



Thoracoabdominal Flap: a Simple Flap for Covering Large Post-mastectomy Soft Tissue Defects in Locally Advanced Breast Cancer

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Abstract

Locally advanced breast cancer (LABC) constitutes 40–50% of breast cancer in developing countries. Large soft tissue defects after mastectomy often require some additional cover. The primary aim of reconstruction in this group should be an expeditious and simple closure with good-quality skin cover, early recovery, and short hospital stay so that the patients can receive early post-operative radio-chemotherapy. Thoracoabdominal (TA) flap is a type-c fasciocutaneous flap and the skin and fat of the upper abdomen are used, based on medial or lateral perforating vessels. We present our experience of TA flap cover for large post-mastectomy defects. A retrospective analysis of prospectively maintained breast cancer database in the Department of Surgical Oncology from January 1994 to December 2017 at All India Institute of Medical Sciences, New Delhi, was performed. The medical records of patients undergoing TA flap cover were analyzed to assess operative duration, blood loss, post-operative morbidity, hospital stay, adjuvant treatment, recurrence patterns, and survival outcome. A total of 3142 breast cancer patients underwent surgery, of which 1840 were LABC and 88 patients (4.13%) of LABC required flap cover for the closure of mastectomy defect. TA flap was used in majority of these patients 72/83 (86.7%) for cover. Majority was stage IIIB (54 out of 72) and we could achieve R0 resection in all patients. TA flap was done following MRM in 60 patients and RM in 12 patients. Upfront primary surgery was performed in 27 patients and 45 underwent surgery after neoadjuvant chemotherapy. Most commonly laterally based flaps were done, except 4 medially based flaps. The mean operating time was 30 min and blood loss was 45 ml. Mean hospital stay was 4.45 days. Superficial flap necrosis occurred in 6 and wound infection in 4 patients, all managed conservatively. Only 2 patients had major flap loss and required debridement and skin grafting. Planned post-operative radiation could be delivered in most of the patients in time. At a mean follow-up of 24 months, only 9 out of 72 (12.5%) patients had a loco-regional recurrence. Results of our experience show that TA flap is a simple, cost-effective procedure for managing large post-mastectomy soft tissue defects in LABC. It has huge potential in developing countries dealing with a large number of LABC because of simplicity and short learning curve.

Keywords Thoracoabdominal flap (TA flap) · Post-mastectomy defects · Locally advanced breast cancer

Introduction

Breast cancer is the most common cancer of women both in developed and developing countries and is the leading

cause of cancer deaths in women. In cancer-related deaths, breast cancer ranks fifth (522,000 deaths worldwide, GLOBOCON 2012) while it is the most frequent cause of cancer death in women in less developed regions (324,000 deaths, 14.3% of total). The proportion of locally advanced breast cancer (LABC) ranges between 40 and 50% in developing countries where as in developed countries, the proportion of LABC ranges between 10 and 15%. The standard of care for most of the locally advanced breast cancers is by neoadjuvant chemotherapy (NACT) followed by surgery and radiotherapy. However, despite NACT, 10 to 15% of LABC may not

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Fig. 1 Showing a laterally based TA flap for large post-mastectomy defect



respond and can present with large fungating masses, bleeding tumors, extensive skin involvement, and sometimes with chest wall infiltration. These patients need radical surgical excision of soft tissues and involved skin to achieve a R-0 status, resulting in large post-mastectomy soft tissue defect not amenable for primary closure. There are multiple options described in literature for managing such post-mastectomy soft tissue defects including transverse rectus abdominis myocutaneous flap (TRAM), latissimus dorsi myocutaneous flap (LD) flap, free flaps, thoracoabdominal flap, skin grafts, and omental flap with skin graft. However, the choice of option depends on various factors including institutional practice and available surgical expertise [1]. Currently, there is no uniform consensus on the ideal surgical option. The primary aim in such scenarios is to offer a simple and reliable surgical technique to facilitate early wound healing and timely institution of adjuvant therapies, which are of critical importance in LABC patients not responding to NACT. There is a need to differentiate between cosmetic breast reconstruction in LABC with good biology and soft tissue cover for LABC with bad biology. In addition, the surgical option should be simple enough to be carried out by a large number of surgeons in developing countries dealing with a high volume of LABC.

In an attempt to address the above issues, we present our experience of thoracoabdominal (TA) flap cover for large post-mastectomy defects.

Material and Methods

A retrospective analysis of a prospectively maintained computerized database of breast cancer patients was performed in the Department of Surgical Oncology, IRCH, AIIMS, New Delhi, India, a tertiary care oncology center in North India. The medical records and clinical details of patients undergoing TA flap cover for LABC between 1998 and 2015 were retrieved and analyzed to assess operative duration, blood loss, post-operative morbidity, hospital stay, adjuvant therapy, and recurrence patterns.

The TA flap is a type-C rotation advancement fasciocutaneous flap which utilizes the skin and subcutaneous tissue of the anterior abdominal wall. It is based on two sets of direct perforating segmental arteries arising from the intercostal and deep epigastric arcades. There are two sets of perforating branches—the lateral, arising from subcostal and intercostal arteries at the level of the anterior border of the latissimus dorsi, and the medial row of perforators, arising from the deep epigastric arcade at the lateral border of the rectus abdominis. Sub-fascial anastomosis is present between the medial and lateral perforators [2, 3]. It is designed and harvested in a rotation advancement fashion. For post-mastectomy defects on the lateral side of the chest wall and axilla, a medially based flap based on the medial perforating branches is preferred whereas for medial soft tissue defects of the chest wall, a laterally based flap on the lateral perforators is recommended (Figs. 1, 2, and 3). The plane of dissection is maintained

Fig. 2 Laterally based TA flap to cover post-mastectomy defect and donor site closure



Fig. 3 Showing medially based TA flap for large post-mastectomy defect



superficial to the rectus fascia and aponeurosis of the external oblique muscle. The limits of the flap are the midline medially (for the lateral-based flap), the anterior axillary line laterally, and a horizontal plane at the level of anterior superior iliac spine inferiorly. The lax abdominal skin can be adequately mobilized to facilitate primary closure of the donor site [4].

Results

Between January 1998 and December 2015, a total of 3142 breast cancer patients underwent surgery. Out of 1840 (55.04%) LABC patients 83 patients (4.13%) required flap cover for the closure of post-mastectomy soft tissue defect not amenable for primary closure. TA flap was used in majority of these patients, i.e., 72 out of 83 (86.7%). Majority of

these patients were staged IIIB (66 out of 72) and R0 resection could be achieved in all the patients. Modified radical mastectomy was done in 60 patients and in 12 patients, radical mastectomy was performed to achieve an oncological clearance. Lateral perforator-based flap was performed in 68 patients and medial perforator-based flap in the remaining four patients. The mean operating time for flap harvest was 30 min and mean blood loss was 45 ml. Mean hospital stay was 4.45 days. Superficial flap necrosis occurred in 6 and wound infection in 4 patients. Only 2 patients had major flap loss and required debridement and skin grafting. Planned post-operative radiation could be delivered in all the patients in stipulated time. At a median follow-up of 42 months, only 9 out of 72 (12.5%)

Table 1 Showing surgical and flap details

Total number	72
Type of resection	
Modified radical mastectomy	60
Radical mastectomy	12
Type of flaps	
Lateral perforator based	68
Medial perforator based	04

Table 2 Showing operative details, morbidity, and recurrence

Mean operating time for flap harvest	30(± 8) min
Mean blood loss	45 (± 20) ml
Morbidity	
Superficial flap necrosis	06 /72
Wound infection	04/72
Major flap loss	02/72
Mean hospital stay	4.45 (3 to 8) days
Post-operative radiotherapy	100%
Local recurrence	12.5% (09/72)

patients had loco-regional recurrence. Among patients with loco-regional relapse all patients had complete axillary clearance and received post-operative radiotherapy and 3 out of 9 patients belonged to upfront surgery group.

Discussion

Breast cancer is the most common cancer among women globally and the incidence of breast cancer in India is showing an increasing trend. Majority of breast cancer patients presents with locally advanced stage in developing countries like India [5, 6] due to lack of awareness, lack of screening, social stigma, delay in referral, inadequate healthcare infrastructure, and long waiting list at tertiary care cancer centers.

Surgery is an integral part of a multimodality approach for treating locally advanced breast cancer after neoadjuvant chemotherapy. Patients who do not respond to NACT can sometimes present with extensive skin involvement necessitating radical removal of involved skin resulting in large soft tissue defects not amenable for primary closure. These patients require some additional surgical procedures to manage soft tissue defects. For managing such post-mastectomy defects, there are multiple options described in literature from the time of Halstead era [7].

In the first half of the twentieth century, large post-radical mastectomy defects were managed by a principle of healing by secondary intention and staged split-thickness skin grafting. But the outcomes of the skin grafting were sub-optimal in view of poor cosmetic and therapeutic outcomes. Skin grafts are associated chances of secondary infection, recipient and donor site morbidity, staged procedures, late contracture, and partial or total graft loss after radiotherapy [8–10] (Tables 1 and 2).

Omental transposition with skin grafting for covering post-mastectomy and chest wall defects has been reported in literature. Lopez et al. have reported a success rate of 76% and an abdominal herniation rate of 8% in 50 patients undergoing omental transposition with SSG for advanced breast cancer [11]. In another series, Cheung et al. have reported a 100% success rate and a mean hospital stay of 16 days in breast cancer patients undergoing omental transposition [12]. However, omental grafting could not become popular in view of extra morbidity of laparotomy along with its complications like herniation, wound infection, and burst abdomen. In addition to laparotomy, patients require skin graft over omental bed which has its own drawbacks [2, 13].

In the last quarter of the twentieth century, myocutaneous (MC) flaps revolutionized the field of reconstructive surgery with excellent outcomes. In 1896, Ignio Tansini first used the latissimus dorsi (LD) myocutaneous flap for managing large post-radical mastectomy defect [3]. Subsequently, the usage of LD flap has declined significantly as Halstead thought this

to be unnecessary and hazardous procedure [14]. In 1975, LD flap was reintroduced for the reconstruction of post-mastectomy defects and this option remained popular till 1982 [14, 15].

Hartrampf et al. in 1982 described transverse rectus abdominis myocutaneous (TRAM) flap [16] for breast reconstruction. In view of superior cosmetic outcomes, reliability, positional advantage, and added bonus of abdominoplasty, TRAM flap has become workhorse for breast reconstruction until the 1990s [17]. However, TRAM flap is technically demanding and associated with significant wound and donor site morbidities.

Myocutaneous flaps like LD and TRAM flaps are technically demanding and cannot be adopted by general surgical community for managing post-mastectomy soft tissue defects. Their use is mainly restricted to cosmetic breast reconstruction in high-volume centers. The main focus of reconstruction in LABC is to achieve a simple, expeditious, and reliable skin cover to facilitate quick recovery and timely institution of adjuvant therapy. Cosmetic breast reconstruction of breast mound is not a priority in a subset of LABC patients with aggressive biology not responding to NACT.

The thoracoabdominal (TA) flap was first described by Brown et al. in 1975. TA flap is a type-C fasciocutaneous flap and the skin and fat of the upper abdomen are used based on medial or lateral perforating vessels [18]. It has been used for breast reconstruction along with a prosthesis and soft tissue cover following surgery for LABC in some studies during the late 1970s and early 1980s [1, 10, 18, 19]. However, with the advent of the myocutaneous flaps in the 1980s, TA flap usage declined significantly.

We attempted the first TA flap for LABC defect in 1998 and with encouraging outcomes, we switched over to TA flap for post-LABC soft tissue defects. The mean operating time of TA flap was 30 min and blood loss was 45 ml. Other significant advantages of TA flap are short hospital stay (mean 4.5 days) and low morbidity. TA flap provides good-quality vascularized skin cover and all patients tolerated post-operative radiation without major wound morbidity. Results of our experience showed that TA flap is a simple, reliable, and cost-effective procedure for managing large post-mastectomy soft tissue defects in a subset of LABC. It has huge potential in developing countries dealing with a large number of LABC patients because of simplicity and short learning curve.

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