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LOCO – REGIONAL FLAPS FOR LOWER LIMB RECONSTRUCTION – A RETROSPECTIVE STUDY

Plastic Surgery

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ABSTRACT

Background: Reconstruction of lower limb defects are always a challenge to the plastic surgeon due to the limited supply of local non-traumatised tissues and the precarious vascular supply post-trauma. The goal of reconstruction is to maintain form and function.

Materials & Methods: This was a retrospective study conducted in the Department of Plastic Surgery, Govt. Chengalpattu Medical College & Hospital, Chengalpattu from December 2008 to December 2010. Patients with soft tissue defects involving lower limb requiring flap cover were included in the study. Orthopedic intervention was done as required. All patients underwent loco-regional flap cover as required according to the site and nature of the defect. The outcomes were later analysed.

Results: Total of 40 patients was included in the study. Most common cause was due to road traffic accidents (RTA) in 30 cases and post infective defects in 10 cases. Right leg was involved in 28 cases and left in 12 cases. Out of the 30 traumatic cases, fractures were present in 16 cases, exposed bone without fracture in 10 cases and no bony exposure in 4 cases. Most commonly performed procedure was fasciocutaneous flaps (60%) followed by muscle flaps (40%). Complications were seen in 4 patients in the post-operative period.

Conclusions: Lower limb reconstruction is a challenge, but there are many options of loco-regional flaps available. In our study, various types of fasciocutaneous, septocutaneous and muscle flaps were used to cover the defects according to the nature of the wound. In this study, skin and superficial soft tissue defects were covered with fasciocutaneous flaps whereas for deep defects and with exposed bone with or without fracture, a muscle flap was used with good results. Loco-regional flaps have the advantage of being single-staged, faster to perform and technically easier.

KEYWORDS

Flaps, Leg defects, Faciocutaneous & Muscle Flaps, Complications

INTRODUCTION

Lower limb injuries are common, and account for about 40% of road traffic accident (RTA) related injuries. Disability resulting from leg injuries are a major cause of morbidity.[1] There have been tremendous advances in the management of lower-extremity trauma, and limbs which would have earlier required amputation can now be salvaged.[2] The goal for successful reconstruction is achieved by stable bony union, vascularised soft tissue cover and ambulation.[3] Soft tissue defects of the lower limb remain one of the biggest challenges in reconstructive surgery. The limited vascularity, paucity of tissues and injured integument and bony injury are some of the major factors complicating the reconstruction. The subcutaneous position of tibia warrants flap cover, and as most muscles become tendons at this level, flap cover becomes mandatory.[4,5] Microvascular free-flap cover has come a long way for soft tissue defects of the leg but difficult due to the high costs involved.[3] The conventional flaps are the gastrocnemius muscle flaps and fasciocutaneous (Ponten) flaps for the upper third leg defects, soleus flaps for the middle third defects and reverse sural artery or lateral calcaneal artery flaps for the lower third defects.[6] Now due to the angiosome concept, loco-regional flaps have been popular tool in the armamentarium of plastic surgeons for covering defects of the lower limb.

MATERIALS & METHODS

This was a retrospective study done in the department of Plastic Surgery, Govt. Chengalpattu Medical College & Hospital, Chengalpattu, for a period of 2 years, from December 2008 to December 2010. All patients with soft tissue defects involving the lower limb (both posttraumatic and post-infective) who required a flap cover were included in the study. Patients who had exposed bone, fracture sites and implants requiring flap cover were included in the study. Wounds treated by primary closure or skin grafting were excluded from the study. Patients with polytrauma and those requiring emergency surgical procedures for other conditions were excluded from the study. A total of 40 patients were included in the study. The details of the patient's demographic data with history and clinical examination were noted. After initial stabilization, X-Ray of the affected limb was taken and orthopaedic and vascular opinions was sought. Under appropriate anaesthesia, the wounds were debrided and dressing done. Fractures were fixed by the orthopaedic team before flap cover. According to the nature of the wound, various reconstructive procedures were done using the reconstructive ladder as a guide. When flaps were being performed, pre-operative marking of the perforators was done by hand-held doppler. All patients were given post-operative antibiotic therapy, analgesics and anti-edema measures. Flap monitoring was done on a daily basis. In patients who underwent skin grafting, first-look dressing was done on the 5th post-operative day.

RESULTS

Of the 40 patients in the study, 28 (70%) were male and 12 (30%) were female. The etiology was RTA in 30 and post-infective in 10.

Table 1: Sex distribution of the patients in the study

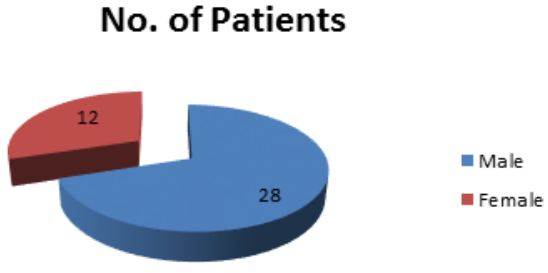
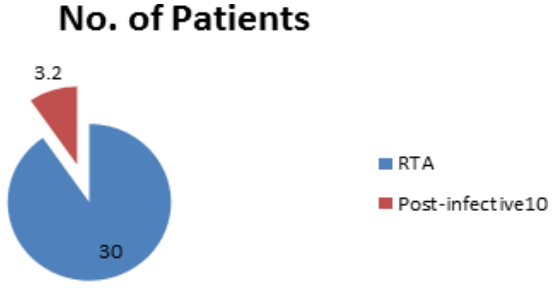
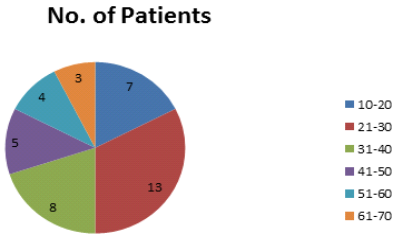


Table 2: Etiology of the cases under the study



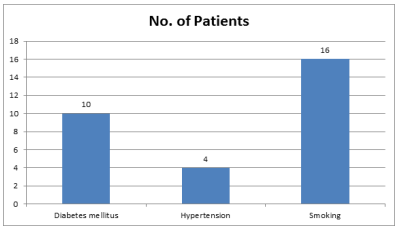
The highest incidence of pattients was in the productive age group of 21 to 30 years.

Table 3: Age distribution of patients in the study.



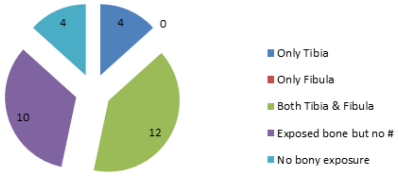
The most common comorbidity encountered was diabetes mellitus, which was found in 10 (25%) patients. 4 (10%) patients were hypertensive and 16 (40%) patients were smokers.

Table 4: Comorbidities of patients in the study.



Fracture was present in 16 cases and exposed bone without fracture in 10 cases. Six patients required orthopaedic intervention along with the flap procedure, and ten had already undergone orthopaedic stabilization prior to the coverage surgery.

Table 5: Status of bone of patients in the study.



Right leg was affected in 25 (6.5%) patients and left was affected in 15 (37.5%) patients. The most common type of injury encountered was crush injury and post surgical defects.

Table 6: Distribution of cases with respect to type of injury.

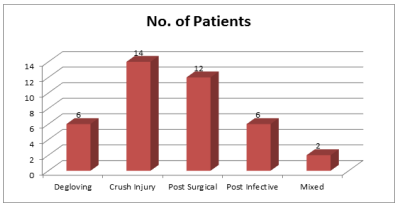
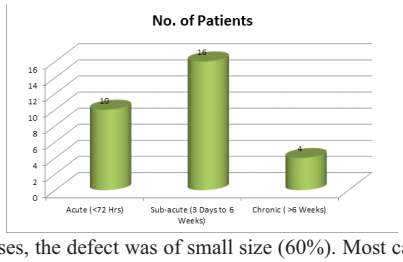


Table 7: Distribution of cases with respect to size of the defect.



In most cases, the defect was of small size (60%). Most cases (70%) were operated in the sub-acute period (3 days to 6 weeks post injury).

Table 8: Distribution of cases with respect to timing of coverage.

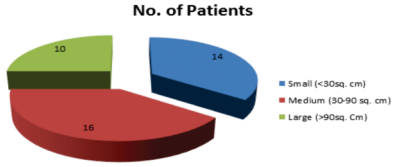


Table 9: Various coverage procedures employed in the study.

Type of flap	No. of cases	Percentage
Fasciocutaneous Flaps		
Rotation flap	2	5%
Transposition	4	10%
Ponten flap	8	20%
Propellar flap	3	7.5%
Bipedicle flap	2	5%
Cross leg flap	3	7.5%
Muscle Flaps		
Gastrocnemius	3	7.5%
Soleus	2	5%
Myocutaneous Flaps		
TFL	1	2.5%
Gastronemius myocut	2	5%
Axial Flaps		
Lateral Genicular Artery Flap	2	5%
Reverse Sural Artery Flap	4	10%
Lateral Calcaneal Artery flap	2	5%
Medial Plantar Artery Flap	2	5%

The most common complication observed in the postoperative period was partial graft loss in 7 (17.5 %) patients followed by flap edema in 5 (12.5%) patients and infection in 4 (10%) patients.

Table 10: Various complications encountered post-operatively.

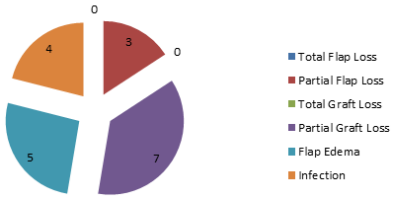


Fig. 1a – Defect upper 3rd of leg

Fig. 1b – Ponten flap (Fasciocutaneous)

Fig. 2a – Medical thigh defect

Fig. 2b – Covered with rotation flap

Fig. 3a – Exposed implant

Fig. 3b – Covered with transposition flap

Fig. 4a – Defect knee

Fig. 4b – Ponten flap cover

Fig. 5a – Defect knee

Fig. 5b- Lateral genicular artery flap

Fig. 6a – Defect mid 3rd of leg

Fig. 6b – Perforator isoloated

Fig. 6c – Propellar flap done

Fig. 7a – Defect upper 3rd leg

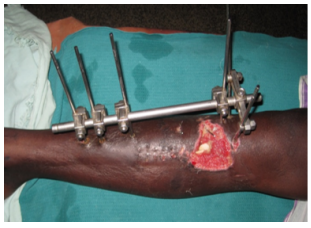


Fig. 7b – Medial gastronemius muscle flap

Fig. 7c – Muscle inset into defect

Fig. 7d – 1 month post – op picture

Fig. 8a – Upper 3rd leg defect

Fig. 8b – Gastronemius myocutaneous flap

Fig. 9a – Mid 3rd leg defect

Fig. 9b – Soleus muscle flap

fig. 9c – 1 month post-op picture

Fig. 10a – Defect mid 3rd leg

Fig. 10b – Bipedicle flap done

Fig. 11 a – Tendoachilles region defect

Fig. 11b – Reverse sural artery flap cover

Fig. 12 a – Defect ankle

Fig. 12b – Lateral calcaneal artery flap

Fig. 12c – 1 month post-op

Fig. 13 – Inf-based cross leg flap for lower 3rd leg defect

Fig. 14a – Plantar heel defect

Fig. 14b - Medial plantar artery flap

DISCUSSION

Reconstruction of lower limb defects is challenge to the plastic surgeon due to the limited vascularity and paucity of locally available uninjured tissue.[4,7] Reconstructive options include local flaps, regional flaps including cross-leg flaps and free-flaps. Comorbid illnesses like diabetes and smoking significantly affect flap survival. The most common comorbidity encountered was diabetes mellitus, which was found in 10 (25%) patients, but 16 (40%) patients were smokers. The most common complication observed in the post-operative period was partial graft loss in 7 (17.5%) patients followed by flap edema in 5 (12.5%) patients and infection in 4 (10%) patients. This is comparable to other studies.[4] Three cases of partial flap loss was observed which required debridement and subsequently healed conservatively. Two of the four cases of local infection, and the one patient who suffered partial flap loss were observed in diabetics. In addition, the other two patients who suffered partial flap loss were chronic smokers.

In present study, most patients underwent loco-regional fasciocutaneous flaps like Ponten flap (20%) followed by transposition flaps (10%) and reverse sural artery flaps (10%). As in literature, the most common indication for flap cover was fracture of both tibia and fibula with exposed bone which was seen in 12 (40%) of the cases. 4 (13.3%) of patients had only tibial fractures requiring stabilization prior to our intervention, and 10 (33.3%) patients had exposed bone without fracture requiring flap cover.

The gastrocnemius muscle is classified as type I according to Mathes and Nahai. It has one main pedicle, the sural artery and accompanied ny two venae commitantes. The medial amd lateral muscle bellies can be used as different flaps. It can also be used as a myocutaneous flap as well to cover defects of upper third of the leg and the knee. The soleus muscle is classified as type II according to Mathes and Nahai. The muscle can be used for reconstruction of middle third and proximal part of lower third of leg defects based on its major vascular pedicle, the posterior tibial artery. For extremely distal leg wounds, the muscle can be used in a reverse manner based on its secondary pedicles (the perforating branches of the posterior tibial artery).[8] The hemi-soleus flap employs the medial part of the muscle, thus preserving plantar flexion, which is performed by the lateral portion of the muscle.[9] In present study, gastrocnemius and soleus flaps were used with good

outcomes where fracture site was exposed, and wound infection was present.

Fasciocutaneous perforator flaps are robust flaps for covering wounds with exposed bones without fractures.[4,7] This is a versatile technique with decreased donor site morbidity. There is a better cosmetic and reconstructive outcome, but the main disadvantage is the increased incidence of venous congestion and technical skill required for raising the flap.[10,11] In present study, reverse sural artery flaps (RSAF) were employed in 10% of the cases. This is comparable to other studies.[7] RSAF is an especially important flap for foot and ankle defects, having the advantage of reliable vascularity, minimal donor site morbidity, no functional muscle loss and wide arc of rotation. Various modifications of the sural artery flap are available.[11] The disadvantage of RSAF is the loss of sensation which can be overcome by preserving the sural nerve.[12]

Most commonly, 16 (53.3%) patients were operated in the sub-acute period, which is similar to that reported in other studies.[4] In literature, early intervention is recommended.[13] The delay in present study can be explained by wounds being unsatisfactory for early intervention and need for debridement and delayed consent for the procedure. Early intervention has the advantages of shorter hospital stay and cost, need for fewer dressings, decreased infection rates and secondary necrosis of exposed tissues.[4]

No mortalities occurred in present study. Mortalities in other studies were attributed to co-morbid conditions like diabetes and peripheral vascular disease.[3] Average duration of hospital stay was least in muscle flaps and fasciocutaneous flaps (60% of patients were discharged within 10 days which was comparable to other studies.[4]

CONCLUSION

Lower limb injuries are a common presentation at the accident and emergency department, and a wide variety of options are available when soft tissue cover is required. In our study, fasciocutaneous flaps were the most commonly performed surgery with good outcomes for covering exposed fracture sites with infected wounds of the lower limb. However, with better understanding of vascular anatomy of the lower limb, a wide variety of loco-regional flaps have been developed, and are a good alternative to free flaps, especially when microsurgical facilities are not available. In major injury give time for the defect to settle, reduce the raw area with SSG, gain time, reduce size of defect and settle with smaller flaps. Patient selection is crucial especially in diabetics and smokers, avoid lengthy pedicles and islanding if possible and delay the flap for safe reach at the destination.

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Conflict of interest: None

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