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Immediate prepectoral breast reconstruction in nipple-sparing mastectomy with Wise-pattern incision in large and ptotic breasts: Our experience and short-term results

E. Antoniazzi [a,*], A. De Grazia [a], F. Dell'Antonia [a], S. Pasquali [b], P. Burelli [c], C. Rizzetto [c], G. Berna [a]

[a] *Plastic Surgery Unit, "Ca' Foncello" Regional Hospital, 31100 Treviso, Italy*
[b] *Plastic and Reconstructive Surgery Unit, Cattinara Hospital-Azienda Sanitaria Universitaria Giuliano-Isontina (ASUGI), University of Trieste, Trieste, Italy*
[c] *Breast Surgery Unit, "Ca' Foncello" Regional Hospital, 31100 Treviso, Italy*

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Wise-pattern;
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Summary *Introduction:* Current breast cancer treatment trends advocate nipple-sparing mastectomy (NSM) as the preferred technique for selected patients. A considerable and ptotic breast is often considered a relative contraindication for NSM due to the increased risk of skin and nipple necrosis.
Methods: A retrospective review was performed for patients who underwent immediate prepectoral breast reconstruction (PPBR) after NSM with Wise-pattern incision between February 2020 and February 2023 at our institution. This procedure was offered to patients with grade II or III ptosis or large breasts eligible for NSM for therapeutic or prophylactic purpose. Exclusion criteria comprised a preoperative nipple-sternal notch distance greater than 30 cm, previous radiotherapy, pinch test < 1 cm, body mass index (BMI) greater than 34 and active smoke. We present our short-term results with this technique.
Results: During the study period, 62 patients (76 breasts) had NSM with Wise-pattern incision. Patients had immediate PPBR with implant or tissue expander, both entirely wrapped with ADM. The median age of the patients was 57.0 years [The Interquartile Range (IQR 50.0–68.6)] with a median BMI of 25.5 (IQR 23.3–28.4). The median mastectomy specimen weight was 472 g (341—578). Median implant volume was 465 g (IQR 370–515). Major complications occurred in 8 patients (10.5%). Three patients experienced total nipple-areolar complex (NAC) necrosis

* Correspondence to: Piazzale Ospedale 1, 31100 Treviso, TV, Italy.
E-mail address: elisa.antoniazzi@aulss2.veneto.it (E. Antoniazzi).

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(3.9%), and partial NAC necrosis occurred in 2 patients (2.6%). Two patients developed implant infection (2.6%). Univariate analysis showed a statistically significant correlation between major complications and the mastectomy specimen weight ($p = 0.003$).
Conclusion: If oncologically indicated, NSM with Wise-pattern incision and immediate PPBR can safely be performed in selected patients with large and ptotic breasts.

Current trends in breast cancer treatment advocate nipple-sparing mastectomy (NSM) as the technique of choice for selected patients. Substantial evidence has demonstrated that the preservation of the nipple-areolar complex (NAC) is oncologically safe in selected patients.[1-3] Additionally, NSM has a positive impact on the patient's quality of life, improving the psychological and sexual well-being[3,4] compared to skin-sparing mastectomy (SSM). This improvement leads to higher satisfaction regarding the reconstruction.[1-3,5]

Preserving more mastectomy skin envelope, the NSM also facilitates immediate breast reconstruction that is esthetically pleasing and psychologically favorable for the patients, along with minor costs and fewer surgical procedures.[6]

Traditionally, NSM was mainly recommended for patients with small, non-ptotic breasts and with a safe tumor-to-nipple distance, due to the concern about complications such as skin or NAC necrosis and poor esthetic outcome for nipple malposition.

However, recent advancements in surgical techniques and multidisciplinary preoperative planning have expanded the inclusion criteria for NSM in patients with ptotic and large breasts. In such cases, breast reconstruction is performed by applying traditional esthetic skin pattern incision, such as the Wise-pattern incision used in mastopexy or reduction mammoplasty.[7] The Wise-pattern skin-reducing mastectomy (SRM) was first reported by Bostwick in 1990; he described the technique of preservation of the inferior dermal mastectomy flap, which is de-epithelialized and used to cover the inferior portion of the implant. By suturing the free edges of the dermal flap to the inferior border of the pectoralis major muscle, a pocket is obtained, made of muscle superiorly and of dermal flap inferiorly.[8]

While this technique did not involve the preservation of the NAC, subsequent studies proved that the NAC bloody supply could be ensured by the subdermal plexus.[9] Several SRM techniques with NAC preservation have been reported, primarily performed in the subpectoral plane, due to the concern about nipple perfusion and wound healing. Lewin et al. described an SRM with NAC preservation and immediate subpectoral reconstruction with a Wise-pattern incision, using a vertical dermal bipedicle flap.[10] Aliotta et al. detailed an SRM technique with NAC preservation and prepectoral reconstruction, maintaining NAC blood supply with a superior dermal pedicle.[11] Currently, with the use of acellular dermal matrix (ADM), prepectoral breast reconstruction (PPBR) is increasingly offered and is considered the gold standard in selected patients. Such muscle-sparing technique reduces postoperative pain, impairment of upper limb movement and strength, and animation deformity, and leads to an improved esthetic result.[12,13] In addition, the ADM's pure collagen nature has been proven to reduce inflammation and promote tissue regeneration, thus reducing the rate of capsular contracture.[14,15]

In patients with large breasts and high body mass index (BMI), autologous reconstruction can be also considered the option of choice. Unfortunately, due to the high number of breast cancers referred to our institution, immediate autologous reconstruction is not always feasible, instead we recommend autologous breast reconstruction in a delayed procedure in selected patients.

The aim of this article is to report our experience, surgical details, results, complications, and their management of ADM-assisted PPBR with ADM after NSM with Wise-pattern skin-reducing technique in large and/or ptotic breasts.

Methods

A retrospective review of a prospectively collected database was performed for patients who underwent immediate PPBR after NSM with Wise-pattern incision and immediate skin-only mastopexy between February 2020 and February 2023 at our institution.

This procedure was offered to patients with grade II or III ptosis according to Regnault's classification, or with large breasts who were candidates for NSM for therapeutic or prophylactic purpose. Some of these patients were also good candidates for autologous reconstruction but they chose an implant-based reconstruction to avoid long operative times procedure, additional scarring or a delayed reconstructive procedure.

Patients with a preoperative nipple-sternal notch distance greater than 30 cm, with previous radiotherapy, with a pinch test < 1 cm, poor NAC, or skin mastectomy perfusion during intraoperative assessment, with a BMI greater than 34 and with active smoking habit were excluded.

Surgical technique

Preoperative planning is performed with a keyhole drawing, with the nipple planned to be lifted in the correct position, not exceeding 5 cm. Vertical limbs of the keyhole are marked at a minimum length of 7 cm.

The keyhole is finely de-epithelialized, leaving the periareolar de-epithelialization for the end of the procedure

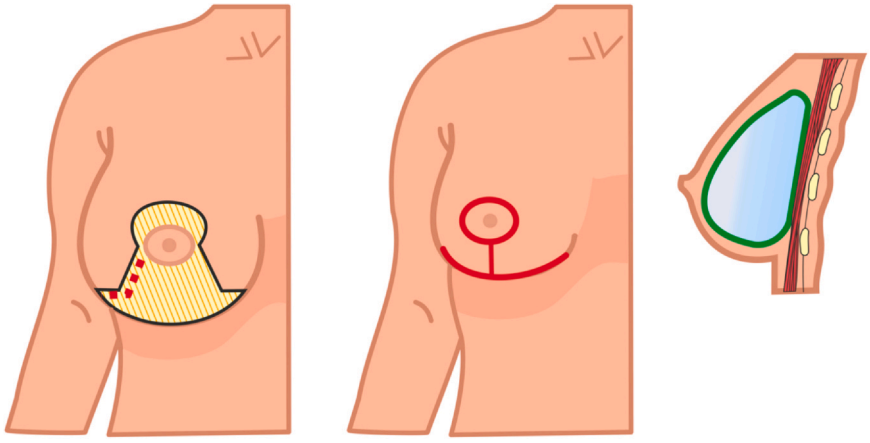

Figure 1 (A) Preoperative markings of the nipple sparing mastectomy with Wise pattern. Mastectomy incision in dotted line, de-epithelialization in the striped area. (B) Postoperative result after skin reduction and NAC preservation. (C) Prepectoral implant wrapped with ADM.

(after the NAC had confirmed to be cancer-free with the intraoperative subareolar frozen section evaluation). The dermal flap is left entirely connected and the mastectomy incision is performed along the vertical and the lateral limb of the keyhole, with an "L-shaped" incision (Figure 1A, B). Special care is taken to preserve the vitality of the skin flaps, so scalpels and scissors are used over electrocautery. The mastectomy flaps are gently pulled during mastectomy. The implant is then completely wrapped with three-dimensional preshaped ADM (Braxon® fast, Decomed, Italy). We use anatomical microtextured implants. The implant volume is selected based on the patient's chest measurement, the gland footprint, and the contralateral breast volume.

The ADM is sutured with interrupted 3-0 Vicryl stitches, and the ADM-prosthesis complex was positioned in the prepectoral pocket and fixed to the pectoralis major fascia with 5 circumferential sutures in 3-0 Vicryl sutures (Figure 1C). Tissue expanders (TE) were used in case of thin skin flaps. They were wrapped with the ADM and filled with air to the entire volume of the breast pocket, avoiding tension on the mastectomy skin flaps. The keyhole sides are then sutured together above the dermal flap, which is used to provide further coverage to the implant and to prevent implant exposure in case of T-junction dehiscence or necrosis. The vitality of the NAC is strictly monitored during and after the procedure. An incisional negative pressure dressing (PICO®, Smith and Nephew, UK) is positioned and left in place for 7 days. The contralateral symmetrization, if needed, is performed during the same procedure to guarantee an immediate good symmetry. Drains are retained until daily output is less than 30 ml, or for no more than 2 weeks. Patients receive intravenous cephazolin as perioperative prophylactic antibiotics. All patients received antithrombotic prophylaxis with Enoxaparin 4000 IU (40 mg)/0.4 ml per day for 2 weeks.

Data collection

Patients demographics and surgical data were collected (age, BMI, comorbidity, ptosis, type of mastectomy, cancer histology, sentinel lymph node biopsy [SNB], lymph node dissection [LND], mastectomy specimen weight, neoadjuvant or adjuvant oncologic treatment, type of reconstruction [TE or implant], implant volume, time to drains removal, antibiotic therapy, complications, possible revision).

According to Clavien-Dindo classification of surgical complications, major complications were defined as those requiring the patient to return to the operating room, and minor complications were defined as those treated with local in-office wound care. Reconstructive failure was defined as definitive implant removal.

Statistical analysis

The study data were prospectively collected and analyzed using SPSS statistical software (version 21.0). Categorical variables are presented as number (%) and continuous variables as mean (SD) when normally distributed or median (IQR) when not. We used chi-squared and Fisher's exact tests to compare categorical variables and the *t* test or the Mann-Whitney U test to compare continuous variables. Multivariate analysis was performed with logistic regression. Two-sided p values < 0.05 were considered statistically significant.

Results

From February 2020 to February 2023, 251 consecutive patients underwent PPBR after NSM. Among these, 189 patients underwent NSM with inframammary fold incision or lateral radial incision, whereas 62 patients (76 breasts)

Table 1 Patient's demographics.

Variable	
Patients	62
Breasts	76
Bilateral mastectomy	14 (22.6)
Age, years old	57.0 (50.0-68.6)
BMI, kg/m^2	25.5 (23.3-28.4)
Comorbidity, of which	20 (32.2)
Diabetes	0
Hypertension	13 (20.9)
Hypothyroidism	5 (8.1)
Autoimmune disease	1 (1.6)
Asthma	2 (3.2)

Categorical variables are presented as n (%). Continuous variables are presented as median (IQR).
BMI, body mass index.

Table 2 Surgical characteristics.

Indication of mastectomy	
Therapeutic	65 (85.5)
Prophylactic	11 (14.5)
Mastectomy specimen weight, grams	472 (341-578)
Tumor histology	
DCIS	19 (25.0)
Invasive ductal carcinoma	37 (48.7)
Invasive lobular carcinoma	13 (17.1)
Axillary LND	12 (15.8)
Adjuvant radiotherapy	15 (19.7)
Neoadjuvant chemotherapy	13 (21)
Adjuvant chemotherapy	14 (22.6)
Type of reconstruction	
Immediate prepectoral expander	7 (9.2)
Immediate prepectoral prosthesis	69 (90.8)
Implant volume, cc	465 (370-512)
Contralateral symmetrization	46 (74.2)
Breast reduction	29
Mastopexy	13
Breast augmentation-mastopexy	3
Implant exchange	1
Length of stay, days	3 (3-4)
Drain removal, days	12.0 (10.0-14.0)

Categorical variables are presented as n (%). Continuous variables are presented as median (IQR).
DCIS, ductal carcinoma in situ; LND, lymph node dissection.

Table 3 Complications.

Variable	
Follow-up, months	8.9 (5.2-13.2) with min. 2.7; max. 43.3
Postoperative complications	15 (19.7)
Mean (SD) time to redo surgery for complication, days	51.2 (46.8)
Minor complications	7 (9.2)
Seroma	1 (1.3)
Hematoma	0
Infection	2 (2.6)
Skin flap necrosis/dehiscence	4 (5.3)
Partial NAC necrosis	2 (2.6)
Major complications	8 (10.5)
Seroma	0
Hematoma	0
Infection	2 (3.2)
Skin necrosis/dehiscence	3 (3.9)
NAC necrosis	3 (3.9)
Implant removal	5 (6.6)
Implant exchange	3 (3.9)
Tissue expander	1 (1.3)
Reconstructive failure	1 (1.3)

Categorical variables are presented as n (%). Continuous variables are presented as median (IQR).
NAC, nipple-areola complex.

had NSM with Wise-pattern incision. Patients underwent immediate breast reconstruction with prepectoral implant or prepectoral tissue expander, in both cases entirely wrapped with ADM. All patients had a second or third degree of ptosis; however, none of them had a preoperative nipple-sternal notch distance greater than 30 cm or a nipple-areola complex lifting greater than 5 cm. The median age of the patients was 57.0 years (IQR 50.0-68.6) with a median BMI of 25.5 (IQR 23.3-28.4). None of the patients were smokers, had diabetes, or had previous radiotherapy. The 20% of patients had comorbidity (Table 1). The median mastectomy specimen weight was 472 g (341—578). Indications of mastectomy were therapeutic in 65 breasts (85.5%) and prophylactic in 11 breasts (14.5%). Tumor histology was ductal carcinoma in situ in 19 patients (25%), invasive ductal carcinoma in 37 patients (48.7%), and invasive lobular carcinoma in 13 patients (17.1%). Twelve patients (15.8%) underwent axillary lymph node dissection. Fourteen patients (22.6%) had a bilateral reconstruction, whereas 46 (74.2%) patients had contralateral symmetrization (29 breast reduction, 13 mastopexy, 3 breast augmentation-mastopexy, and 1 implant exchange). Mean operative times were 183 min for bilateral mastectomy and breasts reconstruction, whereas 155 min for unilateral mastectomy, reconstruction, and contralateral symmetrization. Immediate reconstruction was performed with prepectoral implant in 69 breasts (90.8%) and with prepectoral tissue expander in 7 breasts (9.2%). The median implant volume was 465 cc (IQR 370-515) (Table 2). TE were partially filled intraoperatively with air and, once healed, about 2 weeks later, expanders were deflated and air was exchanged with saline solution.

Thirteen patients (21%) underwent neoadjuvant chemotherapy, whereas 14 patients (22.6%) had adjuvant chemotherapy and 15 patients (19.7%) had adjuvant radiotherapy (Table 2).

The mean follow-up time was 8.9 months (IQR 5.2-13.2). During this follow-up period, all four patients (seven breasts) with prepectoral TE underwent exchange with permanent implant and simultaneous fat grafting after a mean time of 6.2 months.

Table 4 Analysis on factors related with complications.

	Univariate						Multivariate	
	Overall complications			Major complications			Major complications	
	No complication	Yes complications	p	No complication	Yes complications	p	OR (CI 95%)	p
Comorbidity	15 (75)	5 (25)	0.6	16 (80)	4 (20)	0.22		
Axillary LND*	9 (75)	3 (25)	0.44	10 (83.3	2 (16.7)	0.37		
Neoadiuvant chemotherapy	10 (76.9)	3 (23.1)	0.62	11 (84.6)	2 (15.4)	0.54		
Adjuvant radiotherapy*	14 (93.3)	1(6.7)	0.14	14 (93.3)	1(6.7)	0.50		
Adjuvant chemotherapy	10 (83.3)	2 (16.7)	0.37	12 (100)	0(0)	0.15		
Age, year	56.9 (10.1)	61.2 (11.2)	0.16	57.6 (10.1)	60.0 (12.8)	0.54		
BMI, kg/m^2	25.5 (3.3)	26.5 (4.0)	0.36	25.5 (3.3)	27.9 (4.2)	0.08	1-14 (0.88-1.49)	0.32
Mastectomy specimen grams*	461 (155)	592 (240)	0.060	466 (163)	662 (241)	**0.003**	1.01 (1.00-1.01)	**0.04**
Implant volume*	437 (88)	474 (118)	0.22	437 (88)	498 (127)	0.11		
Tissue expander*	7 (100)	0	0.20	7 (100)	0	0.44		
Length of stay, days	3.2 (0.9)	3.7 (1.4)	0.13	3.3(1.0)	3.5 (0.8)	0.6		
Drain removal, days	12.3 (4.2)	16.0 (7.1)	0.17	12.5 (4.1)	18.8 (9.9)	0.3		

Categorical variables are showed as n (%). Continuous variables are showed as mean (SD).
BMI, body mass index; LND, lymph node dissection.
Bold values are statistically significant.
* Analysis on 76 operated breasts not on 62 patients.

Complications

Complications are listed in Table 3. The total postoperative complication rate was 19.7%. The most common complication was skin flap necrosis, most of the time located at the T-junction (7 breasts, 9.2%). Major complications (i.e., Clavien-Dindo ≥3) occurred in 8 patients (10.5%). The mean time to return to the operating room was 51.2 days (SD 46.8). Three patients had total NAC necrosis (3.9%); of these, two patients underwent NAC removal and implant exchange with a smaller size implant and one patient underwent NAC removal and direct closure. Partial NAC necrosis occurred in 2 patients (2.6%) and it was treated with local in-office wound care. Two patients presented infection (2.6%): of these, one patient underwent implant removal and reconstruction with submuscular tissue expander, whereas one patient had reconstructive failure and underwent implant removal.

The univariate analysis of factors associated with postoperative complications showed a correlation between the mastectomy specimen weight and major complications ($p = 0.003$), and overall complications ($p = 0.06$). BMI resulted higher in patients with major complications ($p = 0.08$). The multivariate analysis confirmed the significance of the mastectomy specimen weight as an independent factor correlated with postoperative major complications. Comorbidities, lymph node dissection, neoadjuvant chemotherapy, adjuvant radiotherapy, implant volume age, and BMI did not show a statistically significant correlation with the occurrence of complications (Table 4).

Discussion

NSM is now considered as oncologically safe comparable to SSM. An additional advantage is the possibility of an immediate breast reconstruction, which is psychologically positive for patients and is associated with minor costs and fewer surgical procedures.[1-6]

A large and ptotic breast is often considered a relative contraindication for NSM, because patients with a large BMI, large mastectomy weight, or an increased NAC-sternal notch distance are at increased risk for skin necrosis[1,16-18] Therefore, immediate breast reconstruction after NSM in these cases presents a challenge for the reconstructive surgeon, and the preservation of the NAC demands sophisticated technique of skin reduction to avoid nipple malposition and achieve a satisfactory esthetic outcome.

NSM can be performed through different skin pattern incisions, lateral radial, inframammary fold, periareolar, or Wise pattern. Multiple factors must be considered when planning incisions and in the literature no clear cut-offs are defined. Nevertheless, lateral radial or inframammary fold incisions are usually performed in patients with small and moderate breast ptosis. Wise-pattern incisions are beneficial in patients with moderate or severe ptosis, where skin reduction is necessary to match the breast-skin envelope to the volume of the underlying reconstruction.[19] The advantages of direct-to-implant prepectoral

reconstruction after NSM with a Wise-pattern incision revolve around the pleasant esthetic outcome that derives from the preservation of the native skin and NAC, which allows the shaping of the breast mound by skin reduction and nipple lifting. Prepectoral breast reconstruction is increasingly offered in selected patients as they can avoid the downsides of subpectoral breast reconstruction, such as animation deformity, muscle spasm, increased postoperative pain, and upper limb movement limitation.[13-15,20] Several techniques of skin reduction have been reported, primarily performed in subpectoral reconstructions, due to concerns regarding compromised nipple perfusion and wound healing.

Lewin et al. described a novel technique performed in 17 breasts that underwent immediate implant or tissue expander subpectoral reconstruction following NSM and skin reduction with a Wise-pattern incision, using a vertical dermal bipedicle flap.[10] They reported a rate of NAC necrosis requiring revision of 12%. Maruccia et al. described the prepectoral reconstruction with Wise-pattern and NAC preservation with a superior pedicle in 14 large and ptotic breasts. They reported 1 case of partial NAC loss (5.3%), 2 cases of wound dehiscence (10.5%), and 1 case of seroma (5.3%).[13]

Aliotta et al. reported a case series of direct-to-implant PPBR with skin-only mastopexy after NSM in 25 breasts. In their case series, the NAC is vascularized by a superior dermal pedicle, whereas the inferior skin excess is shaped as an auto-dermal flap reinforcing the T-junction closure. The reported major complications rate is 5% for NAC-T-junction necrosis, 0% for NAC necrosis, 7.5% for seroma, and 2.5% for infections. Minor complications saw 10% of skin necrosis and 5% of superficial NAC necrosis.[11] Manrique et al. described the PPBR (with TE or implant) with simultaneous Wise-pattern mastopexy performed in 15 breasts. The authors reported no nipple or skin necrosis, while the seroma rate was 12%.[4] Mosharrafa presented a large case series of NSM mastopexy based on an inferior adipodermal flap. In 65 patients (125 breast reconstructions), 15 (23%) had implants placed in the prepectoral space, and 50 (77%) had them placed subpectorally. Partial NAC necrosis occurred in six patients (9%). Other complications included partial mastectomy flap necrosis (12%), implant exposure (4%), infection (1%), capsular contracture (6%), and reoperation (16%).[21] Khalil described a technique of NSM based on a bipedicled (superior and inferior) NAC dermal flap and immediate reconstruction with prepectoral implant and ADM. In eight patients (16 breasts), no complications were reported in the follow-up period.[22]

To the best of our knowledge, this is the largest report of prepectoral immediate breast reconstruction after NSM with Wise-pattern incision. Our technique consists of creating a wide dermal flap and a short "L-shaped" incision for mastectomy, performed along the vertical and the lateral limb of the keyhole, as described by Lewin. The keyhole is sutured above the dermal, which provides further coverage to the implant and prevents exposure in case of T-junction dehiscence or necrosis. The 3D ADM completely wraps the implant, allowing its placement on the prepectoral plane.[23]

Due to the well-known risks of NAC and skin necrosis related to NSM in large and ptotic breasts, this technique was not performed in high-risk patients (patients with preoperative nipple-sternal notch distance greater than 30 cm, previous radiotherapy, a pinch test < 1 cm, patients with a BMI greater than 34 kg/m^2, and smokers) or in patients with a poorly perfused mastectomy flaps or NAC evaluated intraoperatively.

Exclusion criteria were defined based both on our own experience through the past years in PPBR after NSM, as well as on other authors' experience with similar techniques of SRM with NAC preservation.[4,11,14,15] In addition to the well-known risk factors in PPBR, widely reported in literature, such as active smoke, preoperative radiotherapy, and high BMI, an increased NAC-sternal notch distance is also a risk factor for skin flap and NAC necrosis after an NSM.[24] Manrique et al. reported excellent results in PPBR after NSM and immediate mastopexy. In their case series, none of the patients had a preoperatively sternal notch to nipple distance longer than 30 cm or a history of breast radiotherapy and they had no cases of nipple ischemia or necrosis.[4]

Careful patient selection and the intraoperative assessment of mastectomy flap vitality are mandatory. In our case series, the intraoperative evaluation of flap and NAC vascularization was performed clinically, without using the indocyanine green dye. In our series, seven breasts with thin mastectomy skin flaps were reconstructed with prepectoral tissue expander. Initially, TE were filled with air to the entire breast pocket, to achieve the desired volume and fill the dead space with less weight and tension on the possibly ischemic mastectomy skin flaps, compared to saline fill. About 2 weeks after surgery, air in the TE was exchanged for saline at a postoperative clinic visit when the skin flap perfusion was improved. We achieved a good outcome and we had no complications in these patients despite the initial small mastectomy skin flaps thickness.[25]

Considering the well-established positive effects of the incisional negative pressure wound therapy in reducing postoperative complications and preventing wound dehiscence and flap necrosis in breast surgery,[26,27] we have routinely used it after reconstruction.

Our major complications rate is 10.5%, with a rate of implant removal of 6.6% (five breasts) and a total NAC necrosis of 3.9%. These results do not differ substantially from those reported by the previously cited similar studies, also

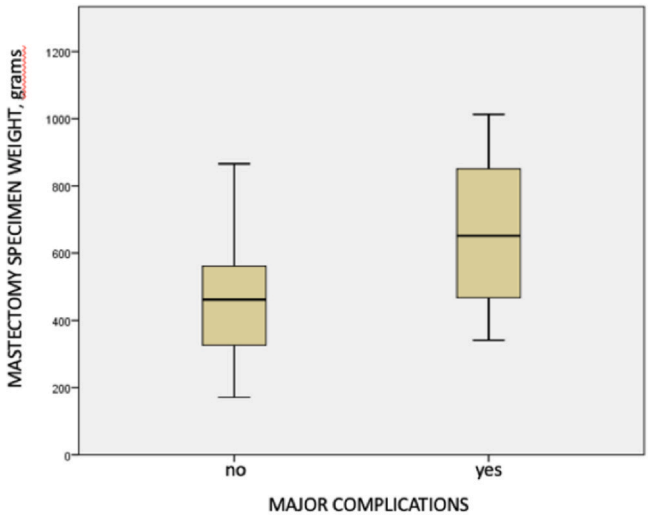

Figure 2 Mastectomy specimen weight (in grams) relative to major complications following nipple-sparing mastectomy with Wise-pattern.

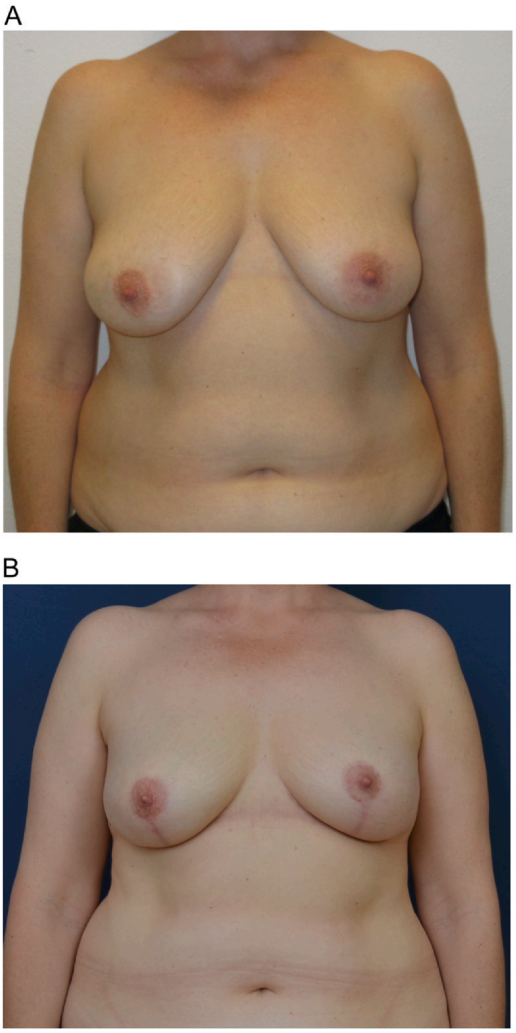

Figure 3 (A) A 35-year-old patient with right breast invasive carcinoma, breast asymmetry, and second grade ptosis. (B) Postoperative pictures of right NSM with Wise pattern and PPBR and left reduction mammoplasty at the 6 month postoperative visit.

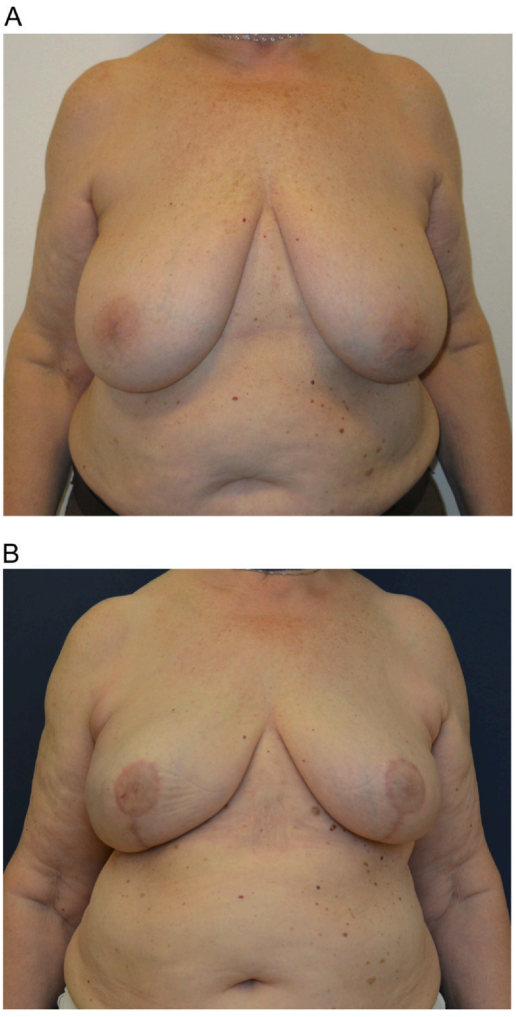

Figure 4 (A) Preoperative photo of a 58-year-old patient with right breast invasive carcinoma and nipple-sternal-notch distance of 29–30 cm. (B) Postoperative photos at 6 months follow-up after right NSM with Wise pattern and PPBR and left reduction mammoplasty.

considering the reported risk of complication in NSM[17] and in immediate prepectoral reconstruction.[14]

Patient-specific risk factors such as age, BMI, comorbidities, neoadjuvant chemotherapy, and adjuvant radiotherapy showed no association with complications. Reconstruction with prepectoral implant or prepectoral tissue expander did not differ in terms of complications.

Mastectomy specimen weight resulted strongly statistically significant ($p = 0.003$) with complications (Fig. 2). Di Candia et al. previously found a significant association between mastectomy weight after SSM with Wise-pattern and major skin complications occurrence. For every 100 g increase in mastectomy weight, there is a 1.6-fold increased risk of major complications.[28,29] Therefore, current traditional NSM with direct-to-implant (or TE) technique data report partial NAC necrosis rates from 5.8% to 13.8% and total NAC necrosis rates from 1.3% to 6.6%. When stratified by mastectomy weights (greater than 800 g, 400 g to 799 g, and less than 400 g), Frey et al. observed total NAC necrosis rates of 12.1%, 2.7%, and 1%, respectively. Partial NAC necrosis rates were 9.1%, 8.8%,

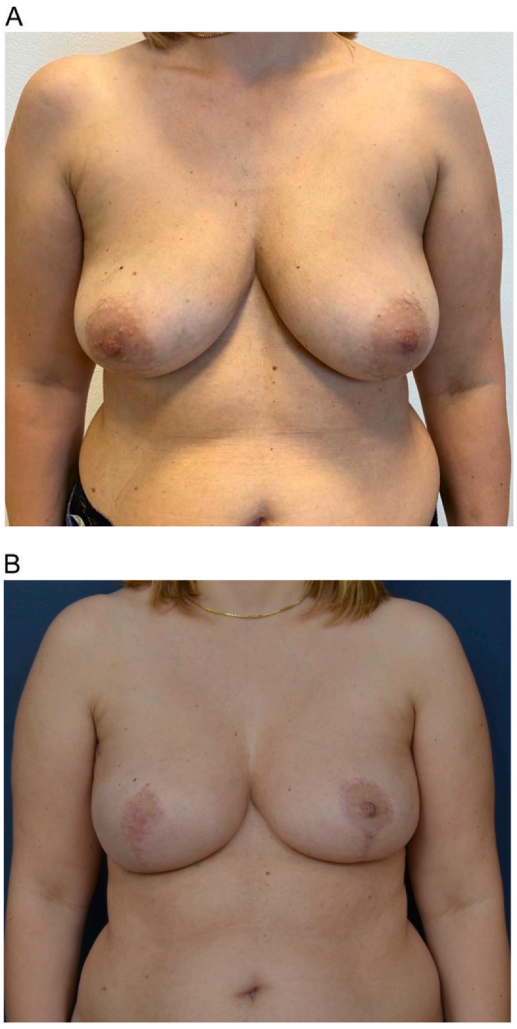

Figure 5 (A) Preoperative photo of a 40-year-old patient with right breast intraductal carcinoma. (B) Postoperative photo at the 12 months postoperative visit after a right NSM with Wise pattern and PPBR with left mastopexy.

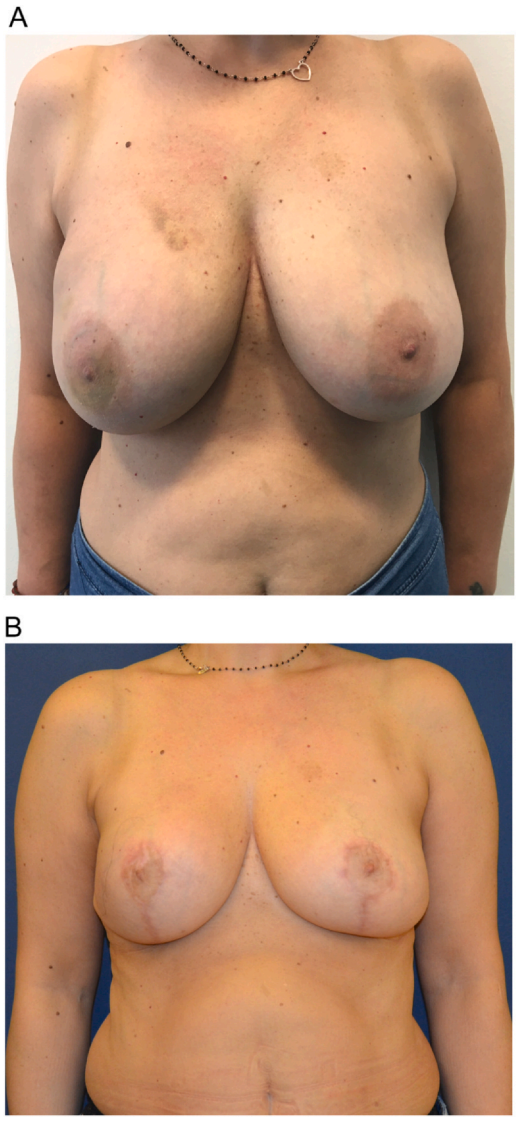

Figure 6 (A) Preoperative photos of a 54-year-old patient with right breast invasive carcinoma and large and ptotic breasts. (B) Postoperative follow up photos at 6 months after right NSM with Wise pattern and PPBR with left reduction mammoplasty.

and 4.1%, respectively, following NSM.[11,17] We did not find a statistically significant association between implant volume and complications; however, other reports identified this factor as a contributor to complication. Large implant volume, in particular, can lead to skin tension and compromise the vascularization of a thin mastectomy flap.[21] Subsequently, in cases involving patients with large breasts, we routinely perform a wide skin reduction of mastectomy flaps (and a contralateral large breast reduction if needed) to allow the insertion of an implant of limited volume (Figures 3-6).

Limitations of the study include its retrospective design and the small size of the study population. In addition, high-risk patients were not included in the study. Besides, only surgery-related immediate complications and short-term postoperative outcomes were evaluated. Additional research is needed to draw more exhaustive conclusions on the long-term outcome of the reconstructive result, both esthetically and functionally.

Conclusion

If oncologically indicated, an NSM with Wise-pattern incision and an immediate PPBR can be safely performed in selected patients with large and/or ptotic breasts. Despite the risk of NAC loss and skin necrosis, this technique demonstrated satisfactory results and can be considered valuable for selected patients who traditionally would have been denied an NSM due to concerns about complications and NAC malposition. The risk-benefit ratio should always be discussed with the patients, and adequate preoperative planning, as well as intraoperative mastectomy flap and NAC evaluation, are necessary to minimize complications.

Institutional Review Board Statement

This study has a retrospective design and was conducted in accordance with the principles of the Declaration of Helsinki and the Patient provided written informed consent.

This article does not contain any studies with animals performed by any of the authors.

Informed Consent Statement

Informed consent was obtained from the subjects involved in the study.

Conflicts of Interest

The authors declare no conflict of interest.

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CRediT authorship contribution statement

E.A., A.D.G., and S.P contributed to conceptualization and writing—original draft preparation. E.A., A.D.G., F.D.A., S.P., C.R., P.B, and G.B contributed to validation, visualization, and supervision. All authors have read and agreed to the published version of the manuscript.

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