ORIGINAL ARTICLE

Open Tibial Fractures, (Its Management by Fasciocutaneous Flaps and Prevention)

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ABSTRACT

Background: Most 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 this burden, spectrum of activities is needed, including injury surveillance, injury prevention and improvement in the care of wound e.g. by use of fasciocutaneous flaps.

Objective: To, "Evaluate the incidence of open tibial fractures (Gustilo type III-B), its management by fasciocutaneous flaps and prevention".

Patients and Methods: This study was a prospective cohort study conducted in the orthopedic 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. The data was collected regarding age, sex, size of the wound, site of the wound and level of fracture mode of injury and use of any preventive/protective measures.

Results: There were 1483 patients who had under gone surgery in ortho unit. Among these, twenty cases had open tibial fractures that needed fascioucutaneous 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. Survival rate was 100%. Complications were noted in 9(45%) patients.

Conclusion: This study has proven of the fasciocutaneous flaps.

Key words: Trauma. Open tibial fractures. Fasciocutaneous flaps.

INTRODUCTION

Most injuries to the tibia are by 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[1].

All orthopedists agree that one third circumference of tibia is subcutaneous. Due to trauma there are many chances of severe skin loss. The vascularity of bone is more important than alignment and fixation of tibia. The status of soft tissue envelope is the single most important factor influencing the outcome[2]. 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[3].

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A healthy soft tissue envelope and good vascularity are fundamental factors in the management. 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[5].

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 fascioucutaneous flaps[6]. At that time, the surgical plane was considered superficial to the deep fascia in the leg. However, Ponton in 1982 has shown that long flaps can be raised in the leg if the deep fascia is included while elevating flap[7]. Many authors have confirmed the reliability of the fasciocutaneous flaps for soft tissue defects of lower leg[8].

Split-thickness skin graft 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 faciocutaneous flaps had been discovered and used successfully[9]. 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 and does not cause venous engorgement. There is good venous drainage via the communicating branches between venae comitantes. Reverse arterial-blood flow flaps in the forearm and peroneal reverse flow flaps in the leg are successfully and reliably used[10].

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 the surgical expertise along with a team work and institutional support[11]. 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[12].

This study was conducted to evaluate the incidence of open tibial fractures and its management by fasciocutaneous flaps. Because the rotational fasciocutaneous flaps are single stage, easy to learn and execute and 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 phenomenon was also studied that what protective methods were adopted to prevent these incidents.

PATIENTS AND METHODS

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

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

All dead tissue was excised. Fasciocutaneous flap was executed when wound was free of infection, usually on 5th day. Split thickness skin graft was done on the donor site on 7th post flap day. The leg was divided into proximal 1/3, middle 1/3 and distal 1/3. Fasciocutaneous flaps were raised deep to the deep fascia as proximally based, transverse based and distally based. Graft dressing was done on 3rd day and sutures were removed on 15th day. All the complications were recorded. The data regarding age, sex, size of skin loss, mechanism of injury, site of the leg wound, type of flap and use of protective measures speed, 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 SD was 14.98 years. The age ranged between 15 to 60 years. This study has revealed that 75% of the injured were between the ages of 15 to 45 years of age. According to mechanism of injury 60% of the patients were hit directly or indirectly by the motorcycle.

During the study period there were 1483 patients who had under gone surgery in ortho. Among these, 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.

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. There were 4(20%) wound infections, skin graft loss partially in 3(15%) and margin necrosis in 2(10%) patients. Majority (95%) have not used any protective/preventive measures. Among the causes of injury 45% were due to rash driving, 30% due to over riding and 60% due to unveven roads.

Table 1: 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%

Table 2: Distribution of cases according to mechanism of injury

Mehanism of Injury	Number of Patients	% age
Motorcycle hit by Motorcycle	09	45%
Motorcycle hit by Motorcar	03	15%
Mixed	08	40%
Total	20	100%

Table 3: Type of Fasciocutaneous Flap and site of the defect

Type of flap	**No. of patients**	**%age**	**Site of the Defect**	**No. of 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
Total	20	100	Total	20	100

Table 4: Distribution of cases according to complications

Complications	**No. of patients**	**Percentage**
Wound infection	4	20
Graft loss partially	3	15
Marginal necrosis	2	10
Total	9	45

DISCUSSION

Injury has become a leading cause of death and disability globally. The 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 (LMICs)[13].

This study has revealed that 75% of the injured were between the ages of 15 to 45 years of age. Among the injured 955 were male and 528 were female. According to mechanism of injury 60% of the injured were hit directly or indirectly by the motor cycle.

There are obvious advantages of the use of fasciocutaneus flaps for reconstruction of leg wounds. The random fasciocutaneus flaps are single-staged and simple without the need of micro-vascular anastomosis. However there is definite disadvantage that there are contour problems and these flaps are asensate[14]. These procedures are simple to execute, however, they often create donor site defects that are aesthetically displeasing to some of the patients[15] but most of the patients are pleased with appearance of the leg. Length to width ratio was kept between 2:1 to 3:1. Although it reduces the reach of the flap but there is higher survival rate. However in our series no problem was seen for reach of the flap. Dog-ears formed were not death primarily as none of the cases dog-ears needed correction. The literature shows that they usually disappear gradually within six months after surgery[16].

In our study 20 random fasciocutaneous flaps were 100% success. N Raghavendra et al performed 23 ipsilateral perforator based flaps in 2008 for moderate size skin defects with 100% success rate 20. Chittoia and Mishra performed twenty flaps random pattern in 2004 with 100% success rate 19. Shalaby in 1995 have shown one failure out of ten cases of partial necrosis in the distally based peroneal island flaps[17]. However, Lagvankar in 1990, have shown no flaps necrosis in ten cases of distally based flaps in upper two third of leg[18]. The Ponton in 1981 concluded that there were three failures in 23 flaps of proximately based fasciocutaneous flaps in the leg[19].

In our series wound infection was detected in 4(20%) cases. This is comparable to other studies[20]. The rate of wound infection in 2008 was 19% in study conducted on 23 patients for ipsilateral fasciocutaneous flaps. The wound infection rate was 10% in 20 patients operated in 2004 for random fasciocutaneous flaps of tibia[21]. The fasciocutaneous flaps executed in this study did not produce any donor or recipient site morbidity just like Ponton who have shown that these flaps did not produce any disfigurement and are acceptable for most of the patients[7]. The other advantage of these fasciocutaneous flaps is that there is no sacrifice of the muscles.

Skin grafts cannot be applied over the exposd 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 proven the worthwhile efficacy of the fasciocutaneous flaps. This is a simple, single-stage and successful procedure for the soft tissue defects of the leg if carried out expeditiously. The incidence of the injury can be reduced by observing the traffic rules and improving the roads and by use of safety measures, use of helmet and safety belts.

REFERENCES

1. Illarry LE, Sendsun A, Pearse MF et al. Comparison of vascularity of Fasciocutaneous tissue and muscle for coverage of open tibial fractures. Plast Reconstr Surg 2010; 124:1211-1219.
2. David LH, Michael S, Beate H. A critical appraisal of SPRINT Trial. Ortho clin North Amer, 2010; 41.241-247.
3. Tarkin IS, Sop A, Pape HC, High energy foot and ankle trauma: principles for formulating an individualized case plan. Foot ankle clin 2008: 13(4). 705-23.
4. Tarkin IS, Siska PA, Zelle BA. Soft tissue and biomechanical challenges encountered with the management of distal tibial nonunions. Ortho Clin North Amed 2010; 41(1): 119-126.
5. Tarkin IS clare MP, Marcantonio A, et al. An update on the management of high energy pilon fractures. Injury 2008; 39(2): 142-54.
6. Haertsch P. the surgical plane in the leg: Br.J. Plast Surg: 1981(34):464-470.
7. Ponton B, The fasciocutaneous flaps: its use in the soft tissue defects of the lower leg: Br. J. Plast Surg: 1981(34), 215-220.
8. Barely T. L. et al: Repair of lower leg injuries with fasciocutaneous flaps: Br. J. Plast Surg, 1982(35): 127-132.
9. Moscona A. R. The island fasciocutaneous flap: a new type of flap for defects of the knee: Br. J. Plast Surg: 1985-(38):512-514.
10. Sluhei Torii, Yausnori Namiki and Ryutaro Mori: Reverse flow island flap: Plast and reconstruct Surg: 1987(4), 600-609.
11. Zook E. G. Russell R. C, Asaadi M: A comparative study of free and pedicle flaps for lower extremity wounds, Ann Plast Surg: 1996, 17-21.
12. Louton R. B, harley R. A, Hagerty R. C: A Fasciocutaneous transposition flap for coverage of defects of the lower extremity: J. Bon, joint Surg, 1989, 71A(7): 988-993.
13. Krug E. Injury: a leading cause of the global burden of disease. Geneva: World Health organization; 1999 (WHO/HSC/PVI/99.11).
14. Fix R. J and Vasconez I. O, Fasciocutancous flaps in reconstruction of the lower extremity: Clinica in plast Surg: 1991-Jul, Vol. 18, No.3,571-582.
15. Steffens K, Houg G, Wang F.B. Reconstruction of lower leg and foot with reverse pedicle posterior tibial fasciocutaneous flap, Br. J. Plast Surg, 1989(39):512-582.
16. Galumbeck M, Golen L.B. Coverage of lower leg: Rotational flap: Orthop. Clin North Am 1993,24(3)473-480.
17. Lagvankar S. P: Distally based random fasciocutaneous flaps, multistage reconstruction of defects in the lower third of the leg, ankle and heel: Br. J. Plast Surg, 1990, Sep. 43(5): 541-545.
18. Shaaby H. A, the distally based peroneal island flap, Br. J. Plast Surg 1995(48): 23-26.
19. Lagvankar S. P : Distally based random fasciocutaneous flaps for one-stage reconstruction of defects in the upper two thirds of the legs. Br. J. Plast Surg: 1990, 43(4)468-472.
20. N Raghavendra, T. V. Joshua, J Kamath: Prospective study of ipsilateral perforator based fasciocutaneous flaps of the leg. The internet journal of surgery: 2008; 17 (2). ISSN: 1528-8242.
21. Chittoria R, Mishra SM Fasciocutaneous flaps in reconstruction of lower extremity: our experience. KU Medical Journal, 2004; 8(4): 344-348.