2 and 'morbidly obese' were those with a BMI >40 kg/m^2.

Statistical analyses

All analyses were conducted by a statistician. The baseline socio-demographic and surgical characteristics of the sample were examined using basic descriptive statistics. Each of the BMI categories were compared with the not overweight group, and the general association between the categorical variables were compared using a chi-square test. The P values generated indicated the significance of a particular variable's outcome and the general association with the BMI category.

Logistic regression was used to examine associations between BMI and each of the three adverse surgical outcomes. These analyses were adjusted for sex, race, age, smoking status, congestive heart failure, use of anti-hypertensives, renal failure, and dyspnea. Missing data were excluded. The statistic of interest in these analyses was the odds ratios (ORs) [95% confidence interval (CI)] and corresponding P values of each of the BMI groups, using the 'not overweight' group as the comparator group.

A negative binomial model was used for examining the association between BMI (measured as a continuous variable) with hospital length of stay (LOS), adjusting for sex, race, age group, calendar year of surgery, smoking status, use of anti-hypertensives, renal failure, and dyspnea. The statistics of interest were the least square mean values (95% CI), the rate ratios (95% CI) and their corresponding P values.

Results

The characteristics of the study sample are summarized in *Table 1*. These analyses consisted of 5,545 implant-based breast reconstructions following mastectomy. This included 1,162 (21%) direct to implant breast reconstructions (single stage breast reconstructions), 1,809 (33%) delayed breast reconstruction with permanent prosthesis (delayed single stage breast reconstructions), and 2,574 (46%) expanders with subsequent prosthesis reconstructions (two stage breast reconstructions). From the dataset, the greatest proportion of breast reconstructions were in the 50–59 years age group (32 %), and the majority of the sample (76%) were Caucasian. The body weight status of the sample comprised of 2,701 patients (49%) not overweight, 1,554 patients (28%) overweight, 1,109 patients (20%) moderately to severely obese, and 181 patients (3%) were morbidly obese.

Tables 2,3 summarize the findings of the associations between BMI status and a number of adverse operative outcomes. A total of 408 patients (7%) experienced postoperative complications. 'Medical complications' occurred in 44 patients (0.8%), 'major surgical complications' occurred in 280 patients (5%), and 'wound complications' occurred in 184 patients (3%) (*Table 2*). 'Wound infections' occurred in 2% of patients (n=113).

Morbidly obese patients had a markedly greater likelihood of 'wound complications' (OR 2.47, P=0.008) compared to their non-overweight counterparts. Morbidly obese patients also had 2.91 times the likelihood of wound infection (P=0.009) and 8.54 times the likelihood of wound dehiscence (P<0.001) compared with non-overweight patients. Those that were obese to severely obese also had an increased likelihood of 'wound infection' compared to non-obese patients (OR 1.64, P=0.048).

The findings further showed that both obese to severely obese and morbidly obese patients had a greater likelihood of 'major surgical complications' (OR 1.46, P=0.022 and OR 2.76, P<0.001, respectively) than their non-overweight counterparts. There was no association between BMI and 'medical complications'. Negative binomial model analyses (*Table 4*) revealed that the average LOS increased by

Table 1 Baseline patient characteristics

Characteristics	Categories	BMI ≤25 kg/m^2		BMI ≥25, and ≤30 kg/m^2		BMI >30, and ≤40 kg/m^2		BMI >40 kg/m^2		Overall, n (% total)
		n (% total)	P*	n (% total)	P*	n (% total)	P*	n (% total)	P*	
Sex	Female	2,696 (48.62)	0.05	1,545 (27.86)	>0.05	1,105 (19.93)	>0.05	180 (3.25)	>0.05	5,526 (99.66)
	Male	4 (0.07)	–	7 (0.13)	–	3 (0.05)	–	1 (0.02	–	12 (0.27)
	Unknown	1 (0.02	–	2 (0.04)	–	1 (0.02)	–	0 (0.00)	–	4 (0.07)
Race	African American	84 (1.51)	<0.01	110 (1.98)	>0.05	132 (2.38)	<0.01	16 (0.29)	<0.01	342 (6.17)
	American Indian (or other)	2 (0.04)	–	1 (0.02)	–	4 (0.07)	–	0 (0.00)	–	7 (0.13)
	Asian	101 (1.82)	–	30 (0.54)	–	13 (0.23)	–	1 (0.02)	–	145 (2.61)
	Caucasian	2,106 (37.98)	–	1,163 (20.97)	–	801 (14.45)	–	140 (2.52)	–	4,210 (75.92)
	Hawaii Indian (or other)	2 (0.04)	–	1 (0.02)	–	4 (0.07)	–	2 (0.04)	–	9 (0.16)
	Hispanic	4 (0.07)	–	4 (0.07)	–	3 (0.05)	–	0 (0.00)	–	11 (0.20)
	Unknown	402 (7.25)	–	245 (4.42)	–	152 (2.74)	–	22 (0.40)	–	821 (14.81)
Age group (years)	16–19	8 (0.14)	<0.01	5 (0.09)	<0.05	1 (0.02)	<0.01	0 (0.00)	>0.05	14 (0.25)
	20–29	78 (1.41)	–	22 (0.40)	–	12 (0.22)	–	0 (0.00)	–	112 ((2.02)
	30–29	366 (6.60)	–	145 (2.61)	–	88 (1.59)	–	14 (0.25)	–	613 (11.06)
	40–49	914 (16.48)	–	422 (7.61)	–	2.72 (4.91)	–	51 (0.92)	–	1,659 (29.92)
	50–59	804 (14.50)	–	528 (9.52)	–	391 (7.05)	–	61 (1.10)	–	1,784 (32.17)
	60–69	398 (7.18)	–	322 (5.81)	–	283 (5.10)	–	49 (0.88)	–	1,052 (18.97)
	70–79	125 (2.25)	–	100 (1.80)	–	61 (1.10)	–	6 (0.11)	–	292 (5.27)
	80–89	8 (0.14)	–	10 (0.18)	–	1 (0.02)	–	0 (0.00)	–	19 (0.34)
	90–99	0 (0.00)	–	0 (0.00)	–	0 (0.00)	–	0 (0.00)	–	0 (0.00)
Smoker	No	2,369 (42.72)	>0.05	1,352 (24.38)	>0.05	990 (17.85)	>0.05	155 (2.80)	>0.05	4,866 (87.75)
	Yes	332 (5.99)	–	202 (3.64)	–	119 (2.15)	–	26 (0.47)	–	679 (12.25)
Diabetic	T1DM	16 (0.29)	<0.01	11 (0.20)	>0.05	39 (0.7)	<0.01	12 (0.22)	<0.01	78 (1.41)
	T2DM	31 (0.56)	–	55 (0.99)	–	99 (1.79)	–	20 (0.36)	–	5,262 (94.90)
	No	2,654 (47.86)	–	1,488 (26.83)	–	971 (17.51)	–	149 (2.69)	–	205 (3.70)

Table 1 (*continued*)

Table 1 (*continued*)

Characteristics	Categories	BMI ≤25 kg/m^2		BMI ≥25, and ≤30 kg/m^2		BMI >30, and ≤40 kg/m^2		BMI >40 kg/m^2		Overall, n (% total)
		n (% total)	P*	n (% total)	P*	n (% total)	P*	n (% total)	P*	
Dyspnoea	At rest	2 (0.04)	<0.01	1 (0.02)	>0.05	1 (0.02)	<0.01	1 (0.02)	<0.01	5 (0.09)
	Moderate	41 (0.74)	–	39 (0.70)	–	55 (0.99)	–	15 (0.27)	–	150 (2.71)
	No	2,658 (47.94)	–	1,514 (27.30)	–	1,053 (18.99)	–	165 (2.98)	–	5,390 (97.20)
Use of antihypertensives	No	2,369 (42.72)	<0.01	1,130 (20.38)	<0.01	619 (11.16)	<0.01	95 (1.71)	<0.01	4,213 (75.98)
	Yes	332 (5.99)	–	424 (7.65)	–	490 (8.84)	–	86 (1.55)	–	1,332 (24.02)
Year of procedure	2007	31 (0.56)	>0.05	22 (0.40)	>0.05	12 (0.23)	>0.05	3 (0.05)	>0.05	69 (1.24)
	2008	98 (1.77)	–	43 (0.78)	–	35 (0.63)	–	9 (0.16)	–	185 (3.34)
	2009	187 (3.37)	–	114 (2.06)	–	74 (1.33)	–	15 (0.27)	–	390 (7.03)
	2010	256 (4.62)	–	139 (2.51)	–	112 (2.02)	–	18 (0.32)	–	525 (9.47)
	2011	803 (14.48)	–	439 (7.92)	–	326 (5.88)	–	43 (0.78)	–	1,611 (29.05)
	2012	1,326 (23.91)	–	797 (14.37)	–	549 (9.90)	–	93 (1.68)	–	2,765 (49.86)
Type of procedure	Direct to implant breast reconstruction	647 (11.67)	<0.01	306 (5.52)	<0.05	183 (3.03)	<0.01	26 (0.47)	<0.05	1,162 (20.96)
	Delayed breast reconstruction with permanent prosthesis	860 (15.51)	–	536 (9.67)	–	349 (6.29)	–	64 (1.15)	–	1,809 (32.62)
	Expander with subsequent permanent prosthesis reconstruction	1,194 (21.53)	–	712 (12.84)	–	577 (10.41)	–	91 (1.64)	–	2,574 (46.42)

P* values obtained from χ^2 analysis. BMI, body mass index.

Table 2 Logistic regression analysis of major complications between BMI categories

Parameters	Overweight *vs.* not overweight		Obese to severely obese *vs.* not overweight		Morbidly obese *vs.* not overweight	
	Odds ratio (95% CI)	Overall P value	Odds ratio (95% CI)	Overall P value	Odds ratio (95% CI)	Overall P value
Medical complication	n/a	0.313	n/a	0.227	n/a	0.437
Surgical complication	n/a	0.421	1.46 (1.05–2.00)	0.022	2.76 (1.61–4.51)	<0.001
Wound complication	n/a	0.314	n/a	0.138	2.47 (1.20–4.38)	0.008

BMI, body mass index; n/a, not applicable.

Table 3 Logistic regression analysis of wound issues for BMI categories

Parameters	Overweight *vs.* not overweight		Obese to severely obese *vs.* not overweight		Morbidly obese *vs.* not overweight	
	Odds ratio (95% CI)	Overall P value	Odds ratio (95% CI)	Overall P value	Odds ratio (95% CI)	Overall P value
Dehiscence occurrences	n/a	0.197	n/a	0.395	8.54 (2.80–21.41)	<0.001
Wound infection occurrences	n/a	0.400	1.64 (1.0–2.7)	0.048	2.91 (1.21–5.94)	0.009

BMI, body mass index; n/a, not applicable.

Table 4 Negative binomial analysis of length of hospital stay using BMI as a continuous variable

Variable	Level	Length of stay, mean (min, max)	Rate ratio (95% CI)	P value
Total hospital stay	BMI (as a continuous variable i.e., not categorised)	0.8 (0, 31)	1.03	<0.001

BMI, body mass index.

0.03 days longer [relative risk (RR) =1.03] with each 1 kg/m^2 increase in BMI.

Discussion

The global obesity epidemic has led to a new array of challenges for surgeons performing post mastectomy breast reconstruction. Implant-based reconstruction has become the most frequent surgical option to recreate the breast mound post mastectomy (6,9,18,19). It is therefore important for surgeons to have knowledge of the complications of such surgery among obese patients, to facilitate their optimal management both peri- and post-operatively. The current study is the largest known population-based study systemically examining the link between obesity and outcomes in implant-based reconstructions in breast cancer patients. The results suggest that obese patients who had these procedures were at a higher likelihood of both surgical complications and wound infections, with increasingly higher risks of these outcomes among patients who were morbidly obese. To date, few studies have examined the effects of obesity specifically in a cohort of patients undergoing implant-based breast reconstruction for breast cancer (7-9).

The findings of the current study are concordant with a number of studies examining surgical outcomes among overweight or obese patients. A number of studies have consistently shown that increasing BMI is strongly associated with increased post-operative complications (7-9,11,12,17-20), with Chen *et al.* showing that obese patients can have as much as an 11.8-fold increase in the odds of experiencing a complication compared to their normal weight counterparts (21). Nguyen *et al.*, showed that a one-unit increase in BMI was associated with a 5.9% increase in risk of overall complications (22). The findings of the current study corroborate with those of Fischer *et al.* (18), who showed that obesity was independently associated with major surgical complications (OR 1.6, P<0.001) and wound complications (OR 2.1, P<0.001) compared to normal-weight patients in a cohort study of 15,937 patients who underwent both autologous and implant-based reconstructions. Similar to the current study, Fischer *et al.* also found the odds of major complications further increased among morbidly-obese patients compared with non-obese patients (14.9% *vs.* 7.1%, P<0.0001) (7,8).

The difficulties associated with operating on obese patients can partially explain why obesity leads to an increased incidence of infection, seroma formation and skin necrosis. Francis *et al.* suggests there is a link between longer operative time and risk of breast pocket field contamination. By virtue of size, the larger pocket increases the field size, and thereby increases the risks of contamination. Also, the larger mastectomy skin flaps have a greater surface area and tend to be further from the blood source vessels, resulting in poorer perfusion, further increasing the risks of ischemia and necrosis (23). An additional mechanism is thought to be the increased dead space secondary to the mastectomy. The larger dead space formed by the removal of the breast in obese patients is also thought to lead to frictional forces developing between tissue planes, principally the mastectomy flap and the pectoralis major muscle (22,24).

The current study included both direct-to-implant reconstruction and two-stage reconstruction with tissue expanders followed by subsequent permanent prosthesis. It has been postulated in other studies that a likely mechanism between BMI and tissue expander related complications may lie with the aggressive expansion needed to fill the large mastectomy pocket in obese patients. It is postulated that when this pocket is under filled, it may lead to increased dead space and subsequent seroma formation due to the redundancy of tissue (22,24).

Patient anatomy has also been associated with infection risk. Francis *et al.* and Khansa *et al.*, identified that women with greater than C-cup sized breasts have increased risk of infection (23,25). This was also confirmed by Yuen *et al.*, who observed greater rates of seroma formation among patients with DD, and D-cup size compared with B or C (54% *vs.* 45% *vs.* 14.9%, P=0.02, respectively). The same study by Yuen *et al.*, also found an association between breast width and rates of seroma, cellulitis, skin necrosis and skin necrosis necessitating surgical revision. Despite the study by Yuen *et al.* being a single-centre retrospective assessment of 70 consecutive patients, it sheds an interesting perspective on complications that could be anticipated based on simple measurements (26).

The findings of the current study differed from those documented by Moran *et al.*, Appleton *et al.*, and Mehrara *et al.* (27-29), who found that obese women undergoing breast reconstruction had a similar length of hospital stay compared to their non-obese counterparts. However, the current study showed that BMI was directly related to both length of hospital stay and post-operative complications among women undergoing breast reconstruction surgery.

In our analyses, none of the obesity classes showed any associations with medical complications. Interestingly these findings differ from those documented by Panayi *et al.*, who performed a large scale 29 paper review meta-analysis assessing the impact of obesity in all modalities of breast reconstruction. Their study showed that obese patients undergoing breast reconstruction suffered higher occurrences of deep-vein thrombosis (DVT) and pulmonary embolism (PE) which was attributed to obese patients often having multiple medical comorbidities which increases the risk of these post-operative complications (9). The discrepancy with this study may be that the current study focused only on a very specific subset of patients undergoing implant-based reconstruction. Hanwright *et al.*, in their assessment of the differential effect of tissue expander reconstruction *vs.* pedicled transverse rectus abdominis myocutaneous (TRAM), latissimus dorsi and free flap reconstruction found tissue expander reconstruction had lower rates of overall morbidity compared to patients who underwent autologous tissue reconstruction (9.5% *vs.* 18%; P<0.001) (30). In their subgroup assessment both total surgical and medical complications, reoperation rates, frequency of PE and prosthesis/flap failure rates were notably higher in the autologous group. The study suggested that the increase in risk could be attributed to either a selection bias as patients prone to thrombotic events were more likely to undergo pedicled reconstruction, or due to the fact that perioperative anticoagulants are more routinely used in patients undergoing free tissue transfer (30). The current study focusses on a discretely different population of patients, and a relatively shorter procedure. Shorter operation time and complexity of operative procedures have shown to be independent predictors of postoperative complications (31).

A number of limitations of the current study need to be discussed in the context of the findings. First, the study cohort was from the NSQIP database, which assumes that all procedures performed were entered in the database.

All affiliated institutions use an ACS-validated, systematic sampling protocol. Therefore, hospitals with larger volumes collect a certain number of cases during this cycle. Those with lower volumes will collect all surgical cases, so the sampling system is not required. Despite the overall goal of the sampling system to remove population bias, the data is captured prospectively, therefore it may take sites an extended period of time to be able to make meaningful comparisons and ascertain effect size due to demographic differences. Second, a disadvantage to the use of the NSQIP database is that the resultant study is retrospective in nature, and the database does not provide robust clinical information, namely more in-depth specifics of the nature of each procedure collated by CPT code. Finally, the study lacks the ability to extrapolate long-term complication data for patients undergoing implant-based reconstruction, as the follow-up period for NSQIP was limited to only 30 days. For example, the database does not capture certain complications that are important to plastic and oncoplastic surgeons, such as capsular contracture rates, keloid and hypertrophic scar formation, and long-term pain by limiting postoperative data collection to 30 days. Furthermore, the dataset does not adequately capture newer methods of reconstruction such as the use of bioprosthetic employed in implant based breast reconstruction. Additionally, data drawn from this database is non-randomly assigned. Surgical techniques are known when selection is made, leading to a selection bias which may account for the differences in patient outcomes. This implies that variables pertaining to patient demographics and comorbidities are a potential source of confounding in these analyses.

To inform potential candidates and to strive to minimise the occurrence of the aforementioned complications to better care for obese women undergoing implant-based breast reconstruction post mastectomy, we would recommend counselling patients about their increased post-operative risks and strategies to reduce their incidence. Clinical counselling would include giving patients realistic expectations of the complications profile they are exposed to as a consequence of their obesity and may even lead to discussions relating to potentially consider weight loss and having delayed reconstruction in some circumstances. However, the known advantages of immediate reconstruction may outweigh these considerations provided the woman is informed. A tailored approach based on each patient's clinical circumstances and comorbidities in the context of the oncological management of the breast cancer is vital. Consideration of the patient's emotional well-being is also of critical importance. In the context of delayed reconstruction, Ozturk *et al.*, established that perioperative weight loss not only facilitated reconstruction (32) and Larson *et al.*, enhances outcomes but also improves post-operative satisfaction among obese women (33).

Conclusions

The incidence of obesity is increasing, and is associated with an increased risk of a multitude of post-operative complications specific to implant reconstruction and the overall risk profile of patients undergoing implant-based breast reconstruction post mastectomy. Information about the increased incidence of the negative consequences of obesity on operative outcomes can be used to counsel patients on the importance optimising preoperative BMI in the context of women undergoing delayed reconstruction. Women undergoing immediate reconstruction must understand the potential impacts of these risks in regards to their oncological management. Clinician consideration of BMI in the context of oncological management can also be used to enhance perioperative decision making by considering a range of other reconstructive options. These results enable surgeons performing reconstructive breast surgery to provide obese patients with tangible, quantifiable complication risks before they undergo surgery.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://abs.amegroups.com/article/view/10.21037/abs-21-2/rc

Peer Review File: Available at https://abs.amegroups.com/article/view/10.21037/abs-21-2/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://abs.amegroups.

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

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