



VARIOUS MODALITIES OF FLAPS FOR RECONSTRUCTION OF DEFECTS AROUND THE KNEE: A PROSPECTIVE STUDY

Surgery

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ABSTRACT

Introduction: Defects around the knee region present a significant reconstructive challenge due to limited local tissue availability and the need to maintain mobility and function. Reconstruction aims to restore skin coverage, preserve joint motion, and ensure durability of the repair, especially in weight-bearing areas. Several flap options, including local, regional, and free flaps, are available, each with distinct indications, advantages, and limitations. **Material and Method:** The present single-center prospective observational study was conducted on 24 patients presenting with defects around the knee. The study was carried out in the Department of General Surgery, GSVM Medical College, LLR & Associated Hospitals, Kanpur, between 2022 and 2024. **Results:** The overall success rate of 83.3% highlights the effectiveness of the flap techniques employed, while a failure rate of 16.7% points to areas for improvement. Factors contributing to failures may include poor flap perfusion, postoperative infections, and non-compliance with care protocols. These findings underscore the need for meticulous surgical planning, optimisation of patient health, and vigilant postoperative monitoring. **Conclusion:** This study highlights the effectiveness of the anterolateral thigh (ALT) flap and medial and lateral gastrocnemius flaps in reconstructing knee defects. Anterolateral Thigh Flap Demonstrates exceptional versatility and reliability for large defect coverage, particularly over the patella and upper leg. Gastrocnemius Flap Offers excellent outcomes for localised defects with minimal complications. Advantage of gastrocnemius myocutaneous flap is that the flap can cover the defect up to middle third of leg successfully without any complications.

KEYWORDS

Anterolateral Thigh (ALT) Flap, Medial Gastrocnemius Flap And Lateral Gastrocnemius Flap.

INTRODUCTION

Defects around the knee region present a significant reconstructive challenge due to limited local tissue availability and the need to maintain mobility and function. Reconstruction aims to restore skin coverage, preserve joint motion, and ensure durability of the repair, especially in weight-bearing areas. Several flap options, including local, regional, and free flaps, are available, each with distinct indications, advantages, and limitations. This study compares the functional and aesthetic outcomes of various flap modalities used in knee defect reconstruction.

"Although various types of flaps like perforator flaps and vascularized free flaps have been reported to cover these defects more frequently, but gastrocnemius myocutaneous flaps and anterolateral thigh flaps remain good alternatives for repairing these defects due to their relatively easy and quick procedure, large dimension, and reliable survival."¹

The causes of soft tissue abnormalities around the knee joint vary. Road traffic accidents are the leading cause of exposed wound over knee and anterior leg. Some patients have history non healing wound due to infective ethologies. The defects around the knee joint and upper leg can have different causes. They are as follows 1. Trauma causing injuries in road traffic accidents: This is the most common cause in our country is trauma due to road traffic accidents. Along with the soft tissue loss, the underlying bone fracture too, presents and needs to be treated and to be planned to cover the bone and transplant the implant. 2. Bared area remaining after tumor resection. Necrosis of Skin and soft tissue over knee due to infections. 3. After release post-burn contractures of knee which will leave a defect.

"Since Song et al. introduced the ALT flap in 1984, gains popularity because of it has several advantages. First, the flap can be harvested simultaneously as two-team work so that the operation time could be reduced. Second, it has enough long pedicle length to anastomosis with recipient vessels. The vein graft could be avoided. Third, the caliber of pedicle vessels is large which makes microanastomosis easier. Fourth, the flap can be treated as fasciocutaneous, adipofascial, or myocutaneous flap as needed. Fifth, flap can have great volume variability. Pliability could be achieved by primary thinning. Bulk of flap could be increased by incorporation of the deepithelialized skin or a portion of muscle cuff. Sixth, to provide sense to the flap, the lateral

femoral cutaneous nerve can be included in harvested flap. Seventh, the flap pedicle could bridge the vascular gap as flow-through flap, especially in mangled extremities. Eighth, morbidity at donar site is minimal."²

Gastrocnemius myocutaneous flap was originally described in 1977, for providing coverage over the knee region. The gastrocnemius flaps are one of the most versatile and useful flaps in lower extremity reconstruction. Conventionally, they can be harvested as the proximally based medial gastrocnemius muscle or musculocutaneous flaps, proximally based lateral gastrocnemius muscle or musculocutaneous flaps for coverage of the knee and upper third tibia defects. They can also be harvested as distally based flaps based on branches of posterior tibial artery for lower third limb reconstruction."³

MATERIAL AND METHODS

The present single-center prospective observational study was conducted on 24 patients presenting with defects around the knee. The study was carried out in the Department of General Surgery, GSVM Medical College, LLR & Associated Hospitals, Kanpur, between 2022 and 2024. All patients provided informed consent, and their data was collected and analyzed in adherence to ethical guidelines.

Study Design

- **Type:** Prospective observational study
- **Duration:** 2022–2024
- **Sample Size:** 24

Study Area

The study was conducted in the Department of General Surgery at GSVM Medical College, LLR & Associated Hospitals, Kanpur.

Selection Criteria

Inclusion Criteria

1. Patients aged between 18 and 60 years.
2. Patients with operable defects around the knee.
3. Patients willing to provide consent and adhere to follow-up schedules.
4. Wound size proper for flap reconstruction techniques.

Exclusion Criteria

1. Patients aged below 18 or above 60 years.

2. Patients with inoperable conditions.
3. Patients unwilling to provide consent.
4. History of trauma affecting the thigh or knee compromising vascularity.

Data Collection and Examination

Patients were evaluated by an experienced surgical team and medical staff. A detailed history was obtained in either the local or English language using a confidential, pre-structured questionnaire.

Initial Assessment

1. Demographics: Name, age, sex, occupation, level of education, date of admission, and discharge to assess total hospital stay.
2. Clinical Examination: History of trauma, puncture wounds, or other predisposing factors was documented.

Investigations

1. Routine laboratory tests: Haemoglobin (Hb%), TLC, DLC, ESR, blood urea, serum creatinine, fasting/random/postprandial blood sugar.
2. Urine analysis: Sugar monitoring three times daily; ketone bodies tested when diabetic ketoacidosis was suspected.
3. Imaging: X-ray (anteroposterior and lateral views) of the affected limb to rule out osteomyelitis or bony involvement.
4. Vascular assessment: Doppler ultrasonography and ECG were performed in cases of suspected vascular insufficiency.
5. Microbiological tests: Pus culture and sensitivity were conducted to guide antibiotic therapy.

Management Protocol

1. Wound Management:

- Serial debridement was performed in cases of infected or necrotic tissue.
- Flap selection for reconstruction was guided by defect size, vascularity, and patient-specific factors.

2. Surgical Intervention:

- Local flaps, perforator-based flaps, free flaps, or skin grafting were performed based on defect characteristics.
- Cases requiring limb salvage underwent extensive planning to ensure functional recovery.

3. Postoperative Care:

- Analgesics and broad-spectrum antibiotics were routinely administered.
- Flap monitoring for vascular compromise was performed daily.

4. Follow-Up:

- Regular outpatient visits for dressing changes, suture removal, and physiotherapy.
- Functional outcomes and complications were assessed at 3, 6, and 12 months.

RESULTS AND DISCUSSION

Reconstructive surgery for knee defects remains a challenging area of surgical practice due to the anatomical complexity and functional importance of the knee joint. This study, conducted at GSVM Medical College, Kanpur, from 2022 to 2024, evaluates the outcomes of various flap modalities in managing defects around the knee. The analysis focuses on patient demographics, complications, and the efficacy of specific reconstructive techniques.

Patient Demographics

The age distribution indicated that the majority of patients were between 46–60 years (50%), followed by those aged 26–35 years (25%). The prevalence of knee defects in the older demographic may be attributed to higher rates of degenerative conditions, such as osteoarthritis, and a greater likelihood of trauma. Although age was not statistically significant in determining the occurrence of knee defects, this observation underscores that such conditions span a wide age spectrum.

Table – I Age Distribution

Age. Group	No of cases	Percentage
15-25	1	4.2
26-35	6	25
36-45	5	20.8
46-60	12	50
Total	24	100

The study observed a male predominance, with 75% of cases being

male. This difference could reflect the increased likelihood of men engaging in high-risk activities such as manual labor, sports, and travel. These lifestyle factors, rather than gender itself, might contribute to the increased incidence of knee defects.

Table II Showing Sex Distribution

Sex	No of cases	Percentage
Male	18	75
Female	6	25
Total	24	100

Clinical and Pathological Findings

Edema was present in 50% of cases, demonstrating an equal distribution among patients with and without edema. The occurrence of edema, a common complication in knee defects, is often associated with inflammatory or traumatic conditions. However, its presence was not found to significantly affect the occurrence of defects.

Table III Showing EDEMA

	No of cases	Percentage
Yes	12	50
No	12	50
Total	24	100

Pus culture and sensitivity results showed that 45.8% of cases were culture-positive, indicating infection, while 54.2% were culture-negative. It suggests a need for rigorous infection prevention measures. Infection remains a critical determinant of surgical success, emphasizing the importance of antimicrobial strategies and preoperative optimization.

Table IV Showing Culture Sensitivity.

Culture	No of cases	Percentage
Positive	11	45.8
Negative	13	54.2
Total	24	100

Complications and Outcomes

Complications were documented in 29.2% of cases, with flap necrosis, dehiscence, and infections being the most common. It highlights the importance of identifying and addressing risk factors to mitigate these complications.

- Flap Necrosis (28.6%): Often resulting from inadequate blood supply or excessive tension on the flap.
- Dehiscence (28.6%): Frequently caused by infection or tension at the suture site.
- Infections (42.8%): Remain a significant challenge, potentially impeding wound healing and necessitating additional interventions.

Table – V Showing Type Of Complications

Type	No. of Cases	Percentage
Flap Necrosis	2	28.6
Flap dehiscence	2	28.6
Infection	3	42.8
Total	7	100

The overall success rate of 83.3% highlights the effectiveness of the flap techniques employed, while a failure rate of 16.7% points to areas for improvement. Factors contributing to failures may include poor flap perfusion, postoperative infections, and non-compliance with care protocols. These findings underscore the need for meticulous surgical planning, optimization of patient health, and vigilant postoperative monitoring.

Table – VI Showing Outcome

Outcome	No of cases	Percentage
Success	20	83.3
Failure	4	16.7
Total	24	100

Flap Selection and Efficacy

Three Types of Flaps were Employed:

- Anterolateral Thigh (ALT) Flap (50%): Known for its versatility and ability to cover large defects, the ALT flap proved highly effective for extensive reconstructions, especially over the patella.
- Medial Gastrocnemius Flap (29.2%): Favored for its robust vascular supply and proximity, it was effective for localized defects around the knee.

- Lateral Gastrocnemius Flap (20.8%): Provided reliable coverage for lateral and smaller defects with minimal complications.

Table IV Showing Types Of Flap

Type	No of cases	Percentage
Distally based Anterolateral thigh flap	12	50
Medial Gastrocnemius Flap	7	29.2
Lateral Gastrocnemius Flap	5	20.8
Total	24	100

The choice of flap depended on defect size, location, patient condition, and surgeon expertise. ALT flaps were preferred for extensive reconstructions, while gastrocnemius flaps were ideal for smaller defects.

Future Directions

The study emphasizes the need for further research to identify predictors of complications and optimize surgical techniques. Advanced training in microvascular surgery and improved infection control measures are essential to enhance outcomes in reconstructive procedures.



Preoperative Images



Intraoperative Images

CONCLUSION

This study highlights the effectiveness of the anterolateral thigh (ALT) flap and medial and lateral gastrocnemius flaps in reconstructing knee defects. Key findings include:

1. Anterolateral Thigh Flap: Demonstrates exceptional versatility and reliability for large defect coverage, particularly over the patella and upper leg. Its consistent anatomy and ability to cover extensive areas make it the preferred choice for complex reconstructions.
2. Gastrocnemius Flap: Offers excellent outcomes for localized defects with minimal complications. Both medial and lateral gastrocnemius flaps provide stable, durable coverage with good aesthetic results and functional mobility. Advantage of

gastrocnemius myocutaneous flap is that the flap can cover the defect up to middle third of leg successfully without any complications.

The high success rate of 83.3% reinforces the efficacy of these techniques. However, the 16.7% failure rate indicates the need for improvements in preoperative planning, surgical technique, and postoperative care to address factors such as infection and flap perfusion.

Advances in surgical techniques, combined with thorough preoperative assessment and meticulous postoperative management, are essential to enhance success rates and reduce complications. The findings of this study provide a robust framework for the continued use and refinement of flap-based reconstructive methods in clinical practice.

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