

Comparison of Primary Success Rate between Pedicled and Propeller Flaps for the Coverage of Tibial Wounds

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ABSTRACT

Objective: To compare the primary success rate (flap survival) of pedicled versus propeller flaps for coverage of tibial wounds.

Study Design: Randomized controlled trial study.

Place and Duration of Study: This study was conducted at the Department of Plastic Surgery Sheikh Zaid Hospital, Rahim Yar Khan and Department of Orthopedic Surgery, Quaid-e-Azam Medical College, Bahawalpur from June 2016 to December 2016.

Materials and Methods: A total of 60 patients with tibial wounds ($\leq 50\text{cm}^2$) of ≤ 1 month duration, 15-60 years of age of both genders were included in the study. Patients with chronic osteomyelitis, polytrauma, peripheral vascular disease and ischemic heart disease were excluded. Then selected patients were placed randomly into two groups i.e. Group A (pedicled flap) & Group B (propeller flap). Primary success rate (flap survival) was compared between the both groups.

Results: The mean age of patients in group A was 32.48 ± 10.84 years and in group B was 33.56 ± 10.13 years. Out of 60 patients, 42 (70.0%) were males and 18 (30.0%) were females with male to female ratio of 2.3:1. The mean size of wound in group A was $24.80 \pm 10.33\text{ cm}^2$ and in group B was $26.48 \pm 12.10\text{ cm}^2$. The mean duration of wound in group A was 11.88 ± 5.27 days and in group B was 12.72 ± 6.02 days. Primary success rate of Group A (pedicled flap) was 27 (90.0%) while in Group B (propeller flap) was 17 (83.33%) with p-value = 0.013.

Conclusion: This study concluded that primary success rate (flap survival upto 2 months) of pedicled flaps is higher compared to propeller flaps in tibial wounds coverage and should be used routinely in our general practice in order to reduce the morbidity of these particular patients.

Key Words: Tibial, wounds, coverage, flaps, survival

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INTRODUCTION

The purpose of lower extremity re-construction is coverage of open wounds of leg to give individuals a healed wound and to let them return to their routine life. Open wounds and defects of the lower extremity results from tumor resection, trauma, diabetes and peripheral vascular disease. Because of many reasons, these wounds needs re-construction. Firstly, any exposed bone which is not surrounded by vascularized soft tissue is at higher risk of bone necrosis, sepsis and osteomyelitis.¹⁻³

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Due to defects of tissue, poor circulation and inadequate and tight local tissues, management of soft tissue around the lower 3rd of the leg and foot poses a considerable challenge to the re-constructive surgeon.^{4,5}

A durable flap having very good texture of skin, good arc rotation arc, reliable vascularity, ease of dissection and minimum morbidity of donor site is the is most desired option for the coverage of these defects.⁶

In routine practice, there is a variety of pedicled or muscular flaps for the re-construction of defects of soft tissues of lower limb. These techniques are not used commonly by orthopedic surgeons because of lack of familiarization with these techniques and problems occurred from the donor site.¹⁻² Conventional reconstructive options include split skin grafting, local random fasciocutaneous flaps, Ponten's super flap, cross leg fasciocutaneous flap, pedicled muscular or musculocutaneous flaps, microvascular free tissue transfer or perforator flaps.⁷

After the introduction of microsurgery, transfer of tissue becomes one of the acceptable re-constructive option for the lower limb in the areas where local flaps are not available.⁸ With the development of perforator flaps, newer and more reliable flaps have become available for the re-construction of lower limb.⁹

Although, perforator propeller flaps are safe, effective and simple, post-operative engorgement does not occur, attractive in shape, and particularly suitable for soft tissue coverage of lower leg and foot defects but pedicled perforator flaps have several obvious advantages over propeller flaps.¹⁰ Additionally, there is no need for special instrumentation and no requirement for transfer of patients to specialist centers.¹¹

As there was very scarce literature available regarding comparison of primary success rate of tibial wounds coverage by pedicled versus propeller flaps, so the rationale of this study was to compare the primary success rate (in terms of flap survival) of pedicled versus propeller flaps for tibial wounds coverage. Moreover, the results of this study provide us with a better technique for tibial wounds coverage, so that particular technique can be recommended and routinely applied in our clinical practice to attain the better results and reduce patient's morbidity.

MATERIALS AND METHODS

This randomized controlled trial was conducted at Department of Plastic Surgery Sheikh Zaid Hospital, Rahim Yar Khan and Department of Orthopedic Surgery, Quaid-e-Azam Medical College, Bahawalpur from June 2016 to December 2016 after approval by the institutional review committee and taking written informed consent from every patient.

Total 60 patients with wounds ($\leq 50\text{cm}^2$) exclusively involving tibia of ≤ 1 month duration, having age from 15-60 years either male or female were selected. Patients with chronic osteomyelitis, fractures with segmental bone loss, mal-aligned bone fixation, patients with polytrauma, patients with peripheral vascular disease and patients of ischemic heart disease were excluded.

All the selected patients were randomly divided into two groups A & B. After adequate debridement, soft tissue coverage was provided by distally based pedicled flap followed by split thickness skin graft in group A patients while with propeller flaps in group B patients. Post operatively, operated leg was elevated to reduce edema and pain. Flap monitoring was done 2 hourly for the first 24-48 hrs for colour, temperature, turgor and capillary refill and if remained uneventful, patients were discharged on 7th post-operative day. All patients were then followed after one week of discharge and then fortnightly for at least 2 months at which final outcome was recorded. Final success rate in terms of flap survival was noted at the end of 2nd month. Flap survival was deemed as yes if covering flap had survived as a whole without necrosis (wound having dead, discolored and soft tissue with a very foul odor) or dehiscence (opening of wound along surgical site) upto 2 months and deemed as no if there was complete or partial flap necrosis or dehiscence upto 2 months. All the collected data was entered in pre-designed proforma.

Statistical analysis was performed by using SPSS version 20.0. Mean and standard deviation was calculated for age, size of wound and duration of wound. Frequency and percentage was calculated for gender and primary success rate (yes/no). The primary success rate of the two study groups was compared for difference. Chi Square test was applied to compare the primary success rate. P value ≤ 0.05 was considered as significant. Confounders like age, gender, size of wound, duration of wound were controlled through stratifications and post-stratification chi square was applied to see their effect on outcome. P-value ≤ 0.05 was taken as significant.

RESULTS

Age range in this study was from 15-60 years with mean age of 33.12 ± 10.39 years. The mean age of patients in group A was 32.48 ± 10.84 years and in group B was 33.56 ± 10.1 years.

Mean size of wound was $25.64 \pm 11.16 \text{ cm}^2$. The mean size of wound in group A was $24.80 \pm 10.33 \text{ cm}^2$ and in group B was $26.48 \pm 12.10 \text{ cm}^2$. Mean duration of wound was 12.21 ± 5.61 days. The mean duration of wound in group A was 11.88 ± 5.27 days and in group B was 12.72 ± 6.02 days.

Primary success rate of Group A (pedicled flap) was 27 (90%) while in Group B (propeller flap) was 19 (63.33%). Statistically significant difference of success rate between the both groups was noted with p-value = 0.013. (Table 1)

Patients of both groups were divided into to three age groups i.e. age group 15-30 years, age group 31-45 years and age group 46-60 years. In age group 15-30 years, primary success rate was noted in 14 (93.33%) patients and 08 (61.54%) patients of study group A & B respectively. Statistically significant difference of primary success rate between group A and B was noted with p value 0.041. In age group 31-45 years, primary success rate was noted in 10 (90.91%) patients and 08 (66.67%) patients of study group A & B respectively. Statistically insignificant difference of primary success rate between group A and B was noted with p value 0.159. In age group 46-60 years, primary success rate was noted in 03 (75.0%) patients and 03 (60.0%) patients of study group A & B respectively. Statistically insignificant difference of primary success rate between group A and B was noted with p value 0.635. (Table 2)

Primary success rate was noted in 20 (90.91%) male patients of group A and 13 (65.0%) male patients of group B. Difference of success rate between the male patients of both study groups was statistically significant with p value 0.041. In female patients of group A, primary success rate was 07 (87.50%) in female patients of group B, primary success rate was 06 (60.0%) but the difference was statistically insignificant with p value 0.196. (Table 3)

Distribution of patients according to their wound size was done and two groups was made i.e. wound size ≤ 25 cm² and wound size $>25-\leq 50$ cm². In patients with wound size ≤ 25 cm², primary success rate was noted in 17 (89.47%) patients of group A and 14 (73.33%) patients of group B but the difference was statistically insignificant with p value 0.335. In patients with wound size $>25-\leq 50$ cm², primary success rate was noted in 10 (90.91%) patients of group A and 05 (41.67%) patients of group B and the difference was statistically significant with p value 0.013. (Table 4)

Division of patients according to duration of wound was done and two groups was made i.e. ≤ 15 days group $>15-\leq 30$ days group. In ≤ 15 days group, primary success rate was noted in 19 (95.0%) patients of group A and 18 (81.82%) patients of group B. Statistically

insignificant difference of primary success rate between the both groups was noted with p value 0.124. $>15-\leq 30$ days group, primary success rate was noted in 08 (80.0%) patients of group A and 01 (12.50%) patients of group B. Statistically significant difference of primary success rate between the both groups was noted with p value 0.036. (Table 5)

Table No.1: Comparison of success rate between both groups

Study Group	Primary success rate		P value
	Yes	No	
A	27 (90)	03 (10)	0.015
B	19 (63.33)	11 (36.67)	

Table No.2: Age distribution

Age groups	Group A		Group B		P-value
	Primary success rate		Primary success rate		
	Yes	No	Yes	No	
15-30	14 (93.33%)	01 (6.67%)	08 (61.54%)	05 (38.45%)	0.041
31-45	10 (90.91%)	01 (9.09%)	08 (66.67%)	04 (33.33%)	0.159
46-60	03 (75.0%)	01 (25.0%)	03 (60.0%)	02 (40.0%)	0.635

Table No.3: Gender distribution

Gender	Group A		Group B		P-value
	Primary success rate		Primary success rate		
	Yes	No	Yes	No	
Male	20 (90.91%)	02 (9.09%)	03 (65.0%)	07 (35.0%)	0.041
Female	07 (87.50%)	01 (12.50%)	06 (60.0%)	04 (40.0%)	0.196

Table No.4: Distribution according to wound size

Size of wound	Group A		Group B		P-value
	Primary success rate		Primary success rate		
	Yes	No	Yes	No	
≤ 25 cm ²	17 (89.47%)	02 (10.53%)	14 (73.33%)	04 (26.67%)	0.335
$>25-\leq 50$ cm ²	10 (90.91%)	01 (9.09%)	05 (41.67%)	07 (58.33%)	0.013

Table No.5: Distribution according to duration of wound.

Duration of wound	Group A		Group B		P-value
	Primary success rate		Primary success rate		
	Yes	No	Yes	No	
≤ 15 days	19 (95.0%)	01 (5.0%)	18 (81.82%)	04 (18.18%)	0.124
$>15-\leq 30$ days	08 (80.0%)	02 (20.0%)	01 (12.50%)	07 (87.50%)	0.036

DISCUSSION

There are a number of methods for achieving closure of open tibial fractures, including direct suturing, split-thickness skin-graft, local muscle flap, local fasciocutaneous flap or free vascularized tissue transfer. So, we have conducted this study to compare the primary success rate (flap survival upto 2 months) of pedicled versus propeller flaps for coverage of tibial wounds.

In our study, primary success rate (covering flap had survived as a whole without necrosis (wound having dead, discolored and soft tissue with a very foul odor) or dehiscence (opening of wound along surgical site)

upto 2 months) of Group A (pedicled flap) was 27 (90.0%) while in Group B (propeller flap) was 19 (63.33%). Georgescu AV et al¹² has shown success rate of propeller flaps in terms of flap survival as 72% while Tintle SM et al¹³ in their study has shown the success rate of pedicled flaps as 97% in soft tissue coverage of distal tibial wounds. In a study done by Zayakova YK et al¹⁴ on 11 pedicled flaps patients, successful results were observed in 10 (83.33%) cases.

In a meta analysis of 50 articles documented success rate of sural flaps as 82%.¹⁵ Similarly in an retrospective analysis of sural flap, the rate of complication was 59%(41/70 flaps), partial and complete necrosis in 17% 19% flaps.¹⁶

In another study, Akhtar S et al¹⁷ reported flap survival rate in 78.5% patients, partial and complete necrosis in 16.5% patients and 9.5% patients.

Ashfaq F et al¹⁸ in their study had used distally based pedicled flap to cover defects of ankle and foot in five cases and a total complication rate of 60% was observed. There was one (20%) total flap loss and two partial flap necrosis (40%). Complication rate is similar to Baumeister, SP et al¹⁹ who critically examined complications of sural flap in 70 consecutive cases and found 59% complication rate with 19 % rate of total flap necrosis and 17% partial flap necrosis. One study from Rawalpindi, Pakistan has compared medial plantar artery flap to sural flap for coverage of heel defects and found former to be better in terms of weight bearing, early mobilization and less complications.²⁰ So, on the whole it is concluded that primary success rate (flap survival) of pedicled flaps is higher compared to propeller flaps in tibial wounds coverage and should be used routinely in our general practice in order to reduce the morbidity of these particular patients.

CONCLUSION

This study concluded that primary success rate (flap survival upto 2 months) of pedicled flaps is higher compared to propeller flaps for the coverage of tibial wounds. So, we recommend that pedicled flaps should be used routinely in our general practice for coverage of tibial wounds instead of propeller flaps in order to reduce the morbidity of these particular patients.

Author's Contribution:

Concept & Design of Study: Kashif Ali
 Drafting: Kashif Ali
 Data Analysis: Muhammad Saleem Akhtar
 Revisiting Critically: Muhammad Saleem Akhtar
 Final Approval of version: Kashif Ali

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REFERENCES

- Harris AM, Althamer PL, Kellam J, Bosse MJ, Castillo R, Lower Extremity Assessment Project (LEAP) Study Group. Complications following limb-threatening lower extremity trauma. *J Orthop Trauma* 2009;23:1-6.
- Saddawi-Konefka D, Kim HM, Chung KC. A systematic review of outcomes and complications of reconstruction and amputation for type IIIB and IIIC fractures of the tibia. *Plast Reconstr Surg* 2008;122:1796-805.
- Scher KS, Steele FJ. The septic foot in patients with diabetes. *Surg* 1988;104:661-66.
- Fracalvieri M, Bogetti P, Verna G, Carlucci S, Favi R, Bruschi S. Distally based fasciocutaneous sural flap for foot reconstruction: a retrospective review of 10 years experience. *Foot Ankle Int* 2008;29:191-8.

- Ajmal S, Khan MA, Khan RA, Shadman M, Yousof K, Iqbal T. distally based sural fasciocutaneous flap for soft tissue reconstruction of the distal leg, ankle and foot defects. *J Ayub Med Coll Abbottabad* 2009;21(4):19-23.
- Xu G, Jin LL. The coverage of skin defects over the foot and ankle using the distally based sural neurocutaneous flaps: experience of 21 cases. *J Plast Reconstr Aesthet Surg* 2008;61:575-7.
- Mukherjee MK, Parwaz MA, Chakravarty B, Langer V. Perforator flap: A novel method for providing skin cover to lower limb defects. *Med J Armed Forces Ind* 2012;68(2012):328-34.
- Hong JP. The use of supermicrosurgery in lower extremity reconstruction: the next step in evolution. *Plast Reconstr Surg* 2009;123:230-5.
- Sasidaran R, Zain MAM, Basiron NH, Ajik S. Propeller Flaps in Lower Limb Reconstruction: Case Series. *Anaplastol* 2013;2(3):1-4.
- Dong KX, Xu YQ, Fan XY, Xu LJ, Su XX, Long H, et al. Perforator Pedicled Propeller Flaps for Soft Tissue Coverage of Lower Leg and Foot Defects. *Orthopaedic Surg* 2014;6:42-6.
- Quaba Q, Quaba A. Pedicled Perforator Flaps for the Lower Limb. *Semin Plast Surg* 2006;20(2):103-111.
- Georgescu AV, Matei IR, Capota IM. The use of propeller perforator flaps for diabetic limb salvage: a retrospective review of 25 cases. *Diabet Foot Ankle* 2012;3:doi: 10.3402/dfa.v3i0.18978.
- Tintle SM, Gwinn DE, Andersen RC. Soft Tissue Coverage of Combat Wounds. *J Surg Orthopaed Adv* 2010;19(1):29-34.
- Zayakova YK. Application of pedicle flaps for wound coverage of lower leg. *J IMAB* 2013; 19(1):382-86.
- Follmar KE, Baccarani A, Steffen P, Baumeister L, Levin S, Erdmann D. The distally based sural flap. *Plast Reconstr Surg* 2007;119:138-48.
- Baumeister SP, Spierer R, Erdmann D et al. A realistic complication analysis of 70 sural artery flaps in a multimorbid patient group. *Plast Reconstr Surg* 2003;112:129-40.
- Akhtar S, Hameed A. Versatility of the sural fasciocutaneous flap in the coverage of lower third leg and hind foot defects. *J Plast Reconstr Aesthet Surg* 2006;59:839-45.
- Ashfaq F, Ghani S, Sadiq M, Beg MSA, Bhatti MA. Avoiding complications in soft tissue coverage of lower extremity: an audit and review of literature. *Pak J Surg* 2010; 26(4):274-79.
- Baumeister SP, Spierer R, Erdmann D, Sweis R, Levin LS, Germann GK. A realistic complication analysis of 70 sural artery flaps in a multimorbid patient group. *Plast Reconstr Surg* 2003;112(1):129-40.
- Rashid M, Hussain SS, Aslam R, Illahi I. A comparison of two fasciocutaneous flaps in the reconstruction of defects of the weight-bearing heel. *J Coll Physicians Surg Pak* 2003;13(4):216-8.