

Original Research Article

**Clinical study of Latissimus Dorsi Flap for Various Defects Following Cancer Resections
Gayatri P¹, Rangaswamy Gurram², N. Nagaprasad Nangineedi³, Praveen Harish⁴**

¹Post Graduate, Department of Plastic Surgery, Osmania Medical College/ Osmania General Hospital, Hyderabad, India

²Associate Professor, Department of Plastic Surgery, MNJIO and RCC, Red Hills, Lakdikapool, Hyderabad, India

³Professor, Department of Plastic Surgery, Osmania Medical College/ Osmania General Hospital, Hyderabad, India

⁴Associate Professor, Department of Plastic Surgery, Osmania Medical College/ Osmania General Hospital, Hyderabad, India

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Abstract

Introduction: The purpose of reconstruction is to restore every resected tissue and its function, as well as to achieve primary wound healing so that rehabilitation and adjuvant therapy can begin as soon as possible. It is no longer enough to simply close a wound in modern reconstructive surgery. It's critical to aim for the absolute best functional and aesthetic outcomes. **Aims:** To evaluate the role of latissimus dorsi flap in reconstruction of Various defects following cancer resections in arm, axilla, shoulder, chest wall, breast, head and neck and scalp. **Materials and methods:** It is a prospective study in Twenty patients with cancers were identified during the study period of one year after thorough workup and after obtaining fitness for anaesthesia, the patients and their attendants are explained about the surgical ablative procedure and the reconstructive procedure contemplated. **Results:** In this study 20 cases the role of using latissimus dorsi myocutaneous flap (LDMF) for soft tissue defects involving breast, chest wall, shoulder and arm was explored. The patients were in the age range of 24 to 80 years. Maximum flap dimension was 30 X 20 cms. All patients underwent immediate reconstruction of the primary defect. In our series out of 20 patients, 13 flaps had healed primarily without flap congestion, margin necrosis, or infection, 3 flaps had medial edge necrosis of about 3-4cms which were debrided and closed primarily. These 3 flaps were extremely large and the lumbar extension of the flap was done to cover the defect. Seroma formation was seen in 3 patients. Out of the 2 cases closed primarily in 1 case donor site had seroma formation which was managed conservatively by serial aspirations and drain was kept in situ for about 18 days and compression dressing was done with dynaplast application. Out 20 cases 2 patients had recurrence through the inferior aspect of the flap. **Conclusion:** Additional care and precautions donor site morbidity can be reduced and overall, the donor site is well tolerated and the patients are functionally satisfied with the reconstruction.

Keywords: latissimus dorsi flap, flap cover, cancer resections.

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Introduction

Cancers are the most common cause of death in adults in India. Breast cancer is the most common female cancer worldwide representing nearly a quarter (25%) of all cancers with an estimated 1.67 million new cases diagnosed in 2012. Cancer registration is not compulsory in India, so the true incidence and mortality may be higher, as many cases are unrecorded and lose follow up. None of the national registry provides cancer incidence or mortality data for India. However, the National Cancer Registry Program provides population – based data from a selected network of 28 cancer registries located across the country[1].

Breast cancer has ranked number one among Indian females both in urban and rural population. In India we are now witnessing more and more numbers of patients being diagnosed with breast cancer to be in younger age groups (in their thirties and forties) increasing the need for reconstruction. Earlier detection of breast cancer offers the best chance for long term survival and has the potential to improve treatment outcomes, with best reconstruction options.

Surgical excision of the primary lesion and axillary lymph nodes form the main stay of treatment in most instances with the addition of radiation, chemotherapy and hormonal therapy as an adjuvant treatment depending on the stage of the disease at presentation. The cosmetic, functional and psychosocial results of breast cancer treatment may combine to produce devastating effects on the patient, especially when the tumor is extensive requiring aggressive treatment. Simultaneous reconstruction of the post surgical ablation defects is a must, to ensure good quality life after the cancer resection and for post op radiotherapy. Common etiologies for chest wall defects include tumor resection, deep sternal wound infections, chronic empyemas, osteonecrosis and trauma. Primary tumors of the chest wall comprise only 5% of thoracic neoplasms.¹The most common primary malignant tumors are sarcomas; chondrosarcoma from the bony structures and desmoidtumors from the soft tissue. Sarcoma resection is recommended to include a 4 cm margin of normal tissue and thus, will almost always necessitate significant chest wall reconstruction. Over half of malignant chest wall lesions represent metastatic disease with breast and lung cancers being the most common. Soft tissue sarcomas of the shoulder are not commonly seen but account for half of all soft tissue sarcomas of the upper extremity. Surgery and radiotherapy are the standard modality

*Correspondence

Dr. Rangaswamy Gurram

Associate Professor, Department of Plastic surgery, MNJIO and RCC, Red hills ,Lakdikapool, Hyderabad,India

E-mail: rangaswamyplastic1@gmail.com

of treatment. 3-5 cms is the margin according to the grade of the tumor leaving a large defect requiring reconstruction [2,3].

Marjolin's ulcer represents malignant degeneration that typically ensues over a period of time in the post burned lesions and scars or any other chronic wounds. The incidence of marjolin's ulcer in such cases is reported to be 0.77%-2%. This malignancy typically develops in the areas of full thickness burns that had been allowed for weeks to months to heal spontaneously by secondary intention, or burn wounds which never healed completely over years and unstable post burned scars. Lower limbs constitute the most frequent site but the upper limb axilla are also frequent sites. Surgical excision of the primary and axillary lymph node clearance for the upper limb is the preferred treatment. For the axilla wide excision and scar release are the treatment of choice which will leave a wide defect exposing the vital vessels obviating the need for reconstruction.

The goal of reconstruction is to provide reconstruction of every resected tissue and the related function and to achieve primary wound healing in the interest of timely rehabilitation and adjuvant therapy. In modern reconstructive surgery, it is not sufficient to merely achieve wound closure. It is important to strive for optimal functional and esthetic results. Any breast cancer patient with no evidence of local or systemic disease, who is medically fit to undergo reconstruction is considered a potential candidate. Main objective of breast reconstruction is to improve the quality of life. No single reconstructive procedure is right for everyone. Reconstruction is individualized depending on the patient's health, type of mastectomy performed, the extent of disease and goal of symmetry with contralateral breast. This study is undertaken in the Plastic and Reconstructive Surgery Department at the MNJ Institute of Oncology and Regional Cancer Centre/Osmania Medical College, which is equipped with state of art operation theatre, well trained Plastic surgery staff, competent anaesthesiologists and an intensive care unit. This is a tertiary care centre which has patients coming from all over the state and from the adjoining states as well. This kind of studies will not only help the patients but also many younger plastic surgery trainees to serve the cancer patients in the suburban areas where patients don't have access to the tertiary care centres.

Materials and Methods

This is a prospective study in Twenty patients with cancers were identified during the study period, starting from March 2017 to August 2018 in the department of Plastic and Reconstructive surgery at the MNJ Institute of Oncology and Regional Cancer Centre / Osmania Medical College.

After thorough workup and after obtaining fitness for anaesthesia, the patients and their attendants are explained about the surgical ablative procedure and the reconstructive procedure contemplated. The patient is taken up for the surgery only after obtaining the consent. Operated at MNJ Institute of Oncology and Regional Cancer Centre, Hyderabad, during the study period which is from March 2017 to August 2018. All the patients were operated under general anaesthesia. All the reconstructions were done primarily.

Inclusion criteria : All defects following cancer resections over chestwall, resections of breast, cancer resections of arm, cancer resections of axilla, cancer resections of shoulder and resections of head and neck.

Exclusion criteria : Previous posterolateral thoracotomy in which the latissimus muscle had been divided.

Preoperative evaluation was done with a view to assess fitness for surgery and anaesthesia was done. No preoperative vessel identification is necessary. In cases of previous axillary dissection or radiation, muscle function has to be evaluated preoperatively. If muscle function is intact, the vessels are usually not violated. If the muscle function does not seem to be good, further studies such as the Doppler probe can be performed to see if the muscle is viable and can be used for wound coverage.

The margins of the latissimus dorsi muscle extend from the tip of the scapula to the midline of the back posteriorly and with its fascial extension to the iliac crest inferiorly. The anterior border of the muscle passes on an oblique line from the midpoint of the iliac crest to the axilla. This prominent border forms the posterior axillary fold together with the subscapular and the teres major muscles.

Flap Dimensions

30 x 15 cm. The skin overlying the muscle may be designed with dimensions similar to a musculocutaneous flap; however, direct closure of the donor site is preferred. A flap width of 7 to 10 cm, depending on adequate skin laxity without excessive thickness of adipose tissue, will permit direct closure. The long axis of the skin island will vary depending on the desired flap length and its relationship to the underlying muscle and the preferred location of the donor site closure scar.

Enlarged Flap

There are different approaches for enlarging the volume of a conventional latissimus dorsi flap. This can be achieved by maximizing the skin island and the amount of subcutaneous tissue with a fleur-de-lis incision, as described by McCraw & Papp.

Extended Flap

Germann et al introduced the extended latissimus dorsi flap in 1996 as a pedicled flap for breast reconstruction. It is a modification that attempts to increase the volume by harvesting the scapular fat fascia in addition to the conventional latissimus flap. The goal is to achieve a sufficient volume to enable surgeons to reconstruct the breast without using an implant.

Skin Islands Superior Posterior Skin Island : In standard flap transposition based on the dominant pedicle the superior transverse skin island places the muscle above the skin island after transposition to the anterior chest wall (see breast reconstruction). The donor site is closed in the region of the brassiere strap.

Oblique Island (superior end, axilla; inferior end, posterior midline): This island has greater length over the muscle. In anterior transposition the muscle is distributed on both sides of the skin island, resulting in less muscle superior to the skin island. The length of the donor site scar is longer but located inferior on the posterior trunk. This skin island is also used for coverage of an inferior posterior midline defect with a reverse latissimus dorsi musculocutaneous flap.

Oblique Island (superior end, posterior superior trunk between scapular and vertebral column; inferior end, lateral inferior trunk): The muscle is distributed on both sides of the skin island. Donor site closure causes less tension in this orientation and is located along more natural skin tension lines. This skin island is also used for coverage of a superior posterior midline defect with a reverse latissimus dorsi musculocutaneous flap.

Vertical Island: This skin island is generally at the anterior edge of the muscle (posterior axillary line). A small skin island is frequently based only on the anterior half of the muscle in segmental muscle transposition with preservation of function. This skin island may be used with a reverse latissimus dorsi musculocutaneous flap.

Patient Positioning: A lateral decubitus position is ideal for flap harvest, although it is possible with the patient in a prone or even a supine position with a 45° lateral tilt. The arm is abducted to 90°, the elbow also flexed 90°. More abduction may stretch the brachial plexus. The arm is prepped sterile so that a limited mobility is permitted. Wrapping with cotton bandages must also protect the ulnar nerve at the elbow. This position allows excellent access to the vascular pedicle as well as the chest wall in case of a pedicled transfer. General anesthesia is needed to harvest the latissimus dorsi flap. All cases in the study were operated under GA and endotracheal intubation.

Procedure

(The following procedure is described for pedicled LD flap harvest)

For all the patients in the study flaps were harvested as pedicled flaps. After the resection of the tumor patients were positioned in lateral position depending on the side of harvest and defect. After positioning the patient anterior muscle border and tip of the scapula were marked to outline the flap borders. Then a line is drawn from the middle of the iliac crest to the posterior axillary fold. On this line the entry of the pedicle into the muscle 10–12 cm below the axilla is marked. The axis of the flap was marked 2 cm posterior to the anterior edge of the latissimus dorsi muscle. The course of the pedicle is relatively constant, about 1–2 cm behind the anterior edge of the muscle. By following this route, the serratus branch can be identified and securely spared. The skin island is based on the size of the defect and is based on the anterior edge of the muscle because of the concentration of perforating vessels. In all the cases in the study first incision exposed the anterior edge of the latissimus dorsi muscle between the axilla and the proximal edge of the flap. Then the

pedicle is found in the fatty connective tissue medial to the muscle and exposed up to its entry into the latissimus dorsi muscle. Once the pedicle is exposed, the skin island is incised around its circumference and elevated anteriorly from the serratus anterior muscle up to the ventral edge of the latissimus dorsi. Next the latissimus dorsi muscle with its overlying skin island is dissected bluntly from the serratus anterior muscle and caudally sometimes sharp dissection was needed. Then the LD muscle is divided below and posteriorly but remains still attached above. To prevent the skin from shearing off the muscle, some stay sutures were applied. Meticulous hemostasis observed during the entire dissection. To pass the flap from the back to the front of the chest or to the upper arm, a tunnel is made across the apex of the axilla. Drains are inserted in the back if closed primarily or SSG applied and bolster dressing applied, the patient is turned to the supine position, where the flap is arranged in the desired position and inset given. Drains are applied under the flap.

Results

Table 1: Demographic distribution of cases

Sex	Number of Cases	Percentage
Male	4	20%
Female	16	80%
Type of flaps		
Muscle flap	1	5%
Myocutaneous flap	19	95%

Total 20 patients underwent reconstruction with LD flap following cancer resection of various parts of the body. Amongst them 16 were female patients and 4 were male patients. The mean age was 51yrs ,youngest patient was 24yrs old and oldest patient was 80yrs.

Out of 20 cases only one case is a muscle flap as the skin paddle got sheared during dissection hence has to be discarded and only muscle was transposed into the defect and SSG done. Rest of the 19 cases are myocutaneous flaps.

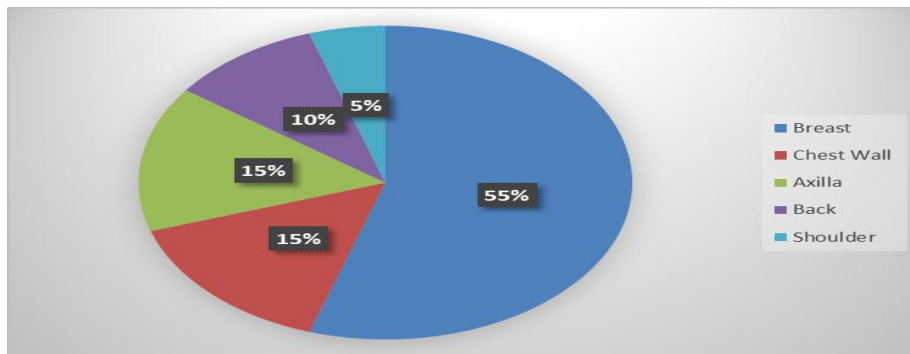


Fig 1: Location of Defect in study

LD flap was done for breast 11 (55%), chest wall 3 (15%), axilla (15%), back(10%), shoulder(5%) reconstructions.

Out of 20 cases largest flap is 30 X 20 cms and smallest is 10 X 8 CMS. Out of 20 cases 2 cases donor site was closed primarily for the defects ranging from 10 X 8 cms and 10 x 10 cms by mobilising the surrounding tissue. Suction drains were kept to avoid seroma

formation. In 18 cases donor area was grafted with thick split thickness skin graft harvested usually from the thigh. Sheet grafts after pie crusting were applied and fixed with skin staplers followed by a bolster dressing.

Table 2: Complications in present study

Complication	Number of cases	Percentage
Complete flap loss	1	5%
Partial flap loss	3	15%
Seroma	2	10%
Donor site complications		
Seroma	1	5%
Partial graft loss	2	10%
Infection	2	10%
Shoulder dysfunction	1	5%

Out of 20 cases there was a complete flap loss in 1 case (5%), partial flap necrosis in 3 cases (15%), seroma formation under the flap in 2 cases (10%).

Out of the 20 cases in 2 cases donor site was closed primarily with drains but in one case seroma formation was observed 5%, out of 18 cases that are grafted partial graft loss was observed in 2 cases 10%, infection in 2 cases 10% and shoulder dysfunction in 1 case 5%.



Fig 2: Images in study

Description: Person aged 45 yrs male with soft tissue sarcoma over left shoulder of size 10 x 15cms. Wide local excision was performed which exposed the shoulder joint

Discussion

The LD flap is the workhorse flap for covering various defects as it is a versatile flap in which thickness and volume can be adjusted for the extent of the defect. For extensive defects, this flap has been found to

be significantly less morbid than any other soft tissue donor site (TRAM, DIEP and free tissue transfers). The LDF is a reliable means for soft tissue coverage providing form and function during breast reconstruction with acceptable perioperative and long-term

morbidities. In our study 20 patients underwent reconstruction with LD flap following cancer resection of various parts of the body. In which 16 were female and 4 were male. The mean age was 51 ,youngest patient was 24 and oldest was 80. The defects for which LD flap was done are breast 11 (55%), chest wall 3 (15%), axilla (15%), back(10%), shoulder(5%). In 1979 Bostwick JB Nahai F et al of Sixty latissimus dorsi flaps[4].A series of 60 latissimus dorsi musculocutaneous (52) and muscle (8) flaps is reviewed. No flap loss is observed. This clinical experience demonstrates the versatility and reliability of this flap for a variety of defects involving functional muscle transfer for elbow flexion (1), breast and chest wall reconstruction (52), and defect coverage in the following areas: abdomen (1), axilla (1), myelomeningocele (2), and upper extremity (2). This article defines both the vascular anatomy of the latissimus dorsi muscle and its anterior and posterior arc of rotation for breast reconstruction and coverage of a variety of defects of the anterior and posterior trunk and upper extremity. No significant donor site morbidity is observed in this large series of patients. In 1985 Neilsen LM, Lassen M, Gregersen .et al studied a series of sixty- two patients with head and neck (10), trunk (22), upper extremity (33) defects that were reconstructed with LD flap. Out of 20 cases in our study we had complete flap loss in 1 patient probably due to damage to the pedicle during axillary dissection and partial flap necrosis was seen in 3 cases on the medial edge due to inclusion of lumbar extension of the flap (random portion) and 16 in cases flap was completely healthy. Needs proper framing Freedlander⁹ discussed about complications related to the use of latissimus dorsi musculocutaneous flap for reconstruction after extirpative head and neck surgery. The author documents that when the latissimus dorsi muscle is transposed superficial to the pectoralis major into the head and neck region it has the potential to compress brachial plexus

Menke H, Erkens M, Olbrisch RR.et al¹⁰ conducted the study on 121 patients with the exception of the occurrence of seroma, the complication rate was low (seroma, 60%; bleeding, 4%; hematoma, 5%; minor wound dehiscence, 3%; wound infection, 2%). No flap was lost. Donor site morbidity was extremely low; 90% of patients had no complaints.

Delay et al[11] presented their technique of autologous breast reconstruction using the latissimus dorsi flap and studied the results that can be expected. A consecutive sample of 100 patients was studied (average follow-up 20 months). Supplementary volume of

Table 3: Flap complication rate in comparison with other studies

Study	Complete flap loss	Partial flap loss	Seroma
our	5%	15%	10%
Delay[11]	1%	1%	79%
Chang deu[13]	4%	14%	10%
Neilson[3]	NR	5%	15%
Hokin silfverskiold[16]	NR	7%	NR

In Neilsen LM, Lassen M, Gregersen BN, Krag Cstudy with LD Complication rates were with hematoma representing the most common complication(15%). Other complications were partial flap loss (5%),and donor site graft loss (4%). No flaps were lost. Complication rates did not increase in patients with irradiated flap recipient sites. Although a cosmetic defect was noted at the donor site, no permanent functional disability was observed. Necrosis is uncommon and usually secondary to vascular pedicle injury during the operative dissection or pedicle thrombosis from twisting of the flap on its pedicle.

Table 4: Donor site complications

Study	Partial graft loss	Seroma	Hematoma	Infection	Shoulder dysfunction
Our	10%	5%	NR	10%	5%
Menke[10]	10%	NR	5%	2%	NR
Delay[11]	9%	NR	5%	5%	NR
Chang due[13]	18%	NR	10%	10%	NR
Neilson	4%	NR	NR	NR	NR

the latissimus dorsi was obtained from five fatty zones: fat on the cutaneous paddle, fat taken from the surface of the muscle, the scapular fat pad, the anterior fatty zone, and the supra-iliac fat pad. The authors found the following complications: 1% partial necrosis; 1% total necrosis of the flap, and seroma 79%, most regularly in obese patients. The level of patient satisfaction was high.

Laitung JFG, Peck F. et al[12] analysed 19patients in whom the latissimus dorsi flap was previously used (range 2-month to 4-year follow-up). The analysis is to determine potential subjective and objective impairment of the shoulder that is devoid of the latissimus dorsi muscle. Objective measurements of muscle donor site shoulder function were compared with the equivalent dominant or non dominant shoulder in control subjects. (A study of adduction power in the control group revealed significant differences in muscle power between nondominant and dominant shoulders.) This study revealed no significant loss in shoulder power following the use of the latissimus dorsi muscle as a flap. Thirteen patients had complete normal range of movement and six had restriction of motion between 5 to 30 degrees. Limitation and range of motion were associated with scar contracture at the donor site. No patient had occupational problems related to shoulder disability. Russell RC et al[13] has undertaken a study to determine the cosmetic and functional problems associated with the latissimus dorsi muscle donor site. Twenty-four patients undergoing pedicle muscle and myocutaneous flap procedures for a wide variety of reconstructive problems were studied. All patients who underwent myocutaneous flap had a contour defect at the donor site. Mild to moderate shoulder weakness and some loss of motion were noted in most patients which improved over the course of several months. An upper extremity disability in strength and shoulder motion should be anticipated following latissimus dorsi transfer, which in most cases is minimized by the recruitment of synergistic muscle units. Vigorous range-of-motion exercises following surgery should be encouraged to minimize adhesions and joint capsule stiffness. Social changes in occupation and daily living activities were noted which were not a problem for most patients. Twenty-three of 24 patients were pleased with the overall outcome of their surgery and would recommend the procedure to others. A prospective study before and after latissimus dorsi transfer followed by a second evaluation 2 to 3 years postoperatively would help to clarify the role synergistic muscle units play in "taking over" latissimus dorsi function.

In a literature review comprising 11 studies, Smith found that LDF reconstruction does cause impaired shoulder range of motion, strength, and functioning generally resolves by 12 months postoperatively; this finding was supported by additional studies that showed similar improvement in shoulder function[14].Out of the 20 cases in 2 cases donor site was closed primarily with drains but in one case seroma formation was observed (5%), out of 18 cases that are grafted partial graft loss was observed in 2 cases (10%), infection in 2 cases (10%) and shoulder dysfunction in 1 case (5%).

Conclusion

Most of the oncological surgeries require extensive resection of tumors and repair of the defects with flaps. Reconstruction of soft tissue defect presents a challenge in terms of anatomy of recipient site and composite losses. A clinical study of reconstruction with LD flap in 20 patients for defects following cancer resections in breast, chest wall, shoulder, arm and back we conclude that LD flap is the most versatile and dissection is rapid, easy, and safe because of the reliable anatomy of the thoracodorsal and subscapular vessels.

The myocutaneous flap is advantageous in providing bulk for the correction of contour defects[15,16]. Though there are donor site complications the advantages outweigh the cosmetic considerations. It is evident in the present study that with some additional care and precautions donor site morbidity can be reduced and overall, the donor site is well tolerated and the patients are functionally satisfied with the reconstruction. Our results revealed Latissimus dorsi flap is a reliable option for many post cancer resection defects.

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