Case Report

Latissimus dorsi flap: safe, reliable and versatile workhorse flap in the era of minimally invasive breast surgery—a case series

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Abstract: Breast reconstruction in Asian women differ from their western counterparts as most Asian ladies have small to moderate sized breast with limited adiposity for abdominal flap reconstruction. Latissimus dorsi (LD) flap is an extremely useful reconstruction option for this particular group of women. Minimally invasive breast surgery is surgery performed via small aesthetically placed incision(s) whilst maintaining oncological principles. As LD flap is conventionally harvested as a myocutaneous flap, it results in a long unsightly donor site scar. Hence, the use of conventional LD flap harvest in combination with minimally invasive oncological resection have raised doubts over its value. To the best of our knowledge, this is the first series to describe our initial experience in using minimally invasive oncological resection techniques in combination with multiple variations of minimally invasive LD flap reconstruction. Consecutive patients who underwent breast reconstruction using LD flap between January to March 2020 were included in this case series and analyzed. Data collection included clinicopathological characteristics of tumor, types of surgery and reconstruction, operative time, blood loss, length of hospital stay, surgical outcomes and complications. Aesthetic outcomes evaluations with clinical and post-operative photography-based assessments were performed, in which patients' consent was obtained. The mean age of patients was 56 years old (range, 45–69). All had early non-metastatic breast cancer, no evidence of skin or chest wall invasion and no clinical evidence of lymph node metastases. Mean pathological tumor size was 2.8 cm (range, 8 mm to 7 cm). Specimen weight ranged from 34 to 51 g for wide excision cases and 117 to 309 g for mastectomy specimens. The mean blood loss for all was less than 15 mL and mean hospitalization was 1 day. Aesthetic outcome assessed by the performing surgeon and patients graded it to be between good and excellent. All patients were satisfied with their scar appearance, wound length and location. Our initial experience demonstrated the safety and versatility of endoscopically harvested LD flap in combination with minimally invasive breast surgery, which offers an attractive alternative for oncological resection in breast cancer management.

Keywords: Endoscopic latissimus dorsi (LD) flap; minimally invasive breast surgery; autologous reconstruction; latissimus dorsi (LD) flap; case series

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Introduction

Latissimus dorsi (LD) flap is a versatile and reliable autologous flap reconstruction for a variety of breast defects with acceptable perioperative and long-term morbidities (1). Recent innovations to the traditional LD flap, including the extended LD flap, 'scar-less' approach, mini-LD and the muscle-sparing LD further increase the use of this flap to suit different patient and disease characteristics (2). However, the application of endoscopic LD flap and its variations in minimally invasive breast surgery has not been

previously described. In this article, we describe our early experience of endoscopically harvested LD flap as part of the minimally invasive breast reconstruction armamentarium. To the best of our knowledge, there has been no reported series on multiple variations of endoscopically-harvested LD flap as a reconstructive option after minimally invasive oncological resection. Herein, we present the following article in accordance with the AME Case Series reporting checklist (available at http://dx.doi.org/10.21037/abs-20-62).

Methodology

Patient selection and outcome measures

Consecutive patients who underwent breast reconstruction using LD flap between January to March 2020 in a tertiary hospital with a full-fledged one stop breast center managing the whole spectrum of benign to complex malignant breast conditions, were included in this case series and analyzed. All patients had pre-operative ultrasound breast, mammography and/or magnetic resonance imaging to assess the extent of cancer in order to decide on the type of oncological resection. Contraindication to LD flap harvesting was previous thoracotomy or surgery which would compromise the blood supply to the LD muscle (2).

Data collection included clinicopathological characteristics of tumor, types of surgery and reconstruction, operative time, blood loss, length of hospital stay, surgical outcomes and complications. Oncological outcomes were not assessed due to the short follow up duration. Aesthetic outcomes evaluations with clinical and post-operative photography-based assessments were performed, in which patients' consent was obtained. Patients and surgeons were asked to grade their satisfaction from a scale of 5: 1- extremely poor, 2- poor, 3- fair, 4- good, 5-excellent. Exemption was obtained from authors' Institution Review Board (IRB) as no identifiable patients' information was required in this study.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient.

Surgical techniques

We present five consecutive cases with three different variations of LD flap in different scenarios using minimally invasive techniques, for both oncological resection and reconstruction. The different surgical techniques and their applications are discussed as follows:

Variation 1: Endoscopic skin-sparing mini LD flap (*Figure 1*)

The skin sparing mini-LD is suitable for partial breast reconstruction where the breast defect is more than 20% of the breast volume. The use of endoscopic dissection allows for the flap harvest to be performed via a small hidden incision placed along the anterior axillary line. Disadvantages include longer operative time (when compared to a level I oncoplastic procedure) and complications associated with LD flap harvest.

Case 1—Right breast wide excision with immediate endoscopic skin sparing mini LD flap reconstruction

Despite extensive pleomorphic microcalcifications distributed over the upper outer quadrant, the patient was keen for breast conserving surgery (BCS). LD bulk requirement was estimated to be small and hence a skin-sparing mini LD flap reconstruction would suffice. Flap harvest was performed endoscopically through a 3 cm incision over the anterior axillary line while the wide excision and flap insertion were achieved via a 2 cm peri-areolar incision.

Variation 2: Endoscopic skin-sparing full LD flap (*Figure 2*)

Skin-sparing full LD flap may be used for full breast reconstruction in ladies with small to moderately sized breast. In larger sized breast, it may be combined with an implant to achieve the desired volume. The use of endoscopic dissection allows for better visualization and ease of dissection while minimizing the size of the incision (located either in the axilla or along the anterior axillary line), thus avoiding an unsightly donor site incision.

Case 2—Endoscopic right nipple sparing mastectomy and endoscopic skin sparing full LD flap reconstruction for right breast cancer

This was a 49 years old lady with a 2 cm invasive carcinoma in an A-cup breast. BCS would result in significant deformity. Clinical pinch test assessed that a skin-sparing full LD flap to be adequate for full breast reconstruction. She underwent a nipple sparing mastectomy with LD flap reconstruction both performed endoscopically through a single 3 cm anterior axillary line incision.

Case 3—Endoscopic left nipple sparing mastectomy with endoscopic skin sparing full LD flap reconstruction for borderline phyllodes tumor

This patient presented with a large 7 cm × 4 cm borderline

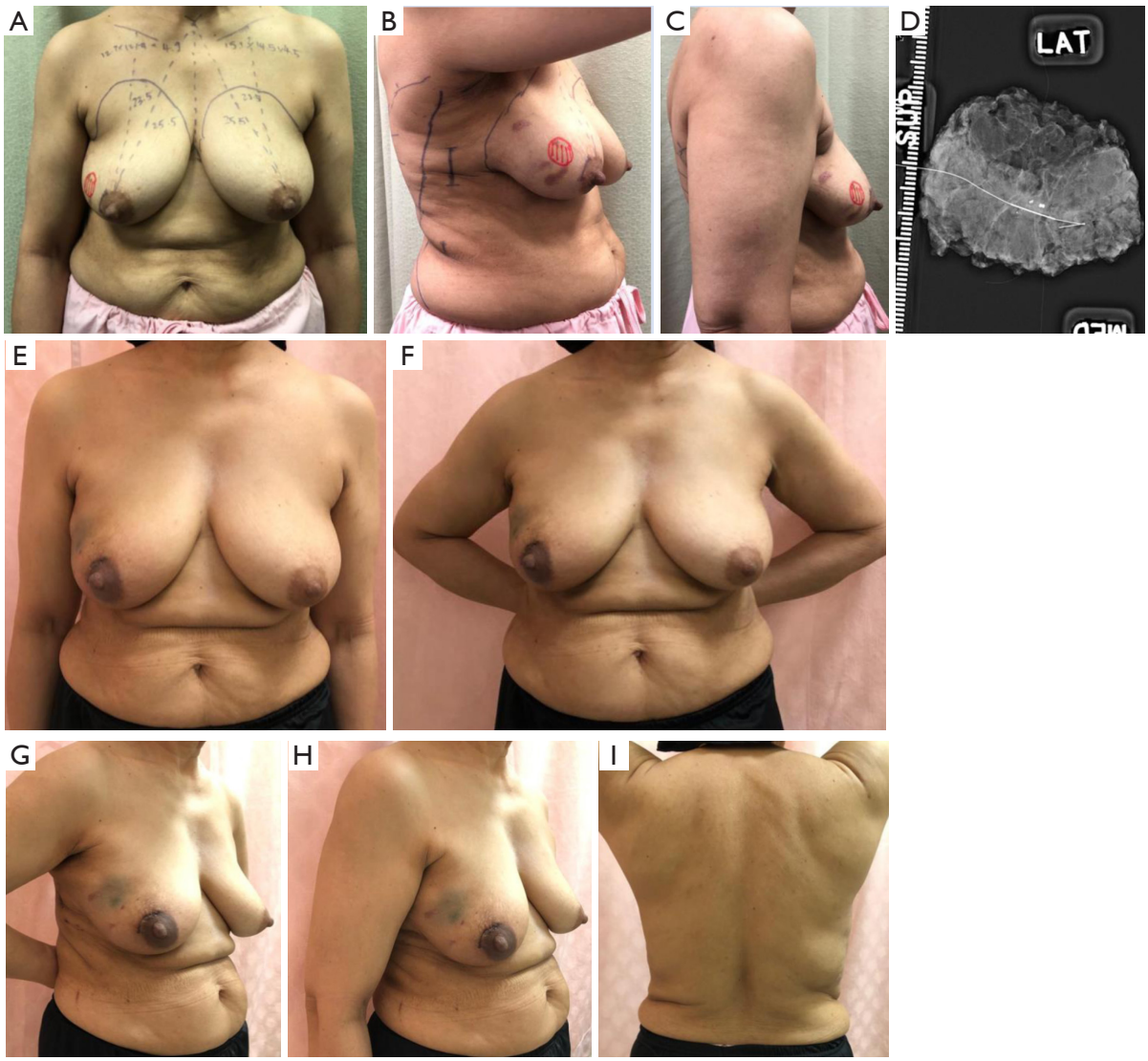

Figure 1 Perioperative pictures of Case 1 with right breast wide excision and endoscopic skin sparing mini latissimus dorsi (LD) flap reconstruction. (A) Pre-operative front view of Case 1 showing pre-operative markings; (B,C) pre-operative lateral views of Case 1 showing the placement of incision along anterior axillary line which was well hidden; (D) intra-op specimen mammography demonstrating a sizeable 8 cm × 6 cm wide excision specimen with clip and microcalcifications seen within; (E,F) post-operative front views showing excellent symmetry; (G,H) post-operative lateral views showing excellent aesthetic outcomes with incision hidden within the anterior axillary line; (I) post-operative view of the back showing the absence of donor site incision.

phyllodes tumor which was removed endoscopically. The margins were inadequate but with an A-cup breast, further margin excision would result in significant deformity. She underwent a nipple sparing mastectomy with skin sparing LD flap reconstruction completely performed endoscopically via a single 2.5 cm anterior axillary line incision.

Variation 3: Hybrid endoscopic full LD myocutaneous flap (*Figure 3*)

In the full LD myocutaneous flap, the inclusion of the skin paddle and subcutaneous fat allows for a larger bulk when compared to skin-sparing LD flap. The hybrid endoscopic technique uses endoscopic-assisted technique for better

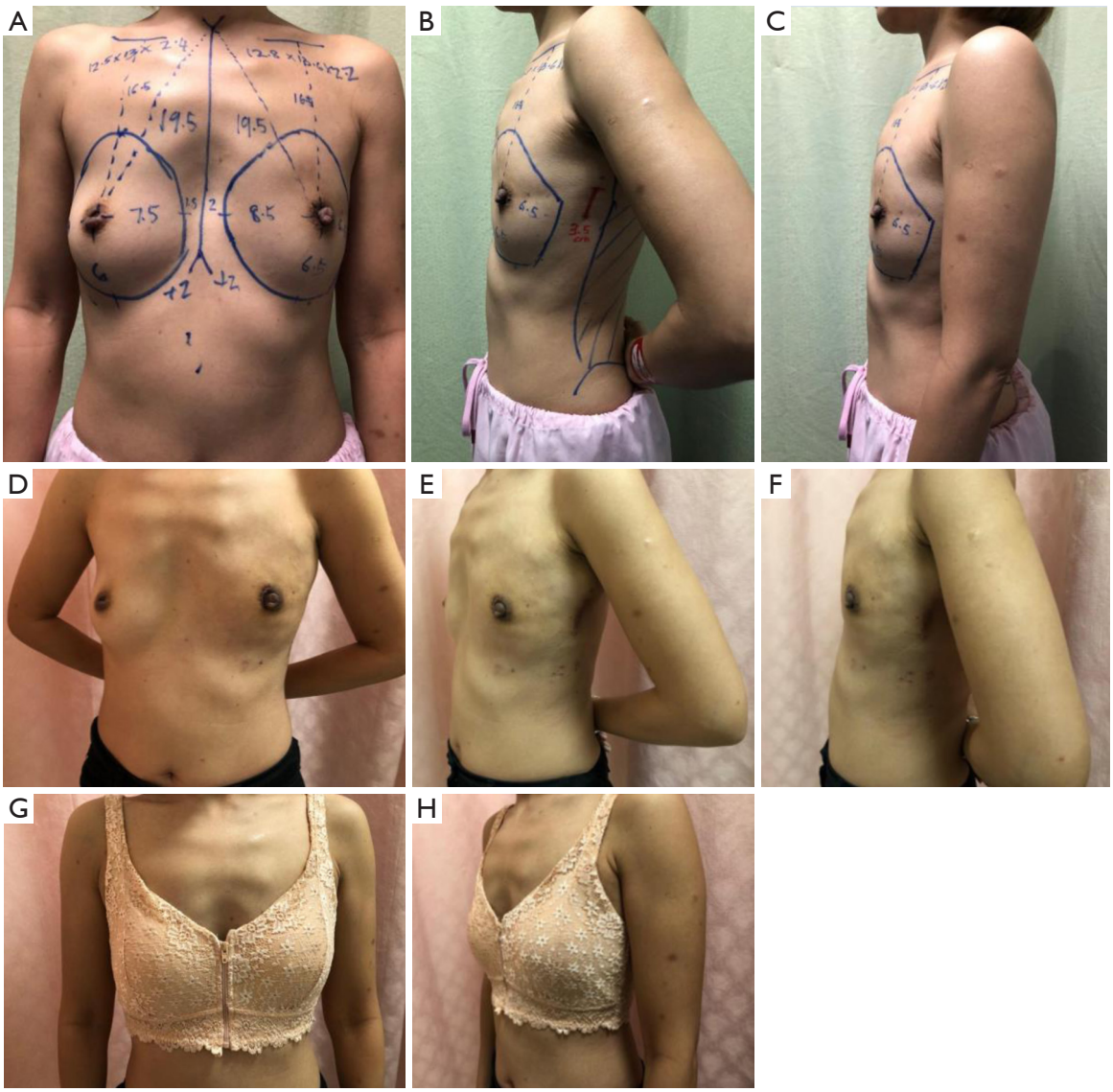

Figure 2 Perioperative pictures of Case 3 with endoscopic left nipple sparing mastectomy with endoscopic skin sparing full latissimus dorsi (LD) reconstruction. (A) Pre-operative front view of Case 3 showing pre-operative markings; (B,C) pre-operative lateral views of Case 3 showing the placement of incision along anterior axillary line; (D) post-operative front view showing excellent symmetry; (E,F) post-operative lateral views showing excellent aesthetic outcomes with incision hidden within the anterior axillary line; (G,H) post-operative views with patient wearing undergarments demonstrating excellent symmetry and aesthetic outcomes.

visualization and accurate dissection, thereby requiring a shorter donor site scar. This technique is useful for either partial or full breast reconstruction depending on the required size/volume of LD flap.

Case 4—Left breast wide excision with hybrid endoscopic full LD myocutaneous flap reconstruction

Vacuum-assisted biopsy of a 1 cm lower outer quadrant left breast lump revealed invasive ductal carcinoma. Pre-operative breast MRI demonstrated significant enhancement of 3 cm around the cavity, suspicious for residual disease. The patient was slim built (BMI 16 kg/m^2) but with a C-cup breast. She had extremely little adiposity for local advancement or perforator flaps and her LD bulk was assessed to be small. The BCS was performed with an inframammary incision. To achieve adequate volume to replace the BCS cavity, a full LD flap including skin paddle

Figure 3 Perioperative pictures of Case 4 with left breast wide excision with hybrid endoscopic full latissimus dorsi (LD) myocutaneous flap reconstruction. (A,B) Pre-operative front and lateral views of Case 4 showing pre-operative markings; (C) hybrid endoscopic assisted harvest of LD flap with small skin ellipse; (D) on-table view showing flap fashioned prior to inset ; (E) immediate post-operative on-table view showing excellent symmetry and aesthetic outcomes with incision along the infra-mammary fold; (F,G,H) post-operative views showing well healed incisions with excellent symmetry and aesthetic outcomes.

was harvested with a 4 cm × 2 cm elliptical skin paddle. The flap was initially raised from the skin paddle to the anatomical boundaries with lighted retractors. Subsequently, endoscopic dissection of the posterior and inferior portion of the LD flap allowed the dissection to reach the anterior superior iliac spine with ease.

Case 5—Endoscopic right skin sparing mastectomy with hybrid endoscopic full LD myocutaneous flap reconstruction

This 69-year-old patient with a C-cup breast, had a retroareolar invasive cancer. A full LD myocutaneous flap was required to obtain enough volume for a full breast reconstruction after a mastectomy. The mastectomy was performed via a periareolar incision. The full LD flap was harvested with an 8 cm × 3 cm elliptical skin paddle, initially raised from the skin paddle to the anatomical boundaries with lighted retractors and subsequently, the posterior and inferior portion was raised endoscopically.

Findings and results

The mean age of patients was 56 (range, 45–69) years old. All had early non-metastatic breast cancer, no evidence of skin or chest wall invasion and no clinical evidence of lymph node metastases. Only 1 was overweight (BMI >23.1 kg/m^2).

Most had small to moderate sized breast and an adequate LD bulk. Two patients who underwent mastectomy had A-cup breasts, whereas three other patients had B to C-cup breasts.

Mean pathological tumor size was 2.8 cm (range, 8 mm to 7 cm). Two patients had multifocal tumor. All had invasive carcinoma except one with borderline phyllodes. Of the former, the final histological stages were Stage 1 (2 cases) and Stage 2A (2 cases). Case 3 had 1.2 mm of residual borderline phyllodes in the mastectomy specimen. Sentinel lymph node biopsy performed for the 4 cases of invasive carcinoma and were negative. Intra-operative frozen section analysis of sub-nipple biopsies performed for nipple sparing mastectomy was negative. All had adequate margin. Specimen weight ranged from 34 to 51 g for wide excision cases and 117 to 309 g for mastectomy specimens (*Table 1*).

The mean overall operation, resection and reconstruction time was 339 (range, 265–425), 126 (range, 50–180) and 217 minutes (range, 200–230) respectively. The mean blood loss for all was less than 15 ml and mean hospitalization was 1 day.

All patients' wounds healed well except for Case 5, who developed minimal skin flap necrosis without infection, at the peri-areolar incision. It healed spontaneously within a week, without the need for dressing or debridement. Two patients received their adjuvant therapy within a month from surgery. The two cases who had hybrid endoscopic full LD myocutaneous flap reconstruction commenced adjuvant therapy 5 weeks post-surgery. Case 4's adjuvant radiotherapy was delayed due to eczematous flare while Case 5, the delay was due to skin flap necrosis. Nonetheless, this was still within the acceptable duration of 6–8 weeks (3,4) where survival outcome would not be affected.

Aesthetic outcome assessed by the performing surgeon and patients graded it to be between good and excellent. All patients were satisfied with their scar appearance, wound length and location (*Table 2*).

Discussion

Breast reconstruction in Asian women have been reported to be different from their Western counterparts (5,6) due to smaller, non-ptotic breasts common to Asian ladies. To further compound the problem, there is a possibility of having a well-endowed but extremely slim lady such as Case 4 reported in our series which further limits the choices for autologous reconstruction.

Despite numerous studies (5-7) on reconstruction options for Asian women, due to their unique physical attributes, no clear advantage have been subscribed to any one technique. Implant-based reconstruction is not ideal in thin women owing to implant visibility and palpability. Moreover, due to recent reports of BIA-ALCL (8), smooth implants are preferred over textured anatomical implants, which leads to poor aesthetic outcome in thin ladies. The lack of abdominal and lateral chest adiposity in Asian women limits the use of autologous local oncoplastic procedures or TRAM or DIEP flap.

LD flap reconstruction, on the other hand, provides adequate bulk for reconstruction in thin ladies without disadvantages of other options. It is suitable for partial or full breast reconstruction (2). The main drawback with conventional LD flap is the long and unsightly donor scar. To overcome this, the LD flap can be safely harvested with the use of minimally invasive techniques as demonstrated in this series. In fact, some patients had the same incision for both oncological breast resection and flap reconstruction. Depending on the volume of LD required, modifications in technique via the 3 variations described in our series, can be tailored to different clinical needs.

In terms of operative safety and outcomes in our series, blood loss was minimal, all patients were discharged the next day and there was only one minor wound necrosis. This is comparable to other series of endoscopically harvested LD flap for reconstruction (9,10). The aesthetic outcomes were either good or excellent as assessed by the patient or primary surgeon using clinical and photography-based assessments.

Previous studies have separately described minimally invasive techniques for oncological resection (11) and endoscopic-assisted LD flap harvest (12,13). Our series describes for the first time, the combination of using minimally invasive oncological breast resection for breast cancer with different variations of LD flap harvested endoscopically. The limitations of this series are the small numbers and the lack of an objective assessment of aesthetic outcomes. Nonetheless, it demonstrates the technical safety and feasibility in suitable patients.

Conclusions

Our initial experience demonstrated the safety and versatility of endoscopically harvested LD flap in combination with minimally invasive breast surgery. Tailoring the appropriate LD volume harvested to suitable patients can result in excellent aesthetic outcomes. A longer follow up study will be essential to ascertain the long-term

Table 1 Demographics and clinical characteristics

Case No.	Baseline demographics					Tumor characteristics		Surgery		
	Age	Co-morbidities	BMI	Cup Size	Location	Tumor size (cm)	Histology	Resection	Axillary procedure	Reconstruction
1	65	Nil	22	B	Right upper outer quadrant	2 clusters of microcalcifications 2 cm apart	Invasive mucinous carcinoma	Wide excision	SLNB	Endoscopic skin-sparing mini LD flap
2	49	Nil	21	A	Left lower outer quadrant	2.0 × 2.0 × 1.2	Invasive ductal carcinoma	Nipple sparing mastectomy	SLNB	Endoscopic skin-sparing full LD flap
3	45	Ex-smoker	21.5	A	Right retroareolar	7.2 × 2.9 × 4.2	Borderline phyllodes tumour	Nipple sparing mastectomy	Nil	Endoscopic skin-sparing full LD flap
4	51	Nil	16.8	C	Location	1.0 × 0.9 × 0.6	Invasive ductal carcinoma	Wide excision	SLNB	Hybrid endoscopic full LD myocutaneous flap
5	69	Nil	24	C	Right upper outer quadrant	2.8 × 2.0 × 1.9	Invasive ductal carcinoma	Skin sparing mastectomy	SLNB	Hybrid endoscopic full LD myocutaneous flap

ER, estrogen receptor; PR, progesterone receptor; HER2, human epidermal growth factor 2; SLNB, sentinel lymph node biopsy; LD, latissimus dorsi.

Table 2 Surgical and treatment outcomes

Case No.	Op	Specimen weight (g)	Overall operating time (min)*	Oncological resection time (min)	Reconstruction time (min)@	Blood loss (mL)	Hospital stay (days)	Margin involvement	Complications	Time to adjuvant therapy(weeks)^^	Patients' satisfaction	Surgeon's satisfaction
1	WE	51	335	95	215	<15	1	No	No	3.5	Excellent	Excellent
2	NSM	117	425	180	225	<15	1	No	No	4	Good	Good
3	NSM	142	270	150	215	<15	1	No	No	Nil adjuvant	Excellent	Excellent
4	WE	34	265	50	200	<15	1	No	No	5	Excellent	Excellent
5	SSM	309	400	155	230	<15	1	No	Skin flap necrosis #	5	Excellent	Good

*, including positioning and preparation time; @, reconstruction time is inclusive of LD flap harvest and subsequent flap inset duration; ^^, time to adjuvant therapy refers to duration from date of surgery to start of adjuvant therapy; #, mild skin flap necrosis around peri-areolar incision which healed spontaneously within a week without evidence of infection and the need for dressing or debridement. WE, wide excision; NSM, nipple-sparing mastectomy; SSM, skin-sparing mastectomy; RT, radiotherapy; Chemo, chemotherapy; Endocrine, endocrine therapy.

outcomes of this versatile technique.

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Footnote

Reporting Checklist: The authors have completed the AME Case Series reporting checklist. Available at http://dx.doi.org/10.21037/abs-20-62

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/abs-20-62). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient.

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