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Original Article

Results of Microvascular Free Flap for Reconstruction of Soft Tissue Defects: Our Early Experience

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Abstracts:

Extensive soft tissue defects following trauma, burn or after cancer surgery need coverage by flaps. Sometimes surrounding tissues are not healthy enough or quantity is not favorable to provide adequate pedicle flaps. Microvascular free flap can provide healthy tissue of adequate amount from distant area for those difficult situations.15 microvascular free flaps were performed from October 2011 to February 2013. Radial forearm free flap was done in 8 and Latissimusdorsi (LD) flap in 7 cases. 10 flaps done in foot, ankle & lower leg region (radial forearm-5, LD-5) and 5 flaps were done in face and scalp region (radial forearm-4, LD-1).12 flaps healed uneventfully with good coverage of the defect. Average ischemia time was 135 min (range 100-240 min) and average anastomosis time was 75 min (average 60-100 min). 2 flaps failed. There was necrosis of the tip of 2 LD and cumbersome swelling of the flap was found in 2 cases of LD flaps.Large soft tissue defect of body where local or regional flaps are not feasible; can be easily covered with free flaps. Its capacity to cover huge soft tissue defect has neutralizes its technical demand. Though complications are still high in our hands; can be reduced performing more number of cases.

Key wards: *Microvascular free flap, reconstruction, soft tissue defects, early experience.*

Introduction:

Microvascular free tissue transfer is the established method of reconstructive procedure in most of the countries of the world even in our neighbor countries. But we are far behind from those facilities. Sporadic few free flaps were done by many of our surgeons but there is no series of large number of cases. In a developing country like us, surgeons are still contending with the basic problems of microvascular free tissue transplantation. With changing pattern of trauma from low to high velocity the limb become so badly injured that single local or regional flap fails to provide adequate tissue coverage. Sometimes cancer and burn area need coverage by free flapswhere pedicle flaps from surrounding area is not suitable. Other important area of free tissue or vacularised bone transfer is in gap nonunion and following cancer surgery. Microvascular free flap can cover a very large area with single vascular anastomosis and can be applied to any area of body where suitable vessel for anastomosis is available. 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.

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Patient and Methods:

15 microvascular free flaps were performed from October 2011 to February 2013 at Dhaka medical college hospital and UttaraAdhunik Medical College Hospital, Uttara. Radial forearm free flap was done in 8 and Latissimusdorsi (LD) flap in 7 cases. Site of the defect, flap used for coverage and recipient vessel for anastomosis are distributed in table [Table-1,2,3]. 10 flaps done in foot, ankle & lower leg region (radial forearm-5, LD-5) and 5 flaps were done in face and scalp region (radial forearm-4, LD-1). Site of the soft tissue defect, Flap used for wound coverage and site of vascular anastomosis are given in the table.

Results:

12 flaps healed uneventfully with good coverage of the defect. Follow up period was 5 months (range 4-18 months). Average ischemia time was 135 min (range 100-240 min) and

Fig-1: *Soft tissue loss over medial aspect & dorsum of foot.*

Fig-2: *Wound is circumferentially extended to the sole of foot.*

average anastomosis time was 75 min (average 60-100 min). 2 flaps failed totally (subsequent 1st & 2nd cases). The LD flap failed due to the fact that the needle tip of suture materials were so blunt that vessel wall could not be pricked and no other sutures were available, additionally the magnification which we were using could not be adjusted properly. Major and minor complications were in 4 cases [Table-4]. The radial forearm flap failed in the face region where anastomosis done with the facial artery; had long vascular pedicle, flap redundancy that was kinked easily and subsequently thrombosed. There was necrosis of the tip of 2 LD flaps which were very large muscle flap. Cumbersome swelling of the flap was found in 2 cases of LD flaps [Fig-4].

Table-I

Site and No. of the defect

Site of Defect	No.
Lower leg ankle foot	6
Leg	3
Foot	1
Face	4
Scalp	1

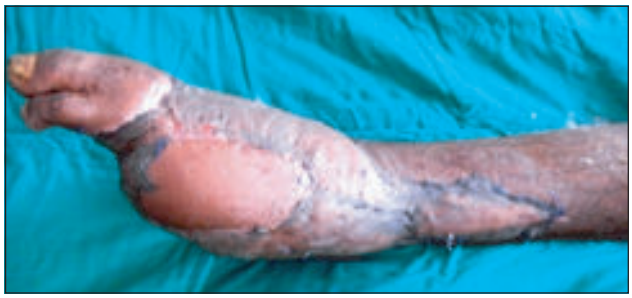

Fig-3: *10th day after free LD flap with split skin graft*

Fig-4: *7 month of follow up of free LD flap with mild swelling.*

Discussion:

In recent years, free tissue transfer either in the form of free muscle or fasciocutaneous flaps have become the corner-stone in reconstruction of soft tissue defects, especially in gross post-traumatic defects[1, 2, 3].

The high survival rate (100%) and low rate of acute postoperative complication is the inspiration and has inclined the reconstructive surgeons more towards the free flaps for reconstruction of tissue defects[3,4,5].

Table-II

Flap used for wound coverage

Used Flap	No.
Radial Forearm	8
Latissimusdorsi	6
Combined Latissimusdorsi and serratus anterior	1

In view of this high success and limited size of the reliable local flaps it can be said that this modality of treatment is the first choice in reconstruction of sizeable defect of the lower leg and the foot[6,7,8]. Our current success is 90% and the figure can be increased by doing more number of cases.

Like other reported series[4,5] free latissimusdorsi muscle flap has been preferred for reconstruction of lower leg and foot for its known favorable anatomical features. It is the largest muscle in the body (up to 20x 40 cm^2); can be tailored easily according to the size of the defect and can be harvested without significant donor site functional deficit. The vascular pedicle is long and posses vessels of compatible size to the posterior or anterior tibial vessels, which allows microsurgical anastomosis outside the zone of injury without need for vein graft[9].

Redundancy of the LD free flap in adult is disappointing. But this is advantageous in children and thin individuals due to optimum bulk (<1 cm thick) allowing it to be draped over irregular surfaces with ease [Fig-5,6,7].

Fig-5: *6 weeks old avulsion of the scalp (Top view)*

Fig-6: *Scalp avulsion (Lateral view)*

Fig-7: *Follow up after 6 of coverage by free latissimusdorsi &serratus anterior flap complex with split skin graft.*

Table-III

Site and No. of vascular anastomosis

Site of Anastomosis	Number
Superficial temporal	1
Facial	4
Posterior tibial	4
Anterior tibial	4
Arteriadorsalispedis	1
Medial descending genicular	1

A child of 7 year had subtotal avulsion of scalp with bare bone; attended 6 weeks after injury.Single latissimusdorsi free flap was not suitable to cover the whole defect. So it was covered with combined Latissimusdorsiand serratus anterior flap. The advantage is that; LD itself is a very big muscle and can be harvested with serratus anterior to create a flap complex based on single thoracodorsalvascular pedicle.For its pedicle length it can be easily anastomosed with any branch of external carotid artery in the neck.

Table-IV

Complications

Complications		Number
TotalNecrosis	LD flap in leg & foot	1
	Radial forearmFlap in face	1
Tip necrosis of LD flap in leg		2

Shaw WW and Ko Cy showed no statistically significant correlations between duration of ischemia time and the incidence of thrombosis, flap complication, or flap failure. The conclusions were that, within a 4-hr period of cold ischemia and especially the "no reflow" phenomenon, generally should not interfere with efficient and orderly free-flap surgery[10]. Gurlek A and Kroll SS also concluded that ischemia time is irrelevant to flap survival, provided that ischemia is not prolonged past 3 hours or to the point where the no-reflow phenomenon occurs[11]. In our series average ischemia time was 135 min (range 100-240 min) and average anastomosis time was 75 min (average 60-100 min). There was more than 4 hour ischemia time in our 1st and 2nd cases which ultimately failed. In these cases we harvested the flap before recipient vessel is prepared.

Failure by thrombosis and venous congestion of flaps of the lower limb varies depending on the primary trauma, the systemic condition of the patient. Winterton, in his series of 2,569 flaps, showed the re-exploration rate of 13%. Among

these patients, the overall success rate was 95.3%[12]. We have never re-explored any of our cases. Though 1 of our radial forearm flaps where anastomosis was done to the facial vessels; was thrombosed, congested and ultimately necrosed before we were aware of it. It was the 2nd performed free flap in our series. We re-explored theanastomtic site of necrosed flap and found that there was kinking of the vessel with subsequent thrombosis. There was redundancy of the flap which enhanced kinking of the vascular pedicle. The vein kinks first due to its thin wall which subsequently blocks the whole vascular channel due to back pressure. To prevent flap necrosis the kink or thrombosis to be relieved before the critical pressure cycle develops.

1st case of our series was a latissimusdorsifree flap and it was totally necrosed. The problem was of logistics. The tip of suture materials was so blunt; that it was hardly pricking the vessel wall. With forcible attempt of prick the vessel wall was being torn. Alternate sutures were not available. Another problem was that the microscope was not familiar during our first time use. Ultimately it took very prolonged time to finish the procedure without proper anastomosis.There was necrosis of tip of 2latissimusdorsi flap. The total muscle was harvested from iliac crest to the humerus. During flap harvest; numerous perforators of variable sizes are found to nourish the distal part of this flap which is the additional source of nutrition. Anastomosis of the single thoracodorsal vessel may not be sufficient enough to nourish so big muscle upto its distal end. An extra anastomosis of a perforator located at the distal end of muscle may be helpful for survival of the flap. Interestingly; the LD flap complex with serratus anterior used for scalp coveragesurvived fully with single anastomosis.

The amount of oedemaand the rate of atrophy of transferred muscles and tissues are unknown[13]. Study shows that the flap reached its maximum bulkiness in the first month, and then gradually become static after a mean of 7.8 months with no further changes for at least 23 months[14,15]. The mechanism of oedema formation in free muscle flap is still unclear. Experimental studies have shown that after flap elevation, blood flow is reduced for less than 1 hour due to vasospasm of surgical trauma, and then stopped completely in the ischaemia period before flap reanimation by vascular anastomosis. Subsequently, there is a long-lasting increase of blood flow, attaining its maximum in 48 hours. Vascular resistance decrease and arterial inflow and venous pressure increased. Denervated muscle flaps do not contract and venous pressure is still increased. The pressure changes are more in lower leg due its dependency with higher venous pressure. This phenomenon lasts for more than 8 weeks after surgery with increasing oedema[16,17]. So compressive elastic socks are recommended to decrease swelling in the earlyfew months after flap healing. Another cause of swelling and redundancy of muscle flap is due to incomplete tension of the flap over the defect, which might need subsequent debulking. 2 of our LD flap are still very bulky at the end of 7 month. They are using pressure stockings. We have not yet done any debulking.

Conclusion:

Though technically demanding the free flaps can be performed in patients with extensive soft tissue defect where local or regional flaps are not feasible. We are at the initial stage of microsurgical free flaps; the success of which is near to 100% in skill hands. But complications are still significant in our hand. Most of the complications are of the earlier cases. The success rate can be improved and complications can be reduced to a minimum by performing more number of cases.

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