

Original Research Article

A study of Flap Coverage of Limbs in Orthopaedics

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Abstract: Open / compound fractures of the limbs are very common and challenging in this modern era of industrial and road traffic accident and is a difficult task for the orthopaedic surgeon. The aim of this study is how to minimise the morbidity, mortality, incidence of amputation and other complications of fractures by way of timely intervention with different types of flap coverage of limbs. This study was carried out in the department of orthopaedics and traumatology and department of plastic surgery - Osmania General Hospital, Hyderabad during June 1996 - Feb 1999. A total no. of 68 cases of soft tissue coverage procedures were done including different varieties of flaps like split skin grafting, fascio cutaneous, muscle, cross leg, abdominal, groin and free flaps in patients of 18 - 45 years of age group and more than 80% patients are males. In our study of 68 cases of reconstruction, 38 cases (55.8%) are carried out in the form of skin grafts, 16 cases (23.5%) are local flaps-muscle and fasciocutaneous flaps, 8 cases (11.7%) are cross leg flaps, 2 cases (2.9%) are abdominal flaps, 2 cases (2.9%) are groin flaps and 2 cases (2.9%) free flaps. The grading of results are assessed based on sound union of the fracture, stiffness / range of movements of neighbouring joints, amount of scar, presence / absence of DNV and flap necrosis. We achieved excellent results in 32 cases (47.0%), good in 20 cases (29.4%), fair in 12 cases (17.7%) and poor in 4 cases (5.9%). It is very much useful by timely intervening and planning for soft tissue coverage in minimising the incidence of infection rate, decreasing the hospital stay and facilitating the congenial condition for further definitive management of fracture union. Flap coverage of the limbs has a most significant role in decreasing the morbidity, mortality and amputations of limbs due to infection of soft tissue and infected non unions.

Keywords: Fasciocutaneous, muscle, cross leg, groin flaps, free flaps delaying / division of the flaps

INTRODUCTION

An open fracture with extensive soft tissue defect still remains one of the most delicate and challenging problem in trauma surgery. Severe bone and soft tissue injuries produced by high velocity trauma have become one of the common causes of morbidity and mortality all over the world [1]. The main aim of treatment of open fractures is to restore the anatomy as normal and its function as early as fully possible. The outcome depends on the degree of soft tissue injury and the degree of contamination.

Open injuries expose many tissues like bone, tendons, nerves and vessels which all tend to die when left exposed and get dry. Hence, it is important to get wound cover as early as possible. Here distinction must be made between wound cover and the wound closure

[4]. While early coverage is advantageous, imprudent closures can result in disasters. Attempts at tight closure in swollen limb or in a limb with potential for swelling in 48 hrs of post operative period can lead to many complications like skin necrosis, compartment syndrome and increase in infection rate.

Bone stability is the foundation for reconstruction of soft tissues, whereas soft tissue cover is the foundation for bony healing. One cannot wait for the other and the golden opportunity of primary reconstruction of both are lost. Then they end up with sliding scale of complications and end in disasters. In extreme cases it may allow salvage of limbs which otherwise might have to be amputated and it often reduces the length of hospital stay as well as decreases the cosmetic defects [9].

Table- 1: Age Incidence

Age in years	No. of patients	Percentage
15 -20	06	08.8
21 - 25	10	14.7
26 - 30	30	44.2
31 - 35	09	13.2
36 - 40	08	11.7
41 - 45	05	07.4
Total	68	

Table- 2: Sex Incidence

Sex	No. of patients	Percentage
Male	60	88.2
Female	08	11.8
Total	68	

MATERIALS AND METHODS

The present work - "Study of flap coverage of the limbs in Orthopaedics" is carried out in the department of orthopaedics and traumatology and department of plastic surgery, Osmania General Hospital, Hyderabad during June 1996 - Feb 1999. A total no. of 68 cases of soft tissue coverage procedures were done including different varieties of flaps like split skin grafts, fascio cutaneous flaps, muscle flaps, cross leg flaps, abdominal flaps, groin flaps and free flaps [5,8,10]. Only few patients were treated on the day of admission and rest are operated during first week second week and still later and the final results are excellent, when soft tissue damage is not extensive associated with or without fractures. Majority of patients are post traumatic / RTA cases associated with other system involvement had to stay in hospital for

longer duration. Cases associated with fractures are stabilised either with external or internal fixation, after thorough debridement, before doing flap covers. Stabilisation with external or internal fixator facilitated better flap survival and reduced incidence of flap necrosis. In cross leg flaps both the lower limbs are immobilised with either pop or external fixator. In our series majority of the patients belong to rural areas between the age group of 18 -45 yrs (adult age group) and more than 80% patients are males. Most of the times we operated for flap covers in combination with plastic surgeons, and operated only few cases in emergency theatres. The flap cover surgery is a time consuming, lengthy procedure and for us on an average it took 2-4 hrs time and it requires lot of patience and skills which varies from surgeon to surgeon.

Table -3: Incidence of upper limb and lower limb

Limb involved	No. of patients	Percentage
Upper limb		
Right	06	08.7
Left	02	02.8
Lower limb		
Right	50	73.8
Left	10	14.7
Total	68	

Table- 4: No. of cases required flaps in relation to Gustillo’s classification of compound fractures

Type	No. of patients	Percentage
Grade I	04	08.6
Grade II	28	60.9
Grade III A	10	21.9
Grade III B	04	08.6
Total	46	

Table- 5: Mechanism of Injury

Type	No. of patients	Percentage
Road traffic accidents	48	70.5
Civil disturbances	06	08.8
Industrial accidents	10	14.9
Agricultural accidents	03	04.4
Leisure activity	01	01.4
Total	68	

Table- 6: Type of Injury

Type	No. of patients	Percentage
Soft tissue alone	16	23.5
Soft tissue injury with fractures	52	76.5
Upper 3rd both bones leg	25	48.0
Middle 3rd both bones leg	20	38.5
Lower 3rd both bones leg	07	13.5
Total	68	

ANALYSIS AND DISCUSSION

In our study the total no. of flaps done is 68, including SSG, out of which 4 flaps were done for upper limb and rest are done for lower limbs. In upper limbs 2 abdominal flaps and 2 groin flaps are done, both of which were ended with good to fair results. Of total 68 cases, non traumatic cases were 4, remaining all are traumatic cases. Of 4 non traumatic cases one is a post electric burns case resulting in chronic ulcer with

exposed patella and other one is done for bedsore over the greater trochanteric region, where we used tensor fascialata muscle cover gave good results and for exposed patella resulting from post electric burns we used medial head of the gastrocnemius muscle cover which gave poor results, remaining 2 are chronic osteomyelitis of tibia for which soleus muscle flap done after debridement, one gave good result and the other with fair result [3].



Out of 30 cases of flaps we have done 8 cases of cross leg flaps with fascio cutaneous flaps, all of which gave good results and facilitated the fracture healing at an early date and also facilitated further procedures like internal fixation or Ilizarov's ring fixator technique. The cross leg flap is still a reliable one for lower leg and foot defects if properly designed and transferred [3,7]. In our study of 30 cases of flap covers there are 9 cases of fasciocutaneous flaps on lower limbs with proximal and distally based flaps, all gave good results except one where we faced with resistant type of post-operative infection and ultimately led to flap failure [5]. Skin grafting is a procedure that is often done prior to a flap cover, since there was relatively long period between injury and reconstruction procedures. There was a granulating bed in most of the wounds which required SSG, so that wound factor controlled to prevent complication rate. Out of 38 cases of SSG only in 4 cases the graft was necrosed hence had to do secondary skin grafting. Out of 8 gastrocnemius muscle flaps one flap is almost totally necrosed which was done for exposed patella, and other one is only tip of the flap was necrosed, still gave good

results [3]. All these flaps were used to cover upper third leg defects and in all cases the medial head of gastrocnemius is used. Out of 3 soleus muscle flaps 2 were done for post traumatic defects in middle third of leg and one is done for chronic osteomyelitis of middle third tibia. All gave good results, procedure was lengthy when compared to other flaps. We have done 2 abdominal flap covers for defects over the hand and one was associated with multiple fractures of shafts of metacarpals and carpal bones, both of which gave good results [8]. In both the cases the limbs were immobilised to the trunk by means of elastoplast bandages. We have done 2 cases of groin flaps for defects in first web space, one was associated with fracture shaft of first metacarpal which was fixed by K-wire. In one case 30% of flap necrosis was observed in second week of p.o. period. The abdominal and groin flaps were done during the third week after injury. In our study we did 2 cases of latismus dorsi flaps associated with fracture both bones middle third of leg, one has given good result the other one had partial tip loss. In both fractures were united well [9,10].

Table- 7: Method of Reconstruction

Type	No. of patients	Percentage
Skin grafts	38	58.8
Local flaps (muscle & fasciocutaneous)	16	23.5
Cross leg flaps	08	11.7
Groin flaps	02	02.9
Abdominal flaps	02	02.9
Free flaps	02	02.9
Total	68	

We achieved bony union in 2 cases, where there is loss of bony fragments (compound grade III) by means of Ilizarov principle after soft tissue coverage of wounds by flaps [5]. In our study of 5 cases, compound fractures of both bone leg grade III, external fixator system is applied on antero lateral aspect of leg to facilitate flap coverage and to prevent pin tract infection and flap necrosis. 3 cases of cross leg flap covers are immobilised by external fixator and in 2 cases by pop in transverse bands above and below the flap level circumferentially. 80% of flap covers were done during 2nd and 3rd week and later on, where the results were good, than early covers done on the day of injury or next day. The delay allowed us to assess the extent of damage and necrosis of the soft tissue and decrease in oedema and infection and also to assess the amount of viable tissue and to know the amount of defect to design the flaps. The division of cross leg flaps was done only after 3 weeks, to give sufficient time for

vascularisation[2], then only the division or delaying of flap was done in centimeter by centimeter over a period of 1 week or 10 days. We did not dare to divide the flap on 1 or 2 sittings for fear of flap failure [2]. Fasciocutaneous flaps enjoyed a surge of popularity following their description by PONTEN in 1979 [6]. Fasciocutaneous flaps are unreliable upto 3 weeks following severe trauma to limbs. This is not surprising because the loose areolar layer superficial to deep fascia which contains the fine vascular network of fascial plexus, is frequently oedematous and haemorrhagic in acute phase following injury. The sharing process of injury transmitted through this delicate layer damages the network of fascial vessels. It is after all the "degloving layer" of the limb. In all fasciocutaneous flaps the deep fascio is included in raised flaps. Cross leg flaps and tube pedicle flaps are slowly loosening their place in modern method of reconstruction [9].

				
Cross leg flap with external fixator	Soleus flap raised	Abdominal flap over right dorsum	Medial head gastrocnemius flap raised	Groin flap inset for defect in hand

There are 2 broad indications for free flap coverage in the legs, a defect in the lower third or an extensive defect at any level. The muscle would appear to be the flap of choice because of its beneficial biological influence on fracture healing. A musculocutaneous flap, extensively bulky results in greater donor defect. The reconstruction was carried out in the form of skin grafts (55.8%), local flaps (23.5%) in the form of fasciocutaneous and muscle flaps, cross leg flaps (11.7%), abdominal flaps (2.9%), groin flaps (2.9%) and free flaps (2.9%) [6]. Among the complications of the flaps, 6 underwent necrosis, but 4 of these still survived the purpose despite the tip necrosis. This necessitated a second flap in 2 of these cases.

The grading of results of flaps are assessed as follows : Excellent : There is sound union of fracture, with no stiffness of the neighbouring joints with full range of painless movements, minimal scar, no DNVD with no flap necrosis. Good : Sound union, terminal degrees of joint movements are restricted, with minimal stiffness and no DNVD, with minimal or no flap necrosis. Fair : Delayed union or malunion of fracture with moderate soft tissue contracture and restriction of movements with no DNVD and minimal flap necrosis. Poor : Delayed union / malunion of fracture, flap failure, soft tissue contracture, grossly restricted movements and with or without DNVD.

Table-8 : Grading of results

Grade	No. of cases	Percentage
Excellent	32	47.0
Good	20	29.4
Fair	12	17.7
Poor	04	05.9
Total	68	

CONCLUSION

In our study we worked out total no. of 68 cases including all types of soft tissue coverage associated with or without fracture. In combination and cooperation of plastic surgeon by timely intervening and planning for soft tissue coverage helped us a lot in minimising the incidents of infection rate and decreasing the hospital stay and facilitating the congenial condition for further definitive management of fracture union. It is also useful and helped in preventing the dangerous procedures, and more over patients will be psychologically stable and fit for rehabilitation program later on. The present study of flap coverage of limbs in orthopaedics has a most significant role in decreasing the morbidity, mortality and amputations of limbs due to infection of soft tissues and infected non unions. It is very much useful for an orthopaedic surgeon in rural/town setup where the plastic surgeons are not available, and every orthopaedic surgeon should undergo some training program / workshop either in state or national level conferences or individually in institutions.

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