

# OUTCOMES OF BREAST RECONSTRUCTION WITH PEDICLED TRANSVERSE RECTUS ABDOMINIS MYOCUTANEOUS (TRAM) FLAP AT CANCER INSTITUTE, A RETROSPECTIVE STUDY OF 10 YEARS OF EXPERIENCE

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**Abstract-** Reconstruction of breast with transverse rectus abdominis myocutaneous (TRAM) flap is the standard for reconstruction of breast following mastectomy. In this article, authors report their experience with pedicled TRAM flap reconstruction of the breast. Records for the patients who had undergone breast reconstruction with pedicled TRAM flap were retrieved. Records of outpatient follow-ups were also obtained. Patient satisfaction with the outcome of surgery was assessed using a detailed questionnaire including a linear visual analogue scale ranging from zero (not satisfied) to ten (most satisfied). There were 61 reconstructions in 59 patients. In 42 (71.2%) cases a synthetic mesh and in 14 (23.7%) cases dermal graft was used for closure of the abdominal fascial defect. The mean hospital stay was 10.67 (1 - 72) days. Patients were followed up for a mean period of 621 days. The overall rates of complications were as follows: partial flap necrosis: 11 (18.6%), flap hematoma: 2 (3.4%), flap seroma: 7 (11.9%), flap wound infection: 7 (11.9%), abdominal wound hematoma: 9 (15.3%), abdominal wound seroma: 5 (8.5%), abdominal wound ischemia: 1 (1.7%), abdominal wound incisional hernia: 6 (10.2%), deep vein thrombosis: 1 (1.7%), complication requiring rehospitalization: 9 (15.3%), complication requiring reoperation: 8 (13.6%). There were no abdominal wound infection, no umbilical necrosis, and no pulmonary embolism. Aesthetic results were classified as excellent (62%), good (28%), fair (10%). The mean satisfaction score was 9.5 (range 6-10). Breast reconstruction with pedicled transverse rectus abdominis myocutaneous flap was associated with a low complication rate and a high level of patient satisfaction in our center.

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## INTRODUCTION

Since the original description by Hartrampf *et al.* (1) in 1982, the transverse rectus abdominis myocutaneous (TRAM) flap breast reconstruction has become the method of choice that provides

enough tissue of similar consistency to match the opposite breast. Its advantages include better cosmetic results when compared with reconstruction using prosthetic implants. Moreover, it avoids in most cases a contralateral reduction mammoplasty to achieve symmetry and the requirement of implants in more than 90 percent of patients (2, 3). Its indications are not limited to breast reconstruction, and the TRAM flap can be used for local or distant soft-tissue coverage (4).

Numerous modifications have been made in an attempt to improve flap reliability further in high-risk patients. Although general principles are unchanged, the various modifications have all been in flap design and tissue perfusion. Such innovations include the free TRAM flap, bipedicle TRAM flap, "recharged" TRAM flap, "supercharged" TRAM flap, and surgical delay (5-9).

In this study, authors report their experience in performing breast reconstruction with pedicled TRAM flap in a retrospective fashion. The focus of this report is on the safety of this procedure and the complication rates.

## MATERIALS AND METHODS

Records for the patients who had underwent breast reconstruction with pedicled TRAM flap between April 1996 and January 2007 in Imam Medical Complex - Cancer Institute were retrieved. Records of outpatient follow-ups were also obtained. Patients' data were recorded in standardized data forms.

Data concerning medical conditions (diabetes, hypertension, hypercholesterolemia, history of corticosteroid use, and cigarette smoking), previous abdominal surgeries, cancer treatment (radiotherapy and chemotherapy), reconstruction (bilateral or unilateral reconstruction, ipsilateral or contralateral flap, flap pedicle, method of abdominal defect reinforcement, reconstruction of nipple-areola complex, and number of drains), hospital stay, follow-up duration, and post-operative complications (flap necrosis, flap ischemia, flap hematoma, flap seroma, flap wound infection, abdominal wound hematoma, abdominal wound seroma, abdominal wound infection, abdominal wound ischemia,

umbilical necrosis, abdominal wound incisional hernia, deep vein thrombosis, pulmonary embolism, complication requiring rehospitalization, and complication requiring reoperation) were obtained and recorded. Aesthetic evaluations were done by another surgeon visiting the invited patients in the outpatient clinic. The patients satisfaction were assessed using a detailed questionnaire including a linear visual analogue scale ranging from 0 (not satisfied ) to 10 (most satisfied). Patients were asked five questions about their satisfaction with the procedure, the possible recognized complications and whether they would recommend this procedure to other patients with similar breast cancer conditions (Fig. 1).

All data were entered into a dedicated data base (Microsoft Access 2000) and were analyzed using SPSS 11.5 for Windows. For comparing categorical data, chi-squared or Fisher's exact test were used, and for hypothesis testing concerning continuous data, *t* test for independent groups was applied.

PATIENTS SATISFACTION ASSESSMENT QUESTIONNAIRE

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Breast Reconstruction With Pedicled TRAM Flap

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1. Are you satisfied with the results of the operation ? please circle a number  
(not satisfied) 0 1 2 3 4 5 6 7 8 9 10 (very satisfied)
2. Did you had any problem with your operation?  
Yes  No   
If yes, did you require surgery to correct it? Yes  No
3. Did you had any delay in further treatment because of having breast reconstruction surgery? Yes  No
4. Did you have nipple reconstruction? Yes  No   
If not, please state the reason:
5. Would you recommend this procedure to another patient?  
Yes  No

**Fig 1.** The Questionnaire

## RESULTS

59 records could be retrieved for the study period. All patients had undergone reconstruction using pedicled flap. The mean age was 40.51 (24-56) years. The mean weight was 68.36 (50 - 98) kg. The height was not recorded, so we could not calculate body mass index and body surface area. All reconstructions were done following mastectomy owing to breast cancer, except for one reconstruction that was carried out after mastectomy because of a giant benign phyllodes tumor. Table 1 summarizes the prevalence of various medical conditions known to be influential on wound healing and vascular health.

In a considerable proportion of the patients (23.7%), a scar was found over the TRAM flap skin. No patient had undergone liposuction prior to surgery. In 31 patients (52.54%) the right breast and in 26 patients (44.06%) the left breast was involved. Two patients underwent bilateral reconstruction.

Immediate reconstruction following mastectomy was done for 17 patients (28.8%). In the remaining patients, the mean mastectomy-reconstruction interval was 37.05 (1-120) months. Table 2 summarizes reconstruction data. Thirty patients (50.8%) had undergone adjuvant radiotherapy and 45 patients (76.3%) had received adjuvant chemotherapy prior to reconstruction.

The mean hospital stay was 10.67 (1 - 72) days. The mean period of follow up was 621 days (from no follow up to 3588 days).

**Table 1.** Prevalence of medical conditions/risk factors among patients.

Medical conditions/risk factors	Frequency
Hypertension	5 (8.5%)
Diabetes Mellitus	2 (3.4%)
Hypercholesterolemia	2 (3.4%)
Steroid Therapy	1 (1.7%)
Cigarette Smoking	6 (10.2%)
Presence of abdominal Scar	22 (37.3%)
Abdominal Scar Site	
Upper Midline	1 (1.7%)
McBurney	2 (3.4%)
Pfannenstiel	12 (20.3%)
Scar In Flap	14 (23.7%)

**Table 2.** Reconstruction data.

Reconstruction data	Frequency
Bilateral Reconstruction	2 (3.4%)
Flap Laterality <sup>1</sup>	
Ipsilateral	36 (59%)
Contralateral	19 (32.2%)
Reconstruction of NAC <sup>2</sup>	12 (20.3%)
TRAM <sup>3</sup> – NAC <sup>2</sup> interval	232 days (9 - 730)
Application of mesh for reinforcement of abdominal wall	42 (71.2%)
Mesh Type	
Prolene	18 (30.5%)
Mersilen	19 (32.2%)
Other	7 (11.9%)
Application of Dermal Graft for Reinforcement of Abdominal Wall	14 (23.7%)

1. In 6 patients, flap laterality was not recorded.

2. Nipple-Areola Complex

3. Transverse Rectus Abdominis Myocutaneous

In Table 3, post-operative complications anytime during hospitalization or later follow-ups, early or late post-operative period are demonstrated.

A third of the flaps were contralateral. In Table 4, rates of flap complications are depicted in contralateral and ipsilateral flaps. Nearly all flap complications were observed more frequently in contralateral flaps.

**Table 3.** Complications after reconstruction.

Complication	Frequency
Any Degree of Flap Necrosis	11 (18.6%)
Flap Necrosis more than 25%	0
Flap Hematoma	2 (3.4%)
Flap Seroma	7 (11.9%)
Flap Wound Infection	7 (11.9%)
Abdominal Wound Hematoma	9 (15.3%)
Abdominal Wound Seroma	5 (8.5%)
Abdominal Wound Infection	0
Abdominal Wound Ischemia	1 (1.7%)
Umbilical Necrosis	0
Abdominal Wound Incisional Hernia	6 (10.2%)
Deep Vein Thrombosis	1 (1.7%)
Pulmonary Embolism	0
Complication requiring rehospitalization	9 (15.3%)
Complication Requiring Reoperation	8 (13.6%)



**Table 4.** Complications after reconstruction based on flap laterality.

Complication	Flap laterality		P
	Ipsilateral	Contralateral	
Partial flap Necrosis	3 (8.8%)	4 (21.1%)	0.003
Flap Hematoma	0	2 (10.5%)	0.113
Flap Seroma	1 (2.9%)	5 (26.3%)	0.038
Flap Wound Infection	1 (2.9%)	4 (21.1%)	0.034
Hospital Stay (days)	9.42	12.17	0.372

To evaluate the effect of experience on complication rates and hospital stay, patients were categorized on whether they underwent reconstruction before 2001 or in 2001 and after 2001. There were 38 (64.4%) patients in the first group (before 2001) and 21 (35.6%) patients in the second group. Table 5 summarizes the complication rates and hospital stay based on this categorization. Except for flap Hematoma, all complication rates in flap showed a trend towards lesser figures in the second group. Also, abdominal wound complications rates also showed an overall decrease but the rate of incisional hernia increased. The mean hospital stay nearly halved. Necessity of rehospitalization and reoperation was somewhat lower in the second group.

We had invited the patients to our outpatient clinic for evaluation of aesthetic result and assessment of their satisfaction. Two of them were died from systemic metastases and seven were missed to follow up. In the remaining patients,

aesthetic results were described as excellent ( 62%), good ( 28%), fair ( 10%) and poor (0%). Fifty patients completed the questionnaire. The mean satisfaction score was 9.5 (range 6-10). All of the respondents would recommend the procedure to other patients.

## DISCUSSION

Transverse rectus abdominis myocutaneous (TRAM) flap reconstruction is the standard in autologous breast reconstruction (10), and a variety of pedicled and free flap options exist that are derived from the abdominal donor site. TRAM flap reconstruction is widely used and is shown to be an effective and reliable option (11, 12).

In this report, the outcomes of approximately 60 breast reconstructions with pedicled TRAM flap were presented. Overall, our data indicates that at our center the procedure is safe and without excessive rates of major complications.

**Table 5.** Complications after reconstruction based on the category of surgery year.

Complication	Category		P
	Before 2001	2001 and after 2001	
Partial Flap Necrosis	10 (26.3%)	1 (4.8%)	0.04
Flap Hematoma	1 (2.6%)	1 (4.8%)	0.589
Flap Seroma	5 (13.2%)	2 (9.5%)	0.516
Flap Wound Infection	6 (15.8%)	1 (4.8%)	0.207
Abdominal Wound Hematoma	6 (15.8%)	3 (14.3%)	0.598
Abdominal Wound Seroma	5 (13.2%)	0	0.08
Abdominal Wound Ischemia	1 (2.6%)	0	0.346
Abdominal Wound Incisional Hernia	3 (7.9%)	3 (14.3%)	0.361
Deep Vein Thrombosis	1 (2.6%)	0	0.644
Hospital Stay (days)	13.35	6.33	0.011
Complication Requiring Rehospitalization	6 (15.8%)	3 (14.3%)	0.598
Complication Requiring Reoperation	6 (15.8%)	2 (9.5%)	0.403

## Outcome of breast reconstruction

After the first 5-year period, the outcome tended to show some degree of improvement, and the post-operative hospital stay was cut by half.

Partial flap necrosis rates and some aesthetic concerns influenced surgeons in selecting free TRAM flap breast reconstruction as an alternative, despite the increased resource use it requires (13-17). Also with free TRAM flap breast reconstruction, there is a risk of complete flap loss secondary to vascular anastomotic thrombosis of 0 to 8 percent, with this risk being higher early in the learning curve (13-17).

Despite successful results of free TRAM flaps, the pedicled TRAM flap remains a popular choice for patients requesting breast reconstruction (18), and although microsurgical procedures were and being performed at our center, no free TRAM flap breast reconstruction has been carried out so far.

A third of the TRAM flaps were contralateral in our patients. Flap complications were more prevalent in contralateral flaps. The literature indicates that the contralateral procedure is the procedure of choice in most institutions that use pedicled TRAM flaps (7,19, 20).

The original description of the procedure was that of an ipsilaterally based pedicle procedure. Concerns about potential folding of the pedicle with possible compromise of the vascular supply and the possibility of radiation vasculitis in ipsilateral flap led many surgeons to prefer the contralateral pedicle.

Partial flap necrosis rates in pedicled TRAM series range from 5 to 44 percent (21).

Simplicity and versatility of flap shaping, give ipsilateral TRAM flaps further advantages.

In a report by Clugson et al, the opinion of the authors was that ipsilateral pedicled TRAM flap breast reconstruction would overcome many of the disadvantages of pedicled contralateral TRAM flaps; the lack of pedicle tension in ipsilateral reconstructions allows greater flexibility in flap positioning and possibly results in less pedicle tension and decreased venous congestion and subsequent flap ischemia. It also eliminates the need for extensive pedicle dissection at the level of the costal margin or the need to remove rib cartilage to sufficiently decrease pedicle tension to allow for easy flap transposition into the mastectomy defect,

as has been reported with contralateral flaps. Together with less need for pedicle dissection, simplified mound shaping in the ipsilateral procedure results in shorter operative times. Also, improved maintenance of the inframammary fold, and lack of disruption of the natural xiphoid hollow leads to better cosmetic results (21).

The main disadvantage when the transverse rectus abdominis musculocutaneous (TRAM) flap is used for breast reconstruction is the potential for weakening of the abdominal wall (22). When primary closure of the abdominal fascial defect is not possible, or is possible only with undue tension, synthetic materials have commonly been used; Gore-Tex (23), mesh (24) and Dermis (25) have been used to patch wide donor site defects.

To find an alternative to synthetic mesh closure of abdominal fascial defects after transverse rectus abdominis musculocutaneous (TRAM) flap harvest, dermal autografts were removed from tissue to be discarded and used for fascial closure (25). But in spite of these measures, complaints of abdominal weakness, difficulties in rising from a supine position, true hernias, and bulging (stretching of the abdominal fascia in the donor-site or in the contralateral side without true herniation) are encountered in up to 40 percent of reconstructions (26).

The incidence of true incisional hernia is low in most reports. In a study conducted by Kross and colleagues, the incidence of abdominal bulges was 3.8 percent and true hernia was 2.6 percent subsequent to either free or pedicled TRAM flap (27). Mascona et al (28) reported no true incisional hernia after reinforcement of the donor site with synthetic mesh. In our study, the incidence of incisional hernia was much higher. In fact most of these 'hernias' were abdominal bulging and were misclassified as a true hernia. At the time of herniorraphy we had found two true hernia and four others had undergone only plication of their synthetic mesh.

In conclusion, our experience indicates that breast reconstruction with pedicled TRAM flap is a reasonably safe procedure at our center. A more complete evaluation with a higher number of patients should be considered.

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## Conflict of interests

The authors declare that they have no competing interests.

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