Section: Orthopedics

Original Research Article

PROXIMAL SURAL ARTERY FLAP FOR RECONSTRUCTION OF COMPLEX KNEE AND PERIKNEE DEFECTS

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ABSTRACT

Background: Soft-tissue defects around the knee and upper leg present a reconstructive challenge, especially in the setting of infection, implant exposure, or trauma. The proximal sural artery flap is a versatile regional option that provides reliable coverage without the need for microsurgical expertise. This study evaluates the outcomes of the proximal sural artery flap in managing complex peri-knee defects. **Materials and Methods:** A prospective clinical interventional study was conducted in the Department of Plastic Surgery at BIRRD Hospital, a tertiary care centre. Ten patients who underwent reconstruction of knee, upper tibial and distal femoral defects using the proximal sural artery flap were included. Patient demographics, etiology, defect characteristics, flap dimensions, complications and flap survival were analyzed. **Result:** The study included 10 patients (6 males, 4 females) with a mean age of 49.3 years. The most common indication was post–total knee replacement infection (40%), followed by post-traumatic defects (40%) and exposed distal femur implants (20%). Defects were primarily located over the knee (70%). Flap sizes ranged from 6 × 4 cm to 16 × 14 cm. All flaps survived completely (100% survival rate). Complications were minimal, with donor site graft loss in 2 patients (20%). No cases of flap loss, infection, or venous congestion were noted. **Conclusion:** The proximal sural artery flap is a simple, reliable, and effective option for soft-tissue reconstruction around the knee, upper tibia, and distal femur. It provides durable, well-vascularized coverage with minimal donor site morbidity. This technique offers thin, reliable, sensate, and stable soft tissue coverage, and can cover larger defects with minimal complications.

INTRODUCTION

Soft tissue coverage around the knee joint remains a challenging problem for reconstructive surgeons due to the limited local tissue availability, the complex three-dimensional contour, and the frequent exposure of vital structures such as tendons, bones, and prosthetic materials. Various reconstructive options have been described for periknee defects including local muscle flaps, fasciocutaneous flaps and free tissue transfers.[1] However, free flaps demand microsurgical expertise and prolonged operative time which may not be feasible in all clinical settings. Local muscle flaps such as the gastrocnemius flap 8are reliable but may cause functional morbidity and has inadequate reach for high suprapatellar or lateral knee defects. The proximal sural artery flap based on the sural vascular axis provides a reliable alternative for such defects.[1,2] It offers thin, pliable tissue suitable for contouring around the knee with minimal donor site morbidity and technically straight forward dissection. This flap combines the advantages of local tissue and reliable vascularity without the need for microsurgical anastomosis.[11]

Objectives

The objective of this study was to evaluate the reliability, versatility, and clinical outcomes of the proximal sural artery flap in the reconstruction of soft tissue defects of the knee and Periknee defects.

MATERIALS AND METHODS

Study design and patients

This is a prospective clinical interventional study conducted in the Department of Plastic Surgery at BIRRD Hospital, a tertiary care centre from December 2023 to August 2025. The study included all patients who underwent soft-tissue reconstruction around the knee and upper leg using the proximal sural artery flap during the study period. The

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demographic data collected from the patients included age, sex, the mode and etiology of the injury, any associated fractures, presentation of the defect, associated comorbid conditions and complications.

All patients underwent a routine surgical profile, including a radiograph of the affected limb. Preoperative Doppler study of the affected lower limb was not conducted in any of the operated cases.

After obtaining informed consents about the prognosis of the condition and the planned procedure, patients were included in the study. These patients then underwent preoperative planning for the flap. This involves marking the dimensions of the defect and planning the flap in reverse using a lint cloth, marking pen, and measuring tape.

S.No	Age	Sex	Etiology	Location of defect	Flap size	Complication
1	54y	F	Post TKR infected wound defect	Over knee	15*10cm	none
2	41y	M	S/P Lower end femur implant exposed	Anterolateral aspect of lower end of femur	7*6cm	None
3	63y	F	Post TKR infected wound defect	Over knee	14*12cm	Donor site graft loss
4	42Y	M	Post traumatic	Over knee	9*8cm	None
5	53y	F	Post TKR infected wound defect	Over knee	12*10cm	None
6	66Y	F	Post traumatic	Upper 1/3rd tibial defect	16*14cm	None
7	52y	M	Post traumatic	Upper 1/3rd tibial defect	11*9cm	None
8	60y	M	Post TKR infected wound defect	Over knee	13*11cm	Donor site graft loss
9	24y	M	Post traumatic	Over knee	9*8cm	None
10	38y	M	S/P Lower end femur implant exposed	Anterolateral aspect of lower end of femur	6*4cm	None

Surgical technique

Either a standard lateral or prone position was adopted after administering spinal or general anesthesia3,5. Under tourniquet control, meticulous debridement of the recipient site was carried out and the exact dimensions of the defect were measured. The axis of the flap was drawn along a line that extended from the midpoint of the popliteal fossa to a point midway between the lateral malleolus and the Achilles tendon. Reverse planning was conducted using a lint piece to verify the reach of the flap. The pivot point of the flap was positioned approximately 2 cm from the midpoint of the popliteal fossa along the described axis. Preoperative Doppler for assessing flow in the sural artery was not conducted in any of the cases included in this study. Along the distal margin of the flap, the skin and fascia were incised. The sural nerve, associated vascular plexus, and the short saphenous vein were identified and cleanly divided and included in the flap. Dissection was carried out from distal to proximal. The deep fascia was included in the flap at the distal, medial, and lateral sides and was secured with the skin to prevent shearing. In the proximal part of the flap, we made only a skin incision. Subdermal flaps were raised. Adipofascial tissue was raised. 3cm of surrounding adipofascial tissue on either side of vascular axis was included. The flap was designed to center the neurovascular bundle. In the upper section, we carefully dissected the sural nerve and the median superficial sural artery between the two heads of the gastrocnemius until we reached the predetermined pivot point11. We then constructed a suitable subcutaneous tunnel to allow the flap and pedicle to reach the recipient site 3. In some instances, we had to incise the tunnel due to potential pedicle compression. We deflated the tourniquet to verify the flap's viability. The flap was then inset at the recipient site, and a corrugated rubber drain was placed under the flap, which was removed between the 3rd and 5th day.

RESULTS

A total of 10 patients underwent soft-tissue reconstruction around the knee and upper leg using the proximal sural artery flap. The age of the patients ranged from 24 to 66 years (mean: 49.3 years). There were 6 males and 4 females. The most common indication for reconstruction was post–total knee replacement (TKR) infected wound defects seen in 4 patients (40%). Post-traumatic defects accounted for 4 cases (40%), while exposed lower-end femur implant constituted 2 cases (20%). Defects were predominantly located over the knee joint (6 cases, 60%), followed by the upper one-third of the tibia (2 cases, 20%) and the anterolateral distal femur region (2 cases, 20%). Flap dimensions ranged from 6 × 4 cm to 16 × 14 cm, with the largest defects observed in upper tibial exposure. All 10 flaps survived completely, with no total or partial flap loss recorded. Complications were minimal and included donor site graft loss in 2 patients (20%) for which regrafting done. No cases of venous congestion, marginal necrosis, infection, or flap failure were noted in this series. The remaining 8 patients (80%) had an uneventful postoperative course with complete flap uptake.

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Figure 1: Raised Proximal sural artery flap. In the superior aspect is the adipofascial component including the pedicle

Figure 2: The donor site covered with SSG

Figure 3: Post op photo of the lower end of femur implant exposure covered with sural artery flap

Figure 4: Post op photo of Post TKR infected wound with soft tissue defect covered with sural artery flap

Figure 5: Post op 12 days follow up of sural artery flap for upper1/3rd leg solft tissue defect with implant exposed

DISCUSSION

Soft tissue reconstruction around the knee and lower thigh remains a demanding challenge for reconstructive surgeons particularly in the setting of infection, implant exposure or previous surgical scarring. The choice of flap must ensure reliable vascularity, adequate reach and minimal donor site morbidity. In this aspect, the proximal sural artery flap has proved to be a simple, dependable and an effective choice.

In our series of ten patients, post–total knee replacement (TKR) infected wound defects, seen in 4 patients (40%). Post-traumatic defects accounted for 4 cases (40%), while exposed lower-end femur implant constituted 2 cases (20%). All flaps survived completely, with only minor complications such as graft loss. The robust vascularity from the median superficial sural artery a consistent branch of the popliteal artery contributes to the high success rate of this flap.

Compared with the gastrocnemius muscle flap8, which has traditionally been the workhorse for knee and upper tibial coverage, the proximal sural artery flap offers several advantages. The gastrocnemius flap, though reliable, provides a bulky tissue cover that may be cosmetically suboptimal and occasionally restricts joint mobility. Additionally, it sacrifices an important muscle, potentially affecting leg function and contour. In contrast, the proximal sural artery flap provides a thin, pliable cover with excellent contour adaptation, preserves the gastrocnemius muscle and allows early ambulation and physiotherapy, particularly valuable in post-TKR patients.[11]

When compared with perforator-based flaps,[7] such as medial sural or lateral superior genicular artery perforator flaps,[6] the proximal sural artery flap is technically simpler and requires less operative time. Perforator dissection demands meticulous technique and magnification, which may not be feasible in infected or scarred fields. The proximal sural flap, on the other hand, can be raised quickly with a consistent vascular pedicle.

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The inferomedial thigh flap 1 also provides reliable coverage for knee defects with a long pedicle and good colour match. However, its dissection lies in proximity to the femoral vessels, requiring patient repositioning and greater operative expertise. Moreover, its reach is more suitable for anterior or medial knee defects, while the proximal sural flap can cover posterior, lateral, and upper tibial defects more effectively.

In comparison to free flaps, such as the anterolateral thigh (ALT) or radial forearm flap,[9,10] the proximal sural artery flap avoids the need for microsurgical expertise, prolonged operative time, and the risk of total flap loss due to anastomotic failure. Free flaps, while ideal for extensive composite defects, are less desirable in infected beds, in elderly patients, or in centers without microsurgical infrastructure. In our experience, the proximal sural flap provided comparable functional outcomes with significantly less morbidity and resource utilization.

Like any other flap, this one also has certain disadvantages, such as its appearance if a skin graft has been used at the donor site. This cosmetic disadvantage is not present if the donor site is primarily closed, specifically in cases where the flap width is less than 3 cm. However, in our study, the donor site was closed using split-thickness skin grafting in all cases. Since the donor site is located on the posterior calf region, which is typically concealed, most patients did not report this as a major complaint during the postoperative period. The donor site morbidity with the proximal sural artery flap was minimal and acceptable. Sensory loss over the lateral foot due to sural nerve sacrifice was noted but did not cause functional disability.

Overall, the proximal sural artery flap combines the reliability of a local flap with the versatility of regional options. It offers an excellent balance between surgical simplicity, dependable vascularity, and aesthetic outcome. Based on our results, it stands as a valuable alternative to muscle, perforator, and free flaps for soft tissue coverage around the knee.

CONCLUSION

The proximal sural artery flap11 is a simple, reliable, and versatile option for the reconstruction of soft-tissue defects around the knee and lower thigh, particularly in post-total knee replacement infections, post-traumatic wounds, and implant exposure cases. It provides well-vascularized, pliable coverage with minimal donor site morbidity and preserves the major vascular axes of the leg. Compared with gastrocnemius, perforator, thigh, and free flaps, it offers a shorter operative time, easier dissection, and fewer complications.

Our experience demonstrates that the proximal sural artery flap should be considered a dependable alternative to muscle and free flaps for knee and lower thigh reconstruction, particularly in centers with limited microsurgical resources.

REFERENCES

1. Masquelet AC, Romana C, Wolf G. Skin island flaps supplied by the vascular axis of the sensitive superficial nerves: anatomic study and clinical experience in the leg. Plast Reconstr Surg. 1992;89(6):1115-1121.
2. Hasegawa M, Torii S, Katoh H, Esaki S. The distally based lesser saphenous neurovascular island flap. Plast Reconstr Surg. 1994;93(5):1012-1020.
3. Hallock GG. The sural fasciocutaneous flap and its modifications for lower extremity reconstruction. Plast Reconstr Surg. 1990;86(5):959-964.
4. Wong CH, Tan BK, Song C. The cross-leg distally based sural artery flap for difficult knee and upper tibial defects. Ann Plast Surg. 2007;58(4):417-423.
5. Akhtar MS, Ahmad I, Khan AH. Proximal sural artery flap for coverage around the knee. Eur J Plast Surg. 2013;36:69-75.
6. Kneser U, Bach AD, Polykandriotis E, Kopp J, Horch RE. The medial sural artery perforator flap. Plast Reconstr Surg. 2005;115(7):383-389.
7. Georgescu AV, Matei IR. Perforator-based flaps for knee and upper leg reconstruction. Microsurgery. 2017;37(1):87-93.
8. Daigeler A, Drücke D, Tatar K, et al. The versatility of the pedicled gastrocnemius muscle flap in soft tissue reconstruction. BMC Surg. 2014;14:15.
9. Wei FC, Mardini S. Free-style free flaps. Clin Plast Surg. 2003;30(3):383-396.
10. Cetrulo CL, Chang DW. Reconstruction of the knee region using local and free flaps. Semin Plast Surg. 2006;20(2):106-115.
11. Palukuri L, Sreedharala S, Dharmapuri M, Pawde S, Sebastian A, Sankar S, Chinthla SR. Proximally based sural artery flap for the reconstruction of soft tissue defects around the knee and proximal third of the leg in India: a clinical study. J Trauma Inj. 2023;36(4):369-375.

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