



RESEARCH ARTICLE



OPEN ACCESS



Autologous coverage for direct-to-implant pre-pectoral reconstruction in large and ptotic breasts: a new technique

Corrado Rubino^{a,b}, Emilio Trignano^{a,b}, Manuela Rodio^{a,c}, Alessandro Fancellu^{b,d}, Nicola Pili^c, Rita Nonnis^a, Domenico Pagliara^e, Noemi Spissu^a and Silvia Rampazzo^{a,c}

^aPlastic Surgery Unit, University Hospital Trust of Sassari, Sassari, Italy; ^bDepartment of Medicine, Surgery and Pharmacy, University of Sassari, Sassari, Italy; ^cPlastic, Reconstructive and Aesthetic Surgery Training Program, University of Sassari, Sassari, Italy; ^dUnit of General Surgery 2 – Clinica Chirurgica, University Hospital Trust of Sassari, Sassari, Italy; ^ePlastic-Reconstructive and Lymphedema Microsurgery Center, Mater Olbia Hospital, Olbia, Italy

ABSTRACT

Direct-to-implant (DTI) breast reconstruction after skin reducing mastectomy in large and ptotic breast is characterized by a high rate of complication. The Dermal Sling is commonly used to give extra coverage to the lower pole of the mammary implant to lower the risk of implant exposure in case of wound dehiscence at the T-junction. The aim of the paper is to detail an original technique that combines an inferior dermal sling with pectoral and serratus fascial flaps, to create a pre-pectoral pouch. We retrospectively review the clinical data of the patients who underwent Type IV/V mastectomy and DTI breast reconstruction with the described technique. Minor and major post operative complications were analyzed. Patient satisfaction and aesthetic outcomes were evaluated at one year of follow-up through Breast-Q and Validated Aesthetic Scale. Ten patients (fourteen breasts) were included in the study. Skin and/or NAC necrosis occurred in three breasts. One patient underwent implant removal due to periprosthetic infection. At one of follow-up no capsular contracture nor migration of the implant were clinically detected in all patients. One patient had a visible rippling at the upper quadrants of the new breast. Good patient satisfaction and aesthetic outcomes were reported. The association of fascial flaps and dermal sling is a viable option for breast reconstruction in patients with large and ptotic breasts. Along with providing an autologous coverage for the implant, it allows to maintain a good projection, maximize symmetrization in case of concomitant contralateral reduction mammoplasty and avoid any implant displacement.

ARTICLE HISTORY

Received 30 April 2024

Accepted 17 July 2024

KEYWORDS

Breast reconstruction;
pre-pectoral;
mammoplasty; dermal
flap; fascial flap

1. Introduction

Direct-to-implant (DTI) breast reconstruction in women with large and ptotic breasts is a challenging procedure for plastic surgeons, as it is characterized by a high rate of complications. In these patients, the use of Wise-pattern mastectomy allows to excise the redundant skin while maintaining a good projection and improving patient satisfaction [1,2]. Despite this, the mastectomy skin flaps are usually long and unreliable with a higher risk of vascular compromise that can lead to skin necrosis and wound dehiscence, especially at the T-junction [3–5]. At the same time, large and ptotic breasts entail the unique opportunity of creating an inferiorly based dermal flap (also known as

dermal sling, DS) by saving the dermis of the inferior component of the reduction pattern. The DS represents an extra vascularized tissue layer that can be used as an additional coverage for the inferior aspect of the implant, with subsequent reduction of the risk of implant exposure and infection, in case of wound dehiscence. The technique was first described by John Bostwick in 1990 [6] for sub-muscular reconstruction. In the original technique, the subpectoral pouch was closed over a permanent implant by suturing to each other the free borders of the pectoralis major, the serratus muscles and the dermal flap. Nipple-areola complex (NAC) was grafted in the new position. Since then, several modifications regarding the submuscular

CONTACT Silvia Rampazzo s.rampazzo@studenti.uniss.it Plastic Surgery Unit, University Hospital Trust of Sassari, Sassari, Italy

© 2024 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

pocket, NAC preservation and patterns of mastectomy have been proposed. The use of a separate superomedial flap carrying the NAC [7] or an inferiorly based NAC-bearing dermal sling [8] or a bi-pedicle McKissock style flap carrying the NAC [9] have been described for nipple areolar complex preservation. The technique has also been described for breast reconstruction after vertical-pattern [10] and modified Wise-pattern (type V) skin sparing mastectomy [11]. The latter one [11] has been designed to treat patients requiring upper quadrant skin excision due to the presence of a superficially located tumor or a scar from previous surgeries (e.g. lumpectomy, quadrantectomy) that may increase the risk of skin necrosis of the Wise flaps.

As pre-pectoral reconstruction has recently gained back popularity due to its reduced postoperative pain and better functional outcomes [12,13], the use of the DS in combination with non-biological mesh or acellular dermal matrix (ADM) has been also described for pre-pectoral reconstruction. Some authors [14] used the matrix to cover just the superior pole of the implant by suturing it to the superior border of the DS and to the chest wall. Others [15,16], instead, reported their use to cover the whole implant which was then placed under the inferior dermal sling. If on one side these products are useful to create an extra tissue layer and to fix the implant to the chest wall in the proper position, on the other, they are associated with several complications and require an adjunctive cost to the procedure [17–20].

A novel surgical technique is here reported, that combines the classic inferior dermal flap with pectoralis major and serratus fascial flaps to obtain complete coverage of a pre-pectoral mammary implant. To our knowledge, the use of pectoral and serratus fascial flap in combination with the dermal flap for DTI breast reconstruction has not been described in literature before.

2. Materials and methods

We retrospectively reviewed the medical data of the patients who underwent breast reconstruction with the described technique in our Institution from December 2021 to March 2023. In particular, we looked over post operative complications, such as full thickness skin flap/NAC necrosis, wound dehiscence, seroma, hematoma, red breast syndrome, infection, implant loss, implant displacement/migration and rippling. The assessment of patients' satisfaction of the outcomes was conducted using the BREAST-Q [21] modules for breast reconstruction. The pre-operative module was administered one to four weeks before

surgery, while the post-operative module was administered after one year of follow-up. The aesthetic result was evaluated one year postoperatively with the Validated Breast Aesthetic Scale [22]: a gender-balanced panel formed by a third party senior plastic surgeon, a plastic surgery resident, a medical student and a nurse filled in the scale and the mean of the results was then calculated.

2.1. Patients selection

The surgical technique has been conceived for women with large and ptotic breasts who require skin or nipple-sparing mastectomy with reduction of the skin and are not willing or are not eligible for autologous tissue reconstruction. An institutional algorithm [23] was applied for patient selection.

Inclusion criteria are sternal notch to nipple distance greater or equal to 26cm and nipple to inframammary fold distance greater or equal to 8cm. Exclusion criteria are inflammatory breast cancer, previous Radiotherapy, heavy smoking habit (> 20 cigarettes/day), morbid obesity (BMI > 40kg/m²), uncontrolled diabetes, collagen diseases or vasculitis. In case the patient requires upper quadrant skin excision due to the presence of a superficially located tumor or a scar from previous surgeries, the modified Wise (type V) [11] reduction mammoplasty pattern is selected for skin/nipple sparing Mastectomy [24]; alternatively, the use of a Wise (type IV) [3,25] pattern is advocated. Intra-operative inclusion criteria are mastectomy skin flap thickness \geq 1 cm and pectoral fascia preservation.

2.2. Surgical technique

All the surgeries were performed with a multidisciplinary approach: Breast Surgeons performed the mastectomies and Plastic Surgeons were entitled to do the reconstruction.

The patient is marked preoperatively upstanding. The conventional Wise pattern [3,25] (Figure 1a) or the modified Wise pattern [11] (Figure 1b) is then drawn according to the tumor location or the existence of scars from previous surgeries. In particular, the modified Wise pattern is proposed to all the patients with the tumor superficially located in one of the upper quadrants and to patients with previous upper-quadrant lumpectomy or quadrantectomy in which the scars could lead to a high risk of Wise-pattern skin flaps necrosis. The new nipple position is located at the projection of the inframammary fold over the meridian breast line. In case of unilateral reconstruction, a contralateral inverted-T reduction mammoplasty with a

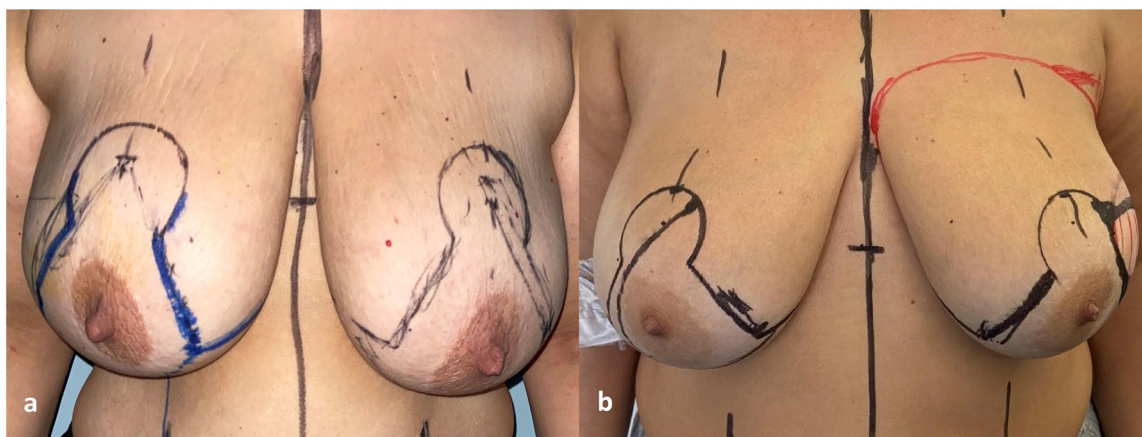


Figure 1. Preoperative markings. (a) Wise pattern (b) modified Wise pattern.

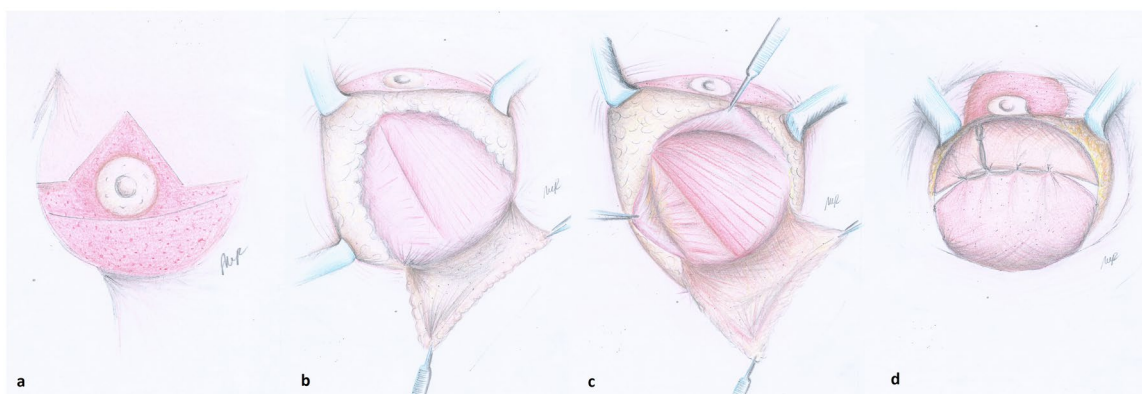


Figure 2. Graphic representation of the technique on the right breast. (a) The triangular shaped wise pattern is first de-epithelized. The horizontal line represents the access for the skin/nipple sparing mastectomy. (b) Identification of the pectoral and the serratus fascia after the mastectomy. (c) Harvest of the two fascial flaps. (d) Coverage of the implant by the pectoral fascia, the serratus fascia and the dermal flap, that are sutured to each other.

superomedial pedicle is planned. A 2 cm (base) x 2 cm (height) triangle of skin is preserved along the inframammary fold to reduce the tension at the T-junction.

A triangular shaped reduction mammoplasty pattern area is first de-epithelized with a 10 blade ([Figure 2a](#)). In case of a conventional Wise pattern, the superior border of the dermal flap is then incised and the mastectomy is performed through this access. In case of a modified Wise pattern, instead, the mastectomy is performed through an incision surrounding the upper quadrant that has to be removed. Frozen section histological evaluation of the retro-areolar margin is performed to determine neoplastic infiltration of the NAC and therefore its removal. When oncologically possible, the nipple-areola complex is preserved and the pedicle bearing the NAC is superiorly based with both reduction mammoplasty patterns.

After the mastectomy is completed, the reconstructive part is performed by the Plastic Surgery equipe. Intraoperative assessment of the mastectomy skin flap

thickness, which in our institution relies on clinical evaluation using palpation and a ruler, and the integrity of the pectoral fascia is then performed. If the mastectomy flaps are thicker than 1 cm and the pectoral fascia is intact, the Surgeons proceed with the following technique. Two fascial flaps are harvested ([Figures 2c and 3a](#)) from the pectoralis major and the serratus muscles: the first one is superiorly based and will cover the upper pole of the mammary implant; the second one is laterally based and will secure the lateral portion of the mammary implant. The pre-pectoral pouch is partially closed ([Figure 3b](#)) by suturing with interrupted absorbable sutures (polyglactin 2-0) the superior border of the DS to the free border of the pectoral fascia and a mammary sizer is used to ensure the proper size of the implant. One suction drain is placed in the subcutaneous pocket. The selected silicone implant is then inserted into the pre-pectoral space and the free border of the serratus fascia is sutured to the dermal flap and to the pectoral

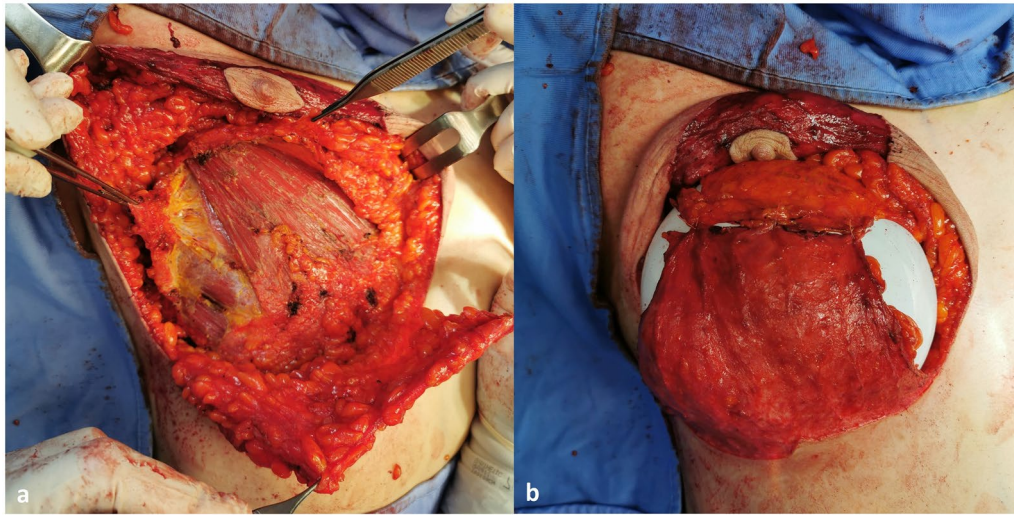


Figure 3. Intraoperative pictures. (a) Elevation of dermal sling, pectoral fascia and serratus fascia. (b) The pectoral fascia is sutured to the inferior dermal flap and a mammary sizer is used to ensure the proper size of the autologous pre-pectoral pouch.

fascia to close the pouch (Figure 2d). A small portion of the medial aspect of the pocket can be left non-sutured if the flaps-tissue are insufficient. If the NAC is preserved, the peri-areolar area of the keyhole is now de-epithelized and the areola is sutured to the new position. Full-thickness skin graft of the NAC may be performed in patients where intraoperative clinical evaluation of NAC perfusion is doubtful. The vertical and the horizontal incisions of the inverted T are closed in layers.

Perioperative antibiotics (cefazoline 2g) are given 30 min before the surgical incision and intraoperative irrigation of the implant with the same antibiotic is performed before its insertion into the pocket. The suction drain is maintained until drainage is less than 30cc/daily for two consecutive days.

2.3. Statistical analysis

The data were entered in Microsoft Excel sheet 2021. The Continuous variables were described as mean \pm standard deviation (SD) and range. The normal distribution of quantitative variables was verified by Shapiro–Wilk test. Paired Student-t test was applied to compare the preoperative and postoperative modules of the Breast-Q questionnaire. A value of $p < 0.05$ was considered statistically significant.

3. Results

From December 2021 to March 2023, ten patients were eligible for the described surgical technique. Six patients underwent unilateral mastectomy and concomitant contralateral Wise pattern reduction

mammoplasty for symmetrization, while four patients underwent bilateral mastectomy. Nipple sparing mastectomy was performed in eleven breasts, while nipple removal was performed in three breasts due to tumor infiltration (the intraoperative fresh-frozen retro areolar biopsy turned out positive). Mean patients age was 56 years (range 34–74 years) and mean BMI was 28,2 kg/m² (range 24–37). Average nipple-to-sternal notch distance was 29 ± 1.4 cm (range 27–31), average nipple to inframammary fold distance was 11.3 ± 1.3 cm (range 8–13) and average breast base width was 15.1 ± 1.0 cm (range 14–18). The majority of patients underwent Type IV mastectomy, while two patients (two breasts) were treated with Type V mastectomy due to superficial tumor location in the upper-lateral quadrant. Implant volume ranged between 300cc to 560cc (mean 406cc). Round implants were used in ten breasts and shaped implants in four breasts.

No cases of hematoma, seroma or red breast syndrome were detected in our cohort (Table 1). Skin and/or NAC necrosis occurred in three breasts: one of them healed by secondary intention, while surgical revision was needed in two cases (Table 1). NAC surgical removal due to total necrosis was needed in one case: after the surgical revision, the patient developed a local infection, with subsequent need of implant removal. Six months after the implant removal, her breast was reconstructed with a pedicled latissimus dorsi flap plus mammary implant. No complications in the reduction mammoplasty side have been recorded in all unilateral patients.

At one year of follow-up (Figures 4 and 5), no patient showed clinical signs of capsular contracture or implant displacement. None of the patients underwent

post-operative adjuvant Radiotherapy. One patient had visible rippling at the upper quadrants of the new breast, thus requiring lipofilling to overcome the issue. All patients but the one with implant removal adequately filled in the five domains of the BREAST-Q questionnaire

(Table 2). Patients scored higher post-operative level of satisfaction with the outcomes, with satisfaction with the breast being significantly increased after surgery ($p < 0.05$). None of the patients who underwent skin sparing mastectomy with nipple removal demanded



Figure 4. Forty-six years old patient with invasive lobular carcinoma superficially located in the upper lateral quadrant of the left breast who underwent left type V skin sparing mastectomy, breast reconstruction with 450cc implant and concomitant contralateral reduction mammoplasty. (a) Pre-operative pictures. (b) Post-operative pictures (twelve months of follow-up).



Figure 5. Forty-three years old patient with BRCA2 mutation and invasive ductal carcinoma of the right breast who underwent bilateral type IV nipple-sparing mastectomy (prophylactic on the left side) and breast reconstruction with 450cc implants. (a) Pre-operative pictures. (b) Post-operative pictures (twelve months of follow-up).

Table 1. Surgical postoperative complications.

Complications	N
Skin/NAC necrosis	3
Wound dehiscence	0
Seroma	0
Hematoma	0
Red breast syndrome	0
Infection	1
Implant loss	1
Implant displacement/migration	0
Rippling	1
Capsular contracture	0

Table 2. BREAST-Q pre and post-operative evaluation: the results are expressed in terms of mean \pm standard deviation. Significant p-value (<0.05) are marked in bold.

BREAST-Q measurements	Preoperatively Mean \pm SD	1y postoperatively Mean \pm SD	p value
Psychosocial well-being	59.4 \pm 5.4	60.3 \pm 5.7	0,799
Sexual well-being	48.7 \pm 13.0	62.8 \pm 19.4	0,204
Satisfaction w/ breast	48.9 \pm 13.2	66.1 \pm 6.2	0,014
Physical well-being (chest)	7.8 \pm 10.4	10.2 \pm 10.2	0,329
Satisfaction w/ implants		6.8 \pm 1.3	

Table 3. Validated Aesthetic Scale Evaluation: the results are expressed in terms of mean \pm standard deviation.

	Measurements	Mean \pm SD
Breast	Breast symmetry	4.4 \pm 0.5
	Breast position	4.5 \pm 0.7
	Inframammary fold	4.6 \pm 0.7
	Volume	4.8 \pm 0.4
Shape and contour		4.5 \pm 0.7
	Appearance	3.8 \pm 0.9
Scar NAC	Nipple symmetry	4.2 \pm 0.8
	Nipple position	4.5 \pm 0.5
	Nipple projection	4.6 \pm 0.7
	Areolar size/diameter	4.7 \pm 0.5
	Areolar shape	4.3 \pm 0.8
	Areolar Color	4.5 \pm 0.7
	Overall appearance	4.3 \pm 0.6

nipple reconstruction and/or tattoo. The aesthetic evaluation carried out with the Validated Aesthetic Scale showed very good overall results (Tables 3).

4. Discussion

In the present case series we report the use of an alternative method for pre-pectoral reconstruction in patients with large and ptotic breasts. The combination of the fascial flaps with the DS allows to create a pre-pectoral pouch entirely made of autologous tissue. This is particularly important as the mastectomy flaps are usually at high risk of necrosis and this technique provides an autologous coverage especially at the T-junction and behind the NAC, which are the areas at higher risk of complication and potential implant exposure. Besides this, the fascial flaps have been designed primarily to avoid implant displacement. Large and ptotic breasts have usually a wide base and,

consequently, implants are keener to lateral and superior movements. In subpectoral reconstruction the muscle itself prevents the implant to move in a superior direction, while the use of a serratus fascia flap [26], meshes [27,28] or the 'dermal cage' technique [29] have been described to avoid later displacement. In pre-pectoral reconstruction, instead, ADMs or non-biological mesh are needed to fix the implant to the chest wall in a proper position [14,15]; nevertheless, these products do not come without complication and adjunctive cost to the procedure [17–20]. Considering the benefits of pre-pectoral reconstruction and willing to offer DTI breast reconstruction without the use of ADM/meshes, we thought to combine the classic inferior dermal flap with pectoralis major and serratus fascial flaps to create a pre-pectoral pouch entirely made of autologous tissue that is also able to stop the implant from moving in a superior and a lateral direction.

As for the classic DS [4,30], this technique is applicable on women with large and ptotic breasts. It has been conceived for patients with a sternal notch to nipple distance greater or equal to 26cm and with a nipple-to-inframammary fold distance greater or equal to 8cm. Absolute contraindications are previous radiotherapy, heavy smoking habit, morbid obesity and uncontrolled diabetes, as they are associated with a higher risk of complications [31–33]. Mastectomy skin flaps must be thicker than 10mm to minimize the risk of skin necrosis [34–36] and visible rippling [37]. Adjuvant tool to assess tissue perfusion is represented by the intraoperative use of the indocyanine green fluorescence [38]; unfortunately the device was not available in our institution at the time of the surgeries, and this may explain the high rate of skin and NAC necrosis that occurred in our case series. In order to perform this technique, the pectoral fascia (PF) must be intact. The oncologic safety of preserving the PF in patients with breast cancer is still controversial. A Systematic Review [39] conducted by Jaco Suijker et al. showed that preservation of the pectoral fascia seems to be oncologically safe, while its removal is recommended in case of tumor infiltration of the fascia or when the tumor is located close to it. A recent study conducted by Chen et al. [40] showed that PF preservation has no impact on the long-term oncologic outcomes of patients with early-stage breast cancer treated with conservative mastectomy and immediate implant-based breast reconstruction. Nevertheless, since the pectoral fascia is routinely removed in many centers, we think that the choice to preserve or not the PF should be up to the Breast Surgeon that performs the mastectomy. Given that the above-mentioned requirements are not

always fulfilled after the mastectomy, our technique may not be applicable in all patients with large and ptotic breasts. This fact may also explain the limited number of patients that resulted eligible for the described technique over a sixteen-month period in a hub center for mammary carcinoma treatment. In case of mastectomy skin flap with a thickness less than 1 cm or pectoral fascia removal, the Authors opt for a subpectoral reconstruction or a pre-pectoral reconstruction with ADM, respectively, according to the Institutional Algorithm [23]. Contralateral reduction mammoplasty is most of the time required when the patient is eligible for unilateral skin reducing mastectomy. In these cases, it is also possible to combine our technique with the autologous dermal patch described by Marongiu et al. [41]: the dermis of the contralateral breast's inferior pole can be used a patch to enlarge the pre-pectoral pouch and obtain a better coverage of the mammary implant, if needed.

Last but not least, patient selection must be addressed very carefully as most of the time women with large and ptotic breasts are also obese, diabetic and active smokers. These conditions are known to be correlated with a higher risk of postoperative complications [31,33], especially in terms of wound healing. Likewise, implant size must be selected properly, as higher volumes can lead to higher rates of complications [42]. The patient that underwent implant removal due to postoperative nipple necrosis and local infection was reconstructed with a 560cc implant and we think that the postoperative complications were likely to be related also to the volume of the implant, which was probably too big. Moreover, the use of smaller implants ensures a more stable result over time as the implant is less keen to inferior descent due to gravity. Therefore, the authors prefer implants volumes lower than 500mL. The Authors prefer to use round implants for this technique in order to prevent breast shape alteration in case of implant rotation, but anatomical implants could be used according to the patient's clinical presentation. All these aspects must be carefully analyzed during the preoperative counseling with the patient to address patient expectations and elucidate the risk of postoperative complication in order to select the proper surgical plan.

The PRO (patient reported outcomes) evaluation reported satisfactory post-operative results. The psychosocial wellbeing of breast cancer survival patients is expected to decrease over a period of one year after surgery, even in patients who underwent breast reconstruction [43]. Nevertheless, the described technique seems to have a positive impact on postoperative patients' psychosocial well-being and quality of life. In

fact, a tendency to higher post-operative values in the modules of psychosocial well-being and sexual well-being was recorded in our cohort, even though the difference was not statistically significant. Moreover, patients' satisfaction with the breast was significantly increased after surgery ($p < 0.05$) and patients' satisfaction with the implant seemed to be extremely good as the patients scored an average 6.8 over 8 points. The patients scored worse postoperative level in the chest physical well-being module, but this could be influenced by the outcomes related to the lymph nodes biopsy or lymphatic dissection as this scale also captures physical problems related to the upper arm. The aesthetic evaluation carried out with the Validated Aesthetic Scale showed very good overall results as a mean greater than 4 over 5 points was scored in almost all the domains. The appearance of the scar was the domain with the worst result (3.8 over 5 points) and this could be related to wound healing problem resulting from skin flap necrosis and to the typical propensity for hypertrophic scar formation of skin reducing patterns.

Fascial flaps have been used worldwide in implant-based breast reconstruction since the beginning of the current century [26]. Traditionally the serratus anterior fascial flap has been used in breast reconstruction to extend the subpectoral pouch and allow autologous coverage of the inferolateral aspect of the implant. The use of this flap not only prevents the lateral displacement of the implant, but have also a positive impact in terms of postoperative pain, lateral projection and reducing the impact of visible rippling [44–46]. Nevertheless, according to the breast size, the sole serratus fascia may not allow the positioning of a definitive implant in the subpectoral plane, thus requiring a two-stage expander-implant reconstruction. To address this issue Kim Y.W. et al. [47] proposed the use of a conjoined fascial flap made by the pectoralis major, the serratus anterior, and the external oblique fasciae. Recently, Hudson D.A. [48] also described the use of fascial flaps in pre-pectoral reconstruction. The latter technique [48] differs from our approach as the dissection of the pectoral and the serratus fasciae starts superiorly (infraclavicularly). Due to the limited distensibility of the fascial layer, this Hudson's approach allows complete fascial coverage of just small size implants; in case a large or very high-profile prosthesis is required, the fascial flaps are combined with a small pectoral muscle flap or a mesh to cover the superior aspect of the implant or, alternatively, a two-stage expander-implant reconstruction is adopted. Our technique, instead, is conceived for patients undergoing Wise pattern mastectomies and allows the placement of a definitive medium/large size implant. Scoring of the fascial flaps is also advocated by Hudson [48] to expand the

lower portion of the pocket, whereas, in our technique, a good breast projection is maintained thanks to the combination of fascial flaps with the dermal sling. In case of extremely large breasts, complete coverage of a pre-pectoral implant with the sole inferior dermal sling has been also described in the literature [49].

On the basis of our results, our surgical technique represents an additional resource when it comes to treat women with large and ptotic breasts. It is suitable for both type IV and V nipple/skin sparing mastectomies and it allows placing a definitive implant in a pre-pectoral pouch, in selected patients, without the use of ADMs/meshes. Our report shows good results in terms of aesthetic outcomes and patient's satisfaction, as the use of skin reducing patterns allows to excise the redundant skin while maintaining a good projection and maximize the symmetrization in case of contralateral reduction mammoplasty. Further studies with a wider patient sample and a longer follow-up period are needed to corroborate our results and to evaluate the outcomes' stability over time.

5. Conclusions

On the basis of our results, fascial flaps for coverage of pre-pectoral implants are a viable option for breast reconstruction in women with large and ptotic breasts with promising aesthetic and patient satisfaction outcomes.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research was granted by the resources of "Fondo di Ateneo per la ricerca 2018 (Corrado Rubino)" and "Fondo di Ateneo per la ricerca 2019 (Corrado Rubino)".

References

- [1] Dec W. Optimizing aesthetic outcomes for breast reconstruction in patients with significant macromastia or ptosis. *JPRAS Open*. 2018;16:24–30. doi:10.1016/j.jpra.2018.01.005.
- [2] Lotan AM, Tongson KC, Police AM, et al. Mastectomy incision design to optimize aesthetic outcomes in breast reconstruction. *Plast Reconstr Surg Glob Open*. 2020;8(9):e3086. doi:10.1097/GOX.0000000000003086.
- [3] Toth BA, Lappert P. Modified skin incisions for mastectomy: the need for plastic surgical input in preoperative planning. *Plast Reconstr Surg*. 1991;87(6):1048–1053.
- [4] Nava MB, Cortinovis U, Ottolenghi J, et al. Skin-reducing mastectomy. *Plast Reconstr Surg*. 2006;118(3):603–610. doi:10.1097/01.prs.0000233024.08392.14.
- [5] De Vita R, Pozzi M, Zoccali G, et al. Skin-reducing mastectomy and immediate breast reconstruction in patients with macromastia. *J Exp Clin Cancer Res*. 2015;34(1):120. doi:10.1186/s13046-015-0227-5.
- [6] Bostwick J. Implant reconstruction with breast skin and volume reduction using an inverted T-incision. In: *Plastic and reconstructive breast surgery*, Vol. 2. St Louis: Quality Medical Publishing; 1990. p. 1369–1373.
- [7] Goyal A, Wu JM, Chandran VP, et al. Outcome after autologous dermal sling-assisted immediate breast reconstruction. *Br J Surg*. 2011;98(9):1267–1272. doi:10.1002/bjs.7531.
- [8] Vrekoussis T, Perabo M, Himsl I, et al. Bilateral prophylactic skin-reducing nipple-sparing mastectomy with immediate breast reconstruction using only a vascularized dermal–subcutaneous pedicle: technique and possible advantages. *Arch Gynecol Obstet*. 2013;287(4):749–753. doi:10.1007/s00404-012-2636-4.
- [9] Lewin R, Jepsen C, Hallberg H, et al. Immediate breast reconstruction with a Wise pattern mastectomy and NAC-sparing mckissock vertical bipedicle dermal flap. *J Plast Reconstr Aesthet Surg*. 2018;71(10):1432–1439. doi:10.1016/j.bjps.2018.05.027.
- [10] Peker F, Yuksel F, Karagoz H, et al. Breast reconstruction using de-epithelialized dermal flap after vertical-pattern skin-sparing mastectomy in macromastia: reconstruction after mastectomy. *ANZ J Surg*. 2015;85(1-2):64–68. doi:10.1111/ans.12570.
- [11] Santanelli F, Paolini G, Campanale A, et al. The "type V" skin-sparing mastectomy for upper quadrantskin resections. *Ann Plast Surg*. 2010;65(2):135–139. doi:10.1097/SAP.0b013e3181c60f41.
- [12] Cattelani L, Polotto S, Arcuri MF, et al. One-step prepectoral breast reconstruction with dermal matrix–covered implant compared to submuscular implantation: functional and cost evaluation. *Clin Breast Cancer*. 2018;18(4):e703–e711. doi:10.1016/j.clbc.2017.11.015.
- [13] Ribuffo D, Berna G, De Vita R, et al. Dual-plane retro-pectoral versus pre-pectoral dti breast reconstruction: an Italian multicenter experience. *Aesthetic Plast Surg*. 2021;45(1):51–60. doi:10.1007/s00266-020-01892-y.
- [14] Sisti A, Sadeghi P, Cuomo R, et al. Pre-pectoral one-stage breast reconstruction with anterior coverage using superior anterior biological acellular dermal matrix (ADM) and inferior anterior dermal sling support. *Medicina (Kaunas)*. 2022;58(8):992. doi:10.3390/medicina58080992.
- [15] Maruccia M, Elia R, Gurrado A, et al. Skin-reducing mastectomy and pre-pectoral breast reconstruction in large ptotic breasts. *Aesthetic Plast Surg*. 2020;44(3):664–672. doi:10.1007/s00266-020-01616-2.
- [16] Kankam H, Hourston G, Forouhi P, et al. Combination of acellular dermal matrix with a de-epithelialised dermal flap during skin-reducing mastectomy and immediate breast reconstruction. *Ann R Coll Surg Engl*. 2018;100(8):e197–e202. doi:10.1308/rcsann.2018.0127.
- [17] Ganske I, Hoyler M, Fox SE, et al. Delayed hypersensitivity reaction to acellular dermal matrix in breast reconstruction: the red breast syndrome? *Ann Plast Surg*. 2014;73(Supplement 2):S139–S143. doi:10.1097/SAP.000000000000130.
- [18] Wu PS, Winocour S, Jacobson SR. Red breast syndrome: a review of available literature. *Aesthetic Plast Surg*. 2015;39(2):227–230. doi:10.1007/s00266-014-0444-x.

- [19] Logan Ellis H, Asaolu O, Nebo V, et al. Biological and synthetic mesh use in breast reconstructive surgery: a literature review. *World J Surg Oncol*. 2016;14(1):121. doi:10.1186/s12957-016-0874-9.
- [20] Hallberg H, Rafnsdottir S, Selvaggi G, et al. Benefits and risks with acellular dermal matrix (ADM) and mesh support in immediate breast reconstruction: a systematic review and meta-analysis. *J Plast Surg Hand Surg*. 2018;52(3):130–147. doi:10.1080/2000656X.2017.1419141.
- [21] Pusic AL, Klassen AF, Scott AM, et al. Development of a new patient-reported outcome measure for breast surgery: the BREAST-Q. *Plast Reconstr Surg*. 2009;124(2):345–353. doi:10.1097/PRS.0b013e3181aee807.
- [22] Duraes EFR, Durand P, Morisada M, et al. A novel validated breast aesthetic scale. *Plast Reconstr Surg*. 2022;149(6):1297–1308. doi:10.1097/PRS.00000000000009156.
- [23] Rampazzo S, Spissu N, Pinna M, et al. One-stage immediate alloplastic breast reconstruction in large and ptotic breasts: an institutional algorithm. *J Clin Med*. 2023;12(3):1170. doi:10.3390/jcm12031170.
- [24] Carlson GW, Bostwick J, Styblo TM, et al. Skin-sparing mastectomy: oncologic and reconstructive considerations. *Ann Surg*. 1997;225(5):570–578. doi:10.1097/00000658-199705000-00013.
- [25] Wise RJ. A preliminary report on a method of planning the mammoplasty. *Plast Reconstr Surg* (1946). 1956;17(5):367–375. doi:10.1097/00006534-195605000-00004.
- [26] Saint-Cyr M, Dauwe P, Wong C, et al. Use of the serratus anterior fascia flap for expander coverage in breast reconstruction. *Plast Reconstr Surg*. 2010;125(4):1057–1064. doi:10.1097/PRS.0b013e3181d17f61.
- [27] Rathinaezhil R, Ugolini F, Osman H. Early experience with implant based breast reconstruction for early breast cancer in ptotic breasts with non biological mesh and lower pole dermal sling. *Ann Surg Innov Res*. 2015;9(1):3. doi:10.1186/s13022-015-0012-3.
- [28] Derderian CA, Karp NS, Choi M. Wise-pattern breast reconstruction: modification using alloderm and a vascularized dermal-subcutaneous pedicle. *Ann Plast Surg*. 2009;62(5):528–532. doi:10.1097/SAP.0b013e3181a0cfee.
- [29] Vljacic Z, Martic K, Budi S, et al. The “dermal cage”: inferiorly based dermal flap technique for breast reconstruction after mastectomy. *J Plast Reconstr Aesthet Surg*. 2020;73(3):486–493. doi:10.1016/j.bjps.2019.09.021.
- [30] Carstensen L. Visualized immediate breast reconstruction with dermal flap and implant. *Gland Surg*. 2019;8(Suppl 4):S255–S261. doi:10.21037/gS.2019.03.07.
- [31] Panayi A, Agha R, Sieber B, et al. Impact of obesity on outcomes in breast reconstruction: a systematic review and meta-analysis. *J Reconstr Microsurg*. 2018;34(5):363–375. doi:10.1055/s-0038-1627449.
- [32] Samuel AR, Stranix JT, DeGeorge BR, et al. Intraoperative fluorescence angiography in implant-based breast reconstruction: identifying risk factors and outcomes. *Ann Plast Surg*. 2022;89(2):207–213. doi:10.1097/SAP.00000000000003215.
- [33] Kim JYS, Mlodinow AS, Khavanin N, et al. Individualized risk of surgical complications: an application of the breast reconstruction risk assessment score. *Plast Reconstr Surg Glob Open*. 2015;3(5):e405. doi:10.1097/GOX.0000000000000351.
- [34] Pagliara D, Montella RA, Garganese G, et al. Improving decision-making in prepectoral direct-to-implant reconstruction after nipple sparing mastectomy: the key role of flap thickness ratio. *Clin Breast Cancer*. 2022;23(2):e37–e44. doi:10.1016/j.clbc.2022.11.007.
- [35] Pagliara D, Schiavone L, Garganese G, et al. Predicting mastectomy skin flap necrosis: a systematic review of preoperative and intraoperative assessment techniques. *Clin Breast Cancer*. 2023;23(3):249–254. doi:10.1016/j.clbc.2022.12.021.
- [36] Salgarello M, Pagliara D, Barone Adesi L, et al. Direct to implant breast reconstruction with prepectoral micropolyurethane foam-coated implant: analysis of patient satisfaction. *Clin Breast Cancer*. 2021;21(4):e454–e461. doi:10.1016/j.clbc.2021.01.015.
- [37] Vidya R, Iqbal FM, Becker H, et al. Rippling associated with pre-pectoral implant based breast reconstruction: a new grading system. *World J Plast Surg*. 2019;8(3):311–315. doi:10.29252/wjps.8.3.311.
- [38] Lauritzen E, Damsgaard TE. Use of indocyanine green angiography decreases the risk of complications in autologous- and implant-based breast reconstruction: a systematic review and meta-analysis. *J Plast Reconstr Aesthet Surg*. 2021;74(8):1703–1717. doi:10.1016/j.bjps.2021.03.034.
- [39] Suijker J, Blok YL, de Vries R, et al. Pectoral fascia preservation in oncological mastectomy to reduce complications and improve reconstructions: a systematic review. *Plast Reconstr Surg Glob Open*. 2020;8(3):e2700. doi:10.1097/GOX.00000000000002700.
- [40] Chen A-X, Li X-X, Guo Z-Y, et al. Preservation of the pectoralis major fascia has no impact on the long-term oncologic outcomes of patients with breast cancer treated with conservative mastectomy and immediate breast reconstruction: a propensity score matching analysis. *J Plast Reconstr Aesthet Surg*. 2023;86:231–238. doi:10.1016/j.bjps.2023.09.001.
- [41] Marongiu F, Bertozzi N, Sibilio A, et al. The first use of autologous dermal patch in DTI pre-pectoral breast reconstruction after skin reducing mastectomy: a new useful and cheap reconstruction option. *Aesthetic Plast Surg*. 2022;46(1):590–592. doi:10.1007/s00266-021-02246-y.
- [42] Negenborn VL, Dikmans REG, Bouman MB, et al. Predictors of complications after direct-to-implant breast reconstruction with an acellular dermal matrix from a multicentre randomized clinical trial. *Br J Surg*. 2018;105(10):1305–1312. doi:10.1002/bjs.10865.
- [43] Devarakonda SK, Timman R, Bouvy PF, et al. Trends in emotional functioning and psychosocial wellbeing in breast cancer survivors: a prospective cohort study using patient-reported outcome measures. *BMC Womens Health*. 2023;23(1):153. doi:10.1186/s12905-023-02243-0.
- [44] Faenza M, Di Pace B, Di Costanzo P, et al. Serratus fascial flap in immediate breast reconstruction with tissue expander: is all that glitters gold? *J Plast Reconstr Aesthet Surg*. 2020;73(2):391–407. doi:10.1016/j.bjps.2019.09.037.
- [45] Faenza M, Lanzano G, Grella E, et al. Correction of rippling in implant-based breast reconstruction with serratus fascia flap. *Plast Reconstr Surg Glob Open*. 2023;11(3):e4862. doi:10.1097/GOX.00000000000004862.
- [46] Sansone P, Giaccari LG, Faenza M, et al. What is the role of locoregional anesthesia in breast surgery? A systematic literature review focused on pain intensity, opioid consump-

- tion, adverse events, and patient satisfaction. *BMC Anesthesiol.* 2020;20(1):290. doi:[10.1186/s12871-020-01206-4](https://doi.org/10.1186/s12871-020-01206-4).
- [47] Kim YW, Kim YJ, Kong JS, et al. Use of the pectoralis major, serratus anterior, and external oblique fascial flap for immediate one-stage breast reconstruction with implant. *Aesthetic Plast Surg.* 2014;38(4):704–710. doi:[10.1007/s00266-014-0351-1](https://doi.org/10.1007/s00266-014-0351-1).
- [48] Hudson DA. Prepectoral prosthetic breast reconstruction without ADM using a subfascial approach. *Aesthetic Plast Surg.* 2024; doi:[10.1007/s00266-024-04009-x](https://doi.org/10.1007/s00266-024-04009-x).
- [49] Sarmah P, Abbott N, Bright-Thomas R. A pure dermal sling for implant reconstruction after mastectomy in the generous breast. *Ann R Coll Surg Engl.* 2012;94(5):364–364. doi:[10.1308/rcsann.2012.94.5.364](https://doi.org/10.1308/rcsann.2012.94.5.364).