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Breast

Postoperative Outcomes in Prepectoral Versus Retropectoral Immediate Implant-based Breast Reconstruction Across Body Mass Index Categories

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Background: Prepectoral (PP) immediate implant-based breast reconstruction (IBBR) is gaining popularity over the retropectoral (RP) breast reconstruction technique. This study aims to compare complication rates across different body mass index (BMI) groups in patients undergoing PP or RP IBBR.

Methods: A monocentric retrospective analysis was conducted on patients who underwent mastectomy and IBBR from January 2018 to December 2023. Preoperative characteristics, BMI, type of mastectomy procedure, PP or RR implant placement, and postoperative outcomes were collected and analyzed.

Results: A total of 217 patients were included, representing 276 IBBRs. The overall complication rate on a per breast basis was 26.4%. The overall complication rate did not differ across BMI groups ($P = 0.314$) and between PP and RP IBBR ($P = 0.8083$). In the PP group, anemia rate increased with low BMI (odds ratio [OR] 0.0215, $P = 0.033$) and skin complications were more frequent with higher BMI (OR 0.0428, $P = 0.0389$). In the RP group, higher BMI was correlated with a higher seroma rate in the RP IBBR group (OR 1.2045, $P = 0.0334$) and a longer hospital length of stay (coefficient 0.248, adjusted R^2 0.082, SD 0.098, $P = 0.014$).

Conclusions: PP IBBR was associated with a significantly higher rate of anemia in patients with low BMI, and a significantly higher rate of skin complications in high BMI. RP IBBR was associated with higher seroma rate and longer hospital length of stay in patients with higher BMI. *(Plast Reconstr Surg Glob Open 2025; 13:e6425; doi: 10.1097/GOX.0000000000006425; Published online 10 January 2025.)*

INTRODUCTION

Breast cancer is the most prevalent malignancy among women.[1] The trend of postmastectomy breast reconstruction (BR) is on the rise in Western countries, with rates increasing from 33.2% to 60.0% between 2005 and 2014 in the United States.[2]

Immediate implant-based breast reconstruction (IBBR) has gained significant traction and is now the most widely used BR technique in the world.[1–4] Indeed, nipple-sparing mastectomy (NSM) and skin-sparing mastectomy (SSM) are the most common surgical procedures for breast cancer treatment in the United States,[4] allowing for the preservation of a maximum of natural breast tissue and reducing the number of stages needed for BR. Prepectoral (PP) implant reconstruction was initially rejected in the 1980s due to high complication rates, favoring retropectoral (RP) implant placement. Although popular for several decades, RP reconstruction has shown several technical limitations, including the difficulty of creating an adequate subpectoral plane, significant postoperative pain, and associated muscle morbidity,[3] contributing to the renewed popularity of PP implant placement, which avoids creating a submuscular plane, thereby reducing postoperative pain and expediting recovery.[5,6]

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Given the heterogeneous nature of the population of breast cancer patients requiring mastectomy with IBBR, a careful evaluation of individual risk factors and risks associated with each technique is crucial.[7]

The global prevalence of obesity has tripled since 1975, particularly affecting women, increasing with age and reaching its peak between 50 and 65 years.[8] This increase in obesity prevalence is a matter of concern, as BR in this population presents challenges both in terms of surgical technique and management of postoperative complications,[9–14] with an increase in postoperative complications of 6%–7%, and reconstructive failure by 8%–13% per unit increase in BMI.[11,15] Considering that increasing variations in BMI are observed in patients requiring BR, the ideal method of reconstruction in these patients has yet to be determined.[16] The present retrospective study aims at evaluating the occurrence of complications in patients undergoing immediate PP or RP IBBR following mastectomy, according to their BMI.

PATIENTS AND METHODS

A retrospective review of medical charts was conducted for patients undergoing mastectomy followed by IBBR from January 2018 to December 2023. This review included demographic data, surgical details, and postoperative outcomes. Exclusion criteria included an incomplete medical record and the use of other surgical techniques for BR. Demographic data including BMI, American Society of Anesthesiology (ASA) scores, venous thromboembolism (VTE) risk assessed via the Caprini Score (CS), history of previous radiotherapy (RT) or chemotherapy (CT), intraoperative details, RP or PP implant placement, operative duration, and postoperative outcomes were extracted from patients' medical records and analyzed. The project was approved by the relevant ethics committee "Commission Cantonale d'Ethique de la Recherche sur l'être humain" (project ID: 2024-00944), and informed consent was obtained from all patients.

Surgical Procedure

The gynecological team started with the mastectomy, either NSM or SSM, depending on the morphological characteristics, the oncological pathology, and patient preferences. The skin incision varied according to patients' morphology, history, and type of mastectomy, using a previous scar, a periareolar approach, or in the inframammary fold. The sentinel lymph node search was then performed. Subsequently, our team proceeded with the BR. The vascularity of the mastectomy flap was assessed clinically in all cases, and if there was any doubt about good vascularity, an indocyanine green test was performed at the end of the procedure. Placement of the prosthesis was decided preoperatively according to the surgeon's preference; the patient's history and morphological characteristics, including BMI; and the patient's wishes. In the case of PP IBBR, the implant was then placed anteriorly to the pectoralis major muscle. The dissection was continued until the inferior edge of the pectoralis major muscle to release the RP plane in case of RP implant placement.

Takeaways

Question: Does body mass index (BMI) impact immediate postoperative outcomes following prepectoral (PP) and retropectoral (RP) immediate implant-based breast reconstruction (IBBR)?

Findings: Overall complication rate did not differ across BMI groups and between PP and RP IBBR. Increased anemia rate was observed in PP IBBR patients with low BMI. In RP IBBR patients, higher BMI was correlated with higher seroma rate and longer hospital length of stay.

Meaning: BMI correlated with the occurrence of various complications. There were no differences across PP and RP IBBR patients in terms of postoperative complication rate.

Statistical Analysis

Continuous variables were analyzed using analysis of variance. Categorical variables were compared using a 2-sided chi-square test or Fisher exact test, as appropriate. Binary logistic regression was used to compare categorical variables, whereas linear regression was used to analyze continuous variables. A power analysis for the analysis of variance test comparing postoperative complication rates across the 4 BMI groups was conducted at an alpha level of 0.05. The study achieved a power of 87.9% for detecting a medium effect size ($f = 0.25$). Statistical analysis was performed using SPSS version 29.0 (IBM, Armonk, NY).

RESULTS

Demographic Data

Of the 217 patients included in the study, 276 IBBR procedures were performed, with 72.8% being unilateral and 27.2% bilateral. The study cohort was separated into 4 groups according to BMI categories—with 9 patients in the underweight (BMI ≤ 18.5 kg/m^2), 125 patients in the normal weight (BMI 18.6–24.9 kg/m^2), 61 in the overweight (BMI 25–29.9 kg/m^2), and 22 patients in the obese (BMI ≥ 30 kg/m^2) categories, respectively. (**See table, Supplemental Digital Content 1**, which displays the baseline characteristics, **http://links.lww.com/PRSGO/D763**.) (**See table, Supplemental Digital Content 2**, which displays operative characteristics, **http://links.lww.com/PRSGO/D764**.) A subgroup analysis according to implant placement was then performed in the cohort, representing 185 PP IBBR and 91 RP IBBR in 155 and 62 patients, respectively. (**See table, Supplemental Digital Content 3**, which displays the operative characteristics in RP and PP groups, **http://links.lww.com/PRSGO/D765**.)

Patient Characteristics

Baseline characteristics were comparable across BMI groups, except for a higher ASA score, and higher CS in the overweight and obese groups. There were no statistically significant differences in age and history of active smoking (**Supplemental Digital Content 1**, **http://links.lww.com/PRSGO/D763**).

Table 1. Logistic Regression Between BMI and Mean Hospitalization Time

	Coefficients	SD	Adjusted R^2	*P*
Mean hospitalization time	0.079	0.061	0.003	0.197
Pre	0.038	0.074	−0.005	0.615
Retro	0.248	0.098	0.082	0.014*

*$P < 0.05$.

Neoadjuvant Therapy

Fifty-seven patients received neoadjuvant treatment, 40 received CT in the past or as neoadjuvant treatment, 8 had a history of RT, and 9 had both. No patients in the underweight group had neoadjuvant CT; 23 patients (18.4%), 18 patients (29.5%), and 8 patients (36.4%) had neoadjuvant CT in the normal, overweight, and obese groups, respectively ($P = 0.045$). In patients who received RT, 4 patients had a secondary autologous reconstruction. Other details on oncological treatment modalities and BMI distribution can be found in (**Supplemental Digital Content 1**, **http://links.lww.com/PRSGO/D763**).

Surgical Characteristics

A total of 276 mastectomies and IBBRs were performed. There was a higher rate of NSM in patient with low or normal BMI, with 7 breasts (63.3%) and 87 breasts (55.1%), whereas the proportion of SSM was higher in patients who were overweight or had obesity, 48 breasts (61.5%) and 25 breasts (86.2%) ($P = 0.004$). Mean resection weight per breast was significantly higher in patient categories with higher BMI ($P = 0.001$). There was no difference in operative time across groups ($P = 0.584$) (**Supplemental Digital Content 2**, **http://links.lww.com/PRSGO/D764**).

Bilateral reconstructions and NSM were more frequent in the RP group with 46.8% and 64.8% versus 19.4% and 48.6% in the PP group ($P < 0.001$ and 0.034). The mean resection weight of 409.6 g (SD 254.4) was significantly higher in the PP group compared with 320 g (SD 169.9) in the RP group ($P = 0.018$). The mean operative time was longer in the RP group with 237.7 minutes (SD 75.0) versus 209.6 minutes (SD 93.0) in the PP group ($P = 0.035$) (**Supplemental Digital Content 2**, **http://links.lww.com/PRSGO/D765**).

Hospital Stay and Complications

The mean length of hospital stay was 6.8 days (SD 1.7), 6.9 days (SD 4.1), 7 days (SD 3.2), and 7.3 days (SD 3.0) across the different BMI group ($P = 0.982$). There were 4 patients (36.4%) who presented postoperative complications in the underweight group, 40 in the normal weight group (25.2%), 22 in the overweight group (28.2%), and 7 in the overweight group (24.1%) ($P = 0.808$). There were no statistically significant differences in the hematoma, infection, seroma, or reoperation rates when comparing the 4 BMI groups. (**See table, Supplemental Digital Content 4**, which displays postoperative outcomes per breast, **http://links.lww.com/PRSGO/D766**.) There were no significant differences in the overall complication rate between the RP and PP groups. However, there was a higher proportion of skin complications that encompass skin flap necrosis, scar necrosis, wound dehiscence, or surgical site infection ($P = 0.021$) in patients with higher BMI in overall population comparing BMI categories and in the PP subgroup ($P = 0.043$) but not in the RP subgroup ($P = 0.411$). Postoperative anemia rate was higher in patients with lower BMI, when comparing across categories ($P = 0.019$). A significantly higher rate of seroma was observed in higher BMI categories in the RP group ($P = 0.033$) but not in the PP group ($P = 0.913$) or in the overall population ($P = 0.149$) (**Supplemental Digital Content 4**, **http://links.lww.com/PRSGO/D766**). This difference was also found when comparing the seroma rate across RP and PP groups, with a rate of 8.7% and 1.6%, respectively ($P = 0.007$). (**See table, Supplemental Digital Content 5**, which displays postoperative outcomes per breast comparing PP and RP breast reconstruction, **http://links.lww.com/PRSGO/D767**.) The overall complication rate was the same between active and nonactive smokers in the overall population, PP and RP groups. (**See table, Supplemental Digital Content 6**, which displays Binary logistic regression, **http://links.lww.com/PRSGO/D768**.)

The anemia rate was lower as BMI increased (odds ratio [OR] 0.8386, 95% CI: 0.7135–0.9857, $P = 0.033$), and this correlation was also found in the PP group (OR 0.7779, 95% CI: 0.6099–0.9921, $P = 0.043$), but not in the RP group. In the overall population, an increase in BMI was associated with an increase in skin complications (OR 1.1406, 95% CI: 1.0235–1.2710, $P = 0.017$), also found in the PP group (OR 1.1325, 95% CI: 1.0063–1.2744, $P = 0.034$), but not observed in the RP group. An increase in BMI was significantly correlated with a higher rate of seroma in the RP group (OR 1.2045, 95% CI: 1.0147–1.4297, $P = 0.033$), but not in the PP group or the entire study population. No additional significant associations were found (**Supplemental Digital Content 6**, **http://links.lww.com/PRSGO/D768**).

The most frequent indication for reoperation was scar revision in 9 patients (3.3%), followed by hematoma evacuation in 8 (2.9%) patients and implant removal due to infection in 4 patients (1.4%) (**Supplemental Digital Content 6**, **http://links.lww.com/PRSGO/D766**).

A trend toward longer hospitalization was observed in patients with higher BMI in the overall population ($P = 0.197$). Moreover, patients with higher BMI who underwent RP IBBR had a significantly longer length of stay (coefficient 0.248, SD 0.098, $P = 0.014$) (Table 1; Fig. 1).

DISCUSSION

IBBR has become increasingly popular following mastectomy, with a renewed interest in PP IBBR.[1] Several studies have shown that PP and RP IBBR have equivalent rates of postoperative complications.[17,18] The current study

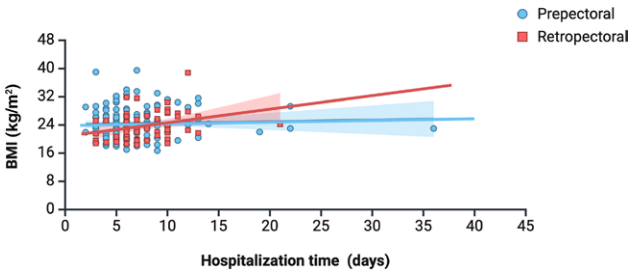

Fig. 1. Scatter plot of hospital length of stay, according to BMI (kg/m^2); an increase in hospital length of stay (d) is observed in patients with higher BMI in the retropectoral group.

aimed at assessing whether BMI was a complicating factor in IBBR with PP and RP implant placement.

Indeed, it is well established that BMI is associated with a higher risk of postoperative complications in mastectomy and BR.[19,20] Numerous studies reported a higher rate of complications, such as skin flap necrosis, seroma, or infection following immediate BR, prompting some surgeons to recommend autologous reconstruction[9,21] or stagged BR with expander[11] in patients with BMI higher than 30 kg/m^2 to limit complications and to obtain better cosmetic results.[16,22,23]

However, IBBR offers significant advantages, including a shorter procedure with no additional donor-site complications or morbidity, and no influence on oncological outcomes.[9,24] This also highlights the importance of studying the safety of IBBR and analyzing the best option in terms of implant placement in patients who are overweight or patients with obesity.

In our cohort, the ASA and CS across BMI groups were both higher in the overweight and obese groups. This is partly explained by the fact that higher BMI is considered a risk factor in these 2 scores.

Noteworthy, the proportion of patients receiving preoperative CT was higher in the higher BMI subgroups. However, a recent study found that neoadjuvant chemotherapy was not associated with an increased risk of postoperative complications following implant-based BR.[25] We also observed that the mean resection weight was more important in patients with higher BMI. Studies showed that higher resection weight was associated with an increased risk of complication,[26] particularly skin complications, explained by a drop in perfusion,[27] more frequent comorbidities.[28] Others have observed that hypertension, diabetes, and obesity are independent factors increasing the risk of skin complications following BR, including IBBR.[28]

In our study, no significant differences in hematoma, VTE, infection, or reoperation rates were observed with increasing BMI, contrasting with findings from Vaccari et al,[11] who noted a higher complication rate in patients who were overweight (22.8%) and patients with obesity (29.9%).

On the other hand, Gabriel et al[19] did not report higher complication rates in this population compared with patients without obesity, with an overall complication rate of 12.9%, which is lower than the overall complication rate of 26.4% observed in our study. For this reason, they concluded that the PP IBBR approach is not contraindicated in patients with a high BMI.[16] It should be noted that their studies had limitations, including the comparison of PP IBBR and dual-plane IBBR and a small population size. Larger studies, such as the one by Vaccari et al,[11] observed an increase in complications of 7% per 1 BMI unit increase.

Our analysis found no significant differences in the occurrence of hematoma, VTE, infection, or reoperation rate in relation to BMI. However, the postoperative anemia rate decreased with higher BMI. This was already described by several authors who studied the predicting factors of postoperative anemia after different types of surgery.[29,30] To our knowledge, our study is the first study reporting this in the context of BR. However, this correlation was found only in PP IBBR and not in RP IBBR.

When analyzing the overall population, the skin complication rate was significantly correlated with an increase in BMI in the overall study population and in the PP IBBR group, but not in the RP IBBR group. Nickel et al[20] reported that higher BMI was a risk factor for skin complications following mastectomy and IBBR, especially in higher BMI categories. Moreover, a large study including 20,061 patients with obesity found that wound dehiscence was the most common complication in this population.[31] This is especially true when considering a PP IBBR, which theoretically leads to greater tension on the skin flap, predisposing to skin complications.[32] In fact, the perfusion of skin flaps is more important than the thickness of the flap.[19] In patients who are overweight or patients with obesity, the skin flap is thicker, hence making the perfusion variable,[20] leading some surgeons to recommend delaying the reconstruction with the use of an expander or favoring RP implant placement when skin flap perfusion is low or doubtful.[20,33,34] Taking these considerations into account and finding no other significantly more frequent complications in patients with low BMI, PP IBBR can be safely offered to patients with low BMI.

Higher BMI was shown to increase the risk of VTE following BR in the literature,[35] but no VTE was noted in our cohort. Castaldi et al[35] reported a higher VTE rate following autologous BR with 1.5% versus 0.4% after IBBR. This may be explained by longer operative time, which is also a risk factor for VTE.[26]

When comparing the RR and PP IBBR groups, we observed a significantly higher rate of seroma in the RP population, with 8.7% versus 1.6% in the PP population, and our regression analysis showed a significant correlation between BMI and seroma rate after RP IBBR. The literature on this subject is more controversial, with Ribuffo et al[36] reporting, in a multicenter retrospective study including 716 IBBRs, seroma rates of 11.2% in the RP IBBR and 4.3% in the PP IBBR groups. However, a recent meta-analysis performed by Ostapenko et al,[37] representing 3101 IBBRs, showed no difference between PP and RP IBBR. Higher BMI is a well-known risk factor for postoperative seromas following IBBR.[1,10,38,39] Gabriel et al[19] argued that the complication rate, including seroma occurrence after PP IBBR is comparable to the normal population, which is akin to what we found.

Regarding the reoperation rate, we found no significant differences across BMI groups. Nevertheless, the literature on the reoperation rate in patients with higher BMI is disputed, with some authors noting an increased risk of reoperation with higher BMI in patients undergoing mastectomy and BR with expander[40] or prosthetic BR,[41] whereas others not reporting BMI as a predictor of reoperation after IBBR.[42]

Although the reoperation rate was similar across BMI groups, our regression analysis showed that an increase in BMI significantly increased the length of hospital stay after RR IBBR. Leitner et al[23] had already observed a correlation between BMI and hospital length of stay following IBBR. As far as we know, our study is the first to describe this correlation in RP IBBR. All the more so as the RP group has a longer operating time, which has already been observed as a risk factor for prolonged hospitalization.[43]

Our study has several limitations inherent to its retrospective and nonrandomized nature, but also due to its small size. The relatively low number of IBBR procedures in both the underweight and obese categories lowers the statistical power of the analysis. However, our results are interesting in that, of what we know, there is currently no study comparing PP IBBR and RP IBBR reconstruction and complication related to BMI. Most of the studies focused on the association between BMI and postoperative complications following 2-stage BR with expander and observed a higher proportion of complications in the obese population after 2-stage BR. In line with our results, the choice of PP and RP IBBR do not lead to more complications in patients with low or high BMI and can therefore be proposed to all patients. All bears in mind that the choice of reconstruction must include a comparison of the risk factors specific to each patient, and specific complications depending on BMI.

CONCLUSIONS

Our study highlights the fact that the population with a low BMI develops a different spectrum of complications following PP IBBR with a higher rate of postoperative anemia. We also found that there is a correlation between BMI and skin complication rate following PP IBBR. Moreover, in patients who had RP IBBR, the seroma rate was higher, and there was a correlation between BMI and seroma rate. The hospitalization length of stay also significantly increased in relation to BMI in patients undergoing RP IBBR, whereas this difference was not found when PP IBBR was performed. To our knowledge, this study is the first study to describe this correlation in patients who underwent IBBR. Further studies are warranted to confirm these findings.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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