



## An Assessment of the Outcome of the Superior Lateral Genicular Artery Flap for Soft Tissue Reconstruction around the Knee

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### Abstract

**Background:** Soft tissue defect around the knee is common following trauma, burns especially electric burn, excision of neoplasm etc. Thigh flap is based on the superior lateral genicular artery flap (SLGA) is a fasciocutaneous flap used for knee reconstruction with minimum donor site morbidity. Such a flap is an effective option for reconstruction of soft-tissue defects around the knee and proximal calf. **Objective:** To assess the outcome of superior lateral genicular artery flap for soft tissue reconstruction after coverage of the soft tissue defects around the knee. **Methods:** It was a prospective observational study carried out in the Department of Plastic Surgery & Burn Unit, Dhaka Medical College Hospital, Dhaka duration 1 January 2015 to 31 December 2016. Fifteen patients who presented with defects around the knee in the Department of Plastic Surgery and Burn Unit were included for the study. **Result:** Mean age was 39.53±13.1 years ranged from 18 to 65 years. Maximum patients were male 10 (66.7%), rest of the patients 5 (33.3%) were female. In this series, RTA were found 4(26.7%), injury due to machinery injury were found in 2(13.3%) cases, after release of postburn scar contracture in popliteal fossa 2(13.3%), electric burn 2(13.3%). In the present series, most common site was popliteal fossa 7(46.7%). All the flaps survived well, except three developed mild venous congestion, which subsided after removing compressive dressings. Outcome after SLGA flap was excellent in 93.3% and satisfactory 6.7% cases. Primary closure of donor site was possible in 8 cases and split thickness in skin graft in 7 cases. **Conclusion:** The SLGA flap provides adequate coverage of soft tissue defects around the knee. The donor site on the lateral aspect of the thigh is inconspicuous. The SLGA flap is a reasonable option for reconstruction of skin defect around the knee.

**Keywords:-** Superior Lateral Genicular Artery Flap and Soft Tissue Reconstruction around the Knee.

### INTRODUCTION

Soft-tissue reconstruction in and around the knee needs thin, pliable, and tough skin. The

availability of local soft tissue, which would meet the requirements best, is limited.<sup>[1]</sup> Hayshi et al & Cormack et al between 2000 and 2002, 6 SLGA flaps were elevated for reconstruction of

defects around the knee.<sup>[2,3]</sup> Indications for the SLGA flap were chronic ulcers after bursectomy of the prepatellar bursa, a pressure ulcer over the patella, and a defect after resection of a malignant fibrous histiocytoma on the anterolateral aspect of the distal thigh. There was no flap loss in any of 6 patients. Three patients had partial tissue loss at the distal tip of the flap. Two of the 3 resulting wounds were effectively covered with split skin graft, the third one eventually healed with wound care. Primary donor site closure was possible in all cases. There were no late complications, either in the flap area or in the donor site region. The SLGA flap is a good option for defect coverage around the knee, because of its fast and easy harvest and the very good aesthetic results.<sup>[1,2]</sup> The superior lateral genicular artery flap (SLGA flap) is a fascio-cutaneous flap based on the cutaneous perforators of the SLGA. In 1990, Hayashi and Maruyama first reported the anatomy and clinical use of this flap.<sup>[3]</sup> The SLGA flap is a frequently used alternative in reconstruction of soft-tissue defects around the knee with minimal donor-site morbidity and excellent aesthetic results.<sup>[4]</sup> First confirmed the presence of at least one supragenicular fasciocutaneous perforator within 3 cm above the adductor tubercle.<sup>[5]</sup> This perforator arises from the saphenous branch of the descending genicular artery, which accompanies two venae comitantes. Inferiorly based anteromedial thigh fasciocutaneous flap can be taken from anteromedial aspect of thigh, which survives on supragenicular fasciocutaneous perforator. Hayashi have reported the inferiorly based ALT fasciocutaneous flap based on the perforators of the lateral superior genicular artery (LSGA) for reconstruction of defects around the knee,<sup>[6]</sup> popliteal region, lower third of the thigh, and

upper one-third of the leg. Due to variable pathway of its pedicle, this flap was not used widely at that time. Since its description, there are few publications focusing clinical application of this flap. It was found in these publications that this flap can be very useful for soft tissue coverage around knee joints. Zumiotti et al,<sup>[7]</sup> (2005) performed an anatomical and histomorphometrical study of the lateral genicular artery flap in 18 fresh cadavers and clinical results of knee reconstruction were demonstrated in four patients. They identified cutaneous perforator of the LSGA in all specimens at a mean distance up to the lateral condyle of the femur of  $7.40 \pm 2.77$  cm and thus, they confirmed the constant location of the vascular pedicle. Al Moktader et al,<sup>[8]</sup> performed inferiorly based thigh flap on 15 patients on the perforators of LSGA for the reconstruction of defects around the knee joint. They had excellent outcome in all cases except one in which distal marginal flap necrosis was noticed that healed by debridement and dressings. The superior lateral genicular artery (SLGA) usually originates from the popliteal artery. It courses superolaterally, giving off branches to the vastuslateralis, biceps femoris, and the knee joint. After travelling in the intermuscular space between the vastuslateralis and the short head of the biceps femoris, the SLGA pierce the deep fascia just proximal to the lateral condyle of the femur.<sup>[4]</sup> The point at which the cutaneous perforator of the SLGA penetrates the deep fascia is about 5cm from the plane of the knee joint. The cutaneous perforator of the SLGA terminates in small cutaneous branches that follow a radial pattern. These branches anastomoses freely with the rete patellae, the lateral perforator of the profunda femoris artery, the musculocutaneous

perforators from the popliteal artery, and the musculo-cutaneous or septocutaneous perforators or both from the descending branch of the lateral circumflex femoral artery.<sup>[9]</sup> Among these anastomoses, the communication between the SLGA and the lateral perforators of the profundafemoris artery are predominant, this arterial communication is well developed in the mid-layer of the subcutaneous adipose tissue.<sup>[10]</sup>

## OBJECTIVES

**General objective:** To assess the outcome of superior lateral genicular artery flap for soft tissue reconstruction after coverage of the soft tissue defects around the knee.

### Specific Objectives:

1. To assess the flap survival;
2. To assess the maximum dimension of defect that can be covered;
3. To assess the maximum dimension of the flap that can be raised safely;
4. To find out the complications;

## METHODOLOGY & MATERIALS

This was a prospective observational study was conducted in department of Plastic Surgery & Burn Unit, Dhaka Medical College and Hospital, Dhaka from July 2015 to June 2016. Due to time constraint and scarcity of patients 15 patients presented with defects around the knee were enrolled in this study using purposive sampling method. Findings of observation and interview with the patient and attendants were recorded on prescribed data

collection sheet (attached here) that were fulfilled by the investigator. After collection of data, all data were compiled in a master table first. Standard formulae were used and statistical analysis of the result was obtained by using window based computer software devised with Statistical package for Social Science (SPSS-22) and Microsoft Office Excel 2007.

### Inclusion Criteria:

- Soft tissue defects around the knee
- Age group: any age group

### Exclusion Criteria:

- Through and through defects around the knee
- Patients with poly trauma and life threatening condition
- Injuries in the area of pedicle.
- Patients with significant co-morbid medical conditions like uncontrolled DM etc.
- Patients unwilling to take part in the study

## RESULT

[Table 1] shows the sociodemographic characteristics of the study people. In the present series, maximum patients were male 10(66.7%), rest of the patients 5(33.3%) were female. Male female ratio 2:1. Age of the patients in this series ranged from 18 to 65 years. Majority of respondents 7(46.7%) were between 36-45 years of age. Mean age was 39.53±13 years. Majority of respondents were farmers 5(33.3%). In the present series, the most common

site of defect was popliteal fossa 7(46.7%)[Table2]. Out of 15 cases the dimension of the wound ranged from 5×3 cm up to 15×4cm[Table3]. The most common size of the wound ranged from 5×3 cm to 7×4 cm[Table3].Out of 15 cases, the dimension of the wound ranged from 6×4 cm to 15×5 cm[Table4]. The most common size (46.7%) of the wound ranged from 10×5-14×5 cm[Table4].In the

present series only 3(20.0%) patients had venous congestion of flap and 1(6.7%) had infection proved by wound swab for C/S[Table5].Excellent outcome was found in 14(93.3%) study people and satisfactory outcome was 1(6.7%) out of 15 cases[Table6]. The operation procedure is shown in [Figure 1 - 7].

**Table-1:** Age distribution of patients (n=15)

Characteristics		Number of patients	Percentage (%)
Sex	Male	10	66.67
	Female	5	33.33
Age (in year)	≤ 25	2	13.33
	26-35	3	20
	36-45	7	46.67
	46-55	2	13.33
	≥56	1	6.67
	Total	15	100
	Mean± SD	39.53±13.1	
	Range	(18-65)	
Occupation	Farmer	5	33.33
	Housewife	4	26.67
	Service	3	20
	Student	2	13.33
	Business	1	6.67
	Total	15	100

**Table-2:** Site involved (n=15)

Site	Number of patients	Percentage (%)
Front of knee joint	2	13.33
Lateral side of the knee	3	20.00
Popliteal fossa	7	46.67
Prepatellar region	3	20.00
Total	15	100.00

**Table-3:** Distribution of the patients by dimension of the of the wound (n=15)

Dimension of the wound size (cm)	Number of patients	Percentage (%)
5×3 - 7×4	7	46.67
7×4 - 9×4	1	6.67

9×4 - 13×4	5	33.33
13×4 - 15×4	2	13.33
Total	15	100.00

**Table-4:** Distribution of the patients by dimension flap size (n=15)

Dimension of the flap size (cm)	Number of patients	Percentage (%)
6×4 - 8×5	3	20.00
8×5 - 10×5	3	20.00
10×5 - 14×5	7	46.67
14×5 - 15×5	2	13.33
Total	15	100.00

**Table-5:** Postoperative complications (n=15)

Complication	Number of patients	Percentage (%)
Infection	1	6.67
Congestion	3	20.00
None	11	73.33
Total	15	100.00

**Table-6:** Final outcome (n=15)

Final outcome	Number of patients	Percentage (%)
Excellent	14	93.33
Satisfactory	1	6.67
Total	15	100.00

**Case 1:**



**Figure 1:** After identifying of SLGA by Doppler and applying of tourniquet and marking of the operative area



**Figure 2:** Measuring of the wound width



**Figure 3: VII: Designing of flap**



**Figure 4: Harvesting of flap**



## DISCUSSION

Various flaps have been used to cover soft issue defects around the knee. Factors, which affect the choice of flap, include the location and size of the defect, potential donor site morbidity and status of the vessels. A local random pattern skin flap has indistinct perfusion and is limited in size. The cross-leg flap has the disadvantage of a long period of immobilization and several operative stages. Although the free flap covers the defect successfully in a one-stage operation,

**Figure 5: Perforator vessel**



**Figure 6: Inset of the flap**



**Figure 7: After 25 days of operation**

it requires a long operating time and can be technically difficult because of deep recipient vessels.<sup>[11]</sup> The distally based vastus lateralis muscle flap is too bulky to cover the knee defect, and morbidity of donor site is a consideration.<sup>[12]</sup> The conventional gastrocnemius muscle is also a choice for providing soft-tissue coverage over the knee; the main disadvantage is that the volume of the distal part of the muscle is small and sometimes it does not provide enough coverage for large defects around the knee joint, particularly in the

suprapatellar region.<sup>[13,14]</sup> The bulk of local muscle flaps should also be considered. The sural artery perforator flap can provide thin and pliable tissue for the reconstruction of a knee defect, but the size of the flap is limited.<sup>[15,16]</sup> Thigh flap is based on the superior lateral genicular artery flap is a fasciocutaneous flap used for knee reconstruction with low donor site morbidity.<sup>[7]</sup> Such a flap is an effective option for reconstruction of soft tissue defects around the knee and proximal calf. Its advantages are among pedicle, thin tissue, and minimal donor site morbidity without obvious depressive deformation, with a good appearance without bulk.<sup>[17]</sup> The present study aims to see the outcome of superior lateral genicular artery flap for soft tissue around the knee. In present study among 15 cases, age of the patients in this series ranged from 18 to 65 years. Majority patients 7 (46.7%) were age 36-45. yrs. Mean age was  $39.53 \pm 13.1$  years. Maximum patients were male 10(66.7%), rest of the patients 5(33.3%) were female. Male female ratio 2:1. Male patients were predominant in this study. Al-Moktader et al,<sup>[8]</sup> conducted a study included ten patients were men and five patients were women with age range 13 to 55 and mean age  $39.3 \pm 14.42$  years, which correlate well with present study. In present study common occupation was farmer 5 (33.3%) and but no other data found regarding occupation in other studies. In the present series, the most common site was popliteal fossa 7(46.7%). Al Moktader et al,<sup>[8]</sup> reported involved site (40%) was popliteal fossa. Findings of this study are consistent with that study. In this series, out of 15 cases, dimension of the wound size ranged from 5×3 cm upto 15×4 cm. The most common size (46.7%) of the wound ranging from 5×3-7×4 cm. Flap size ranged from 6×4 cm up to 16×5

cm. The most common flap sizes (46.7%) were ranging from 10×5-14×6 cm. Wiedner et al,<sup>[18]</sup> found flap rang 7×5 cm upto 18×6 cm. This data was almost similar to present study. The flap was always designed slightly larger than the defect. In each case flap dimension was 1 cm more both in length and width than that of the wound in this study. In present study, 11 flaps survived completely, partial flap necrosis occurred in 1(6.7%) case and venous congestion occurred in 3(20.0%) cases, which led to partial epidermal necrosis. Zumiotti et al,<sup>[9]</sup> reported no complication was seen in three cases while a partial loss of the distal end of the flap was seen in one patient and was treated with debridement and skin graft. The postoperative outcome of flap of our study had no gross dissimilarity compared to other studies. In most series, the skin defect of less than 4 cm over the donor site can be closed directly in 8 cases. Split thickness in skin graft in 7 cases, skin necrosis developed in 1 case due to hematoma and suture under tension. This wound healed spontaneously by secondary intension. Sahasrabudhe et al,<sup>[19]</sup> observed six out of eight donor sites were closed primarily and rest of the two were closed by split thickness of skin graft. In present study 13 cases had acceptable scar, 2 cases had ugly scar, in 1 case infection occurred which was confirmed by clinical examination and culture and sensitivity of discharge. Specific treatment was given according to culture and sensitivity and wound was healed without surgical intervention. Among 15 patients in this series 14 flaps survived completely, one third loss occurred in 1 case. Sahasrabudhe et al,<sup>[19]</sup> reported seven out of eight flaps survived well without any flap loss. One flap with a skin island measuring 12×20 cm suffered a loss of 2 cm distally, which

is correlates with our study. In this study most of the cases after SLGA was excellent 93.3% and satisfactory 6.7% cases. It was concluded that inferiorly based thigh fasciocutaneous flap on the perforators of SLGA is a good option in the reconstruction of the defects around the knee joint. Al Moktader et al,<sup>[8]</sup> performed inferiorly based thigh flap on 15 patients on the perforators of SLGA for the reconstruction of defects around the knee joint. They had excellent outcome in all cases except one in which distal marginal flap necrosis was noticed that healed by debridement and dressings. The inferiorly based thigh perforator flap (SLGA flap) is closer than the distally based reverse flow ALT flap to the knee or popliteal region, making it more versatile for coverage of defects of these regions.<sup>[20]</sup>

#### Limitations of the study:

Sample size was not sufficiently enough to make a firm conclusion. It was a single center study. Duration and follow up period were short. Selected co-morbid patients were excluded from this study. Preoperative functional outcome could not be assessed.

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#### CONCLUSION

The SLGA flap provides good coverage of soft tissue defects around the knee. It is a single stage procedure, less time consuming and reduces hospital stay. This is beneficial for the patients. It has less donor site morbidity. So, the SLGA flap is a reasonable option for reconstruction of soft tissue defect around the knee. The successful knee reconstruction requires the appropriate selection of the various available methods, a careful preoperative planning, a meticulous surgical technique and a close postoperative monitoring. Perforator flaps represent a reliable and elegant option for the reconstruction of the soft tissue defects of the lower limb, due to the limited donor site morbidity, to the relatively rapid dissection and flap elevation, and to the reliable skin territory. The lateral genicular artery flap represents a useful procedure for reconstruction of anterior, antero-lateral knee defects and popliteal defect, as this cutaneous flap brings pliable, supple and flexible cutaneous tissue, similar to the original skin, without bulk or irregularities. Large sample size should be taken and follow up period should be long.



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