

Study of Gastrocnemius muscle and Gastrocnemius myocutaneous flap in compound defects of knee and upper 1/3rd of leg.

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Abstract

Background: Compound wound management around the upper-third of the leg, and knee is a challenge faced by a majority of surgeons. The posterior aspect of leg is usually spared, thus Gastrocnemius muscle & myocutaneous flap serves excellent & versatile option for these defects.

Methods: Retro Prospective study was carried out at our institute, compiling data for 1 ½ years for prospective study. A total of 56 patients with compound defect over the upper third of leg and knee were included in this study. Patients with vascular, connective tissue disorders involving lower limb & patients unwilling for surgery were excluded from our study.

Results: We performed gastrocnemius muscle flap in 50 patients & medial gastrocnemius myocutaneous flap in 06 patients out of which 48 were having upper third leg defects, 04 had knee defects and 04 had junction of upper 7 middle 1/3rd defects.

Conclusion: Gastrocnemius muscle flap was found to be reliable in patients having upper 1/3rd leg defects & gastrocnemius myocutaneous flap was found to be

reliable option in patients with defects involving knee 7 junction of upper & middle 1/3rd of leg.

Keywords: Gastrocnemius Muscle Flap, Gastrocnemius Myocutaneous Flap, Upper Third Leg Defects, Defects Involving Knee & Junction Of Upper & Middle 1/3rd Leg; Trauma.

Introduction

Compound defects of upper 1/3rd leg & around knee is a challenging problem in reconstructive surgery. Among traumatic injuries, open tibial fractures are the main cause of compound defects in legs. The relatively unprotected anteromedial portion of tibia results in exposed bone after trauma, which requires flap cover. Various reconstructive choices for coverage of compound defects of upper 1/3rd leg & around knee are available depending on the location, size & depth of the defect. Traditionally in reconstruction of lower limb compound defects, muscle flaps have been gold standard for Gustillo Anderson Grade III B fractures involving upper 1/3rd of leg & around knee. Despite severe trauma over anterior aspect of leg, the posterior region of leg is usually spared and thus, gastrocnemius myocutaneous

flap is an excellent and versatile option available for a large defect because of its reliable anatomy and vigorous blood supply^{1,2}.

Gastrocnemius myocutaneous flap was originally described in 1977³. for providing coverage over the knee region. The gastrocnemius muscle has two heads: medial and lateral. Each head can be mobilized on its own neurovascular pedicle⁴. The Sural arteries, one medial and one lateral, supply the medial and the lateral head of the gastrocnemius muscle, respectively. Each musculocutaneous perforator can supply a large area of skin proximally and also a significant amount distal to muscle belly⁵. This study was chosen, as this institute has a greater number of patients presenting with compound defects of leg & around knee due to various etiological factors due to RTA, assault, post operative wound which have to be treated as early as possible to prevent complications. While considering reconstructive options, the plan must always be tailored to the individual patient's needs. Early surgical attempt to cover defect provides less complications and short hospital stay of patients.

Material & Methods

The study was conducted in the Department of Plastic & Reconstructive Surgery at a tertiary care Centre.

A total of 56 patients were included in this study. Retrospective study of 46 patients & prospective study of 10 patients. This is a clinical, retro prospective and observational study. Prospective study from Jan 2021 to June 2022. Retrospective study from Jan 2014 to Dec 2020.

Inclusion criteria

Patient with compound defects in the upper third of leg, and knee due to road traffic accidents, assault admitted in the Department of Plastic & Reconstructive Surgery, Gandhi Medical College.

Exclusion criteria:

- Patients with vascular diseases involving lower limb.
- Patients with connective tissue disorders.
- Patient unwilling for surgery.

Operative technique

- All patients underwent lower limb fracture fixation prior to flap surgery.
- Surgeries were performed under spinal anaesthesia.
- All defects were thoroughly debrided and washed.
- Defect size measured.
- Flap markings done by planning in reverse.
- Posterior midline incision was used in gastrocnemius muscle flap harvest & in case of gastrocnemius myocutaneous flap Distal margin was taken as per defect site tailored to each case and was extended maximally to 5cm to 7cm from level of medial malleolus.
- Sural nerve identified between the two heads of gastrocnemius muscle and was ligated.
- Flap raised until the origin of respective gastrocnemius muscle as per need.
- Inset given over the defect with Proline 3-0.
- Split thickness skin grafting harvested from thigh of the opposite limb for addressing donor flap raw area in case of myocutaneous flap Bolster dressing done over flap donor site & donor flap incision site in case of gastrocnemius muscle flap was closed primarily.
- Aseptic dressing done.

Results

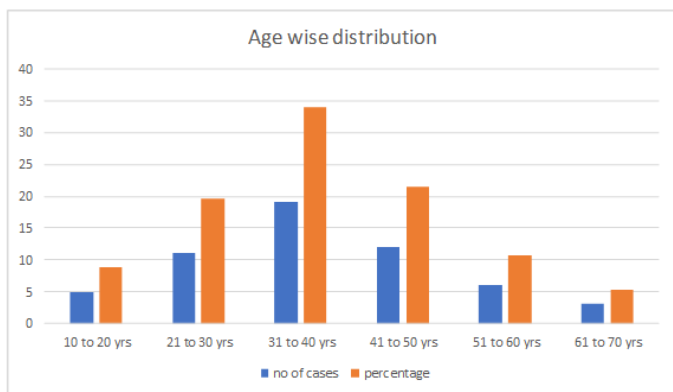
In this study a total of 56 patients were studied. We have analyzed all the cases based on specific site of injury (knee, upper 1/3rd leg, junction of upper & middle 1/3rd leg) or localization of the defect (anteromedial, anterolateral), incidence of complications and detail of complications. The following variables were also

documented for each patient: age, gender, etiology and types of flaps used for reconstruction.

Table 1: Age incidence

Age group	No. of cases	Percentage
10 - 20 years	5	8.92%
21 - 30 years	11	19.64%
31 - 40 years	19	33.92%
41 - 50 years	12	21.42%
51 - 60 years	6	10.71%
61 - 70 years	3	5.35%

Graph 1 Age wise distribution of patients.

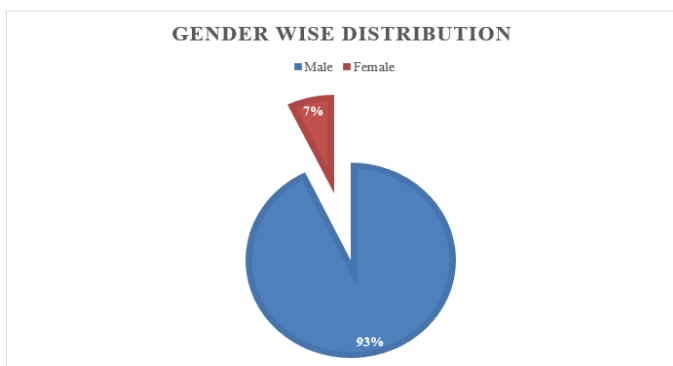


In this study, 19 patients (33.92%) belonged to 31 to 40 yrs. age group.

Table 2: Gender wise distribution

	Number	Percentage
Male	52	92.85%
Female	04	7.14%
Total	56	100%

Graph 2: Gender wise distribution

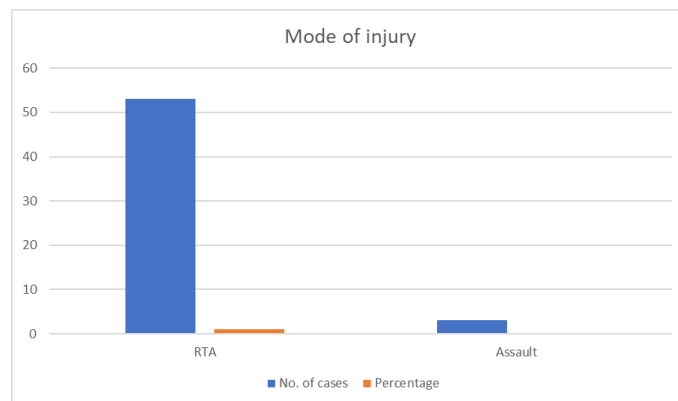


About approximately 93% of population (52 patients) were male.

Table 3: Mode of injury

Aetiology	Number	Percentage
Road traffic accidents	53	94.64%
Assault	03	5.35%

Figure 3: Distribution of cases according to mode of injury

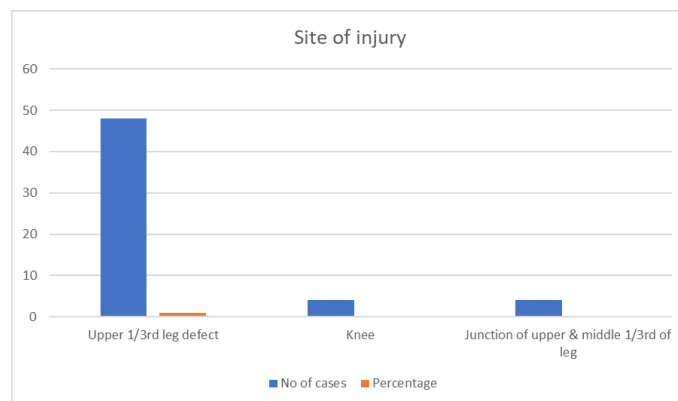


In this study, majority of the patients had leg defects due to road traffic accidents i.e., approximately 95%.

Table 4: Site of injury

Area	Number	Percentage
Upper third of leg	48	85.71%
Knee	04	7.14%
Junction of upper & middle 1/3 rd leg	04	7.14%

Figure 4: Distribution of cases according to site of injury

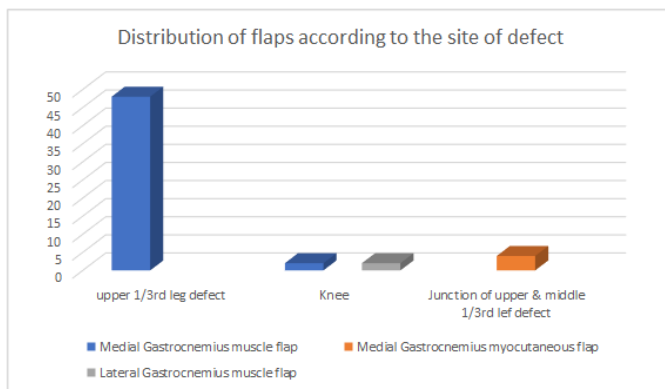


Most common site involved was upper 1/3rd of leg in 48 patients approximately 86% patients.

Table 5: Operative procedures

Defect site involved	Type of flap utilized	No. of cases
Upper 1/3 rd leg	Medial Gastrocnemius muscle flap	48
Knee	Lateral Gastrocnemius muscle flap	02
Knee	Medial Gastrocnemius myocutaneous flap	02
Junction of upper & middle 1/3 rd of leg	Medial Gastrocnemius myocutaneous flap	04

Figure 5: Distribution of flaps according to the site of defect.

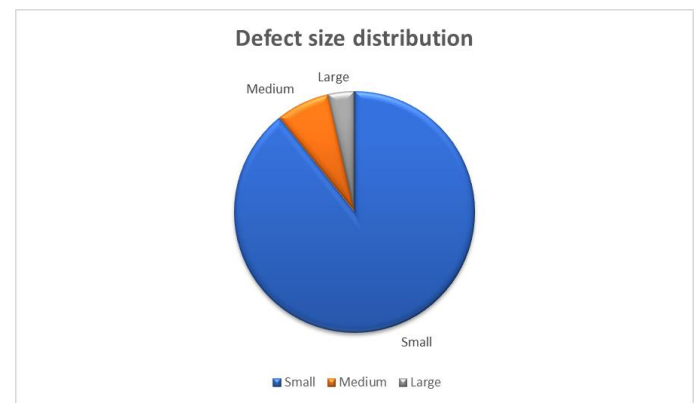


We have used Medial Gastrocnemius muscle flap for mostly upper 1/3rd leg defects in 50 patients (89.28%) and Medial Gastrocnemius myocutaneous flap for junction of upper & middle 1/3rd of leg defects 6 patients (10.71%).

Table 6: Distribution of defect size

Defect size	Number of patients	Percentage
Small (<10 cm ²)	50	89.28%
Medium (10 to 20 cm ²)	04	7.14%
Large (>20 cm ²)	02	3.57%

Figure 6: Defect size

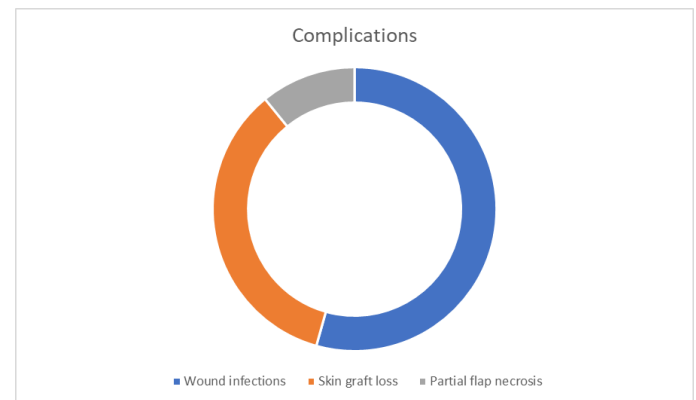


In this study most frequent defect size encountered was <10 cm² in 50 patients (approximately 90% cases).

Table 7: Complications

Complications	Gastrocnemius muscle myocutaneous flap	
	Number	Percentage
Partial flap necrosis	05	8.92%
Graft loss	16	28.57%
Wound infections	25	44.64%

Figure 7: Complications seen in the study.



Major complication in the form of wound infection was seen in 25 patients, we also saw 16 cases with skin graft loss which were not required any secondary procedures and 5 patients had partial flap necrosis as complication.

Discussion

Demographics: In this study, the mean age of the patients was 37.27 years. In a study of 25 patients conducted by Rao et al⁶, the mean age of the patients was

32.13 years. In a study of 31 patients conducted by Saiiq et al, the mean age was 27.47 years, in Shahzad et al⁷ study was conducted on 139 patients.

In this study, the youngest patient operated was 14 years old and the oldest patient was 68 years old.

In this study, male predominance was noted with 52 male patients and 04 female patients. Similarly, most of the studies in literature show similar demographics.

Aetiology

In this study, trauma was the commonest cause of compound defects with road traffic accidents accounting for 53 (94.64 %) cases. In a study conducted by Rao et al⁸, 25 out of 25 patients were of road traffic accidents. In a study conducted by Saiiq et al⁹, 31 out of 31 patients were trauma cases & in Shahzad et al it was in 85.65 cases.

Site of injury

In this study, most common site involved was upper 1/3rd leg in 48 cases (85.71%). Same as in a study conducted by Rao et al¹⁰, most patients had upper 1/3rd leg defects. In a study conducted by Saiiq et al¹¹, defects over upper 1/3rd leg & knee were common.

Reconstructive options used

In this study Gastrocnemius muscle flap was used in 50 cases in which 48 cases were having upper 1/3rd leg defect & 2 cases had knee defect, as compared to Rao et al¹² study, in which 24 cases (90%) were given Gastrocnemius muscle flap & Gastrocnemius myocutaneous flap was used in 06 cases, in Rao et al study it was used in 1 case, in Shahzad et al¹³ study Gastrocnemius muscle flap was given in 76 cases (55%), Gastrocnemius myocutaneous flap was given in 63 cases (45%).

Complications

In this study, the major complications observed were wound infections in 25 cases (44.64%) and graft loss in

16 cases (28.57%). In a study conducted by Rao et al¹⁴, wound infections were seen in (20%) cases. In a study conducted by Shahzad et al¹⁵, 14.37% cases had wound infections.

Partial flap necrosis was encountered in 05 cases (8.92%) in this study, in Rao et al study it was in 105 cases & in Shahzad et al study it was seen in none of the cases.

Illustrative Cases

1. Gastrocnemius muscle flap cover for defects involving upper 1/3rd of leg.

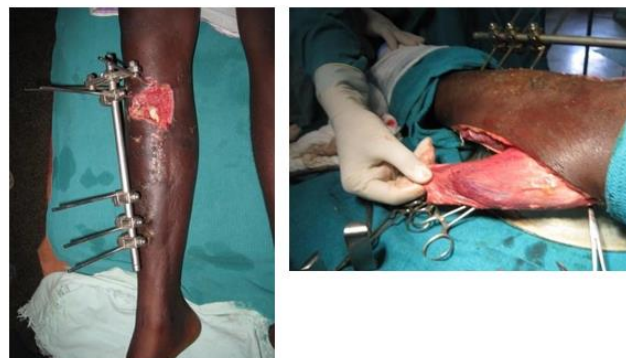
(a) Pre op post op



(b)



(c)





2. Gastrocnemius muscle flap cover for defects involving knee.



3. Gastrocnemius myocutaneous flap for defects involving junctional area i.e., junction of upper 1/3rd and middle 1/3rd



(b)



Conclusion

1. The common age of presentation in this study was between 30 to 40 years, males were mostly affected.
2. Trauma (RTA) was the major cause in this study.
3. Upper one third leg defects were most common site of defect involved in this study.
4. Right limb was more commonly involved and most common site being anteromedial aspect of upper 1/3rd of leg.
6. Most of the patients presented with Grade IIIB compound fractures with external fixation done by treating orthopedician.
7. Most of the patients had small size leg defects of size i.e., < 10 sqcm.
8. The most common reconstructive procedure done was Gastrocnemius muscle flap with SSG.
9. Medium and Large size defects were reconstructed mostly by medial Gastrocnemius myocutaneous flaps.

10. Defects around knee and upper 1/3rd of leg were reconstructed using Gastrocnemius muscle flap cover with SSG.

11. Defects involving junction of upper 1/3rd and middle 1/3rd of leg (junctional area) were reconstructed using medial gastrocnemius myocutaneous flaps.

12. The distal reach of medial gastrocnemius myocutaneous flap was tailored to each case and was taken maximally at a distance of 5 to 7cm from medial malleolus for most of cases.

13. Most of the patients were given primary flap cover within 1 week of injury to facilitate early wound healing, decrease incidence of infection, shorter duration of hospital stay and less complications.

Statements & Declarations

Author Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by all authors. The first draft of the manuscript was written by the corresponding author and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethics approval

Approval for this study was granted by the Institutional Ethics Committee of Dr. KNR University of Health Sciences, Warangal, Telangana (Rc No. IEC/GMC/2021/01/12).

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