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Experience in Flap Reconstruction of Lower Limb Defects in a Tertiary Care Center of Nepal

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ABSTRACT

Introduction

Lower limb defects are caused by trauma, chronic ulcers or oncological resection. Being a large and varied area of the body, lower limb reconstruction is challenging. This study analyzed clinical presentation of such defects, surgical management and outcomes in Nepalese context.

Methods

Single-center retrospective study of flap reconstruction of lower limb defects conducted in Tribhuvan University Teaching Hospital, Kathmandu over a two years period (April 2019-March 2021). Demographics, clinical presentation, comorbidities, treatment and complications were recorded and analyzed.

Results

A total of 53 flaps were performed on 47 patients with 50 defects (35 males and 12 females). Road traffic accidents (38.3%) and pressure ulcers (17.02%) were common causes. Ankle-foot was the most affected site (48%), followed by leg and thigh (18% each). Defect size ranged from 3 cm^2 to 396 cm^2. Surgery consisted of 46 pedicled and seven free flaps. Reverse sural artery flap was the commonest flap performed (30.2%). All free flaps were performed on defects larger than 100cm2. Overall complication rate was 30.2%, partial flap loss being the commonest (15.1%). Total flap loss occurred in one pedicled and one free flap. Eleven pressure ulcers were operated on, with 36.4% complication rate. Average hospital stay was 33.5±26.88 days.

Conclusion

Multiple surgeries, comorbidities and high complication rates with hospital stay of more than a month reflect the difficulties encountered in lower limb reconstruction. Despite these challenges, majority of our patients were discharged with stable wound coverage.

Keywords
Lower limb reconstruction, pressure ulcers, reverse sural artery flap

INTRODUCTION

Reconstruction of lower limb defects is challenging. Causes of defects are trauma, pressure ulcers, tumor resection, infection, diabetes, etc. Reconstructive principles mandate replacing like with like, with minimal donor morbidity to achieve best cosmesis and function.[1] Options include secondary intention healing, negative pressure therapy, primary suturing, tissue expansion, skin grafts, and flaps.[2] Surgical planning must be tailored to the individual's needs and should entail parallel, creative thoughts rather than sequential processing.[1]

Free flaps and pedicled flaps like gastrocnemius, soleus and reverse sural artery flap (RSAF), along with newer propeller and keystone flaps have revolutionized lower extremity reconstruction. When compared with free flaps, propeller flaps have been shown to have shorter duration of surgery and lower complication and revision rates.[3] Associated complications are flap necrosis, hematoma, seroma, wound dehiscence, infection and donor site morbidities.[2] Pressure ulcers coverage is challenging, due to failure to distribute pressure away from the surgical site leading to significant complications.[4]

Our objective was to analyze lower limb defects in terms of demographics, defect characteristics and surgical outcomes in a tertiary care centre of Nepal.

METHODS

After ethical approval from institutional review committee, we collected pertinent data from medical records section of Tribhuvan University Teaching Hospital (TUTH), Kathmandu. For this retrospective analysis, we included information of patients with lower limb defects i.e., gluteal region, thigh, leg and ankle-foot, who were admitted in Department of Plastic Surgery and Burns and treated with flap reconstruction between April 2019 - March 2021. Parameters evaluated were age, sex, cause of defect, site and size of defect, comorbidities, surgical treatment, complications and duration of hospital stay. Area of the defect was calculated using graph paper method.

Patients were admitted in our department either directly from emergency room or after initial admission for surgical treatment by department of orthopaedics or general surgery. Medical comorbidities were managed via interdepartmental consultations with relevant subspecialties.

All included patients underwent flap reconstruction and were discharged with stable wound coverage. Patients treated with primary closure, skin grafts, secondary intention healing or vacuum assisted closure have been excluded from the study.

RESULTS

Among 47 patients admitted, 35 (74.5%) were males and 12 (25.5%) were females. Mean age of male patients was 37.48±18.76 years and that of females was 48.92±23.83 years. Most number of patients (11, 23.4%) were in age group 51-60 years, followed by 11-20 and 21-30 years (nine, 19.57%).

The commonest cause of the defect was road traffic accidents (RTA, 18, 38.3%), followed by pressure ulcers (eight, 17.02%) (fig. 1).

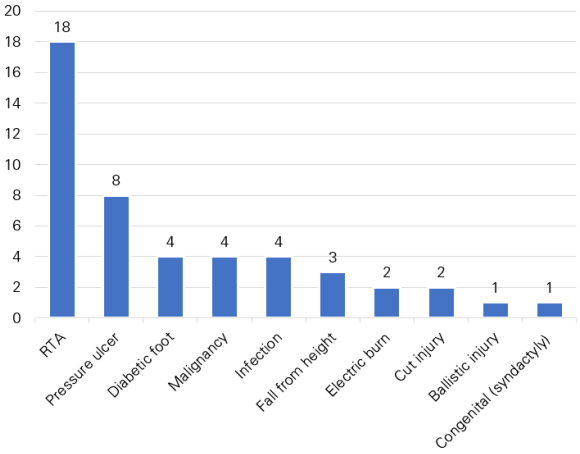

Figure 1. Cause of defect

Ankle-foot was the commonest site of defect (24 out of 50, 48%) followed by thigh (nine, 18%), leg (nine, 18%) and gluteal region (eight, 16%). The size of the defect ranged from 3 cm^2 to 396 cm^2. There were 14 defects of size less than 10 cm^2, 27 defects between 10–100 cm^2 and nine defects more than 100 cm^2.

Out of 47 patients, 19 (40.4%) had associated medical comorbidities. More than two comorbidities were present in six patients, while 28 patients had none. Cardiovascular issues in the form of hypertension and myocardial infarction were present in ten cases (21.28%) followed by neurological deficiency (seven cases, 14.89%).

In total, 53 flaps were performed: seven free flaps and 46 pedicled flaps. Among free flaps, four anterolateral thigh (ALT) flaps were performed, while medial plantar, latissimus dorsi (LD) myocutaneous and gracilis myocutaneous flaps were performed once each. Among pedicled flaps, 42 were fasciocutaneous and four were muscle flaps (two sartorius, one lateral gastrocnemius and one hemisoleus). Out of 42 pedicled fasciocutaneous flaps, 16 (38.1%) were RSAF's (fig. 2). Out of 11 pressure ulcers operated on eight patients, four were trochanteric and seven were ischial pressure ulcers. Four (36.4%) flaps experienced complications out of 11. Three of the four tensor fascia latae (TFL) flaps (for trochanteric ulcers) and one flap done for ischial ulcer experienced complications.

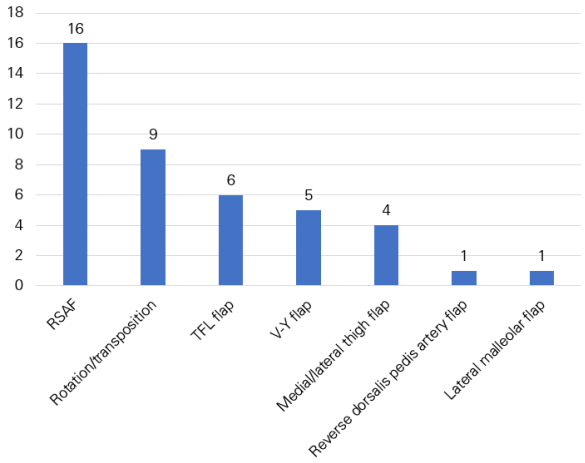

Figure 2. Pedicled fasciocutaneous flaps

Complications were experienced by 17 out of 47 patients. Out of 53 flaps, 16 flaps (30.19%) had flap related complications, while one patient of thigh melanoma suffered non flap related complication postoperatively in the form of stroke and seizures. Twelve (26.09%) out of 46 pedicled flaps and four (57.14%) out of seven free flaps had complications. There were two cases of total flap loss (one free and one pedicled) and one LD free flap was salvaged after re-exploration and vessels re-anastomosis. Partial flap loss was encountered in eight out of 53 flaps (15.09%), followed by persistent post op discharge/infection (three, 5.67%) (table 1). Partial flap loss was encountered in six out of 16 RSAF's (37.5%). Out of five RSAF's with delay procedure, two (40%) underwent partial flap loss. Average hospital stay of patients was 33.55±26.88 days.

DISCUSSION

Lower limb consists of gluteal region, thigh, leg and foot, each area unique, with varied anatomy and specialized functions. A thorough understanding of anatomy is necessary for reconstructing lower limb defects. Treatment of wounds with loss of substance due to various causes is a challenging endeavour requiring specialized techniques to cover vital exposed structures and restore form and function. Our study aimed to analyze lower limb defects in patients admitted to a tertiary level health care center in Kathmandu, Nepal on the basis of demographics, nature of the defect, comorbidities, surgery and overall outcome.

The commonest cause of defect in our study was RTA, followed by pressure ulcers. Stepniewski et al. and Bekara F et al. also reported RTA as the commonest cause, followed by delayed wound healing, chronic infections, oncological resections etc.[3,5] One of our patients presented with ballistic injury to scrotum and medial thigh and was treated with right orchidectomy, femoral vein repair and partial V-Y advancement flap cover.

Table 1. Complications

Complications	Frequency
Partial flap loss	8
Total flap loss	2
Discharge/infection	3
Hematoma	2
Early flap ischemia (salvaged)	1

Even small defects in heel (with exposed tendoachilles), or in anterior aspect of leg (with exposed tibia/implants) required flap coverage because of absence of tissue laxity in these regions. This renders primary closure of such wounds difficult, and if attempted will generally lead to wound dehiscence or unstable scars.

Ponten, in 1981, offered first description of local fasciocutaneous flaps for coverage of soft tissue defects of limbs.[6] Since then, local fasciocutaneous flap has remained a major tool in a plastic surgeon's armamentarium. Among pedicled fasciocutaneous flaps, RSAF was the commonest flap performed in our study, particularly in ankle-foot defects where scarcity of local tissues makes wound coverage challenging. It is an easily and rapidly dissectible, reliable alternative to free flaps for this area, without sacrificing any major arteries of lower limb.[7-13] Out of 16 RSAF's, 12 were performed in ankle-foot defects and four in leg defects.

Venous congestion with partial flap necrosis is a well-documented complication of RSAF. In our study 37.5% of RSAF's and 40% (two out of five) of delayed RSAF's suffered this fate. Flap delay was performed when post-operative flap complications were anticipated beforehand. Without delay procedure, the complication rates in those five cases would probably be higher. Scientific studies have documented partial or complete necrosis in 25% to 36% of the flaps.[14-16] It is especially common in patients with comorbidities. Baumeister et al. found a complication rate up to 36 % in patients from this group.[15] Figure 3 shows a leg defect with exposed tibia and fracture site, covered with RSAF

Figure 3. A, medial leg defect. B, RSAF delay procedure. C, well settled flap with stable coverage

after a delay procedure.

All seven (100%) free flap procedures performed during our study period were on defects more than 100 cm^2. Also, seven out of nine (77.8%) wounds more than 100 cm^2 required free flap reconstruction. Because of relative paucity of soft tissues in leg and foot, pedicled flap reconstruction for large defects is not feasible. Since 1980's, microsurgical reconstruction has been the primary method of coverage of such defects. Success rates have been exceptionally high, above 90%.[17-19] Strikingly, in our study, 57.14% of free flaps had complications, with one (14.3%) total flap loss. This is very high, even in our manpower and resource limited setup, especially when studies have established such procedures to have high success rate.[14,20,21] In our study, the patient who suffered total loss of free flap had to undergo below knee amputation. Stepniewski et al. had reported overall complication rate of 38.24% in free flaps with similar rate of total flap loss (14.7%) in their study.[3]

Interestingly, a circumferential 375 cm^2 defect on foot-ankle was covered with a pedicled RSAF, along with skin grafts and with an uneventful post-operative period. Larger sized defects in gluteal region and thigh can still be reconstructed locally. A 150 cm^2 trochanteric pressure ulcer was reconstructed with TFL flap. There is no consensus among scientific community regarding the safe limit of a defect size for usage of a particular kind of flap. Yasir et al. demonstrated that upto 190 cm^2 flap can be raised on a single perforator.[20] Bekara et al. noted that surface area larger than 100 cm^2 had no significant influence on complication rates.[5] However, Panse et al. cautioned that a flap longer than a third of limb length is at risk of necrosis six times higher than average.[21]

More than half of patients in our study (24 out of 47) had to undergo two or more surgeries, in the form of debridement, delay procedure, flap re-exploration or second flap surgery. Although multiple surgeries were indicated in those cases, this ultimately contributed to extra morbidity, prolonged hospital stay and financial burden to the patients.

Pressure ulcer coverage is particularly complicated, usually due to issues regarding the continuation of pressure at the reconstructed site. Complication rate in our study was 36.4% (four out of 11). Three out of four such flaps required revision surgery. Even though some papers have reported a relatively low rate of complications,[22-24] complication rates of these surgeries have traditionally been high (21-62%).[25-29] Suture line dehiscence, infection, hematoma, flap necrosis have been reported, which were also encountered in our study.

Hospital stay for patients with lower limb defects tends to be long, because of requirement of multiple surgeries, presence of comorbidities and post-operative complications. In our study, the average hospital stay was 33.55±26.88 days. A patient of multiple pressure ulcers with acute demyelinating disease and sepsis was admitted in the hospital for 161 consecutive days.

Relatively short study period and a small sample size are the limitations of our study. For achieving clinically relevant conclusions, similar study with a longer study period is necessary.

CONCLUSION

The commonest flap utilized in our study was RSAF, for ankle-foot defects, where free flaps are usually recommended. Around half of the patients in the study had to undergo at least two surgeries. Nearly a third of our flaps encountered some form of complications, with more than 50% complication rate in free flaps. However, complication rate of 36.4% in pressure ulcers coverage is comparable with international data. Multiple surgeries, high complication rates and long duration of hospital stay of over a month reflect the difficulties encountered in lower limb reconstruction. Despite all these challenges, majority of our patients were discharged with stable wound coverage.

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CONFLICT OF INTEREST

The author(s) declare that they do not have any conflicts of interest with respect to the research, authorship, and/or publication of this article.

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