

Endoscopic Latissimus Dorsi Muscle Flap for Breast Reconstruction After Skin-Sparing Total Mastectomy: Report of 14 Cases

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Abstract

Background Some authors have mentioned that the endoscopic harvesting of the latissimus dorsi muscle flap for breast reconstruction is an uncommon technique that has been abandoned due to its technical complexity. Therefore, its use for immediate breast reconstruction after skin-sparing total mastectomies is reported for only a few patients, without clinical images of the reconstructed breast or of the donor site. This report describes 14 breast reconstructions using the aforementioned approach, with the latissimus dorsi muscle flap harvested by endoscopy plus the insertion of a breast implant in a single surgical procedure. The objective is to show images of the long-range clinical aesthetic results, both in the reconstructed breast and at the donor site as well as the complications so the reader can evaluate the advantages and disadvantages of the technique.

Clinical Cases From 2008 to 2011, 12 women who experienced skin-sparing total mastectomy and 2 women who underwent modified radical mastectomy were reconstructed using the aforementioned technique. The average age was 42 years (range 30–58 years), and the average body mass index was 29 kg/m² (range 22–34 kg/m²). Three patients were heavy smokers: one had undergone a previous abdominoplasty; one had hepatitis C; and one had undergone massive weight loss. Immediate reconstructions were performed for 11 patients, and 3 reconstructions were delayed. The implant volume ranged from 355 to 640 ml.

The average endoscopic harvesting time was 163.5 min (range 120–240 min), and the average bleeding was 300 ml. Four patients experienced seromas at the donor site. Acceptance of the reconstructed breast was good in six cases, moderate in seven cases, and poor in one case. Acceptance of the donor site was good in 13 cases and moderate for 1 case.

Conclusions Endoscopic harvesting of the latissimus dorsi muscle has technical difficulties that have limited its acceptance. However, this technique offers the same quality of breast reconstruction as the open harvesting technique, with the advantage of a smaller scar at the donor site. Based on the results, the authors consider the reported technique to be useful and valid.

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Keywords Breast reconstruction · Endoscopic flaps · Latissimus dorsi muscle

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Endoscopic harvesting of the latissimus dorsi muscle flap in reconstructive surgery was initially described in 1994 [1], but its use for breast reconstruction was not reported until the year 2000 [2]. Since then, only a few reported series have shown its use for oncologic breast reconstruction. The largest series reported its utility for immediate breast reconstruction after skin-sparing partial mastectomy [3, 4]. Only three series of respectively 52, 14, and 8 patients have reported immediate breast reconstruction after skin-sparing total mastectomy [5–7]. None of these three studies showed images of the clinical results.

Endoscopic harvesting of the latissimus dorsi muscle with an open harvesting technique has not achieved popularity because of difficulties maintaining the optic cavity and thorax anatomic curvature [5]. Consequently, endoscopic harvesting with this method requires prolonged surgical time. Menke et al. [8] reported only two endoscopically harvested latissimus dorsi muscle flaps among 121 cases of breast reconstruction using the latissimus dorsi muscle flap. Aly et al. [9] pointed it out as an uncommon technique, and Vasconez [10] stated that he has abandoned this harvesting technique.

However, some patients who undergo skin-sparing total mastectomy desire the fewest possible complications, effective postoperative care, and diminished surgical stages for breast reconstruction. These patients generally are young and thin with insufficient abdominal tissue for use as a transverse rectus abdominis muscle (TRAM) flap. Other patients do not want a TRAM flap because of its morbidity, and still others desire a smaller scar at the donor site or have other personal reasons. Hence, these patients can benefit from breast reconstruction using the latissimus dorsi muscle flap harvested by endoscopy plus breast implant insertion in a single surgical procedure.

For these reasons, we report 14 patients who underwent reconstruction using the aforementioned technique with the aim to show images of the long-term aesthetic clinical results regarding the reconstructed breast, donor site, and complications. In this way, the reader can evaluate the advantages and disadvantages of this technique. An additional objective is to increase the number of reported cases, thereby maintaining endoscopic harvesting of the latissimus dorsi muscle as a valid option for breast reconstruction.

Technique

The flap was harvested after the mastectomy. For this, the patient was placed in the ventral decubitus position. Initially, 500–1,000 ml of Klein's formula was infiltrated into the subcutaneous tissue of the latissimus dorsi muscle area. We continued with an initial 6- to 8-cm-long incision in the posterior axillary line anterior to the lateral border of the latissimus dorsi muscle. Through this incision, the free border of the latissimus dorsi muscle was identified as we continued the macroscopic subcutaneous and submuscular dissection to create the optic cavity.

A blunt dissector was carefully introduced, first through the subcutaneous tissue and then under the muscle to amplify the optic cavity. To continue with the endoscopic dissection, a 10-mm trocar was introduced through the initial incision, and the wound was sutured with 2-0 nylon. To avoid skin distension and to prevent carbon dioxide

(CO₂) gas leakage, a plastic protector was adhered over the skin and around the trocar. This was followed by optic cavity insufflation with CO₂ gas at a pressure of 8 mmHg and a flow of 3 l/min.

Two trocars were additionally introduced into the optic cavity under endoscopic vision according to the principles of endoscopic surgery triangulation (Fig. 1). The endoscopic dissection was initially subcutaneous, followed by a submuscular dissection. Posteriorly, the paravertebral and inferior insertions of the latissimus dorsi muscle were sectioned with an ultrasonic scalpel, and the perforator vessels were occluded with hemoclips. Thus, the muscle was extracted through the initial incision and rotated to the recipient site. The thoracodorsal nerve was conserved in all patients. A 19-Fr Blake drain was placed in the donor site. Staggered points of the subcutaneous tissue to the deep muscular plane were placed in the macroscopically accessible areas. Finally, the wounds were sutured.

To proceed with the surgery, the patient was turned over to the supine position. In the recipient site, the medial and inferior insertions of the pectoralis major muscle were sectioned. The latissimus dorsi muscle was rotated and sutured along the inframammary fold. The breast implant was placed under the pectoralis major and latissimus dorsi muscles, and both muscles were sutured (Fig. 2). A 19-Fr Blake drain was introduced under both muscles. At the recipient site, the skin was sutured according to the breast reconstruction surgical plan. A shoulder immobilizer was placed and used for 10 days.

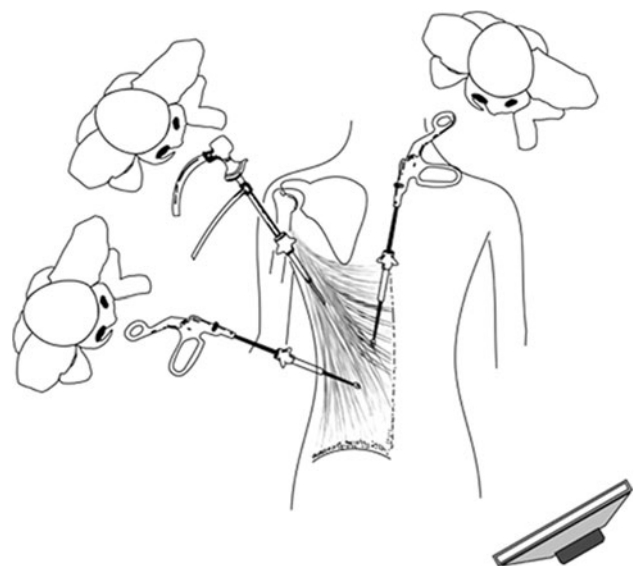


Fig. 1 Position of the patient, the surgeon, and the surgical assistants for the endoscopic harvesting of latissimus dorsi muscle

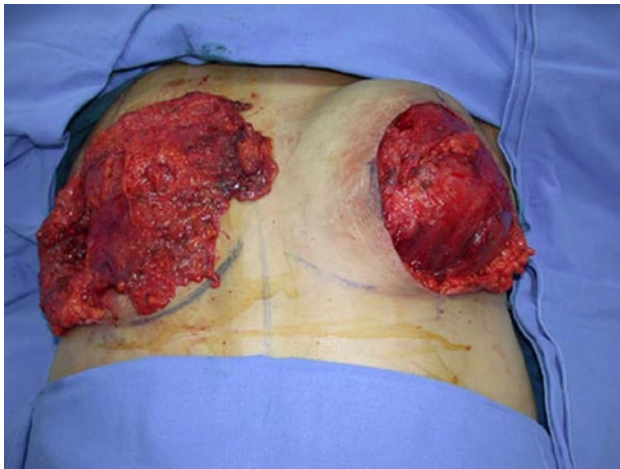


Fig. 2 Immediate bilateral breast reconstruction with endoscopic harvesting of the latissimus dorsi muscle. On the *right side*, the latissimus dorsi is rotated. On the *left side*, the breast implant is placed under the muscles, and the pectoralis major and latissimus dorsi muscles are sutured together

Clinical Cases

From 2008 to 2011, 12 women who had undergone skin-sparing total mastectomy and 2 women who had undergone modified radical mastectomy benefited from breast reconstruction with an endoscopically harvested latissimus dorsi muscle flap and breast implant placement in a single surgical procedure. The demographic and clinical data are presented in Table 1. In the bilateral reconstruction cases (patients 2, 4, and 12), the skin-sparing total mastectomy indication was breast cancer and prophylaxis in the contralateral breast.

The volume of the implants used, the surgical procedure time for the endoscopic harvesting of each latissimus dorsi muscle, the total surgical procedure time, the average hospitalization duration and surgical bleeding, the number of patients with transfusions, the seroma rate and complications in the donor and receptor sites, and the follow-up time are shown in Table 2. Patient 7 required two units of packed red cells and had a prolonged hospital stay due to hematomas in the reconstructed breast and flap donor site.

Patient 12 experienced an accidental sectioning of the thoracodorsal artery of one flap, requiring microsurgical repair and prolongation of the total surgical time. Four patients experienced donor-site seromas (patients 6, 8, 10, and 14), which were treated with serial percutaneous punctures on an outpatient basis. Patient 2, who had a heavy smoking history, experienced thoracic cutaneous flap necrosis and underwent wound care on an outpatient basis until secondary healing was achieved.

The patients evaluated their results. One of the authors directly interviewed them at least 6 months after their surgery. They were questioned about several concepts regarding their approval of the reconstructed breast (Table 3) and acceptance of the donor site (Table 4). Six patients described good acceptance of their reconstructed breast (Figs. 3, 4), and seven patients described moderate acceptance (Fig. 5). Their most frequent complaint was asymmetry compared with the contralateral breast when the reconstruction was unilateral, and one patient with bilateral reconstruction experienced Baker's grade 2 capsular contracture (patient 2). Patient 7 reported poor acceptance. This patient had a history of hepatitis C and experienced volume, position, and shape asymmetry as well as Baker's grade 3 capsular contracture (Table 5).

Table 1 Demographic and clinical data

Patient	Age (years)	BMI	Risk factors	Comorbidity	Type of mastectomy	Type of reconstruction	Time of reconstruction
1	39	30			SSTM	Unilateral	Immediate
2	52	27	Heavy smoking	Previous abdominoplasty	SSTM	Bilateral	Immediate
3	38	29			SSTM	Unilateral	Immediate
4	43	28	Heavy smoking		SSTM	Bilateral	Immediate
5	37	28			SSTM	Unilateral	Immediate
6	37	32			SSTM	Unilateral	Immediate
7	58	27	Heavy smoking	Hepatitis C	MRM	Unilateral	Delayed
8	41	33			SSTM	Unilateral	Immediate
9	51	26			SSTM	Unilateral	Immediate
10	46	34		Massive weight loss	MRM	Unilateral	Delayed
11	30	22			SSTM	Unilateral	Delayed
12	42	27			SSTM	Bilateral	Immediate
13	40	30			SSTM	Unilateral	Immediate
14	35	30			SSTM	Unilateral	Immediate

BMI body mass index, *SSTM* skin-sparing total mastectomy, *MRM* modified radical mastectomy

Table 2 Surgical outcomes

Breast implant volume (ml)	355–640
Mean endoscopic procedure time (min)	163.5 (120–240)
Mean total procedure time (min)	292.1 (200–480)
Mean total bleeding (ml)	300 (120–800)
Mean hospital stay (days)	3.2 (1–16)
Transfusion	1 patient
Seroma formation	4 patients
Complications	2 patients
Surgical reoperation	1 patient
Follow-up (months)	20 (6–36)

Table 3 Satisfaction evaluation of the patient with breast reconstruction using the endoscopic latissimus dorsi muscle flap

Reconstructed breast evaluation			
	Total points	Results	Points
Shape	10	Desired and satisfied	10
		Not desired and satisfied	5
		Not satisfied	0
Symmetry	15	Position symmetry	5
		Position asymmetry	0
		Volume symmetry	5
		Volume asymmetry	0
		Inframammary fold position	5
Consistency	5	Without contracture	5
		With contracture	0
Classification		Good	30–25
		Moderate	20–15
		Poor	<10

Satisfaction regarding the donor site was good for 13 patients. Patient 2 had moderate satisfaction with the donor site because she desired smaller scars.

Discussion

The main difference between open and endoscopic harvesting of the latissimus dorsi muscle is the resulting scar at the donor site. With the open technique, this scar generally is wide with irregularities and folds [11]. Although Hammond [12] reported improvement of the resultant scar and Vasconez [10] stated that the resulting scar will be of no importance to the patient if the breast reconstruction is appropriate, the scar still is the main disadvantage of this method.

Table 4 Satisfaction evaluation of the patient with breast reconstruction using the endoscopic latissimus dorsi muscle flap

Donor-site evaluation			
	Total points	Results	Points
Donor-site scar	5	Very satisfied	5
		Satisfied	3
		Unsatisfied	0
Social, working, and sportive acceptance	5	Donor-site appearance approved	1
		Donor-site appearance disapproved	0
		Use of backless clothes	1
		No use of backless clothes	0
		Without limitations in daily activities	1
		With limitations in daily activities	0
		Without limitations in working activities	1
		With limitations in working activities	0
		Without limitations in sportive activities	1
Classification		Good	10–8
		Moderate	7–5
		Poor	<4

Regardless of the scar's appearance, it is almost always a concern, especially in young patients. With endoscopic harvesting, the resulting 6- to 8-cm scar extension contrasts with the 21.61-cm scar that resulted from the open harvesting technique of this muscle in one study [11]. Although our evaluation was subjective, the patients were satisfied.

Many patients have benefited from the addition of a skin island. However, in other patients, preoperative mastectomy planning can conserve much of the skin. These patients can benefit from endoscopic harvesting of the latissimus dorsi muscle flap. The resulting scar will be shorter.

Endoscopic harvesting of the latissimus dorsi muscle differs in various technical concepts (Table 6). All the current authors agree that patients who undergo reconstruction with this technique experience less pain, enjoy a faster recovery, and have a smaller scar at the donor site than those who undergo the open harvesting technique. In addition, the use of this muscle for breast reconstruction does not affect the patient functionally [13]. We understand that although all these benefits have been reported, it is necessary to perform comparative studies.

The dorsal decubitus position, the infiltration of Klein's formula, and the maintenance of the optic cavity with CO₂

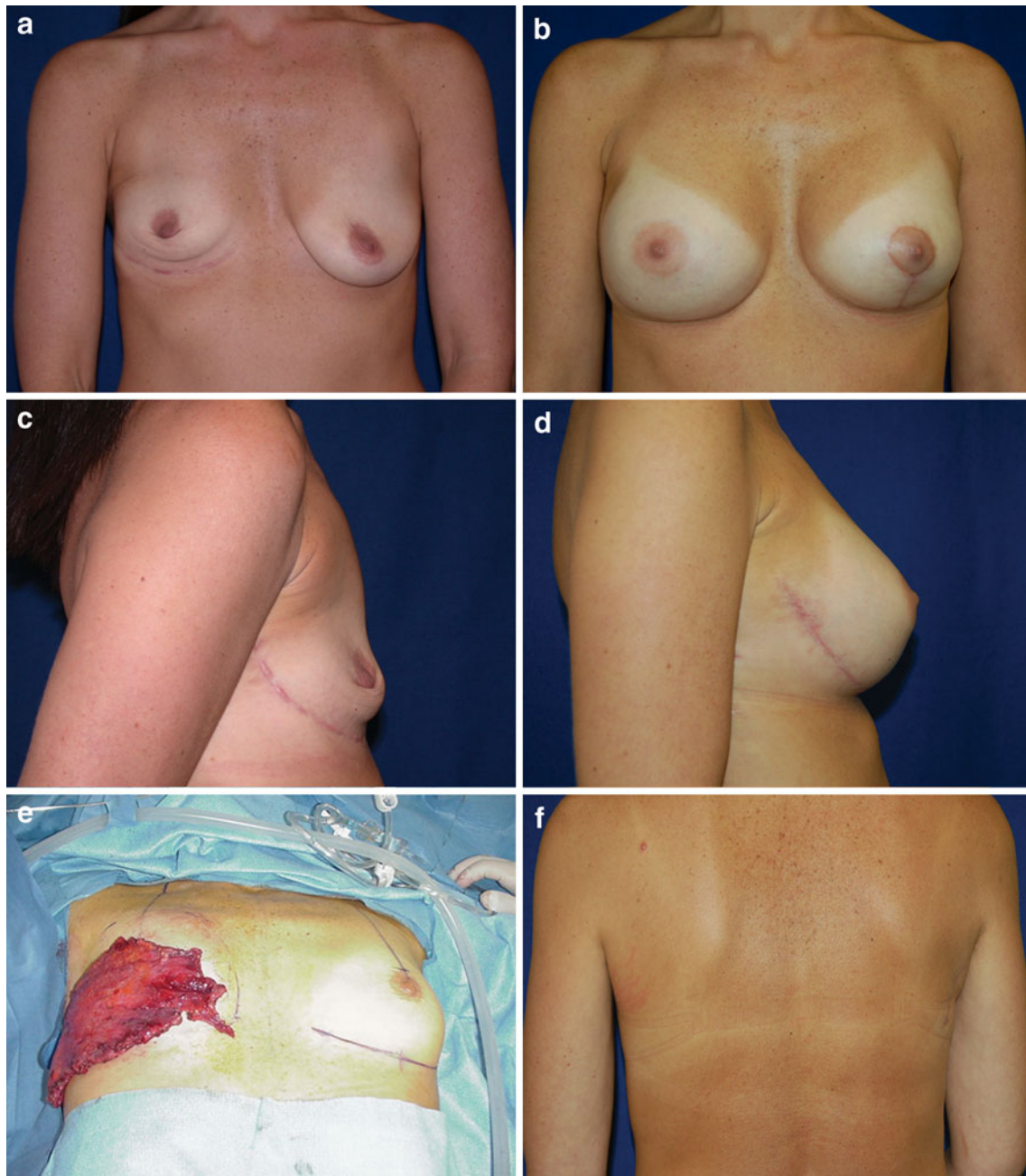


Fig. 3 A 30-year-old woman (patient 11) who had a thoracic wall sarcoma and underwent resection of the third, fourth, and fifth costal arches; pectoralis major and minor resection; skin-sparing total mastectomy; and pleura resection. **a, c** Preoperative view. **b, d** Delayed breast reconstruction with the latissimus dorsi muscle

endoscopic flap and breast implant of 315 ml and a contralateral mastopexy with breast implant of 195 ml. View 6 months after surgery. **e** The latissimus dorsi muscle has been rotated at the recipient site. **f** Resulting donor-site scar

allowed us to achieve total latissimus dorsi muscle extension more easily and comfortably. Pomel et al. [7], Missana and Pomel [5], and Güemes et al. [14] reported that endoscopic harvesting of the latissimus dorsi muscle is a mixed technique involving macroscopic and endoscopic dissection. The 6- to 8-cm initial incision facilitates identification of the anatomic planes and macroscopic dissection of a larger

initial optic cavity. It also facilitates placement of the 10-mm trocar in the back in a position more medial to the posterior axillary line. All the aforementioned factors allow performance of endoscopic dissection in the paravertebral region despite the thoracic curvature.

The reported surgical time for harvesting of the latissimus dorsi muscle with the open technique ranges from 88 to

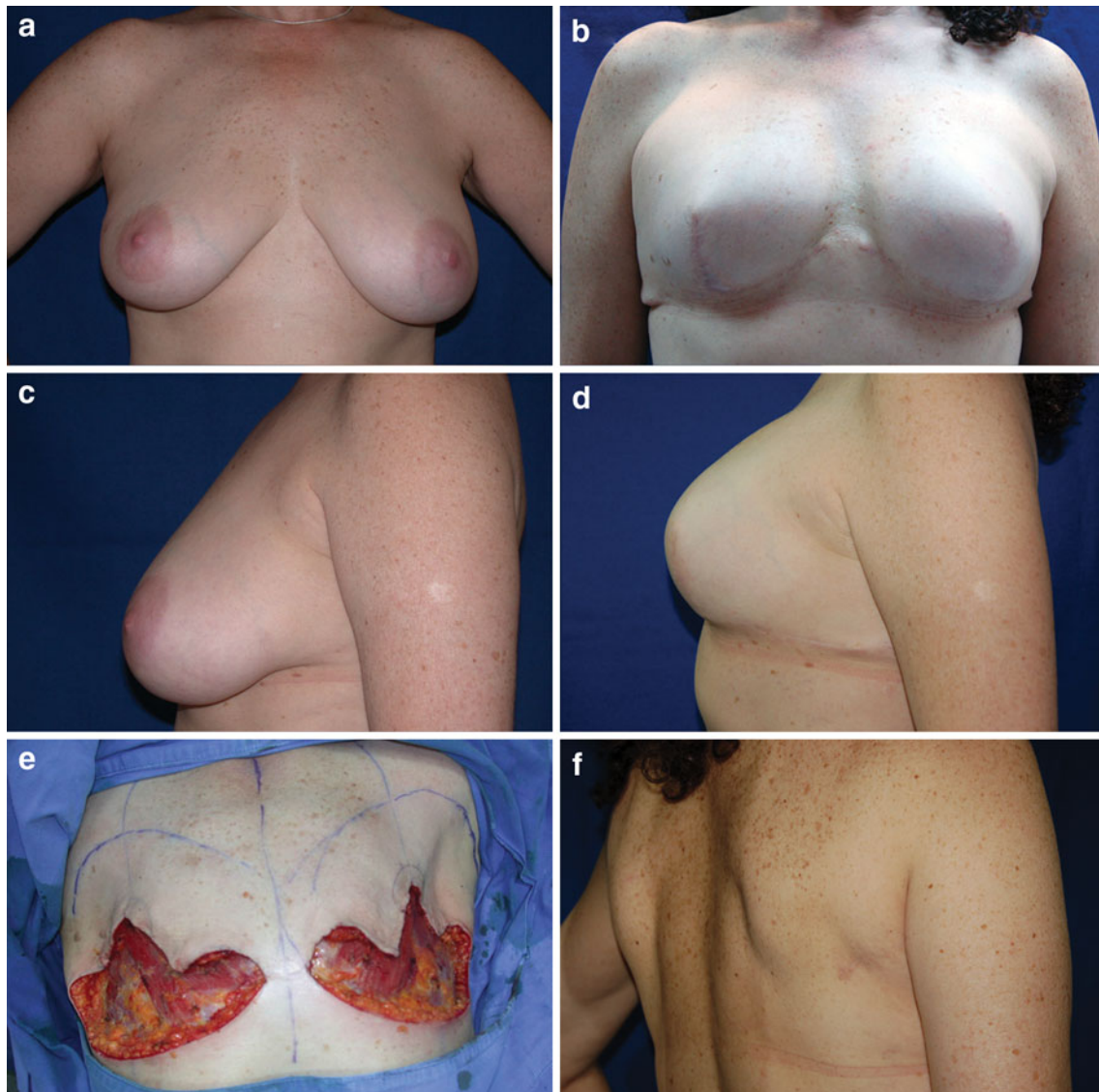


Fig. 4 A 42-year-old woman (patient 12) who had in situ breast cancer and a positive family history for breast cancer. **a, c** Preoperative view. **b, d** Postoperative outcome after bilateral skin-sparing total mastectomy with immediate reconstruction using endoscopic

latissimus dorsi muscle and 355-ml implants. View 18 months after surgery. **e** Skin-sparing total mastectomy. **f** Resulting donor-site scar 18 months after surgery

289 min [8, 11]. Therefore, the paradigm of prolonged surgical time required to harvest the latissimus dorsi muscle endoscopically remains in doubt compared with the times listed in Table 6. In 168 cases of endoscopic harvesting of the latissimus dorsi muscle flap for breast reconstruction, Nakajima et al. [4] managed to decrease the surgical harvesting time to 50 min. Missana and Pomel [5] decreased the surgical time to 64 min in 52 cases. The surgical time of 163.5 min for endoscopic harvesting in the current 14 cases also can be decreased once the learning curve is overcome by the constant use of this technique. With this method, a main disadvantage of endoscopic harvesting of the latissimus dorsi muscle flap can be eliminated.

We consider that despite our prolonged surgical time for endoscopic harvesting, the reported technique is useful for breast reconstruction because it results in an objectively smaller scar at the donor site while maintaining the same aesthetic results in the reconstructed breast according to the evaluation by our patients.

The use of acellular dermal matrixes has allowed the completion of breast reconstruction with breast implants in a single procedure. The percentage of capsular contractures reported with this technique is 0.5 %, and the percentage of total complications is 2–15 % [15]. Hence, this type of reconstruction has gained great popularity. However, when risk factors exist, such as cutaneous flaps with circulatory

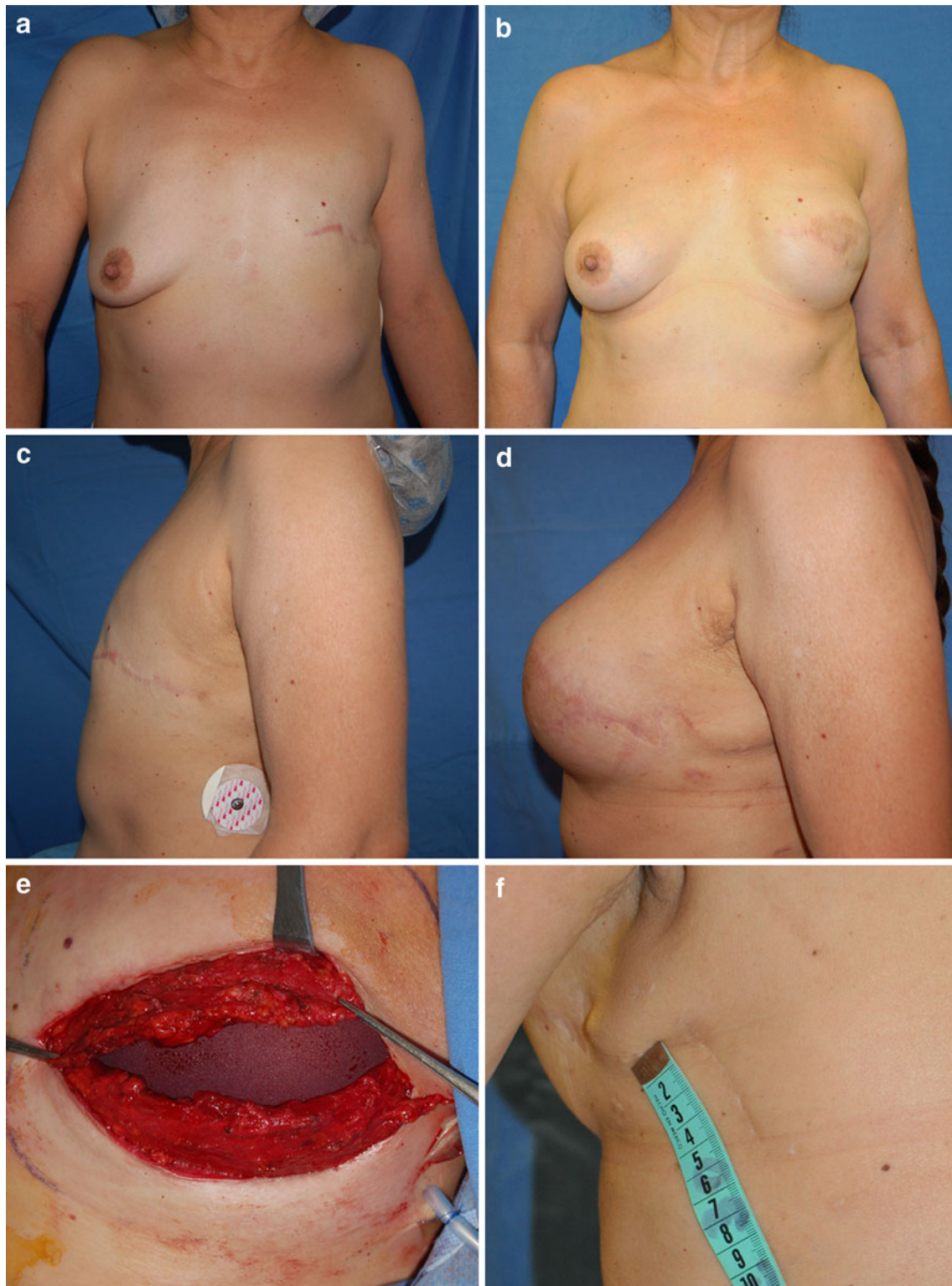


Fig. 5 A 46-year-old woman (patient 10) who had a modified radical mastectomy and massive weight loss. **a, c** Preoperative view. **b, d** View 2 years after breast reconstruction with endoscopic harvesting of the latissimus dorsi muscle flap and a 350-ml breast implant. Breast

augmentation with a 140-ml breast implant in the right breast. **e** Breast implant, pectoralis major, and latissimus dorsi muscles. **f** Resulting donor-site scar 24 months after surgery

Table 5 Results and patient satisfaction

Patient	Breast reconstruction	Donor-site satisfaction
1	Moderate	Good
2	Moderate	Moderate
3	Moderate	Good
4	Good	Good
5	Good	Good
6	Good	Good
7	Poor	Good
8	Moderate	Good
9	Good	Good
10	Moderate	Good
11	Good	Good
12	Good	Good
13	Moderate	Good
14	Moderate	Good

disturbances, smoking, obesity, radiotherapy, or previous scars, breast reconstruction in a single surgical procedure is preferentially performed with autologous tissues [16].

The cost of acellular dermal matrixes is another factor that can limit their use, resulting in the use of autologous tissues. Finally, the general condition of the patient, the local circumstances, and the surgeon's experience all help to determine the best technique.

The total extension of the latissimus dorsi muscle together with the pectoralis major muscle provided a robust muscular cover over the breast implant and created a more favorable microenvironment. No implant loss occurred despite the thoracic cutaneous flap necrosis in patient 2. Thus, we agree with Ramakrishnan et al. [2], who reported that this technique is indicated for patients at a high risk of thoracic cutaneous flap necrosis such as patients with a smoking history.

The utility of harvesting the latissimus dorsi muscle endoscopically is well defined for breast reconstruction secondary to skin-sparing partial mastectomy because the

provided volume is sufficient to achieve the breast reconstruction in a single surgical procedure [3, 4]. Some authors have added subfascial fat to the flap to maintain a permanent transferred volume [3]. However, application of this technique in skin-sparing total mastectomy has been reported for very few patients. Missana and Pomel [5] and Nakajima et al. [6] reported a main series but did not show clinical images of their results.

In our 14-case report, we showed the clinical images of three reconstruction cases. These will guide the readers in evaluating and comparing the usefulness of endoscopic harvesting of the latissimus dorsi muscle plus breast implant insertion in a single surgical procedure for breast reconstruction in patients who have undergone skin-sparing total mastectomy.

Breast reconstruction with a latissimus dorsi muscle flap harvested using the open technique plus breast implant insertion in a single surgical procedure is associated with a capsular contracture rate reaching 75 % [12]. For this reason, several authors first place a breast expander, and then during a second surgical procedure 6 months later, they switch it for a definitive breast implant. They thereby decrease the capsular contracture rate to 10 % [8, 12].

In this report, only two patients (14 %) experienced capsular contracture: one with Baker grade 2 contracture (patient 2) and one with Baker grade 3 contracture (patient 7). This rate of capsular breast contracture is similar to that in staged breast reconstruction.

The described reconstruction technique also has been used for breast reconstruction secondary to modified radical mastectomy. In these cases, the reconstruction was performed in two surgical procedures. During the first procedure, a breast expander was placed and covered with the dorsi muscle. The reported results were good [2, 17]. Nonetheless, Güeven et al. [17] did not report the contracture rate or evaluate the breast reconstruction.

We used this technique for patients 7 and 10, with both experiencing a modified radical mastectomy. Despite this, however, they had sufficient amounts of skin, and we thus

Table 6 Surgical data (various authors)

Author (references)	Patients	Type of mastectomy	Surgical procedures	Incision length (cm)	Maintaining optic cavity (CO ₂)	Klein formula	Endoscopic surgical time (min)
Güeven et al. [17]	12	MRM	2	4	No	Yes	74.2 (50–125)
Nakajima et al. [4]	168	SSPM	1	5–7	No	No	50
Güemes et al. [14]	5		1	10	No	No	
Missana and Pomel [5]	52	SSTM	1	3	Yes	No	64 (25–160)
Losken et al. [3]	39	SSPM	1	3–4	No	No	
Pomel et al. [7]	8	SSTM	1	3	Yes	Yes	112 (85–140)
Nakajima et al. [6]	14	SSTM endoscopic	1	5–7	No	No	
Ramakrishnan et al. [2]	12	MRM	2	4–5	Yes	Yes	60–300

CO₂ carbon dioxide, SSPM skin-sparing partial mastectomy, SSTM skin-sparing total mastectomy, MRM modified radical mastectomy

decided to perform the reconstruction in a single surgical procedure.

Our results and those of other authors show that the seroma rate, surgical bleeding, hematomas, hospitalization, and reoperations are similar between endoscopic [3, 7, 11] and open harvesting of the latissimus dorsi muscle flap [8, 12, 14, 18, 19].

Various concepts have been taken into consideration in evaluating breast reconstruction results [5]. Each author has described his or her personal concept. The surgeon's evaluation takes into consideration the shape, position, and volume of the reconstructed breast [20]. However, the patient provides the best evaluation. In this study, the patients evaluated their satisfaction with the appearance of the reconstructed breast and donor site scar as well as the limitations in their social, working, and sport activities.

Our results show that breast reconstruction with a latissimus dorsi muscle flap harvested using the endoscopic technique offers the same quality of breast reconstruction as the open harvesting technique, with the advantage of a smaller scar at the donor site. Based on our results, we consider the described technique to be useful and valid.

Acknowledgments The authors declare that they have no conflict of interest.

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