

## SOFT TISSUE DEFECTS IN OPEN TIBIAL FRACTURES AND THEIR MANAGEMENT BY FASCIOCUTANEOUS FLAPS

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### ABSTRACT

**Background:** Most of the traumatic injuries to the tibia are caused by motor cycle or automobile accidents. Motor cycle related tibial injuries have high incidence of skin and soft tissues loss. To decrease the ensuing burden, a spectrum of activities is needed, including injury surveillance, injury prevention and improvement in care of the wound e.g. by use of fasciocutaneous flaps. **Objective:** To determine the efficacy of using fasciocutaneous flaps in covering soft tissue defects in open tibial fractures. **Patients and Methods:** This study was a descriptive study, conducted in the orthopaedic unit of Sheikh Zayed Medical College, Rahim Yar Khan, from July 2008 to June 2009. All those patients who had skin loss over the tibia with intact distal neurovascular status along with ample normal surrounding skin were included in the study. Data was collected regarding age, sex of patients, size of the wound, site of the wound, level of fracture, mode of injury and use of any preventive/ protective measures. **Results:** Twenty cases had open tibial fractures that needed fasciocutaneous flaps; there were 19 (95%) males and one (5%) female. Twelve (60%) flaps were proximally based, two (10%) transversally based and six (30%) distally based. Eleven (55%) flaps were between 6cm to 8cm. All (20) the flaps survived (100%). Complications were noted in 9 (45%) patients. Majority (95%) did not use any protective/ preventive measures for accidents. **Conclusion:** This study concluded the worthwhile efficacy of the fasciocutaneous flaps. The incidence of the injury can be reduced by observing traffic rules and improving road safety.

**Key words:** Trauma, Open tibial fractures, Fasciocutaneous flaps

### INTRODUCTION

Tibia is commonly injured in motorcycle or automobile accidents. Motorcycle related tibial-injuries have high incidence of bone injury and skin loss requiring coverage. When soft tissue loss is extensive and closure by primary suture or split thickness skin grafting is not possible, flaps become necessary.<sup>1</sup>

One third circumference of tibia is subcutaneous. Due to trauma, there are many chances of severe skin loss. The vascularity of a bone is more important than alignment and fixation, and in case of subcutaneous bone, the status of soft tissue envelope is the single most important factor influencing the outcome.<sup>2</sup> Acute skin and soft tissue loss may be managed in many ways. Rotational flaps, cross-leg flaps, rotational muscle and myocutaneous flaps and free flaps can be performed to cover the exposed tibia.<sup>3</sup>

A healthy soft tissue envelope and good vascularity are fundamental factors in the management.<sup>4</sup> Achieving osseous union and improved functionality requires an individualized plan of care based on the personality of the nonunion and host. Attention must be focused on providing mechanical stability at the site of nonunion and providing biologic supplementation.<sup>5</sup>

Reconstruction of soft tissue defects of the leg has always been a difficult task. Moreover, open injuries are more common in tibial fractures than anywhere else in the body. In the late twentieth century, it was thought that skin flaps in the leg are unreliable and may cause serious problems, while raising the fasciocutaneous flaps.<sup>6</sup> At that time, the surgical plane was considered superficial to the deep fascia in the leg. However, Ponton in 1982, showed that long flaps can be raised in the leg if the deep fascia is included while elevating flap.<sup>7</sup> Many authors have confirmed the reliability of the fasciocutaneous flaps for soft tissues defects of lower leg.<sup>8</sup>

Split-thickness skin grafts cannot be applied over exposed bone, tendons, vessels and nerves. These exposed structures can be covered by myocutaneous, muscles or fasciocutaneous flaps. Recently, single stage island fasciocutaneous flaps have been used successfully.<sup>9</sup> Reverse flow island flap has been developed. These relatively recently developed flaps rely on retrograde arterial flow. These flaps are reliable and their venous drainage is sufficient via

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the communicating branches between venae comitantes. Reverse arterial-blood flow flaps, like posterior interosseous fasciocutaneous flaps in the forearm and peroneal reverse flow flaps in the leg, are successfully and reliably used.<sup>10</sup>

Micro vascular techniques have revolutionized the coverage of the soft tissues defects of the leg. However, its application needs expensive equipment, prolonged operative time and most important of all, surgical expertise along with a team work and institutional support<sup>11</sup>. There is higher incidence of wound dehiscence if the soft tissues bed is infected. It has been advised that it is better to perform fasciocutaneous flaps when infection is controlled<sup>12</sup>

Because the rotational fasciocutaneous flaps are single stage, easy to learn and execute with minimal donor site morbidity, the fasciocutaneous flaps are used in all the soft tissue defects of the leg in which there is no infection. This study was conducted to determine the incidence of open tibial fractures with soft tissues defects and its management by fasciocutaneous flaps and what protective methods can be adopted to prevent these incidences.

## PATIENTS AND METHODS

All the patients having Gustilo type IIIB open fractures of tibia with extensive soft tissue loss and ample surrounding normal skin were included in the study, irrespective of age and sex. The patients having skin loss due to non-traumatic causes, peripheral vascular disease, rheumatoid arthritis, diabetes mellitus and other chronic illnesses were excluded from the study.

Patients were thoroughly examined and prepared for surgery. All the relevant investigations including X-rays were done. Systemic cephalosporin was started preoperatively and continued according to the condition of wound. Immediate stabilization of fracture was done with external fixator.

All dead tissue and material was removed. Fasciocutaneous flap was executed when wound was free of infection, usually on 5<sup>th</sup> day. Split thickness skin graft was done on the donor site on 7<sup>th</sup> post flap day. Fasciocutaneous flaps were raised deep to the deep fascia, and were proximally based, transverse based and distally based. Graft dressing was done on 3<sup>rd</sup> day and sutures were removed on 15<sup>th</sup> day. All the

complications were recorded. Data regarding age, sex, size of skin loss, mechanism of injury, site of the leg wound, type of flap and use of protective/preventive measures- normal speed, no over loading of riders, use of helmet and safety belt-were noted. The data was analyzed by SPSS version 14.

## RESULTS

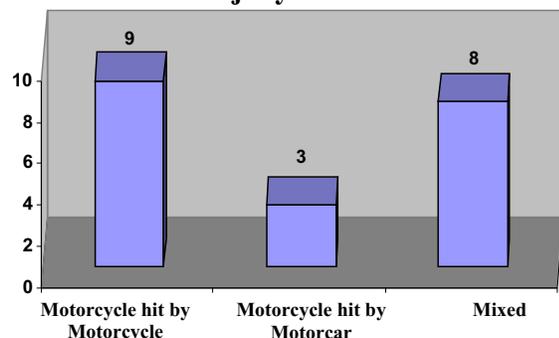
The mean age of the patients was 46.85 years  $\pm$  14.98 years. The age ranged between 15 to 60 years. This study revealed that 75% of the injured were between the ages of 15 to 45 years of age (Table I). According to mechanism of injury, 60% of the injured were hit directly or indirectly by another motor cycle (Figure :I).

During the one year study period, twenty cases had open tibial fractures that needed fasciocutaneous flaps. The incidence rate was 13.5 per 1000 cases. All the open tibial fractures were treated with rotational fasciocutaneous flaps. Among these, there were 19 (95%) males and one (5%) female. Twelve (60%) flaps were proximally based, two (10%) transversally based and six (30%) distally based. Eleven (55%) flaps were between 6cm to 8cm. The base of the flaps was chosen on the availability of healthy skin. Length to width ratio was kept 2:1 to 3:1. (Table :II)

All the flaps were examined on third day and skin grafting at donor site was done after one week. All (20) flaps survived. Complications were noted in 9 (45%) patients and there were 4 (20%) wound infections, partial skin graft loss in 3 (15%) and marginal necrosis in 2 (10%) patients (Table: III). Majority (95%) did not use any protective/preventive measures before injury. Among the causes of injury, 45% were due to rash driving, 30% due to over riding and 60% due to uneven roads.

**Table I: Age and Sex wise distribution of cases**

Age in years	Male	% age	Female	% age
15 -30	06	30 %	0	-
31 -45	09	45 %	1	5 %
46-60	04	20 %	0	-
Total	19	95 %	01	5 %

**Figure I: Distribution of cases according to mechanism of injury****Table II: Type of Fasciocutaneous Flap and site of the defect**

Type of flap	Patients	% age	Site of the Defect	Patients	% age
Superiorly based	12	60	Proximal 1/3 leg	08	40
Transverse based	02	10	Middle 1/3 leg	07	35
Inferiorly based	06	30	Distal 1/3 leg	05	25
<b>Total</b>	<b>20</b>	<b>100</b>	<b>Total</b>	<b>20</b>	<b>100</b>

**Table III: Distribution of cases according to complications (n = 9)**

Complications	Patients	% age
Wound infection	4	20
Graft loss partially	3	15
Marginal necrosis	2	10
<b>Total</b>	<b>9</b>	<b>45</b>

## DISCUSSION

Injury has become a leading cause of death and disability globally. The two age groups most affected are older children (aged 5-14 years) and adolescents and younger adults (aged 15-44). For every person injured, many more are left with temporary or lifelong disabilities. The burden of injury is especially pronounced in low- and middle-income countries.<sup>13</sup>

This study has revealed that 75% of the injured were between the ages of 15 to 45 years of age. Among the injured, 95% were male and 5% were female. According to mechanism of injury, 60% of the injured were hit directly or indirectly by a motor cycle.

There are obvious advantages of the use of the fasciocutaneous flaps for reconstruction of leg wounds. The random fasciocutaneous flaps are single-staged and simple without the need of

micro-vascular anastomosis. However there is definite disadvantage regarding contour problems and asensate nature of the flap.<sup>14</sup> These procedures are simple to execute, however, they often create donor site defects that are aesthetically displeasing to some of the patients except for a few who were displeased with appearance of the leg. Length to width ratio was kept between 2:1 to 3:1.<sup>15</sup> Although it reduces the reach of the flap, there is higher survival rate. In our series, no problem was seen for reach of the flap. Formed dog-ears were not dealt with primarily. Literature shows that they usually disappear gradually within six months after surgery.<sup>16</sup> In our study, 20 random fasciocutaneous flaps were 100% successful. N Raghavendra et al performed 23 ipsilateral perforator based flaps in 2008 for moderate size skin defects with 100% success rate.<sup>17</sup> Chittoia and Mishra performed twenty flaps random pattern in 2004 with 100% success rate.<sup>18</sup> Shalaby in 1995 had one failure out of ten cases of partial necrosis in the distally based peroneal island flaps.<sup>19</sup> However, Lagvankar in 1990, showed no flap necrosis in ten cases of distally based flaps in upper two third of leg.<sup>20</sup> Ponton, in 1981, concluded that there were three failures in 23 flaps of proximally based fasciocutaneous flaps in the leg.<sup>7</sup>

In our series, wound infection was detected in 4 (20%) cases. This is comparable to other studies.<sup>20</sup> The rate of wound infection was 19% in a study conducted on 23 patients for ipsilateral fasciocutaneous flaps in 2008. The wound infection rate was 10% in 20 patients operated in 2004 for random fasciocutaneous flaps of tibia.<sup>19</sup> The fasciocutaneous flaps executed in this study did not produce any donor or recipient site morbidity, just like Ponton, who showed that these flaps did not produce any disfigurement and are acceptable to most of the patients.<sup>7</sup> The other advantage of these fasciocutaneous flaps is that there is no sacrifice of the muscles.

Skin grafts cannot be applied over the exposed bones, tendons, ligaments and neurovascular structures. All these structures need full thickness skin for their survival and maintenance of the integrity. Muscle flap can be rotated easily in the proximal two thirds of the leg, but there is definite deficit of the musculotendinous units in the distal one third of the leg.

## CONCLUSION

This study has pointed to the worthwhile efficacy of

the fasciocutaneous flaps. This is a simple, single-stage and successful procedure for soft tissue defects of the leg, if carried out expeditiously. The incidence of injury can be reduced by observing the traffic rules and improving the roads and by use of safety measures, like helmets and safety belts.

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**Success is the ability to go from failure to failure without losing your enthusiasm."**

**Winston Churchill**