



# A New Concept of Interval TRAM for Immediate Breast Reconstruction in Obese Women

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## Abstract

Performing pedicled TRAM in obese women carries risk of flap loss or native breast envelop necrosis. Our technique depends on performing total flap delay at the same setting with mastectomy with flap suture in situ to be followed 1 week later by flap transfer. This study included 24 operable women who were candidates for skin sparing or modified radical mastectomy. In one case, delay was only done and followed by mastectomy and flap transfer. In later experience, delay plus mastectomy was done first and followed later by flap transfer. Operative data and postoperative complications were recorded. The mean BMI was  $37 \pm 2.75$ . The mean total operative time was  $200 \pm 20.37$ . The mean total hospital stay was  $9.1 \pm 3.35$  days. The mean total volume of blood loss was  $380 \pm 82.33$  ml. Breast envelop necrosis was encountered in four cases; three of them were replaced by the TRAM skin. There was no total flap loss while partial loss was recorded in five cases. Fat necrosis occurred in eight cases. Most of mastectomy bed and abdominal complications were in average. Most of cases showed satisfactory esthetic outcome. Our new concept of “Interval TRAM” enables safe immediate breast reconstruction with pedicled TRAM in obese women and ensures presence of a skin pack up for the native breast envelop skin. We recommend this technique in every obese female who undergoes skin sparing mastectomy with immediate pedicled TRAM flap reconstruction.

**Keywords** Mastectomy · Reconstruction · TRAM flap · Interval · Obese

## Introduction

Transverse rectus abdominis musculocutaneous flap (TRAM flap) is considered one of the most valuable flaps for immediate breast reconstruction [1]. It was the flap of choice by most of breast surgeons [2, 3]. Owing to the problem of postoperative abdominal wall weakness, the deep inferior epigastric perforator free flap (DIEP) and other perforator flaps which spare the rectus muscle were introduced, but a debate is still present about their superiority over the muscle sparing pedicled TRAM flap and the free TRAM flap [4]. Since the introduction of immediate breast

reconstruction with TRAM flap by Hartrampf in 1982 [5], some difficulties were encountered with this flap. The most important difficulty was the vascular inadequacy especially in obese women with relatively larger flap volume with less flap perfusion [6, 7] and smokers [8, 9]. This vascular inadequacy may result in partial or total flap loss in approximately 15% of patients or increase the incidence of fat necrosis [10, 11]. Many attempts were made to overcome the problem of vascular inadequacy in smokers and obese patients; one of them was the supercharging of flap with anastomosis of the inferior epigastric vessels to the thoracodorsal system [12], the other trend was to use free TRAM which is technically demanding, time-consuming, requires a special surgical expertise, and still harboring a risk of flap loss [1]. Another problem that may lead to flap loss is the problem of venous congestion. It is due to the fact that the main flap venous drainage is directed towards the inferior epigastric vein; the ligation of which may result in a state of temporary venous stasis [13]. This lasts for several hours until the choke vessels become accustomed to the new direction of venous return towards the superior epigastric

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vein. Many methods aimed to reduce this problem but the best one was the vascular delay which entails ligation of the inferior epigastric vessels at least 1 week before the flap transfer. This leads to both superior epigastric artery dilatation and venous augmentation as well [14, 15]. A third important problem was the breast skin envelope loss which results in a very terrifying cosmetic problem especially when the flap is de-epithelialized. This raised the attention to preserve the TRAM skin as a salvage for the envelop skin. The first thinking to solve this problem was to “Bank” the TRAM skin [16, 17]. Dunya Atisha and her coworkers introduced the concept of interval inset of TRAM flap by elevation of flap without skin de-epithelialization to be buried underneath the mastectomy flaps then after 4 days, the mastectomy envelope skin was revised. There was mastectomy envelope necrosis in 27% of cases that was replaced by the TRAM flap skin [18]. In the current study, we introduced a new concept of interval TRAM flap inset in risky obese women with BMI above 35 by performing skin sparing mastectomy with total vascular and skin delay in the same setting to be followed 1 week later by flap transfer into the mastectomy bed with evaluation of the flap success, complications, and incidence of envelop necrosis that required replacement by the TRAM flap skin.

## Patients and Methods

Twenty-four operable biopsied cases with breast carcinoma who were candidates for either modified radical mastectomy or skin sparing mastectomy were enrolled into this study in the period from January 2014 to January 2016. All patients were consented with a written consent after explanation of the procedure and approval by the local institutional ethical committee. Patients with poorly controlled diabetes, chronic prolonged steroid therapy, those with autoimmune disease, disabling cardiac or pulmonary disease, smokers, those with prior irradiation, inoperable, and metastatic disease were excluded from the study.

## Technique

In the early experience, total vascular and skin delay of TRAM flap was done with suturing of the flap in situ and the patient was discharged after 2 days of hospital stay. After 1 week, the patient was admitted for skin sparing mastectomy with flap transfer into the mastectomy bed after de-epithelialization of the flap skin (Fig. 1). After 5 days, a native breast skin envelope necrosis occurred and this was treated by debridement with resultant skin deficiency (Fig. 1). In the later



**Fig. 1** An early experience. **a** Complete vascular and skin delay. **b** Resutured flap in situ with evident area IV loss; **c** 4 days later, a photo after the second stage which included mastectomy with transfer of the delayed

flap with evident envelope skin necrosis which was debrided later. **d** One year postoperative view

**Fig. 2** A case with pathologically proven left breast cancer (a) (with duplex perforator localization “arrow”) to whom an interval technique was done; the first operation included complete vascular and skin delay together with skin sparing mastectomy at the same setting with leaving an empty mastectomy envelope (arrow) with the suturing of the flap in situ (b). This was followed 1 week later by transfer of the delayed flap (c). d 2 months postoperative photo



23 cases, mastectomy was carried out with total vascular and skin delay of TRAM flap in the same setting with suturing of the flap in situ. Patients were kept at hospital for dressing and antibiotic care; then, they were readmitted to the theater after 7 days for flap transfer into the mastectomy bed with abdominal defect closure using a proline mesh in all cases. Vascular delay was done by identification and ligation of the inferior epigastric vessels at the lower lateral border of the rectus abdominis muscle of the selected flap side. The skin delay entailed flap elevation off the anterior rectus sheath with division of all lateral skin attachments and muscle perforators of the contrary side to the pedicle (Figs. 1 and 2). Operative data were recorded as regards patients' demographics (Table 1), the operative details including operative time, hospital stay, mean blood loss, breast envelope necrosis, and replacement of the envelope skin by TRAM flap skin either due to envelope necrosis or due to oncologic means, total or partial flap loss, fat necrosis, mesh placement, mastectomy bed, and abdominal wound complications (Table 2). The esthetic outcome was assessed using a combination between a subjective score from 0 to 10 about patients' satisfaction and an objective score that was assessed by a non-specialized general surgeon depending

on a mix between 2 scores that were described by Garbay et al. [19] and Calabrese et al. [20] yielding a 10-point score that is based on the volume, shape, symmetry, scar cosmeses, NAC definition, and position (Table 3).

## Results

Table 1 shows patients' demographics. The mean age was  $47.6 \pm 3.45$  years while the mean BMI was  $37 \pm 2.75$ . Four patients were diabetics (all were less than 5 years and were on oral hypoglycemic treatment), five women were hypertensive, and one patient was treated for coronary heart disease. The mean tumor size was  $3.4 \pm 3.35$  cm. Table 2 shows the operative outcome. The mean total operative time was  $200 \pm 20.37$ . The mean total hospital stay was  $9.1 \pm 3.35$  days. The mean total volume of blood loss was  $380 \pm 82.33$  ml. Breast envelope necrosis was encountered in four cases; three of them were replaced from the TRAM flap skin without contour compromise while the fourth case was just debrided and went smoothly without replacement. In three cases, there was replacement of the native skin due to either excision within the safety margin or due to actual positivity for the tumor cells. No total flap loss was encountered in this study. Partial flap loss requiring operative readmission occurred in two cases and in both, the flap was salvaged. Partial flap loss not requiring operative readmission occurred in three cases and it was managed by simple debridement in an outpatient basis. Fat necrosis occurred in eight cases, in most of them it passed without further interference apart from radiologic follow-up. Mastectomy bed, abdominal wound, and systemic complications are shown in Table 2 and all were not accompanied with any mortalities. By combining both subjective and objective esthetic scores, 2 cases showed an excellent score, 15 cases expressed good outcome, 5 cases expressed fair, and 2 cases scored poor outcome (Tables 3 and 4).

**Table 1** Patient demographic and clinical data (total = 24 cases)

	Mean	Range
Age (years)	$47.6 \pm 3.45$	33–62
Mean BMI ( $\text{kg}/\text{m}^2$ )	$37 \pm 2.75$	35–44
Breast volumes ( $\text{cm}^3$ )	$750 \pm 30.6$	700–850
Maximum tumor size	$3.4 \pm 0.85$	2.5–4.5
Positive axillary nodes	$3 \pm 0.75$	0–9
	Number	Percentage
Diabetes	4	(16.7%)
Hypertension	5	(20.8%)
Ischemic heart disease	1	(4.2%)

**Table 2** Operative outcome

	Mean	Range
Total operative time (m)	200 ± 20.37	180–240
Total hospital stay (days)	9.1 ± 3.35	8–14
Mean total blood loss (ml)	380 ± 82.33	190–450
Blood transfusion in units of packed RBC	1 ± 0.25	0–3
	Number	Percentage
Breast envelope necrosis	4	(16.7%)
Required replacement by the TRAM skin	3	(12.5%)
Not requiring TRAM skin replacement	1	(4.2%)
Breast envelop replacement by the TRAM skin for oncologic reasons*	3	(12.5%)
Flap loss		
Total flap loss	0	0
Partial flap loss requiring operative readmission	2	(8.3%)
Partial flap loss not requiring operative readmission	3	(12.5%)
Fat necrosis	8	(33.3%)
Minimal and not requiring excision	7	(29.2%)
Requiring excision	1	(4.2%)
Mesh placement	24	(100%)
Mastectomy bed complications		
Seroma	3	(12.5%)
Hematoma	4	(16.7%)
Sepsis	3	(12.5%)
Wound gaping	2	(8.3%)
Abdominal wound complications		
Seroma	2	(8.3%)
Hematoma	1	(4.2%)
Sepsis	2	(8.3%)
Bulge	4	(16.7%)
Hernia	0	0
Umbilical necrosis (treated by excision)	1	(4.2%)
Systemic complications		
Chest infection	2	(8.3%)
DVT	0	0

\*For being a part of safety margin, being close to the tumor or being infiltrated

**Table 4** Esthetic outcome

Excellent (9–10)	2
Good (7–8)	15
Fair (4–6)	5
Poor (0–3)	2

### Discussion

Obesity is an obstacle that faces all surgeons who prefer doing pedicled TRAM flap for breast reconstruction because of the potential risk of flap loss owing to disparity between fat volume and the vascular caliber in obese women. In an interesting study by MD Anderson cancer center in 1989, 82 women undergoing pedicled TRAM for breast reconstruction, patients were divided into 4 groups according to their BMI and a significant increase in the rate of complications was noticed with increase in the body mass index [21]. In a study by Kroll and his coworker, the complication rate in the obese group was 41.7% versus 15.4 in the average weight group [21]. This was supported by many other studies even those investigating free TRAM [7]. Vascular delay was advised to decrease the ischemic complications from about 18 to 7% [15]. Since the acute flap complications are not limited to the risky group but they are more or less “unpredictable,” Hartrampf and many other surgeons recommended a some sort of surgical delay as a routine in every unipedicled TRAM [15]. In a study that included 15 patients, Restifo and his coworkers found a significant augmentation of the superior epigastric vessels on Doppler assessment after achievement of delay procedure [22]. Codner showed that the arterial pressure raises and the venous congestion is lowered significantly after the vascular delay [14]. In Alderman’s series that included 76 risky patients (obese, smokers, irradiated and combined) who underwent unipedicled TRAM following a vascular delay, there was a 6.6% partial flap loss [11]. In a study by Atisha et al. in 2009, there was a 6.6% incidence of ischemic complications among cases of unipedicled TRAM flap who underwent some sort of delay versus 17.6% incidence of ischemic complications in those without delay with a significant decrease of the odds of flap ischemia by this technique to nearly one fifth [15]. There is a controversy about the interval from delay until flap transfer but the least reported interval was 1 week [23]. It was found that total delay (which includes vascular delay with ligation of the superficial and deep inferior epigastric vessels together with skin delay which is carried out by elevating the bulk of the flap off

**Table 3** Our used breast esthetic scale (combined from both Garbaya a Calabrese scales)

	0	1	2
1-shape	Poor	Moderate	Satisfactory
2-volume	Inadequate	Mod. adequate	Adequate
3-symmetry	Markedly asymmetric	Moderately asymmetric.	Symmetric
4-scar cosmoses	Disfiguring	Little disfigurement	Satisfactory
5-NAC definition and position	Markedly displaced	Mod. displaced	Well placed

the abdominal fascia with division of lateral skin and muscular perforators of the contralateral side) is superior to a single type of delay especially among the risky group of patients [24]. Another problem that faces surgeons while doing a skin sparing mastectomy with TRAM flap reconstruction is the problem of native skin envelope necrosis after transfer of flap with de-epithelialization. To solve this problem, Atisha et al. introduced the term “Interval inset of TRAM flap” with burying of flap without de-epithelialization inside the pocket of mastectomy until being sure about integrity of the envelope then readmit patients for de-epithelialization of TRAM and definitive wound closure [18]. Our new concept of “Interval TRAM” in obese women depends on achievement of skin sparing mastectomy with total TRAM flap delay in one setting; this is not the new idea, the new was to re-suture the flap in situ after vascular delay to be left for 1 week in place to leave the pedicle in peace without any twist or further division of lateral perforators to give a chance for vascular augmentation and venous accommodation and to give a time for the surgeon to assess both the flap and native envelope skin. Then, after at least 1 week, the patient is readmitted for definitive flap transfer into the pocket after being sure about the breast envelope viability with de-epithelialization of the required part of the flap skin. In our first experience, we performed a delay procedure only that was followed 1 week later by mastectomy with flap transfer. In this early experience, the native breast envelope flap loss changed our attitude towards the recent trend of simultaneous delay and mastectomy at the first operation with a very satisfactory esthetic outcome and nearly safe procedure among this risky group of patients. The relatively high incidence of fat necrosis in this cohort of patients may be due to the relatively small number of cases that may be changed if more cases were entailed. One important drawback of this technique is the re-entrance to the operative theater and the related costs; however, this occurs in the same hospital stay and the total operative time is nearly equal to the single TRAM flap transfer and we can consider that it is the cost of flap saving in those groups of risky patients [25].

## Conclusion

Our new concept of “Interval TRAM” enables safe immediate breast reconstruction with pedicled TRAM in obese women and ensures presence of a skin pack up for the native breast envelope skin. We recommend this technique in every obese female who undergoes skin sparing mastectomy with immediate pedicled TRAM flap reconstruction.

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## Compliance with Ethical Standards

All patients were consented with a written consent after the explanation of the procedure and approval by the local institutional ethical committee.

**Conflict of Interest** The authors declare that they have no conflict of interest.

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