JPRAS Open 31 (2022) 105–113

Contents lists available at ScienceDirect

JPRAS Open

journal homepage: www.elsevier.com/locate/jpra

Original Article

Evaluation of seromas in postmastectomy breast reconstruction: A retrospective observational study

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ARTICLE INFO

Article history:
Received 4 August 2021
Accepted 17 November 2021
Available online 24 November 2021

Keywords:
Breast reconstruction
Latissimus dorsi flap
MSLD
Seroma

ABSTRACT

Background: To evaluate seroma complications, two techniques were carried out in breast reconstruction: conventional latissimus dorsi flap (CLD) and muscle-sparing latissimus dorsi flap (MSLD) after cancer-related mastectomy.
Methods: A total of 108 postmastectomy procedures were performed with autologous tissue reconstruction with latissimus dorsi flaps (LDs) between January 2016 and May 2020. The patients were divided into two groups. The first group was reconstruction with the CLD, and the second group was reconstruction with the MSLD. Forty (40) patients in the first group and 68 patients in the second group were analyzed. Seroma formation was evaluated as the primary outcome.
Results: The total number of seromas found in the donor area was 27, of which 45% ($n = 18$) were found with the CLD and 13.24% ($n = 9$) with the MSLD, with a difference of 31.76% in favor of the MSLD, with an 95% CI of 14–49 ($p < 0.001$).
Conclusions: We found a significantly lower incidence of seroma as a complication in patients who underwent MSLD breast reconstruction compared with those who underwent CLD breast reconstruction.

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https://doi.org/10.1016/j.jpra.2021.11.001

Background

Breast cancer, after skin cancer, is the most common cancer in women worldwide and is the third leading cause of death in women in the USA. It is most commonly diagnosed between the ages of 55 and 64 years old. The death rate has declined since the 1970s due to increased screening and adjuvant treatment strategies.[1]

It is a serious disease that leaves both physical and psychological sequelae and requires an individualized and multidisciplinary approach.[2] One of the pillars of treatment is mastectomy, where breast reconstruction techniques play a fundamental role.[3] Therefore, plastic surgery is important in the comprehensive treatment of patients with this diagnosis.

Breast reconstruction is an individualized process planned according to the required oncological treatment (lumpectomy, total mastectomy, chemotherapy, and/or radiotherapy). It can be performed immediately or in a further stage and often requires several surgeries to achieve satisfactory results. Different surgical techniques are used involving multiple prosthetic devices, pedicled flaps, and microsurgical techniques.

Autologous tissue is the first-line treatment in patients who do not want breast implants, particularly in patients with radiotherapy sequelae or failed reconstructions with autologous tissue or alloplastic devices.[4]

Latissimus dorsi (LD) muscle flaps are one of the most frequently used flaps in plastic surgery. The technique was described in 1896 and published in 1906 by the Italian physician Ignio Tansini for the coverage of mastectomy-associated large defects.[5] This technique was forgotten for many years and again used for radiation ulcer coverage in the chest wall by Olivari in 1976 [6], Schneider in 1977, and Bostwick in 1978, who developed breast reconstruction techniques.[7,8]

Its versatility due to the caliber and length of the pedicle allows for the mobilization of large muscular, musculocutaneous, and osteomuscular tissue [9], making it useful in breast reconstruction associated with cancer mastectomy and neck, upper limb, and chest wall defect reconstruction. Additionally, it can be used as a free flap after evaluation of the patient's comorbidities and the morbidity and costs of the microsurgical technique.[10]

The LD muscle is the most superficial dorsal muscle and is covered by the trapezius muscle in its posterior medial part. It is categorized as a type V flap in the Mathes and Nahai classification.[11] Irrigation is given by the thoracodorsal artery (branch of subscapular artery), which is its dominant pedicle, and by perforating branches of the posterior intercostal arteries.

Anatomical variations of the thoracodorsal arteries occur in 3–5% of patients. This might be an axillary or lateral thoracic artery branch. In more than 90% of cases, the artery ramifies into medial (transverse) and lateral (vertical) branches, which travel parallel to the muscular lateral border described by Angrigiani et al. in 1995.[12] This vertical or anterior descending branch is the main irrigation for the skin and muscular paddle flap, the muscle-sparing latissimus dorsi flap (MSLD).[9] Schwabegger et al. developed the MSLD technique in 2003 using the anterior muscle fringe with a vertical skin portion.[13] Hamdi et al. described transverse skin paddles with thoracodorsal artery perforator flaps for breast reconstruction with or without implants in 2006 and 2008,[14–18] and Saint-Cyr et al. used transverse skin paddles with thoracodorsal descending branches and a muscular fringe in 2009,[19–20] achieving low morbidity and satisfactory functional and esthetic results.

Patients and methods

A descriptive study was conducted in an academic center with breast cancer patients who underwent postmastectomy reconstructive surgery by a unique surgeon. The patients were sequentially

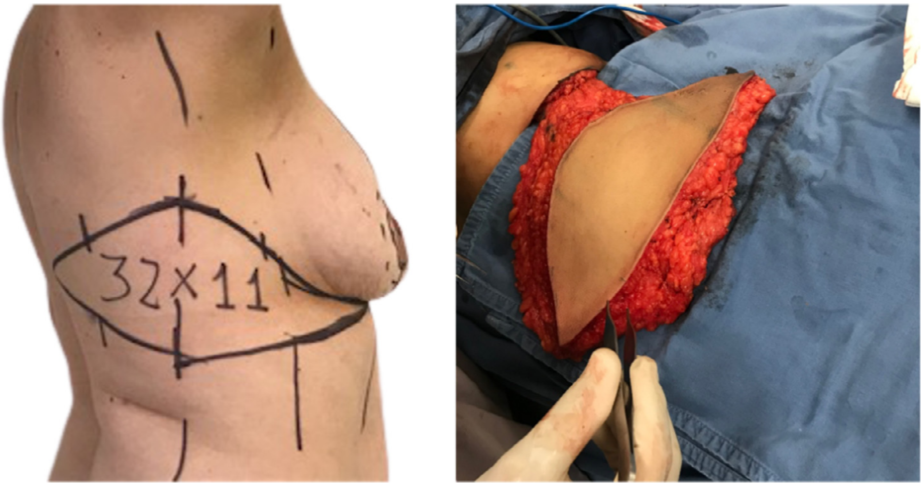

Figure 1. (left) Preoperative skin marking for right muscle-sparing latissimus flap and (right) skin paddle in a MSLD.

admitted to the study after having a mastectomy and were candidates for breast reconstruction. All surgeries were performed under general anesthesia after pre-anesthetic assessment.

In addition to mastectomy, some patients had received other types of treatment, such as radiotherapy and/or chemotherapy.

The statistical sample was made up of 108 selected procedures of breast reconstruction surgery from January 2016 to January 2018 for the conventional latissimus dorsi flap (CLD) and from February 2018 to May 2020 for the MSLD. Demographic, anatomical, and pathological breast features, type of reconstructive surgery, BMI, chemotherapy and radiotherapy pre- and post-oncological surgery, surgical time, period of drainage, hospital stay, and complications were collected on a case collection form.

All patients with CLD breast reconstruction had implants or tissue expanders. The alloplastic MSLD breast reconstruction option depended on the amount of back tissue, pending radiotherapy, and desire of the patients.

MSLD flap surgical technique

In a standing patient, a skin paddle is designed transversely in the back continuing across the inframammary fold up to the anterior midline breast, and a pinch test is performed to ensure primary closure.

Under general anesthesia and in the lateral decubitus position, the skin paddle is dissected with a 2 cm margin in its periphery of adipose tissue, and a 5 cm-wide muscular anterior LD strip is dissected distally 4 to 5 cm from the lower margin of the skin paddle. The flap is rotated, vacuum drainage is placed, and the primary closure of the donor area is carried out. In the supine position, through the scar or the mastectomy approach, the rotated flap is recovered, and breast reconstruction is performed with or without an implant. A vacuum drain is left behind (Figure 1).

CLD flap surgical technique

On a standing patient, a skin paddle is designed on the back, transversely, obliquely, or vertically, according to the amount of skin required and the final position and orientation of the skin paddle of the musculocutaneous flap in the area to be reconstructed. A pinch test is performed to ensure primary closure, and dissection of the entire LD flap is fulfilled.

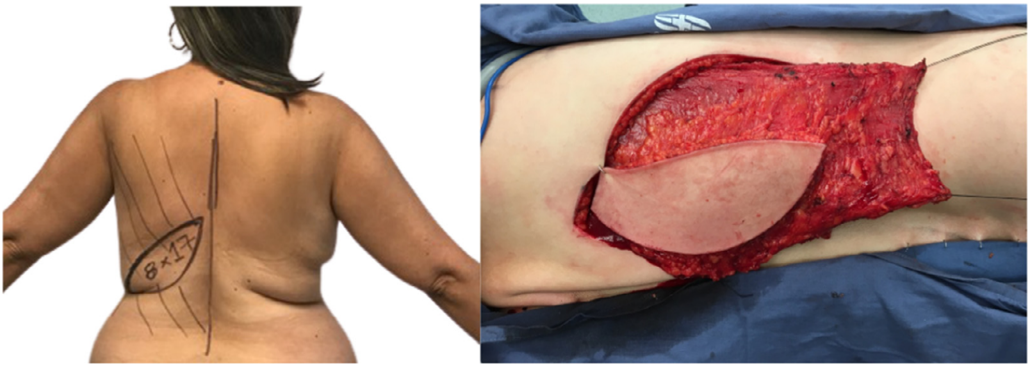

Figure 2. (left) Preoperative skin marking for left Conventional latissimus dorsi flap and (right) demonstrating of the majority of muscle and skin paddle.

Under general anesthesia in the lateral decubitus position, the LD muscle is dissected (with or without a skin paddle), tunneled, and rotated to the ipsilateral anterior chest. Vacuum drainage and primary closure of the donor area are performed. In the supine position, through the scar or mastectomy approach, the rotated muscle-skin flap is recovered, and breast reconstruction is performed with or without an implant. Vacuum drainage of the anterior hemithorax is utilized (Figure 2).

Seroma formation was evaluated clinically. None of the patients had a diagnostic ultrasound. All patients who presented with a seroma posterior to the drain removed were treated with percutaneous drainage and local triamcinolone. Weekly follow-up was undertaken for 4 to 6 weeks.

Statistical analysis

All analyses were performed using Stata ® 15.1 software (StataCorp, College Station, Texas, EEUU), and a 2-tailed $p < 0.05$ was used to indicate statistical significance. A descriptive analysis was performed for demographic, clinical, pathology, and complication data. Group comparisons were made using chi-square tests for equal proportions, t-tests for normally distributed data, and Wilcoxon rank-sum tests, otherwise, with results presented as frequencies with percentages, means with SDs, and medians with interquartile ranges (IQRs), respectively, using the Shapiro–Wilk test of normality. No imputation applies to any missing data. This study was approved by the Clinica Medellin Review Board, and all study participants signed a written informed consent form.

The sample included 108 patients who underwent reconstructive breast surgery from January 2016 to May 2020. The sample size showed 93% power at a 2-sided level of 0.05 based on a chi-square test to compare the difference between two different proportions.

Results

There were 108 postmastectomy procedures performed during the study period. Forty patients underwent the CLD postmastectomy reconstructive surgical technique, and 68 underwent the MSLD technique. The groups were similar in age (mean 49 +/- 9.33 years) and BMI (mean 26.53 +/- 4.04 kg/m^2). Baseline demographics, comorbidities, breast features, and oncological data are presented in Tables 1 and 2.

The CLD technique was performed in 37.38% of cases ($n = 40$), and the MSLD was performed in 62.96% of cases ($n = 68$). The paddle flap area was greater with the MSLD compared to that with the CLD, 269.44 ± 66.06 cm^2 vs. 204.18 ± 44.94 cm^2 ($p < 0.002$), respectively; this explains why the rates of dehiscence and re-interventions in the MSLD donor area are higher. The mean period of drainage was longer with the CLD compared to that with the MSLD, 13.8 ± 0.5 days vs. 10.24 ± 0.4 days ($p < .001$), respectively. The median surgical time was longer with the MSLD than with the CLD (210 minutes vs. 150 minutes, $p < 0.001$). The MSLD data had a more delayed breast reconstruction (60.29%

Table 1
Patient data.

Data	CLD (n = 40)	MSLD (n = 68)	P-value
Mean age in years (SD)*	49.25 ± 7.56	48.84 ± 10.31	0.81†
Median BMI (Kg/m^2) (IQR)**	26.54 (28-24)	26.58 (29-22)	0.94§
Hypertension (%)	10 (25)	9 (13.24)	
Diabetes (%)	2 (5)	1 (1.47)	
Smoker (%)	4 (10)	4 (5.97)	0.44++
Personal history breast (%)	11 (27.50)	34 (50)	0.022+
Breast size (%)			0.326+
Cup A	11 (27.50)	12 (17.65)	
Cup B y C	14 (35)	20 (29.41)	
Cup D y >	2 (5)	2 (2.94)	
Ptosis (%)			0.368+
Grade I	5 (12.50)	10 (14.71)	
Grade II	9 (22.50)	10 (14.71)	
Grade III	6 (15)	5 (7.35)	

* SD standard deviation.
** IQR interquartile range (p75–p25).
† p-value derived using t-test for parametric data.
§ p-value derived using Wilcoxon rank-sum test for non-parametric data.
+ p-value derived using chi-square test for categorical variables.
++ p-value derived using Fisher's exact test when cell sizes were below five.

Table 2
Oncological data.

Data	CLD (n = 40)	MSLD (n = 68)	P-value
Neoadjuvant chemotherapy (%)	16 (40)	22 (32.35)	0.422+
Oncological surgery (%)			0.536+
Lumpectomy	1 (2.50)	2 (2.99)	
Mastectomy	39 (97.50)	63 (94.03)	
Prophylactic mastectomy	0 (0)	2 (2.99)	
NSM (%)	17 (42.50)	20 (29.41)	0.166+
SSM (%)	21 (52.50)	38 (55.88)	0.056+
ALNC (%)	25 (62.50)	38 (55.88)	0.501+
BCT 1(%)			0.118+
Invasive cancer	20 (52.63)	44 (64.71)	
Cancer in situ	12 (31.58)	15 (22.06)	
Cancer mixed	2 (5.26)	1 (1.47)	
Others	2 (5.26)	8 (11.76)	
BCT 2 (%)			0.287+
Ductal	28 (75.68)	54 (80.60)	
Lobular	2 (5.41)	3 (4.48)	
Others	5 (13.51)	10 (14.93)	
ALNC (%)	10 (28.57)	18 (26.87)	0.855+
Postmastectomy chemotherapy (%)	12 (30)	23 (34.33)	0.644+
Postmastectomy radiation Therapy (%)	25 (62.50)	37 (54.41)	0.412+

NSM: nipple-sparing mastectomy. **SSM**: skin-sparing mastectomy **ALND**: axillary lymph node dissection. **BCT**: breast cancer type. **ALNC**: axillary lymph nodes compromised
+ p-value derived using chi-square test for categorical variables.

vs. 45.00%), while the CLD data had a more immediate breast reconstruction (55.00% vs. 39.71%). The hospital length of stay was not different (mean MSLD 1.04 ± 0.26 days vs. mean CLD 1.02 ± 0.27 days) (Tables 3 and **4)**.

Donor area seromas were the main complication evaluated in the study and occurred in 27 procedures: 45% (n = 18) in the CLD and 13.24% (n = 9) in the MSLD. The number needed to treat (NNT) was 3.14, and the absolute risk reduction (ARR) was 31.76% (95% CI: 14–49, $p = < 0.001$). Besides the donor area seromas, the other complication to note is the reported MSLD flaps necrosis; however, this

Table 3
Characteristics of the type of reconstructive surgery

Characteristics	CLD (n = 40)	MSLD (n = 68)	P-value
Timing of reconstruction (%)			0.123
		27 (39.71)	
Immediate	22 (55.00)	41 (60.29)	
Late	18 (45.00)		
Alloplastic material			<0.001[++]
None	2 (5.00)	44 (64.71)	
Silicone implant	22 (55.00)	22 (32.35)	
Expander implant	16 (40.00)	2 (2.94)	
Median breast excision weight (grs)[¶] (IQR)	577.50 (849-387) (n = 30)	590 (857-375) (n = 55)	0.93[§]
Mean paddle skin area (cm^2)[¶] (SD)[*]	204.18 ± 44.94 (n = 11)	269.44 ± 66.06 (n = 67)	0.002[†]
Median surgical time (min)[¶] (IQR)[**]	150 (180-120)	210 (240-180)	<0.001[§]
Mean hospital days (SD)[*]	1.02 ± 0.27	1.04 ± 0.26	0.725[†]
Mean period of drain (SD)[*]	13.8 ± 2.50 (n = 25)	10.24 ± 3.24 (n=65)	<0.001[†]

[¶] **grs**: grams. **cm^2**: square centimeters. **min**: minutes.
[*] **SD**: standard deviation.
[**] **IQR**: interquartile range (p75–p25).
[†] p-value derived using t-test for parametric data.
[§] p-value derived using Wilcoxon rank-sum test for non-parametric data.
[++] p-value derived using Fisher's exact test when cell sizes were below five.

Table 4
Outcome postoperative complications

Outcomes	CLD (n = 40)n (%)	MSLD (n = 68)n = (%)	P-value	95% CI[*]
Complications				
-Donor area seroma	18 (45)	9 (13.24)	< 0.001	(14 to 49)
-Mastectomy flap necrosis	8 (20)	5 (7.35)	< 0.05	(2 to 30)
-Dehiscence	4 (10)	8 (11.76)	0.360	(-17 to 5)
-Flap reconstruction necrosis	0 (0.0)	4 (5.88)	0.118	(-11 to 2)
-Hematoma	2 (5)	1 (1.47)	0.584	(-5 to -9)
-Infection	1 (2.5)	2 (2.94)	0.893	(-6 to 5)
-Reconstruction area seroma	0 (0.0)	3 (4.41)	0.893	(-6 to 5)
-DVT[¶]	0 (0.0)	1 (1.47)	0.441	(-4 to 1)
Reintervention	3 (7.50)	6 (8.82)	0.810	(-11 to 9)
Transfusion	3 (7.50)	3 (4.41)	0.499	(-6 to 12)

[*] **95% CI:** confidence interval
[¶] **DVT:** Deep vein thrombosis

occurred in small border areas and did not compromise the shape and the aesthetic appearance of the reconstructed breast. (Table 4)

Discussion

In the literature, different breast reconstruction techniques have been proposed; however, the technique with LDs in patients who have undergone mastectomy for breast cancer continues to represent the most widely used technique in our country and worldwide in breast reconstruction with autologous tissue.

It was described more than a century ago, forgotten for many years, and later rediscovered in the 1980s for chest wall reconstructions. Saint-Cyr in 2013 made modifications, giving rise to the MSLD, which was previously classified by Hamdi as an MS-TDAP type II flap (17), to reduce patient morbidity, which has some advantages over the CLD.

Currently, there are few studies with larger patient samples. MSLD breast reconstruction reduces the risks of complications, particularly donor area seromas. Therefore, more studies are required with

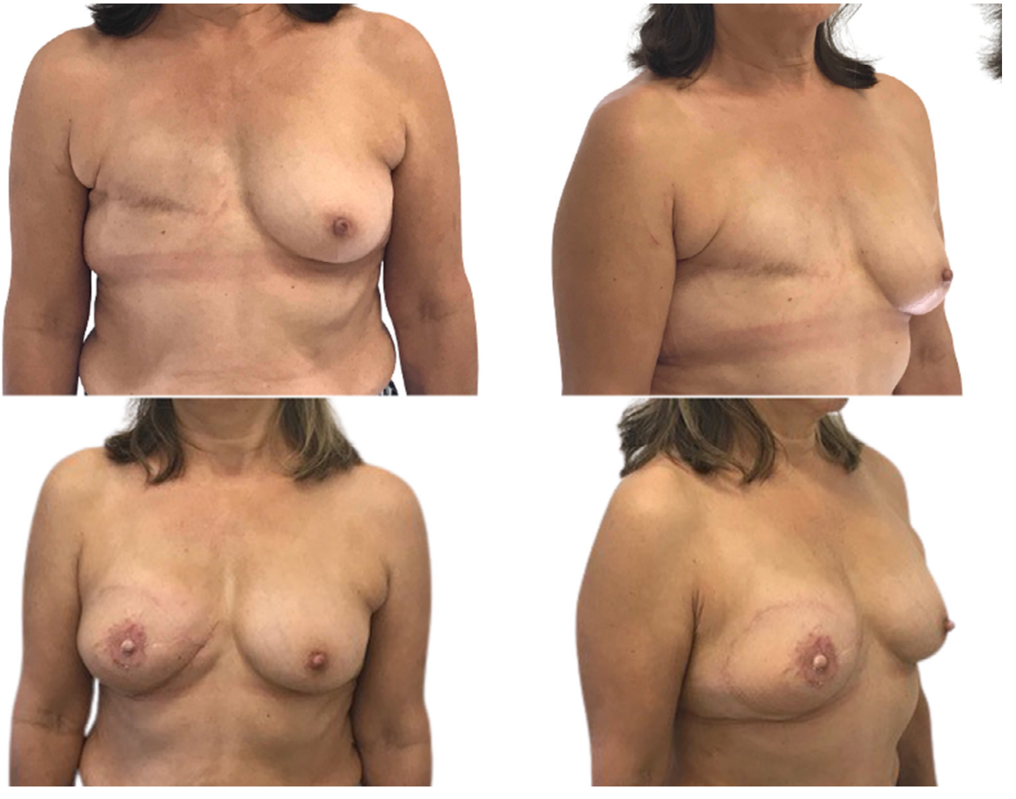

Figure 3. (above) delayed reconstruction with a muscle-sparing latissimus dorsi flap shown preoperatively and (below) postoperatively.

samples large enough to provide statistical significance to support techniques with less morbidity and better esthetic results. (Figures 3–4)

In 2017, Barnavov et al. declared it a "workhorse" flap for breast reconstruction. This has encouraged us to consider the MSLD as an innovative option. In fact, since 2018, we have been performing it in our service instead of the CLD. We observed in our patients a meaningful decrease in early and late postoperative complications and quite favorable esthetic results, even without implants.

Sowa-Numajiri et al. reported a 40% seroma incidence with the CLD and 13.3% with the MSLD, as well as an average BMI under 23 kg/m^2, and Barnavov et al. registered a 5.6% seroma incidence with the MSLD and an average BMI of 30 kg/m^2. [21-22] Our data show a higher seroma rate (15.38%) with the MSLD in patients with an average BMI of 26.5 $\pm$ 4.41 kg/m^2. We highlight that most of the patients had severe breast hypertrophy, radiotherapy, and intervention at advanced oncological stages, making reconstruction and successful esthetic results more challenging. Our data take into account all tumor stages and BMI levels of patients. This gives value to our research and shows other valid results in the incidence of complications, mainly donor area seromas.

Flap vascularity assessment with intraoperative Doppler ultrasound or indocyanine staining is a frequent practice worldwide, but in our health system, it is not possible due to the high costs.[21] However, the reliable vascular pattern of the MSLD with the anterior descending branch is reinforced with four cases of partial flap necrosis, as Koonce et al. described a small area of necrosis in zone 3 without damaging the viability of the flap.[23]

The versatility of flap rotation from 90 to 180 degrees and the availability of a greater rotated skin surface measured in centimeters, such as Saint-Cyr and Barnavon, helped us to achieve a bet-

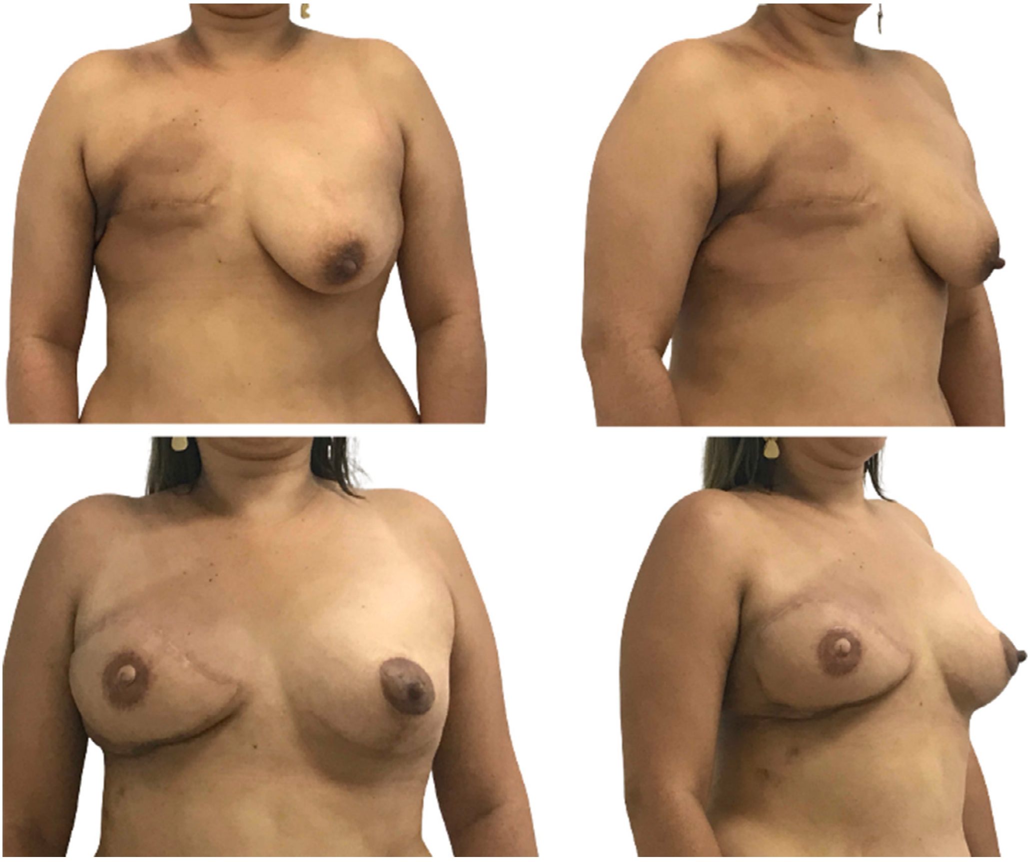

Figure 4. (above) pacient with mastectomy history and Preoperative of reconstruction view (below) Postoperative appearance after breast reconstruction using muscle-sparing latissimus dorsi flap, nipple-areola complex reconstruction.

ter reconstruction result, even without breast implants. Others such as Sowa and Kim used weight measurements in grams.[19,21,22,24]

We also emphasize that the period of drainage and hospital length of stay in the MSLD and CLD data were lower than those stated in other articles. Finally, the horizontal scars in the back of the donor area were easily hidden with satisfactory esthetic results for the patients.

In conclusion, this is the first report written in Latin America on MSLD breast reconstruction comparing seroma rate results with those of developed countries, such as the USA and Japan. We show that the MSLD is superior to the CLD because of its 31.76% lower risk and incidence of complications.

We encourage further research on the benefits of the MSLD breast reconstruction without implants by comparing the rotated skin surface with other breast reconstruction flaps.

Declaration of Competing Interest

Authors Nothing to disclose

Funding statement

No funding was received for this article

Ethical approval statement

The study was approved by the ethics committee, and all patients signed a consent form

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