# VERSATILITY OF LATISSIMUS DORSI FREE FLAP-A PROSPECTIVE STUDY

ISLAM AFMA[1], KHAN MRK[2], SUMI SA[3], KHAN HA[4], KALAM MA[5]

**Abstract:**

***Introduction***: *Free flaps offer a great variable of available tissues to cover larger, multifocal or multistructural defects. The choice among different free flap is dependent upon their recipient site requirement. Reconstruction with latissimus dorsi flap is now versatile tool in coverage. It can resurface large wound with reliable vascularity, consistent anatomy ,long pedicle length, opportunity for tailoring of flap. It has less donor site morbidity and has very little post-operative complications.*

***Objective***: *To evaluate the versatility of free Latissimus dorsi flap for soft tissue reconstruction.*

***Materials and methods***: *A prospective, observational study design was used in Department of Plastic Surgery of Dhaka Medical College and Hospital. Here 20 patients with soft tissue defect of variable sizes over lower limb, head neck and trunk underwent coverage with microvascular surgery. The study was carried out from July 2017 to June 2018.*

***Result***: *Regarding the age distribution, the mean age was 35.65with an SD of + 10.81. The lowest age was 20years and the highest age was 56 years, Male female ratio was 3:2.The major cause (65.0%) of soft tissue defect of the samples was RTA. The flap was used to reconstruct the soft tissue defect over lower leg in 13 (65%)cases, on scalp 05 (25%) cases and over anterior trunk in two cases. The mean flap dimension was 229.25cm$^2$ and its range was between 120 – 384 cm$^2$. The standard myocutaneous flap was harvested in 80% cases, chimeric (10%) and partial Latissimus muscle flap in two cases. The donor site in all the 20 (100%) cases was closed primarily. The outcome of reconstruction was excellent in 16(80%), good in 02 (10%) cases and poor in 02 (10%) cases. There was no significant complication during the three months postoperative period*

***Conclusion***: *The Latissimus dorsi flap is a versatile option for resurfacing the soft tissue defect in different areas of the body with variable flap components and with minimal donor site morbidity.*

***Keywords***: *Latissimus dorsi flap, Free flap, Versatility*

*J Dhaka Med Coll. 2019; 28(2) : 142-152*

## Introduction:

Now a day's high velocity trauma and machinery injury causing increased number of badly injured soft tissue which are difficult cover with single stage or simple conventional procedure. Besides cancer and burn area need coverage by free flaps where pedicle flaps from surrounding area is not suitable. Pedicle flaps when applied to any area of the defect, it should be rotated to variable degrees which needs extra amount of donor tissue but free flap does not require rotation in most cases and cover relatively larger area.[1]

The Latissimus dorsi myocutaneous flap is one of the most reliable and versatile flap used in reconstructive surgery.[2] It may be transferred

1. Dr. Abu Faisal Md Ariful Islam, RS Plastic Surgery, Department of Burn & Plastic Surgery, Dhaka Medical College & Hospital
2. Dr. Mohammad Rabiul Karim Khan, Associate Professor of Plastic Surgery, Sheikh Hasina National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh.
3. Dr. Sharmin Akter Sumi, Assistant Professor of Plastic Surgery, Sheikh Hasina National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh.
4. Dr. Mohammad Hedayet Ali Khan, Associate Professor of Plastic Surgery, Sheikh Hasina National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh.
5. Professor Md. Abul Kalam, Director, Sheikh Hasina National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh.

**Correspondence:** Dr. Abu Faisal Md. Ariful Islam, RS Plastic Surgery, Department of Burn & Plastic Surgery, Dhaka Medical College & Hospital, Contact no: 01711814590, E- mail:abu.faisalk4@gmail.com.

***Received:*** *15-07-2020* ***Revision:*** *20-08-2020* ***Accepted:*** *29-09-2020*

as a myofascial flap, a myocutaneous flap or as a composite osteomyocutaneous flap when harvested with underlying serratus anterior muscle and rib. For even greater reconstructive flexibility, the latissimus dorsi free flap can be harvested in combination with any or all of the other flaps based on the subscapular vessels (the so-called subscapular compound flap or "mega-flap"), including serratus anterior, scapular, and parascapular flaps.[3,4]

The Latissimus dorsi is a flat, broad muscle measuring about 20 by 40 cm. It extends from the posterior axilla to the midline of the back and inferiorly to the posterior portion of the iliac crest. The muscle originates from the posterior iliac crest and from the spinous processes of the lower 6 thoracic vertebrae, the lumbar and sacral vertebrae, and the thoracolumbar fascia arising from the dorsal iliac crest. As the Latissimus extends superiorly and laterally, the muscle is adherent to the external surface of the serratus anterior muscle and the 4 lowermost ribs. The Latissimus inserts anteriorly into the lesser tubercle and intertubercular groove of the humerus between the teres major and pectoralis major muscles. The Latissimus functions mainly as an adductor,extensor and medial rotator of the arm. It also serves to pull the shoulder inferiorly and posteriorly [5.]

The Latissimus dorsi muscle is supplied by 2 separate vascular systems. The dominant blood supply arises from the thoracodorsal artery, which is the terminal branch of the subscapular artery. It also has a secondary blood supply, which arises from segmental perforating branches off of the intercostal and lumbar arteries. These vessels enter the deep surface of the muscle near the posterior midline and are responsible for perfusion of the inferior and medial Latissimus[5].

The subscapular artery originates from the third portion of the axillary artery. It divides into the circumflex scapular artery and the thoracodorsal artery, which enters the Latissimus dorsi muscle at about 8.5-9 cm distal to the origin of the subscapular artery, as shown below. Typically, a robust branch to the serratus anterior is present and must be severed to harvest the Latissimus. Alternatively, this branch can be maintained if the serratus is harvested to create a separate muscular paddle[5].

The thoracodorsal artery and vein course along the thoracic wall on the undersurface of the latissimus muscle. The artery has a diameter of 1.5-4 mm, and the vein usually ranges from 2.5-4.5 mm. Overall, the extramuscular pedicle length varies between 6-16 cm and is about 9 cm on average. The intramuscular thoracodorsal artery reliably divides into vertical and transverse branches, which allows the flap to be divided into 2 separate muscle and skin paddles.[6,7]

LDMF has most of the characterstics of an ideal flap to address a wide array of defects in different parts of the body and can be adjusted according to the requirement of the recipient defect and reliable as a versatile flap.

**Patients and method:**

A prospective, observational study design was used in the Department of Plastic Surgery of Dhaka Medical College and Hospital. Here 20 patients with soft tissue defect of variable sizes over lower limb, head neck and trunk underwent coverage with microvascular surgery. The study was carried out from July 2017 to June 2018.

**Surgical technique:**

**Design and Marking:**

With the patient standing and sitting, forceful contraction of the Latissimus dorsi muscle allows the anterior margin at the posterior axillary fold to be visualized or palpated or marked. The tip of the scapula is marked with patient's arm at the sides .This denotes the superior margin of the Latissimus dorsi muscle. The posterior vertebral column represents the posterior flap border. The posterior iliac crest is marked to determine the inferior flap margin of the flap. The skin paddle design should overlie the muscle for reliable perfusion. There are two Basic designs depending on the tissue requirements and donor scar location.

**Fig.-1:** *Designing of the flap (a) in lying position, (b) In sitting position.*

The largest skin island can be harvested in an oblique fashion. The inferior marking of a skin paddle is generally placed 8cm superior to the posterior superior iliac crest.

**Patient Positioning:**

Among the several options lateral decubitus position is commonly used because it facilitates a two team approach and aids in closure of the skin in Myocutaneous variant. A sand bag is helpful for holding the torso in the proper position the field and an axillary roll will prevent the compression of the axilla. The arm may be draped in the field and rested on a Mayo stand or other support device.

**Guide to flap dissection:**

The area around the skin island is incised with a bevel away from the skin island. Initial dissection exposes the superficial surface of the muscle. The superior fibers of the muscle are located below the tip of the scapula. The uppermost tendinous origin can be located under the inferior trapezius muscle fibers. These superior medial fibers are divided and the muscle is separated from the underlying paraspinous muscle.

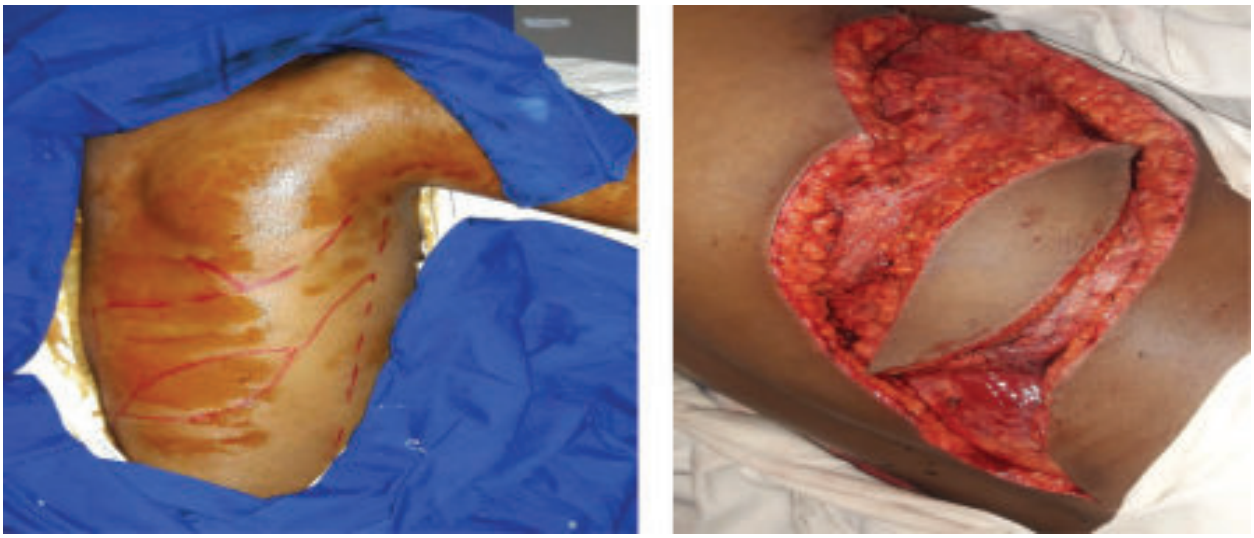

**Fig.-2:** *(a)Designing (b)Flap dissection*

The inferior extent of muscle harvest is then delineated by dividing the muscle inferiorly, taking care to separate the serratus posterior laterally where it is fused. The entire muscle is elevated toward the axilla, When serratus anterior muscle is reached, the natural plane will carry the dissection deep to serratus. Superior elevation of the muscle exposes its deep surface in the posterior axilla. The thoracodorsal artery and vein are identified at the point of entrance into the muscle.

Capillary refill and dermal bleeding are evaluated before ligation and division of the pedicle. The donor site is closed primarily in all cases keeping negative suction drain in situ.

Another team in the mean time dissect the wound and prepare the recipient vessels thus saving the valuable anesthesia time.

**Microsurgical procedures**:

1. Preparation of recipient site by wound excision
2. Preparation of the recipient artery and vein is done.
3. Transfer of harvested free tissue from donor site to recipient site.
4. Finally, anastomosis is done under the operating microscope.

**Fig.-3:** *(a) Flap harvesting, (B) Pedicle identification*

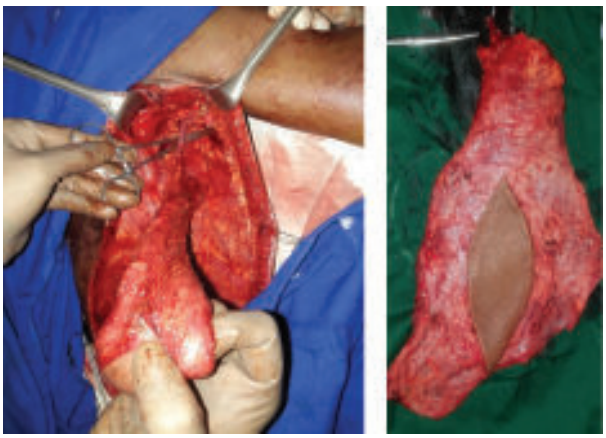

**Fig.-4:** *(a)Thoracodorsal vessels (b) after harvesting of Latissimus dorsi muscle*

**Fig.-5:** *(a)Wound with exposed Tibia,(b)Anasomosis with ant Tibial vessels (c,d)Flap inset.*

**Variation of Latissimus Dorsi Flap:**
**Standard flap:**

Muscle flap with a vertical or oblique skin paddle is a standard flap.

**Chimeric flap:**
Flaps supplied by the subscapular axis of vessels can be harvested as combined flaps on one vascular pedicle. Here latissimus dorsi muscle can be combined with the serratus muscle on the thoracodorsal pedicle or can be combined with scapular or parascapular flaps by extending thd dissection of the pedicle to the subscapular vessels.

**Fig.-6 :** *Latissimus dorsi chimeric flap combined with serratus anterior muscle.*

For a chimeric flap the serratus branch of the thoracodorsal pedicle is maintained and pedicle dissection proceeds into the axilla to achieve adequate pedicle length.

**Functional Muscle transfer:**
The thoracodorsal nerve enters the latissimus dorsi muscle beneath its insertion in the posterior axilla. The nerve divides into two funicles that separately innervate the medial and lateral portions of the muscle. Thus it is very suitable for single functional free muscle transfer.

**Partial latissimus muscle flap:**
The broad flat muscle has an unique ability to be used as partial or tailored flap.

**Postoperative care:**
All patients were put on a standard post-operative regime that included:

Maintaining nutrition, adequate hydration, oxygenation and correction of anemia to expedite wound healing process.

- Antibiotic according to wound swab culture and sensitivity.
- Keeping the limb on pillow to avoid pressure on the flap.
- Sequential clinical examinations for arterial insufficiency and venous congestion.
- Check dressing was done on 5$^{th}$ post-operative day.
- To assess viability of the flaps, they were monitored for color, local temperature, tissue turgor, dermal bleeding, flap congestion, blister formation, edema, hematoma, seroma, marginal necrosis and wound infection. Dressing of skin donor site would be monitored for soaking or bad odor. For any sign of infection from any of operative area, wound swab was taken and sent for culture and sensitivity.
- On 14$^{th}$ post operative day, flap was monitored again. Stitches were removed. Plaster cast was removed. Flap donor site and skin donor site was inspected for healing and presence of infection. Gentle range of motion exercise was initiated once the flap was stable, about 2 weeks after reconstruction.
- After two weeks ,Skin grafting was done.

**Management of complications:**
Management of complications was done according to the nature of complications developed. Vascular compromise might be arterial or venous. Venous cause was more common than arterial. If any flap showed cyanosis or congestion within 72 hours of surgery, following measures were taken:

- o Removal of all dressings
- o Removal of any pressure over flap pedicle
- o Removal of stitches
- o Avoid any kinking of flap
- o Even flap might be need return back to its own position
- o Normal body temperature, well hydration and pain free state should be maintained as well.

- If any part of flap was lost, excision of lost portion was done as early as possible and skin grafting or reconstruction by alternative procedure was done

**Follow up of the patients:**

Patients were advised for follow up on 28th, 42nd post-operative day and 3 month post operatively for assessment of outcome of the procedure.

**Result and Observation:**

Regarding the age distribution, the mean age was 35.65with an SD of ±10.81. The lowest age was 20years and the highest age was 56 years, Male female ratio was 3:2.The major cause (65.0%) of soft tissue defect of the samples was RTA. The flap was used to reconstruct the soft tissue defect over lower leg in 13 (65%) cases, on scalp 05 (25%) cases and over anterior trunk in two cases. The mean flap dimension was 229.25cm$^2$ and its range was between 120-384 cm$^2$. The standard myocutaneous flap was harvested in 80% cases, chimeric (10%) and partial Latissimus muscle flap in two cases. The donor site in all the 20 (100%) cases was closed primarily. The outcome of reconstruction was excellent in 16(80%), good in 02 (10%) cases and poor in 02 (10%) cases. There was no significant complication during the three months postoperative period.

**Table-I**

*Distribution of patients according to etiology of wound (n=20).*

| Cause of soft tissue defect requiring coverage | Frequency | Percentage |
|---|---|---|
| 1. RTA | 13 | 65.0%. |
| 2. Machinery injury | 05 | 25.0%. |
| 3. Electric Burn | 02 | 10.0%. |
| Total | 20 | 100%. |

**Table-II**

*Distribution of patients according to Size of the defect (n=20).*

| Measurement | Mean (+SD) | Range |
|---|---|---|
| Transverse dimension (cm). | 11.50±5.14 | 08-18. |
| Longitudinal dimension (cm). | 17.60±5.14 | 12-30. |
| Wound dimension (cm$^2$) | 204.20±75.47 | 96-360 |

**Table-III**

*Distribution of patients according to Flap dimension (n=20)*

| Measurement. | Mean (±SD). | Range. |
|---|---|---|
| Length (cm). | 17.60±18.85 | 12-30. |
| Width (cm). | 12.00±2.10 | 10-15. |
| Flap dimension (cm$^2$). | 229.25±83.04 | 120-384 |

**Table-IV**

*Distribution of patients according to Site of vascular anastomosis (n=20).*

| Site of defect | Site of anastomosis | Number of patients | Type of anastomosis |
|---|---|---|---|
| Distal leg (13) | Popliteal artery | 01 | End to side |
| | Medial Sural Artery | 03 | End to end |
| | Posterior tibial artery | 03 | End to side |
| | Anterior tibial artery | 05 | End to end (02) |
| | | | End to side (01) |
| | Arteria dorsalis pedis | 01 | End to end |
| Scalp (05) | Superficial temporal vessels | 03 | End to end |
| | Occipital vessels | 01 | End to end |
| | Facial vessels | 01 | End to end |
| Anterior Trunk (02) | Femoral vessels | 01 | End to side |
| | Inferior epigastric vessels | 01 | End to end |

Table-4 shows anterior tibial vessels were the anastomotic vessel in 05 cases and in 03 cases the site was Sural artery in lower extremity..End to end anastomoses were done in maximum cases (17) whereas end to side anastomoses were done only two cases .In case of scalp superficial temporal vessel was the favored vessels and two different vessels were chosen in two cases of anterior trunk.

**Table-V**

*Distribution of patients according to type of flap (n-20).*

| Type of flap | Number | Percentage |
|---|---|---|
| Standard Myocutanous | 16 | 80.00 |
| Chimeric flap | 02 | 10.00 |
| Partial latissimus muscle flap | 02 | 10.00 |
| Total | 20 | 100.00 |

**Table-VI**

*Distribution of patient according to donor site morbidity (n=05).*

| Nature of complication | Number | Percentage |
|---|---|---|
| No morbidity | 17 | 85.00% |
| Seroma | 02 | 10.00% |
| Wound dehiscence | 01 | 05.00% |
| Wound infection. | 01 | 05.00% |
| Total | 20 | 100.00% |

**Table-VII**

*Distribution of patients by survivability of flaps (n=20)*

| Nature of complication | Number | Percentage |
|---|---|---|
| Completely Survived | 16 | 80.00% |
| Partial flap loss | 02 | 10.00% |
| Total flap loss | 02 | 10.00% |
| Total | 20 | 100.00% |

**Table-VIII**

*Distribution of patients according to Management of complication (n=05).*

| Site | Nature of complication | Management | Frequency | Percentage |
|---|---|---|---|---|
| Donor site | Wound infection | Treatment by antibiotic | 02 | 80%. |
| | Seroma formation | according to C/S | 01 | |
| | Wound dehiscence | Aspiration of Seroma | 01 | |
| Flap | Marginal flap necrosis | Conservative healing | 01 | 10%. |
| | Partial flap necrosis | Secondary suture | 02 | |
| | Total flap loss | skin graft | | |
| | | Reconstruction by other flap | | |

**Table-IX**

*Outcome of reconstruction (n=20).*

| Outcome. | Criteria | Frequency | Percentage |
|---|---|---|---|
| Excellent | No flap loss. | 16. | 80%. |
| | No infection. | | |
| | Excellent flap adhesion. | | |
| Good | Marginal flap necrosis. | 02. | 10%. |
| | Salvageable. | | |
| | Minor donor site infection | | |
| | Seroma formation | | |
| Poor. | Total flap loss. | 02. | 10%. |
| | Alternative procedure was required | | |

**Discussion:**

Reconstructive surgery is always a magnificent combination of classical principles of surgical technique, critical anatomical assessment and application with innovative formulation of newer options[8,9] In these consequences Latissimus dorsi muscle flap is verified with different techniques, combination, in variable body parts with different purposes required by the recipient site[10, 11]. This study was designed to qualify the versatility of the free latissimus dorsi muscle flap and was carried out in Burn and plastic surgery department of Dhaka Medical College Hospital from July 2017 to July 2018.Sample size was twenty (20).

Like other reported series[12, 13] free LD muscle flap has been preferred for reconstruction of extreme part of the body as lower extremity and scalp for its known favorable anatomical features. It is the largest muscle of the body (up to 20x40 $cm^2$).So it become the only option when recipient site is complex and extensive. It can be taken as mega flap in combination with serratus anterior (Chimeric flap)[14.]

In this study, free LD flap has done in different age group of patients. The age range was 20-58 years with a mean age of 35.65 years. It reflects that this type of injury is more common among young and active population. The average age was 33 years in Herrera et al with age range of seven to seventy nine. It was 26.4 in song et al study. In Hossain I et. al. study, the sample age range was 23-56 years with a mean age of 36.6 years .

Sex distribution of the study was male 60% and female 40% (1.5:1). Male female ratio was found 4:1 in Hossain et al study which was also held in Bangladesh three years back. This study includes five female worker having extensive degloving injury over the scalp in rice mill accidents. So male female ratio shows a bit difference than previous series in Bangladesh.

This study showed that, RTA (65%) was the commonest cause of injury followed by Machinery injury(25%). Two patients sustained electric burn. On query, it was found that the machinery injury was caused by similar type device. It was a power driven rotatory machine usually used in rice mill. Female worker wearing shari / long scarf with long hairs being trapped by the machine and sustain similar pattern of degloving injury over the scalp and present with varying degree of exposed skull. Whereas Herrera et al shows scalp avulsion injuries were secondary to multiple causes i.e. motor vehicle accidents in 14 patients, one go-kart accident, one linen press accident, one drive shaft accident, and one mountain lion attack. Tumor extirpation resulted in eight scalp defects; three defects from unstable scars/ chronic wounds; two resulting from radiation necrosis while treating a scalp malignancy; one wound was the result of electrical burn; and one wound was from a birth-related injury. [17] Hossain et al study shows most of the injury (50%) were due to road traffic (RTA) injury followed by, machinery injury (20%) and 10% by burn.[15] The etiology was a little bit different in the study of El-Shazly,et al. [11] Acute post traumatic wounds with hardware exposure were the topmost cause ,in six patients among 11 sample size. Unsteady scarring with recurrent ulcerations in three patients and chronic trophic ulcerations were the cause in another two patients. However in another study of our country also suggests changing pattern of trauma from low velocity to high velocity is the highest cause for the defect of lower limb. It seems RTA is more common in our country and causes devastating injury.

This study includes 13 cases of soft tissue defect in lower extremity,05 cases in scalp and 02 cases in anterior trunk. Among the cases of lower extremity, distal leg was involved in 10 cases. In remaining three cases, one was over ankle joint, one over dorsum and another was over sole of the foot. The study of Hossain I et al included 10 cases in his study of lower extremity soft tissue defect and shows the maximum cases (50%) wound were located in the distal part of leg. Among the other locations, dorsum of foot 02(20%), over ankle joint 02(20%), and another 1(10%) was in sole of foot and the rest one was in the extensive involving distal leg and foot. [15] Biswas D and et al which was conducted in Plastic surgery Department of Dhaka Medical College Hospital and Uttara Adhunik Medical College Hospital showed almost similar pattern. The have performed 10

cases of lower limb defect. The site of the wound were 6 in lower leg, Dorsum of foot 3 ,1 in ankle and 1 in sole of foot. [2] There are many studies are available where latissimus dorsi muscle flap was performed ie over the complex defect of midfoot (Akcal et al) [16],lower leg (Kim et al)[18],fabricated chimeric LD flap in extensive foot defect(Song et al) [19],combined LD and Serratus anterior muscle flap with rib for composite defect(Tragnano et al) [20].Herrera et al performed secondary microvascular scalp reconstruction in the 23 patients; all secondary flaps completely survived except for two cases which sustained partial flap loss. Flap choices included 17 latissimus dorsi (LD)-based flaps (two partial superior LD flaps with and without reinnervation, two LD combined with serratus flap, one LD combined with parascapular flap, one LD combined with split rib, and 11 only LD flaps with STSG). [17]Thereby versatility is observed for latissimus dorsi muscle flap to be used in different combination in various parts of body.

In this study the flap dimension ranged between 120 to 384 $cm^2$ with an average of 229.25 $cm^{2.}$.Flap dimension was 18 X 11 $cm^2$ to 08 X 06 $cm^2$ in Hossain et al study. [15]They discussed 02 cases that had marginal flap necrosis were the relatively larger ones. Although the largest flap was not associated with any complications. So there was no clear cut co-relation between increased flap size and chance of postoperative complications, as revealed in this current study also. Akcal reported two cases of midfoot bone and soft tissue reconstruction with 50-112 $cm^2$ perforator-based skin island, 225-300 $cm^2$ LD muscle flap, and 6 to 8$cm^2$ section of scapular bone were raised with the thoracodorsal and angular arteries following gun shot injury. [16]Herrera et al performed LD muscle flap for defect area of average of 442 $cm^2$ (range,120 to 900 $cm^{2)}$).The LD flap was combined with serratus, parascapular, and split rib to address composite and more extensive defects in that study. For smaller defects, the latissimus can be split longitudinally on a transverse intramuscular branch of the thoracodorsal vessels to address "rectus muscle sized" defects. They claimed their institution first described the latissimus muscle flap as a partial superior latissimus flap, thereby preserving form and muscle function. This modification was used in two cases of smaller size defects (150 $cm^{2)}$).Song et al used fabricated chimeric flap for extensive foot defects with size ranging from 23x12 $cm^2$ to 38x 14 $cm^2$.Thus versatilty can be found in flap dimension and composition in different studies. [17]

In this study, Chimeric flap and superior partial muscle flap was also used beside the standard myocutaneous flap. The subscapular artery branches into two main arteries, the circumflex scapular and the TD artery, which runs distally and gives off the SA branch before entering the LD muscle. The TD artery also gives rise to the angular branch to the scapula, permitting the harvest of a segment of scapula. There are numerous LD perforators, including septocutaneous, direct cutaneous, and Musculocutaneous perforators, that are all reliable, and can nourish a large area of flap. The subscapular system offers a variety of separate components, such as muscle, skin, fascia, and bone, all attached to a common pedicle which is the basis of chimeric flap. Kim et al done 19 chimeric flap for extensive defect and suggested that thoracodorsal artery perforator based chimeric free flap can be used to prevent pedicle compression in lower extremity reconstruction. [19]

In this study, superficial temporal (ST) artery (n = 03), facial artery (n = 2), occipital artery (n = 1) was used as recipient artery in case of scalp, A variety of recipient vessels were used including the superficial temporal (ST) artery (n = 26), facial artery (n = 4), occipital artery (n = 3), superior thyroid artery (n = 1), supra-orbital artery (n = 1), and postauricular artery (n = 1) in the study of Herrera at el. The majority of recipient veins used were the ST veins (>70%), followed by facial vein, and occipital vein in three patients. Vein grafts were required in 15 cases. In case of lower limb, Medial sural artery (n=03), anterior tibial artery(n=5),posterior tibial artery (n=03) and arteria dorsalis pedis were used as recipient vessel in the current study. Song et al used either anterior(n=3) or posterior tibial artery(n=2),Hossain et al used anterior tibial artery(n=5),posterior tibial artery (n=03) and arteria dorsalis pedis (n=2) as recipient vessel

for lower leg reconstruction. Length of thoracodorsal vessels allow to access variable recipient vessels for anastomosis.

In this study, major flap loss occurred two. One was in scalp and Another case was in lower limb. The cause was post operative venous thrombosis started on 2nd POD in scalp case and on 4th post operative day. Re-exploration was done in both cases but failed. Skin graft was done to manage the wound temporarily. Hossain et al study reveals, out of their 10 cases 06 (60%) cases healed without any complications. Wound infection occurred in 02 (20%) cases, flap margin necrosis occurred in 02 (20%) cases. There was no (00%) incident of total flap loss. Out of the 04 cases that had post-operative complications 02 (20%) were treated conservatively, 02 (20%) were treated with excision of unhealthy margin followed by direct closure. None needed any advancement after excision or any other alternative procedure of reconstruction. [15] In the 08 cases operated by Bishwas et al. there was no report of post operative wound infection, only one case developed total flap loss due to logistic problem. Necrosis of distal tip of flap occurred in 02 (20%) cases which were repaired with excision and direct closure in both of the study. [2] In the study of Mohamed El-Shazly and et al, there was a intraoperative failure of free LD flap. It occurred due to patient's hemodynamic instability through the procedure in the form of an insufficient intravenous fluid therapy and inadvertent vasopressor injection to raise the blood pressure by a junior anaesthesist, which led to irreversible arterial spasm. This patient was treated then with a temporary coverage by a STSG. But they didn't mention about post operative infection or partial flap necrosis.[9]The overall microvascular success rate in Herera et al series shows 92% which is consistent with the literature's success rates. [17] Kim et al shows all his flaps survived with minor complication was there like donor site wound disruption.[18]

This study shows outcome of reconstruction was excellent (80%) in term of no infection, no flap loss and excellent flap adhesion, Good (10%) as there was Seroma formation or minor donor site infection or marginal necrosis but salvagable and poor (10%) due to total flap loss or alternative procedrure was required. The study of Hossain et al reveals 06 (60%) good. acceptable in 04 (40%) cases. None of the cases had any poor outcome. [15] No debulking procedure was performed in our study as well as in the 08 cases operated by Bishwas et al. [2] In that study, they mentioned that different studies shows that the flap reached its maximum bulkiness in the 1st month and then gradually become static after a mean of 7.8 months with no further changes for at least 23 months. The mechanism of edema formation is free flap is still unclear. Out of their 10 flaps, 07 flaps were bulky at the end of 7 month. They were using pressure stockings. [2] Song et al used the flap combination which provided the patients with both more tissues and better functions. Most of the functional areas obtained effective coverage and no recurrent ulcer and flap breakdown developed in chimeric flap areas in their 3.5 years long follow-up period. [19]

Trignano et al shows the result at 2 years from surgery which was also was good both from an aesthetical and functional point of view as the patient was able to walk without support and wear shoes. Only one patient required debulking procedure. The patients occasionally complained of foot pain when standing or walking for a long time. [20]

**Conclusion:**

Latissimus Dorsi free muscle flaps are useful with high versatility for a range of defects and complex reconstructive problem. It contains maximum tissue components and can be tailored to fulfill the recipient site requirement. Flap is easy to dissect, anatomical variation is rare, long pedicle length which allow to anastomose with suitable recipient artery and finally donor morbidity is negligible. For larger and complicated scenario, chimeric flap can be used but must always be made prudently, as the surgical procedures are technically sophisticated and represent the complex end of the reconstructive ladder. Nevertheless, if the defects involve multiple regions of important functional areas, LD-serratus anterior chimeric flap may be an alternative.

## References:


1. William L,The first free flaps and the problem they addressed. Ann Plast Surg. 2014. Dec.73(6): 623-624.
2. Biswas D, Kalam MA, Ahmed T, Khan MRK. Results of Microvascular Free Flap for Reconstruction of Soft Tissue Defects: Our Early Experience. *BDJPS* 2012; 3(2): 33-37
3. Kim JT, Kim SW, Youn S, Kim YH. What Is the Ideal Free Flap for Soft Tissue Reconstruction: A Ten-Year Experience of Microsurgical Reconstruction Using 334 Latissimus Dorsi Flaps From a Universal Donor Site. *Ann Plast Surg*. 2015 Jul. 75 (1):49-54.
4. Spiegel JH, Polat JK. Microvascular flap reconstruction by otolaryngologists: prevalence, postoperative care, and monitoring techniques. *Laryngoscope*. 2007 Mar. 117(3):485-90.
5. Tomita K, Yano K, Nishibayashi A, Fukai M, Miyasaka M, Hosokawa K. The role of latissimus dorsi myocutaneous flaps in secondary breast reconstruction after breast-conserving surgery. *E plasty*. 2013. 13 -28.
6. McCraw and Arnold's Atlas of Muscle and Musculocutaneous Flaps,2nd edition ,p-288.
7. Bailey BN,GodfreyAM. Latissimus dorsi muscle free flap. Br J Plast Surg 35:47,1982.
8. Dabb R,Davis R M.Latissimus dorsi free flaps in the elderly: An Alternative to below knee amputation .Plast Reconstr Surg73:633.1984
9. Tahseen A. Cheema S et al. Transfer of Latisssimus Dorsi Muscle as as a Myopcutaneous Flap.JPMA, 54 -58, March 1991.
10. Buntic R F,Horton K M,Brooks D et al.The free partial superior latissimus muscle flap: preservation of donor site form and function.Plast Reconstr Surg 121:1659,2008
11. Mohamed EI-Sh,Mohamed M et al.Microsurgical free tissue transfer as a valuable reconstructive procedure in foot reconstruction.Ind J Plast Surg 2007,vol 40,issue 2
12. Rainer C ,Schwabegger A.H ,Bauer T,Nincovic M, Klestil T, Harpf C, Nincovic M.M :Free flap reconstruction of foot .Ann. Plast.Surg.1999;42:606.
13. Vikaratitis S.,Nokus T.,Austraukas T.,Kaikaris V.,Rimdeika R. and Averkina S. Freemusculo-cutaneous and muscle flaps for foot reconstruction:a clinical and gait analysis study. Europ. J .plast. surg. 2000; 23:111.
14. Godina M. early microsurgical reconstruction of complex trauma of extremites.plast. Reconstr. Surg. 1986;78:285
15. Imam H, Khan MRK.Use of Lattisimus Dorsi Free Flap for Lower Limb Reconstruction. *BDJPS* Jul 2017; 8(2): 50-56
16. Akcal OA, Kerim Ul, Tahsin G,Mehmet AA,Zekiye B. Reconstruction of midfoot bone and soft tissue loss with chimeric partial scapula and latissimus dorsi muscle flap and short perforator-based skin flap following gunshot injuries:Report of two cases.[online],2016;wileyonlinelibrary.com/journal/micr. 36: 598-603
17. Herrera F,Rudolf B,Brooks D,Buncke G,Anuja K. Microvascular approach to scalp replantation and reconstruction [online ] ,18 August 2012,Available from: in Wiley Online Library (wileyonlinelibrary.com).DOI 10.1002/micr.22037.
18. Kim S,Youn D,Kim J T,Kim Y H.A thoracodorsal artery perforator chimeric free flap for prevention of microvascular pedicle compression in lower extremity reconstruction,[online]30 September 2015 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/micr.22504
19. Song B,Chen J,Han J,Hu Y,Li Y.The use of fabricated chimeric flap for reconstruction of extensive foot defects. online 6 March 2015 in Wiley Online Library(wileyonlinelibrary.com). DOI: 10.1002/micr.22399
20. Trignano E, Falliko M., Nitto A and Chen H C.The treatment of composite defect of bone and soft tissues with a combined latissimus dorsi and serratus anterior and rib free flap.[ online] 25 February 2013 in Wiley Online Library (wileyonlinelibrary. com). DOI 10.1002/micr.22067