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COVERAGE OF EXPOSED TIBIA;
COMPARISON OF VARIOUS METHODS

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ABSTRACT... The alarming rise in road traffic accident has resulted in increased incidence of degloving lower limb injuries requiring some sort of cover for exposed bones e.g tibia. **Objective:** To study and compare the rate of wound infection & decreased morbidity in degloving injuries of lower limb following early bone coverage by various surgical methods of bone coverage. **Design:** Comparative, prospective study, **Place & duration of study.** Allied Hospital SU II Faisalabad. **Period:** From January 2002 to October 2004. **Material & Methods:** Thirty (30) patients divided into four groups, muscle & musculocutaneous flaps for 15 patients, local rotational flaps for 05 patients, cross leg flaps & decortication for 05 patients. The patients in each group were divided unequally because of unavailability of patients. Patients were also examined postoperatively for 06 weeks. **Results:** The patients underwent surgery for degloving injury of leg. Most of them were young males between 5-45 years of age resulting mainly from different types of accidents. 2 out of 15(13.3%) patients having, musculocutaneous flaps developed wound infection. 1 out of 5(20%) with local rotational flaps, 2 out of 5 (40%) with cross leg flaps & 3 out of 5(60%) with decortication developed wound infection. 14 out of 15(93.3%) patients with muscle & musculocutaneous flaps while 4 out of 5(80%) with local rotational flaps recovered within 3 weeks. Patients with cross leg flaps recovered after one month while patients with decortication recovered after forty five days. 13 out of 15 regained full function (86%) with muscle & musculocutaneous flaps while patients having local rotational flaps regained 100% full function. 4 out of 5(80%) regained full function with cross leg flaps & 1 out of 5(20%) regained full function with decortication. **Conclusions:** Muscle & musculocutaneous flaps for exposed tibia is safe and effective method of treatment having low rate of wound infection with wider coverage & decreased morbidity.

Key words: Tibia, musculocutaneous flap, local rotational flap, cross leg flap, decortication.

INTRODUCTION

Soft tissue coverage[1] of exposed tibia is one of the commonest problems. A large number of international[2] and national studies have been carried out emphasizing various aspects of this commonly encountered problem. One of the most challenging problems for the general and plastic surgeon is the coverage of exposed bone devoid of its periosteum[3]. This problem, caused by trauma, is particularly severe in the lower extremity[4], where tibia[5] is located subcutaneously throughout its length.

Musculocutaneous flaps[6] involve the technique of muscle transfer with overlying skin cover or muscle flap plus split skin graft. The use of these flaps in lower leg coverage with the muscles, and the region where their use is recommended.

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Defect over the knee joint and upper third of leg can easily be covered by transposing the medial head of gastrocnemius[7]. Defects in the middle third of leg are covered by the soleus[8] alone or together with flexor digitorum longus[9]. When the tibial defect is long or narrow, the anterior tibialis[10] is used. Flexor digitorum longus[11] will cover defects in the upper part of lower third of tibia and adductor hallucis brevis[12] may be transposed to fill defects on the lower medial aspect of the leg.

Defects above the ankle joint are impossible to cover by muscle transposition; alternative methods must be considered. Local rotational flaps or fasciocutaneous flaps[13] are the flaps that rotate around a point and are usually used locally[14] to cover adjacent tissue defects. Cross leg flaps[15] are flaps that are applied from the contralateral normal leg and crossing it over to cover the defect on the affected leg. In this case the affected leg has short muscular element for adequate cover. This is an appropriate method of coverage of ulceration over the distal tibia where muscle flaps are not available[16].

Decortication is the removal of the center (cortical) tissue of a bone. This method is applied in various conditions where tibia is exposed[17] and surrounding muscles are either thin or atrophied or bruised and swollen (as in recent injury) or cannot fully cover the bone. Decortication with a curved chisel down to bleeding bone is used, followed by a split skin graft particularly meshed. This provides sufficient capillaries from the Haversian canals to revascularize the graft[18].

The muscle and musculocutaneous flap is the method of choice for defects in the proximal two third of the leg[19]. The muscle useful for lower leg coverage and the region where their use is recommended include the following;

Proximal third leg defects;
1 Gastrocnemius.
2 Skin-fascial gastrocnemius.

Middle third leg defects;
1 Soleus.
2 Skin-fascial gastrocnemius.
3 Flexor digitorum longus.
4 Peroneus longus.
5 Tibialis anterior.
6 Extensor digitorum longus.

Distal third leg defects[20]
Soleus.
Skin-fascial gastrocnemius.
Extensor digitorum longus.
Tibialis anterior.
Extensor hallucis longus.
Peroneus brevis.
Cross-leg skin-fascial gastrocnemius.

AIMS AND OBJECTIVES

Aims of the study is to compare rate of
1. Wound infection.
2. Early skin coverage.
3. Decreased morbidity,

following exposed tibia by various methods to resume early mobilization and physical activity.

MATERIAL AND METHODS

This is a comparative and prospective study. The study was conducted on thirty patients, by dividing the patients in four groups as follows.

1. In the first group of patients muscle and musculocutaneous flaps were applied for 15 patients.
2. In the second group of patients local rotational flaps were applied for 5 patients.
3. In the third group of patients cross leg flaps were applied for 5 patients.
4. The fourth group of patients decortication of tibia was done for 5 patients.

All patients were operated in surgical unit-II of Allied Hospital Faisalabad. History, general physical examination, local examination and systemic examination was done. Investigation included haemoglobin level, blood urea, sugar, x-rays of affected bones and joints. In case of patients above forty years of age ECG and x-ray chest PA view was done. Chromic catgut and vicryl were used

for muscles and proline No. 2/0 for skin stitching.

INCLUSION CRITERIA

All age group except those unfit and unwilling for surgery.

EXCLUSION CRITERIA

Paraplegic, debilitated patients, unfit patients, patients with cardio-respiratory problems were excluded from study.

OPERATIONS PERFORMED

The thirty patients operated for tibial coverage are categorized as follows.

Muscle and musculocutaneous flaps

Among the fifteen patients selected for muscle and musculocutaneous flaps, following operations were performed.

Nine patients were operated for gastrocnemius flaps, with following injury grading. Five patients have grade 3, two of them were grade 3a, while two patients have grade 3b injury. Five patients were operated for right leg and four on left leg. All patients recovered with 100% uptake. Two patients were operated for gastocnemius muscle flap with split skin graft, while seven patients were operated for gastrocnemius musculocutaneous flaps. Three patients were operated for soleus flaps with split skin graft with grade 3a injury in which gastrocnemius flaps were not available. One patient required alternative procedure. Flexor digitorum longus was used in one patient with grade 2 injury. Peroneus longus was used in mid tibial defect in one patient with grade 1 injury. One patient was operated by taking flap of tibialis anterior with split skin graft.

Local rotational flaps

Local fascio-cutaneous gastrocnemius flaps were applied in five patients with grade 2 injury. All recovered with 100% uptake.

Cross leg flaps

Five patients were selected for cross leg flaps. Two of these patients had grade 2 injury, while three had grade 3 injury in distal third of tibia, where other methods are inconvenient. Skin fascial gastrocnemius flaps were used in all of patients. Four of them recovered with full function return, while one recovered partially.

Decortication

Five patients were selected for decortication of tibia, in distal one third of tibia with grade 1 and grade 2 injury. It did not prove to be appropriate method of tibial cover.

All the results were enumerated in tables.

RESULTS

1. Age and sex incidence;

Most of them were between 5-45 of years of age. The youngest being 3 years of age and the oldest 65 years of age. (Table I)

Table-I. Age incidence of patients of exposed tibia

Age	No. of patients	%age
< 20 years	10	33.3%
20-30 years	7	23.3%
30-40 years	6	20%
40-50 years	4	13.3%
> 50 years	3	10%

2. Mode of presentation

The most frequent causes of tibial degloving injuries are shown in table-II.

3. Comparison of wound infection

Wound infection was observed in two out of fifteen patients of muscle and muculocutaneous flaps. In five patients of local rotational flaps infection was observed in one patient. Among five patients operated for cross leg flaps, two patients developed wound infection, while

three patients developed wound infection following decortication of five patients. (Table III)

Table-II. Mode of presentation		
Presentation	**No. of patients**	**% age**
Motor-cycle accidents	9	30%
Vehicle accidents	5	16.6%
Domestic accidents	3	10%
Pedestrian accidents	5	16.6%
Crushing lesions	3	10%
Firearm accidents	4	13.3%
Works & sports related	1	3.3%

Table-III. Comparison of wound infection		
Operative procedure	**No. of Pts having wound infection + out of total patients**	**%age**
Muscle & Musculocutaneous flaps	2 (15)	13.3%
Local rotational flaps	1 (5)	20%
Cross leg flaps	2 (5)	40%
Decortication	3 (5)	60%

4. Comparison of early skin coverage

Fourteen patients were completely recovered within three weeks of first operation among fifteen patients operated for muscle and musculocutaneous flaps, while one patients have complete recovery after twenty eight days. Four patients operated for local rotational flaps recovered within three weeks. Cross leg flaps have prolonged duration of one month for complete recovery. Patients having decortication recovered after forty five days. (Table IV)

Table-IV. Comparison of early skin coverage			
Operative procedure	**Total no. of Pts**	**No. of Pts having early skin coverage i.e. within 3wks**	**%age**
Muscle & Musculocutaneous flaps	15	14	93.3%
Local rotational flaps	5	4	80%
Cross leg flaps	5	0	0%
Decortication	5	0	0%

5. Comparison of decreased morbidity

The 13 out of 15 patients with musculocutaneous flaps had good recovery with full function at both donor and recipient sites, while one have some loss of donor function and other one at recipient site. Five patients operated for local rotational flaps recovered fully with no loss of function at either site. As far as cross leg flaps are concerned patients suffered much discomfort and inconvenience, although four of them recovered full function, while one suffered partial loss of function at recipient site. Among the five patients operated for decortication one of them recovered fully, two of them recovered with some loss of function, while for other two alternative procedures adopted. (Table-V).

Table-V. Comparison of decreased morbidity					
Operative procedure	**Total No. of Pts**	**Full function return**	**Partial loss of function**	**%age of full function return**	**Early return to work within six wks.**
Muscle & musculocutaneous flaps	15	13	2	86%	100%
Local rotational flaps	5	5	0	100%	100%
Cross leg flaps	5	4	1	80%	80%
Decortication	5	1	2	20%	20%

DISCUSSION

Degloving injuries of tibia is the commonest surgical problems amongst all degloving injuries. All age groups are affected, our study shows peak incidence in the second and third decades of life which is comparable to other studies carried out in other countries.

In our study 26% patients were having motorcycle accidents, 20% having vehicle accidents, 15% having firearm accidents, 12% pedestrian accidents, 12% crushing lesion, 10% domestic accidents, and 5% miscellaneous causes such as work and sports related accidents in our country. In the present study aim was to compare different method of soft tissues coverage for exposed tibia in terms of early post operative complications like wound infection, early skin coverage and decreased morbidity.

In this study it was observed that infection rate[21] was 13.3% in muscle and musculocutaneous flaps i;e two out of fifteen patients. Local rotational flaps have infection rate of 20% i;e one patient out of five patients. This is contrary to what has been mentioned in the literature. Studies conducted so far has always shown comparatively greater infection rate in muscle and musculocutaneous flaps as compared to local rotational flaps. If we compare our study with those already available we have shown better results in this regard for muscle and musculocutaneous flaps[22]. Cross leg flaps and decortication have infection rate of 40% and 69% respectively.

We found that skin coverage was observed earlier i;e within three weeks among muscle and musculocutaneous flaps i;e; fourteen patients out of fifteen patients, 93.3%, while among local rotational flaps, cross leg flaps and decortication, in our study it was 80%, zero% and zero% within three weeks respectively. As far as decreased morbidity was concerned we found that patients with muscle and musculocutaneous flaps return to work within six weeks with 100% successful results full function 86% (13 out of 15) and partial loss of function 14% (2 out of 15). Patients with local rotational flaps have 100% successful results with 100% full function return. Cross leg flaps and decorticated patients showed 80% and 20% early return to work within six weeks.

If we have a critical look at the results of present comparative study, muscle and musculocutaneous flaps[23,24] are still to be preferred as it is a gold standard in the management of exposed tibia with only a few % age of partial loss of function. Local rotational flaps had disadvantage of distant transfer, while cross leg flaps and decortication are no more reliable and effective methods as shown in this study. So, going for muscle and musculocutaneous flaps for exposed tibia is at par with the advances and is the gold standard for surgical treatment of exposed tibia as the present study has proved in our country.

CONCLUSION

In conclusion, muscle and musculocutaneous flaps for exposed tibia is safe and most effective, having less rate of wound infection, with wider coverage and decreased morbidity. It is the gold standard for the treatment of exposed tibia for soft tissue coverage as proved by present study as well as other studies conducted all over the world.

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