



Procedures Used for Reconstruction of Lower Extremity Soft Tissue Defects

KEYWORDS

Lower Extremity Defects, Reconstruction, Skin Grafting, Flaps.

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ABSTRACT

This study was designed as a prospective study carried out at a medical college. The study population included 60 patients with lower extremity defects. Aim of the study was to study various types of reconstructive procedures that can be used for lower extremity defects. The principal cause of lower extremity defects was road traffic accidents (52%). The age of patient varied from 4 years to 80 years, the highest incidence being between age group of 16 to 40 years (61.60%). In our study 45 patients were male and the remaining 15 patients were female. 31 patients (52%) had soft tissue defect in right lower extremity, 25 patients (42%) had soft tissue defect in left lower extremity whereas 4 patients had soft tissue defect in both lower limbs. 51 patients (83%) in our study had soft tissue defect below the knee joint and the remaining 9 patients had soft tissue defect above and below the knee joint. In the present study in 30 patients (50%) split thickness skin grafting was done. In 17 patients (28%) local flaps were used for covering the soft tissue defect. Cross leg flap was performed in 4 patients and in 9 patients (15%) reconstruction of lower limb soft tissue defect was done using free tissue transfer procedures.

Introduction

Lower extremity defects whether having loss of skin, or degloving injury exposing muscles, tendons and bones are very common. The functional loss of the lower limb due to the defects not only curbs the physical activity of the individual it also leads to social and economical loss for the patient and his family, hence the great importance of reconstructive surgical techniques for covering lower extremity defect to restore the patients physical, social and economical life back to its normal limits.

The leading causes of lower extremity defects are road traffic accidents, infections leading to cellulitis, osteomyelitis, and gangrene of lower limbs due to peripheral vascular disease, tumors of the lower limb, Diabetes leading to neuropathy or cellulitis and Burns involving lower limbs.

Various types of reconstructive procedures have been devised which help in protecting exposed parts and surfaces. Different methods of treatment such as Skin grafting¹, cutaneous local flaps², musculocutaneous flaps³, fasciocutaneous flaps⁴, cross flaps⁵ and free tissue transfer flaps⁶ have been used. Surgeons choose the most suitable surgical technique after careful examination of the defect, its extent, and possible involvement of tendons, bones and the integrity of the local vascular pedicle.

Material and Method-

The study was conducted in a medical college over a period of two years as a hospital based prospective study. 60 cases of lower extremity soft tissue defects were included in this study.

A detailed history was taken and the clinical examination was done as per the standard proforma. The laboratory and radiological work up of the patient was done on admission and the plan of treatment and of operation was explained to the patient. Preoperatively the patient was evaluated again for the – amount of tissue loss (size of the defect), localization of the defect and for any neurovascular damage. Preoperatively broad spectrum antibiotics were started in cases of infected wounds.

Intraoperatively for major surgery, the patient was positioned according to both the location of defect and the type of re-

construction planned to allow simultaneous flap harvest and preparation of recipient area. Intraoperatively viability of flap was judged according to the color of the flap and dermal bleeding from the edges of the flap.

Postoperatively in early period close monitoring was done for flap viability according to reconstructive procedure. For free tissue transfer monitoring was done every 2 hours in the first 2 days and 6 hourly from day 3 till day 14 to detect complications like hemorrhage and flap edema, necrosis, infection, wound gaping and fistulas.

Every patient undergoing flap reconstructive procedure was followed up every 2 weeks till the first month post operatively and then once every month till 6 months and then once after 12 months for stability and contour of the reconstructive procedure.

The criteria which were used to assess the efficacy of different methods used for reconstruction were as follows

Good	Satisfactory	Poor
Successful flap/graft transfer No loss of flap	Successful flap/graft transfer Partial loss of flap (up to 1/3 rd)	Loss of flap/graft-total or partial (more than 1/3)
Adequate coverage of defect	Adequate coverage of defect	Inadequate coverage of the defect.
No infection	Infection with minimal breakdown of suture line	Infection with discharge and suture gaping.
Cosmetically satisfactory with no secondary deformity	Minimal Secondary deformity	Severe secondary deformity
No readjustment required	Readjustment required later	Immediate secondary reconstruction required.

Discussion-

The range of age of patients in the present study was between 4 years to 80 years. The highest incidence 61.60% was found between the age of 16 and 40 years followed by 16.6% in the age group range of 41-60 years. The slight preponderance of highest incidence in the age group between 16

to 40 years may be attributed to the fact that this is the age of maximum activity & movement leading to more exposure to factors which can cause soft tissue defect like road traffic accident, infections.

In the present study male were found to have a higher incidence 75% of lower limb soft tissue defects as compared to the females (25%) giving male to female ratio of 3:1. In the present study out of the 60 patients having lower extremity soft tissue defects, 32 patients (52%) had road traffic accidents as the cause of the defect. 10 patients developed lower extremity defect as a result of surgical debridement done for treating infective processes such as cellulitis and osteomyelitis. Post burn lower extremity soft tissue defect was found to be the cause in 10 patients. 3 patients had malignancy of soft tissue of lower limb and had lower limb soft tissue defect after treatment for the malignancy of lower limb. In 5 patients guillotine amputation done for wet gangrene was the cause of soft tissue defect of lower extremity.

In our study 31 (52%) patient out of 60 had defect of right lower limb, 25 patients (41.5%) had defect of soft tissue of left lower limb and 4 patients had bilateral lower limb soft tissue defect. In our study 30 patients having lower limb soft tissue defect underwent skin grafting. 9 patients required free tissue transfer for reconstruction of defect. 4 patients required cross leg flap for covering the lower limb defect and the remaining 17 patients required reconstruction procedures like local fasciocutaneous and adipofascial flaps. In our study we used proximally and distally based fasciocutaneous flaps for lower limb soft tissue defects in 7 patients. The random fasciocutaneous flaps with a width to length ratio of 1:3 are safe. The ratio must never exceed 1:3.^{7,8,9,10} The flaps size varied from 3X9 cms to 5x15 cms. After flap transfer we closed the donor site with a split thickness skin grafting or by direct primary closure. During second stage, 4 weeks after the initial transfer operation, the pedicles of the flap were divided and the carrier segments were returned. All flaps survived and showed no complications. These flaps have been demonstrated to be both effective and reliable in lower limb reconstruction. Operating time is shorter, donor site morbidity is lower and skin cover is robust.^{11,12,13} In 3 patient adipofascial flap was used for reconstruction of the lower limb defect. The flap was used as an island flap to cover the defect. The donor site was closed with primary suturing. The raw surface of the flap was covered with split thickness skin grafting. All flaps survived and showed no complications. These flaps have the advantage of being more pliable due to absence of skin and preservation of major vessels of extremities. Donor site skin is preserved hence no donor site morbidity is seen.¹⁴

In 4 patients (3male & 1 female) we used a Gastrocnemius muscle flap to cover the lower limb soft tissue defect. This flap has the advantage of being a one stage, safe and easy procedure that can be used for repairing deep defects.

In 3 patients we used a sural artery based island flap. All flaps had good result with no complications. The sural artery based island flap with distally based flap is a superior surgical method to cover defects of distal third of leg, because of its wide arc of rotation, easy and quick dissection and decreased operative time.^{15,16,17}

In 4 patients we used distant flap in the form of cross leg flaps. 3 flaps were done for defects on right leg whereas 1 flap was done for the soft tissue defect of Left leg. We used cast application for immobilization of the legs in 2 cases.¹⁸ In the remaining 2 cases we used Steinmann pins for transosseous fixation of both lower extremities.¹⁹ All the flaps done in our study had good results with no complications which is comparable to the results in other series of cross leg flaps.^{20,21}

In our study we did free tissue transfer in 9 patients. In 4

patients we used Rectus abdominus muscle for free tissue transfer. In one patient we harvested the skin paddle along with the muscle and in remaining 3 patients we transferred only the muscle. In all 3 patients where we harvested only muscle, split thickness grafting was done to cover the muscle at recipient site. In 1 patient we had a satisfactory result with partial necrosis of the flap which was treated with debridement and subsequent split thickness grafting after granulation. In 1 patient there was complete necrosis of the flap that was treated by debridement and subsequent cross leg flap procedure. In the remaining 2 patients we had good results with no complications. The rectus abdominus musculocutaneous flap is easily elevated, has a long and large vascular pedicle and the donor site scar is generally not exposed.^{22,23}

Latissimus Dorsi free tissue transfer flap for coverage of lower extremity defects has been described in literature.^{24,25,26} In 2 patients we used latissimus dorsi muscle free flap to cover the lower limb soft tissue defect. In 1 patient we had good result and no complication whereas in the other patient we had poor result which was treated by debridement and cross leg flap.

In 2 patients we used the radial artery based fasciocutaneous free tissue transfer flap. The donor site was covered with split thickness skin grafting. The patients had good result with no complications. Kuo Y R described the anterolateral thigh flap for extremity reconstruction.²⁷ In 1 patient we used anterolateral thigh free flap for covering the soft tissue defect. The donor site was closed with primary skin grafting. The flap had good results with no complications.

In total 3 patients out of the 9 who were treated with free tissue transfer developed complications. 2 patients had complete necrosis of flap and 1 patient had partial loss of flap. All patients developing complications had road traffic accidents as the etiology of the defect. Vascular thrombosis was the cause of the failure.

In 30 patients we reconstructed the soft tissue defects by split thickness skin grafting. In these 5 patients had defect above knee joint and the remaining 25 had soft tissue defect below knee joint. The grafting was done secondarily as the patients were referred to us late after injuries and had infected wounds. In 10 patients we did mesh grafting while in 20 patients we did stamp grafting. Out of the 30 patients who had skin grafting 6 patients had complications wherein 2 patients had partial loss of graft and 4 patients had total loss of the graft which was treated later by giving antibiotics and repeat skin grafting after achieving healthy granulation.

Conclusion

In the present study on reconstruction of soft tissue defect of lower limbs, out of the 60 patients treated good results were obtained in 51 patients (84%) and 9 patients had complications.

The local flaps are one of the best methods for good reconstruction and rehabilitation in case of small wounds. They are easy to elevate, are safe and require less operative time. In centre without microsurgical facilities local flaps provide the only viable method of reconstruction.

The distant flap in the form of cross leg flap is used in case of large wounds in immediate post traumatic period as the limb having the defect has hopelessly scarred tissue which cannot be used for local flaps. Its use has decreased because of the tedious procedure, long period of immobilization and availability of other alternatives.

The free flaps have become an accepted method of reconstruction. The free flap assists the traumatized limb in early wound healing and functional restoration. Correct flap is critical to successful reconstruction. Free flaps with long, large caliber vascular pedicle such as rectus abdominus or the an-

terolateral thigh flaps are a good choice. In addition rectus abdominus and anterolateral thigh flap can be used as thin flap and require less number of revision surgeries.

The radial artery based fasciocutaneous free flap can be used in lower extremity defects where less bulk is required to cover the defect. The latissimus dorsi free flap is useful in case of large defect and where muscle bulk is required as in weight bearing areas.

Skin grafting remains the best treatment option either in mesh graft or the stamp graft form in wounds which are large, granulating and where there is no exposure of bones, tendons or nerves.



Image 4- Cross leg flap.



Image 1- Adipofascial flap elevation.



Image 5 – Sural flap dissection.



Image 2- Adipofascial flap with skin graft.



Image 6 – Sural flap follow up.



Image 3- Adipofascial Flap follow up.

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