

**Original  
Article**

**ASSESSMENT OF AESTHETIC OUTCOME AFTER RADIOTHERAPY ON THE RECONSTRUCTED BREAST BY TRANSVERSE RECTUS ABDOMINIS MYOCUTANEOUS FLAP VERSUS IMPLANT BASED LATISSIMUS DORSI FLAP**

**Mohamed Megahed<sup>1</sup>, Dalia M. ElSakka<sup>1</sup> and Naser Abd El Bary<sup>2</sup>**

<sup>1</sup>Faculty of Medicine, Menofia University, Plastic surgery and <sup>2</sup>Clinical Oncology departments, Egypt.

---

**ABSTRACT**

---

**Background:** Several studies have evaluated patient satisfaction following breast reconstruction with the transverse rectus abdominis myocutaneous (TRAM) flap and implant based latissimus dorsi flap. However, the effects of regional radiotherapy after pedicled TRAM flap breast reconstruction and Implant based Latissimus dorsi flap on aesthetic outcome have not been previously extensively studied.

**Aim of the Work:** Compare the effect of radiotherapy on patients undergoing immediate breast reconstruction using either TRAM flap or implant based latissimus dorsi flap as a regard the aesthetic aspect and the patient satisfaction.

**Patients and Methods:** A retrospective review was conducted on 53 consecutive patients who underwent immediate Breast reconstruction followed by radiotherapy in Menofia University, Plastic surgery and Clinical Oncology departments from August 2005 to July 2009.

The patients were divided into two groups:

**Group I:** Included 21 patients who underwent TRAM flaps

**Group II:** Included 32 patients who underwent Implant based Latissimus dorsi flap.

Patients were polled on their age, mastectomy type, laterality of reconstruction and adjuvant therapy. Aesthetic satisfaction based on breast shape, symmetry of breast shape, breast size, symmetry of breast size, breast scarring and breast sensation, hyperpigmentation, flap contracture was assessed using a 5-point scale.

**Results:** 53 patients with 21 TRAM flaps and 32 Implant based latissimus dorsi flap responded. In terms of overall aesthetic outcome, the TRAM group consistently rated better than the post implant based latissimus dorsi flap ( $p = 0.021$ ). The TRAM group also had clinically and statistically significant less hyper pigmentation and flap contracture than the post Implant based latissimus dorsi group ( $p = 0.0001, 0.0001$ , respectively).

**Conclusions:** We concluded that aesthetic outcome and patient satisfaction after radiotherapy for the reconstructed breast is highly influenced by the type of reconstructive procedure which was better by using TRAM flap procedure than using Implant based latissimus dorsi flap procedure.

---

**Key Words:** Breast cancer, radiotherapy, TRAM flap

---

**Corresponding Author:** Dr. Mohamed Ahmed Megahed Tel.:0020105268496

---

**INTRODUCTION**

---

With the recent increase in breast cancer awareness, most patients have become well informed about options for reconstruction after mastectomy, including the transverse rectus abdominis myocutaneous (TRAM) flap and implant based latissimus dorsi flap<sup>1</sup>.

The conventional (pedicled) transverse rectus abdominis myocutaneous (CTRAM) flap was the first truly effective method of autologous tissue breast reconstruction and since its introduction by Hartrampf et al.<sup>2</sup>, it remains the most commonly used

technique of autologous tissue breast reconstruction in the world<sup>2</sup>.

All other forms of reconstruction are routinely compared with the TRAM flap in terms of efficacy, aesthetic outcome and cost.

Breast reconstruction using the Implant based LD flap was probably a common reconstructive procedure until the early 1980s when its popularity waned. This was because of three principal drawbacks of this procedure:

- Problems with the prosthesis (migration and capsular formation) but the advent of textured prosthesis greatly reduced this particular complication especially when complete muscle coverage of the implant could be obtained.
- Large scar on the back (seroma formation common).
- Need for contralateral breast reduction to achieve symmetry which is difficult to be achieved in patients with large and ptotic breasts without carrying out a contralateral reduction<sup>3</sup>.

Adjuvant radiation has been used after mastectomy for many decades. It is clear that mastectomy without radiation offers excellent local-regional control rates for most patients with noninvasive or stage I or IIA disease<sup>4</sup>. In contrast, patients with stage III breast cancer (four or more positive lymph nodes or T3 or T4 primary tumors) have a clinically relevant risk of local-regional recurrence after mastectomy and thus would benefit from adjuvant radiation<sup>5</sup>. Pooled data from many meta-analyses have conclusively demonstrated that radiation has an important role in the management of locally advanced breast cancer. By reducing the risk of recurrence after mastectomy, radiation offers an incremental improvement in overall survival. Radiation seems to offer the greatest benefit when given using modern treatment techniques that minimize the risk of normal tissue injury and maximize the probability of tumor control and when given to patients who also receive systemic treatments.

The timing of radiation therapy with breast reconstruction over the past two decades has virtually reversed. Initially, most patients receiving radiation after mastectomy would have had radiation first and then reconstruction later. More recently, breast reconstruction after mastectomy has become more routine as an immediate procedure and thus more patients are having reconstruction first followed by radiation<sup>6</sup>.

This shift to post reconstruction radiation requires that we look at post reconstruction radiation with special care because it is becoming increasingly common. Therefore, the awareness about the long-term aesthetic outcome in irradiated post reconstruction patients has its importance when planning the type of surgery<sup>7</sup>.

Several studies have addressed overall patient satisfaction with each method of breast reconstruction

but they have been limited by small patient numbers, with surgery performed by multiple surgeons at various institutions, in addition, they have focused on determining which method is preferred, without evaluating the effect of irradiation<sup>8</sup>.

This study evaluated the aesthetic criteria for satisfaction after the effect of radiotherapy on two types of breast reconstruction (TRAM flap and Implant based latissimus dorsi flap).

## PATIENTS AND METHODS

Fifty three female patients Table (1) who underwent breast reconstruction followed by radiotherapy at the Menofia University Hospital, Plastic and Clinical oncology departments between August, 2005 and July, 2009, were identified and classified into two groups;

**Group I:** Includes 21 patients and underwent TRAM flaps (Figure 1, 2)

**Group II:** Includes 32 patients and underwent Implant based Latissimus dorsi Flap with implant (Figure 3).

The TRAM flaps were performed with a fascia sparing technique, in which the anterior rectus fascia was opened to expose the entire rectus abdominis muscle, with only a small cuff of fascia at the level of the perforators elevated with the muscle prior to transfer. The abdominal fascia was then closed primarily without the use of mesh.

All latissimus dorsi with implant patients had textured implants placed in an entirely sub-muscular position.

Data including age, marital state, type of reconstruction (latissimus dorsi with implant versus TRAM flap, laterality of reconstruction (unilateral versus bilateral), adjuvant therapy were collected and analyzed.

Radiotherapy was given by Varian Linac (6 MV linear accelerator machine) with target volume including the flap with chest wall by 2 tangential medial and lateral wedged fields aiming at total dose of 5000 cGys by the standard radiation schedule (200 cGy/fraction, one fraction/day, 5 days/week for 5 weeks). Irradiation of the axilla as well as supraclavicular area was given to patients who have extensive (>3 involved LNs) or extacapsular nodal infiltrations.

Patients were treated in the supine position, with the arm abducted (90 degrees or greater). Custom made breast tilt boards with armrests were used to maintain the patient's daily position with the slope of the chest wall parallel to the Table, often in combination with immobilization devices were used to reproduce daily positioning and minimize day-to-day set up errors.

Individual determinants of aesthetic satisfaction, including breast shape, symmetry of breast shape, breast size, symmetry of breast size, breast sensation, breast scarring and donor site scarring (if applicable), hyperpigmentation, flap contracture were evaluated by doctors, pre and postoperative photographs and patients' satisfaction with the 5-point Likert scale, in which "5" indicated the highest level of aesthetic satisfaction and "1" indicated the lowest level. The unpaired Students't test and analysis of variance were used to evaluate differences in patient satisfaction based on their demographics and background information. Statistical significance in all analyses was set at  $P < 0.05$ .

## RESULTS

Figures (4, 5, 6 and 7) Both groups were balanced as regard pathological type, tumor size and grade, axillary node involvement as well as type and number of cycles of chemotherapy given before irradiation. For patients who received chemotherapy, Radiotherapy was started after full recovery of bone marrow (average 3 weeks).

These patients had underwent 21 TRAM flaps and 32 latissimus dorsi flaps with implants. Age at the time of reconstruction did not differ between both groups (Group I was 47.3 years and Group II was 48.6 years;  $P > 0.05$ ).

The percentage of patients married at the time of reconstruction likewise did not differ between both groups (72.4% in group I and 73.2% in groupII;  $P > 0.05$ ).

When all TRAM recipients were compared with all latissimus flap with implant recipients, TRAM flap patients rated breast shape, symmetry of breast shape and symmetry of breast size significantly higher than did implant patients (Table 2). Breast size and breast sensation were also ranked higher, although they did not reach statistical significance. Breast scarring did not differ between both groups. The TRAM group also had clinically and statistically significant less hyperpigmentation and less flap contracture than the post Implant based latissimus dorsi group ( $p = 0.0001$ ,  $0.0001$ , respectively).

Local recurrence was observed In 1 patient in group 1 after 29 months of follow up and in 2 patients in group 2 after 26 and 38 months of follow up with no statistical difference between both groups. Those 3 patients who developed local recurrence (histopathologically confirmed) were excluded from the study at time of diagnosis of local recurrence.

**Table 1:** Patient's demographics.

	Group A		Group B	
Age	Mean 47.3		Mean (48.6)	
<b>Marital state</b>				
Married	15/21	71.42%	23/32	71.87 %
Not married	6/21	28.58%	9/32	28.13%
Type of reconstruction	TRAM 21/53	40%	Latismus Dorsi 32/53	60%
<b>Pathological type</b>				
IDC type		17 (81%)		28 (87.5%)
Lobular type		4 (19%)		4 (12.5%)
<b>Tumor size</b>				
≤2cm		3 (14.28%)		5 (15.62%)
≥2cm		18 (85.72%)		27 (84.38%)
<b>Grade</b>				
GI		2 (9.5%)		4 (12.5%)
GII		16 (90.5%)		23 (87.5%)
GIII		3 (14.28%)		5 (15.62%)
<b>LN</b>				
N0-1		1 (4.7%)		2 (6.2%)
N2		19 (90.6%)		28 (87.6%)
N3		1(4.7%)		2 (6.2%)

ASSESSMENT OF AESTHETIC OUTCOME AFTER RADIOTHERAPY

**Table 2:** Aesthetic Evaluation of TRAM versus Latissimus dorsi with implant reconstruction after radiotherapy.

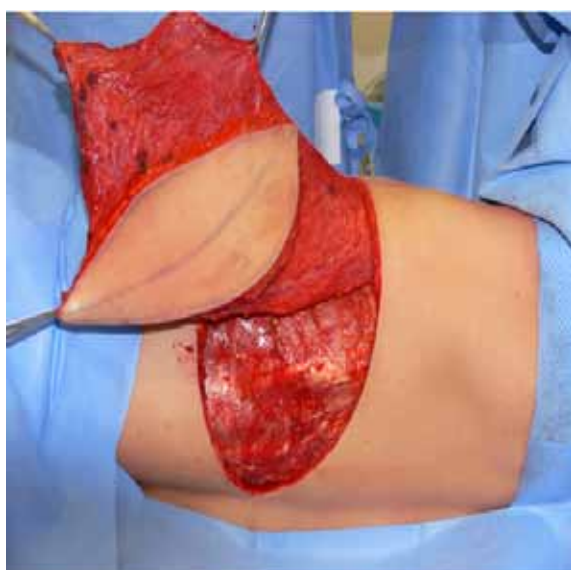
Aesthetic Parameter	TRAM	Latissimus with Implant	P Value
Breast shape	4.3	3.7	< 0.001
Symmetry of breast shape	4.1	3.6	0.004
Breast size	4.2	3.9	0.104
Symmetry of breast size	4.1	3.6	0.013
Breast scarring	3.9	3.9	0.451
Breast sensation	3.2	3.0	0.327
Hyperpigmentation	4.3	3.7	< 0.001
Flap contracture	4.3	3.7	< 0.0001



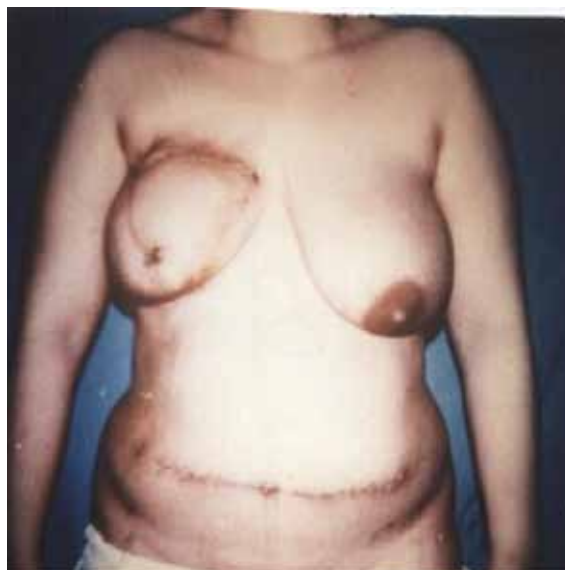
**Figure 1:** Tram Flap Elevation.



**Figure 3:** Latissimus is not bulky flap so radiotherapy effect is more.



**Figure 2:** TRAM flap is bulky, so radiotherapy effect is less.



**Figure 4:** TRAM flap after radiotherapy.



**Figure 5:** Post-radiation therapy after immediate reconstruction of the left breast by TRAM flap.



**Figure 6:** Post-radiation therapy after latissimus flap breast reconstruction.



**Figure 7:** Implant Based Latissimus Dorsi. Flap using a 360-cc silicone gel implant after radiotherapy.

## DISCUSSION

Patient satisfaction with reconstructive surgery is an important component of the healing process after breast cancer. Several studies have shown significantly higher patient satisfaction with autologous reconstruction<sup>9</sup>.

The TRAM flap has proven to be a reliable and safe method of autologous breast reconstruction. In fact, the TRAM flap is the method against which other methods of breast reconstruction are often compared. Reviews of extensive clinical experience with this form of breast reconstruction have been published elsewhere<sup>10</sup>.

Tissue/prosthetic reconstruction have several advantages in the setting of post reconstruction radiotherapy. Autogenous tissue flaps provide pliable, well vascularized soft tissue, which can facilitate both wound healing and the process of tissue expansion. So latissimus dorsi flap facilitates successful prosthetic reconstruction<sup>11</sup>.

As post mastectomy reconstruction has become more routine as an immediate procedure, thus more patients are having reconstruction first followed by radiation. Therefore, awareness about the long-term effects of radiation performed after flap reconstruction has become critical<sup>16</sup>.

Post reconstruction radiation has been linked to poor cosmetic outcome in several studies<sup>12</sup>. Tran et al.<sup>13</sup> found a significant increase in the amount of fat necrosis, skin hyperpigmentation and firmness in irradiated patients<sup>13</sup>. Some suggest that post reconstruction radiation is well tolerated and is not associated with an increased incidence of side effects and therefore can be given safely, with excellent cosmetic results<sup>14</sup>.

The goals of the current study were to evaluate the effect of post reconstruction radiotherapy on patient's satisfaction between TRAM and implant based Latissimus dorsi Flaps.

We reviewed our experience with patients who have undergone radiation therapy either after immediate TRAM flap breast reconstruction or Implant based latissimus dorsi flap. We were interested in particular in whether there were any ill effects, such as contracture, fibrosis, shrinkage, asymmetry, pigment changes, or overall poor cosmesis.



After ensuring similarity among the various subgroups in terms of age, smoking history and weight, we were able to make accurate conclusions without the influence of confounding variables. Our data suggest that post reconstruction radiation not increases the risk for most previously commonly reported serious flap or donor-site complications. This is similar to another previously published report<sup>15</sup>.

Radiation of Implant based latissimus dorsi; however, had a deleterious effect on overall aesthetic outcome, symmetry, contracture and hyper pigmentation. This finding agrees with previously published studies showing greater satisfaction with the TRAM technique when compared with implant reconstruction<sup>16</sup>.

The goal of any breast reconstruction is to recreate a breast that is soft, symmetrical and of texture and color similar to the natural breast. In our series, we objectively rated the quality of the reconstruction in those patients who received radiation after two type of breast reconstruction. Intuitively, one would expect overall results to be better in those patients who received radiation after TRAM flap. The results would be especially better when comparing the TRAM group with Implant based Latissimus dorsi flap group. This was certainly the case, as witnessed by the overall better scoring in the TRAM group and a higher statistical power when compared with the radiation post Implant based Latissimus dorsi flap group. In fact, as presented in Table (1), the TRAM group fared significantly better in terms of overall aesthetic appearance, symmetry, hyper pigmentation and contracture than the Implant based latissimus dorsi flap group. Overall, these findings have affected the type of reconstruction at our institution. We now prefer to postpone Implant based Latissimus dorsi flap breast reconstruction in those patients known or likely to receive post reconstruction radiation. Immediate postoperative radiation is still considered in those expected to have TRAM flap reconstruction.

The question that arises is what to do in the situation in which it is not known for sure whether the patient is to receive postoperative radiation. In these situations, when there is a high level of suspicion that postoperative radiation will be recommended on the basis of clinical examination, we prefer TRAM reconstruction but if this flap is not available (previous scarified) then we must wait until the pathologic data in terms of tumor size and axillary node positivity are known. Only then will the need for postoperative radiation be ascertained and

future breast reconstruction planned. If postoperative radiation is not in the plan, then “delayed” immediate breast reconstruction with implant based latissimus dorsi flap can be performed within few days.

Therefore, when one faces the circumstances under which immediate reconstruction is followed by radiation therapy, an appropriate operation for those patients should be designed. This could be accomplished by using more flap tissue than usual (anticipating post radiation shrinkage)<sup>17</sup>

Finally, the method of grading satisfaction may be criticized. We used the 5-point Likert scale but did not specify objective criteria by which the patients should grade their results. Nonetheless, Lowery et al.<sup>18</sup> examined satisfaction after breast reconstruction and found that such scales achieve the best interpreter reliability<sup>16</sup>. Although various methods of grading, such as 4-point scales, visual analogue scales, linear manual measurements of patient photographs and computer analysis of linear and volumetric measurements, have been used in other studies, none have shown convincing superiority over the method used in the current study.

## CONCLUSION

---

We concluded that aesthetic outcome and patient satisfaction after radiotherapy for the reconstructed breast is highly influenced by the type of reconstructive procedure which was better by using TRAM flap procedure than using Implant based latissimus dorsi flap procedure.

## REFERENCES

---

1. Andrade WN, Baxter N, Semple JL. Clinical determinants of patient satisfaction with breast reconstruction. *Plast.Reconstr.Surg.* 2001 Jan;107(1):46-54.
2. Hartrampf CR, Scheffan M, Black PW. Breast reconstruction with a transverse abdominal island flap. *Plast.Reconstr.Surg.* 1982 Feb;69(2):216-25.
3. Kraemer O, Andersen M, Siim E. Breast reconstruction and tissue expansion in irradiated versus not irradiated women after mastectomy. *Scand.J.Plast.Reconstr. Surg.Hand Surg.* 1996 Sep;30(3):201-6.
4. Clarke M, Collins R, Darby S, Davies C, Elphinstone P, Evans E, et al. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and 15-year survival: An overview of the randomised trials. *Lancet* 2005 Dec 17;366(9503):2087-106.

5. Huang EH, Tucker SL, Strom EA, McNeese MD, Kuerer HM, Buzdar AU, et al. Postmastectomy radiation improves local-regional control and survival for selected patients with locally advanced breast cancer treated with neoadjuvant chemotherapy and mastectomy. *J.Clin.Oncol.* 2004;22(23):4639-47.
6. Hanks SH, Lyons JA, Crowe J, Lucas A, Yetman RJ. The acute effects of postoperative radiation therapy on the transverse rectus abdominis myocutaneous flap used in immediate breast reconstruction. *Int.J.Radiat. Oncol.Biol.Phys.* 2000 Jul 15;47(5):1185-90.
7. Recht A, Edge SB, Solin LJ, Robinson DS, Estabrook A, Fine RE, et al. Postmastectomy radiotherapy: Clinical practice guidelines of the American Society of Clinical Oncology. *J.Clin.Oncol.* 2001 Mar 1;19(5):1539-69.
8. Wellisch DK, Schain WS, Noone RB, Little JW,3rd. Psychosocial correlates of immediate versus delayed reconstruction of the breast. *Plast.Reconstr.Surg.* 1985 Nov;76(5):713-8.
9. Cederna PS, Yates WR, Chang P, Cram AE, Ricciardelli EJ. Postmastectomy reconstruction: Comparative analysis of the psychosocial, functional and cosmetic effects of transverse rectus abdominis musculocutaneous flap versus breast implant reconstruction. *Ann.Plast. Surg.* 1995 Nov;35(5):458-68.
10. Paige KT, Bostwick J,3rd, Bried JT, Jones G. A comparison of morbidity from bilateral, unipedicled and unilateral, unipedicled TRAM flap breast reconstructions. *Plast.Reconstr.Surg.* 1998 Jun;101(7):1819-27.
11. Germann G, Steinau HU. Breast reconstruction with the extended latissimus dorsi flap. *Plast.Reconstr. Surg.* 1996 Mar;97(3):519-26.
12. Kroll SS, Coffey JA,Jr, Winn RJ, Schusterman MA. A comparison of factors affecting aesthetic outcomes of TRAM flap breast reconstructions. *Plast.Reconstr. Surg.* 1995 Sep;96(4):860-4.
13. Tran NV, Evans GR, Kroll SS, Baldwin BJ, Miller MJ, Reece GP, et al. Postoperative adjuvant irradiation: Effects on tranverse rectus abdominis muscle flap breast reconstruction. *Plast.Reconstr.Surg.* 2000 Aug;106(2):313-7; discussion 318-20.
14. Proulx GM, Loree T, Edge S, Hurd T, Stomper P. Outcome with postmastectomy radiation with transverse rectus abdominis musculocutaneous flap breast reconstruction. *Am.Surg.* 2002 May;68(5):410-3.
15. Williams JK, Carlson GW, Bostwick J,3rd, Bried JT, Mackay G. The effects of radiation treatment after TRAM flap breast reconstruction. *Plast.Reconstr.Surg.* 1997 Oct;100(5):1153-60.
16. Brandberg Y, Malm M, Blomqvist L. A prospective and randomized study, "SVEA," comparing effects of three methods for delayed breast reconstruction on quality of life, patient-defined problem areas of life and cosmetic result. *Plast.Reconstr.Surg.* 2000 Jan;105(1):66-74; discussion 75-6.
17. Spear SL, Boehmler JH, Taylor NS, Prada C. The role of the latissimus dorsi flap in reconstruction of the irradiated breast. *Plast.Reconstr.Surg.* 2007;119(1):1-9.
18. Lowery JC, Wilkins EG, Kuzon WM, Davis JA. Evaluations of aesthetic results in breast reconstruction: An analysis of reliability. *Ann.Plast. Surg.* 1996 Jun;36(6):601-6; discussion 607.