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An experience with free scapular flap for reconstruction of lower extremity defects at Aga Khan University Hospital Karachi

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AN EXPERIENCE WITH FREE SCAPULAR FLAP FOR RECONSTRUCTION OF LOWER EXTREMITY DEFECTS AT AGA KHAN UNIVERSITY HOSPITAL KARACHI

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Back ground: Reconstruction of large composite tissue defects with exposed vital structures and weight bearing surfaces are extremely difficult for reconstructive surgeons. Coverage of such difficult defects can be achieved with free tissue transfer provided microsurgical expertise is available. This study was carried out to determine the outcome of free scapular flaps performed for lower extremity defects. **Methods:** Clinical records of the patients were reviewed and important variables included demographic data, etiology of soft tissue defects, site and size of defect, complications and percentage of wound coverage by flap. Patient satisfaction and objective assessment of flap coverage and motion of involved joints was made. **Results:** There were 13 male patients with mean age of 30.46 years. The causes of tissue defects were road traffic accident in 8 cases, industrial accidents in 2 and 3 cases had bomb blast, gunshot and gas gangrene one in each case respectively**.** Nine scapular flaps were performed to reconstruct the defects around the foot, ankle and lower leg; two flaps for amputation stumps and two flaps for defects around the knee and popliteal fossa. Post flap surgery, 3 cases had vascular compromise which required urgent exploration of anastomosis. Two cases were revived and one flap did not survive. With respect to cosmetic appearance, coverage of required defect, performance of activities of daily living and functional range of motion of involved joints, 6 cases were graded excellent and 7 cases were good. **Conclusion:** In our cases of lower extremities defects, scapular flap helped to salvage the limb. In conclusion scapular flap is a versatile flap which can be used for lower extremity defects.

Key Words: **Scapular Flap, lower extremity defects, circumflex scapular artery and vein,**

INTRODUCTION

Reconstruction of soft tissue defects especially defects around the foot, ankle, lower leg and weight bearing surface of heel are difficult and challenging problem for orthopedic, plastic and reconstructive surgeons. Soft tissue defects usually occur due to trauma, tumor excision or fulminating infection with skin necrosis. Defects with exposed vital structures (neurovascular bundles, tendons, bones, joints and flexion creases) and weight bearing surfaces require coverage with mobile, supple skin to carry out early reconstruction and rehabilitation.[1-5]

Various soft tissues defects requiring free flap reconstruction include open fractures (grade III B and III C), degloving injuries, road traffic accidents, industrial injuries and domestic machine injuries. Fulminating infections with necrotizing fascitis can cause full thickness skin loss over the vital structures (tendons, bones, joints and over the creases of joints) and require early coverage with free flaps for better functional outcome. Large soft tissue defects, produced due to tumor excision necessitate single stage reconstruction with free flaps.

Although local or remote pedicle flaps are available for reconstruction of soft tissue defects around the foot and ankle but amount of tissue obtained from local flaps (sural artery flap, supramalleolar flap) is limited. In case of remote pedicle flaps (cross leg flap) procedure is carried out in two stages. Other disadvantage being, delay in reconstruction of damaged structures and rehabilitation.[2,4,6]

With the advances in microsurgical techniques, free flap coverage of soft tissue defects has become a routine practice. Free flap coverage provides a single stage reconstructive procedure with early rehabilitation and better functional outcome.[7] The ideal flap for soft tissue coverage should have few characteristics like long vascular pedicle, sensate, easy dissection, thin and pliable. There should be minimum donor site morbidity and tissue of free flap should be expendable[5]

It is very difficult to have ideal flap but free scapular flap is the one, which bears maximum characteristics. The scapular flap has few drawbacks; it is insensate, and occasionally very thick and hairy.[2, 4, 7]

Saijo[8] is the first person to recognize the potential for transfer of free flap from the back of scapula based on circumflex scapular artery (CSA) and circumflex scapular vein (CSV). Santos[9] was the first who used free scapular flap in clinical setting successfully. Her clinical experience with free scapular flap was based on her cadavers dye injection studies and subsequent dissection of flap in 35 cadavers. Since that time various authors[1, 2, 4, 9, 10] have refined the technique and applications for extremity defects. We have used this flap for different defects of lower limbs. This study was carried out to determine the outcome of free scapular flaps, complications of procedure, factors responsible for the complications and functional motion of involved joints.

MATERIAL AND METHODS

We are reporting a case series of free scapular flap in 13 patients, who were operated at Aga Khan University Hospital Karachi, from December 1998 to July 2001. All the patients who underwent reconstruction of lower extremity defects with free scapular flap were

included in the study. Clinical records of the patients were reviewed and a questionnaire data form was filled out. The important variables included demographic data, etiology of soft tissue defects, site and size of defect, associated injuries in the limb, size of scapular flap, immediate complications, (blockage or revision of anastomosis) long term complications and patient satisfaction.

The technique of scapular flap elevation was standard and uniform in all the cases as described by Santos and others.[2,4,9,10] Postoperative protocol was uniform; high hydration with intravenous fluids, 750 units of heparin I/V hourly for 5 days. Oral Aspirin was given in lower doses (300mg) for 6 weeks. Postoperative monitoring was purely clinical, hourly maintenance of chart (recording temperature, color, turgidity and capillary refill of flap) by trained nursing staff. In the case of arterial or venous insufficiency, anastomosis of flap was explored immediately and anastomosis revised if blockage detected.

Final assessment (subjective and objective evaluation) was done in the clinic. Subjectively patients were inquired about pain, limitation of motion of ankle, toes, weight bearing status and cosmetic disfigurement. Objectively flaps were assessed in terms of coverage of original defect, necrosis of flap (partial or complete), limitation of motion of underlying joints (range of ankle and knee joint), weight bearing status, shoe wear and ability to perform routine activities was determined.

RESULTS

All the patients in this case series were male. The mean age of patients was 30.46±14.15 years. The demographic data, mechanism of injury, defect site and size are shown in Table.1. All the patients had associated tendon, neurovascular or bony injuries in the same limb, which required prior reconstruction. The average hospital stay was 17 days ranging from 12 - 40 days. The average size of flap was 21.27 cm long and 12 cm wide, ranging form 11-30 cm in length and 7-15cm in width. There were 2 cases of venous blockade within first 24 hours, which were revised successfully. One case had both arterial and venous blockage, which could not be revived in spite of anastomosis revision, as revision of anastomosis was not carried out timely due to late information conveyed to the surgeon, which delayed ischemia time beyond survival. Four cases had wound infections two superficial, which settled with wound dressing and proper antibiotic therapy. Other two had deep infection, which required formal debridement and adequate antibiotics coverage. Flaps survived in 12 patients, (survival rate of 92.3%) and provided robust, mobile and supple coverage for underlying soft tissue defect. The defect site in one patient, who had complete failure of scapular flap, was covered with supramalleolar flap. Cosmetically flap was acceptable in 11 patients while it was not acceptable in one patient due to excessive thickness and hairy nature of flap. One patient had neuropathic ulcer, which required a modified shoe to prevent the repeated break down of skin. Subjectively all these patients were able to perform activities of daily living and did not complain of any functional deficit. Objective evaluation of function and range of motion of involved joints was limited but functional in 7 cases. Six cases had almost full range of motion equal to the sound side. The functional outcome and range of motion of involved joints is shown in Table 2. Two patients had widened scar at the donor site, which was acceptable to them. All the patients had good functional outcome after physical and occupational therapy. With respect to cosmetic appearance, coverage of required defect, performance of ADL and functional range of motion of involved joints, 6 cases were graded excellent and 7 cases were good.

Figure-1: Showing the defect over ankle covered with skin graft, associated with loss of extensors of ankle and toes.

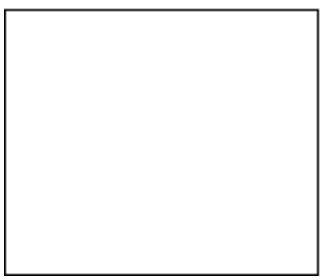

Figure-2: Peroperative photograph showing coverage with scapular flap following tendon transfer (peroneus longus to midfoot)

Figure-3: Post operative photograph showing coverage of ankle with scapular flap.

Figure-4: Post operative photograph showing coverage of ankle with scapular flap.

Table-1: Demographic data, defect site, mechanism of injury and size of scapular flap

S.No	Age	Sex	Mechanism of Injury	Defect Size	Flap Type	Size
1	19	M	Machine injury - degloving	Plantar aspect of foot/ leg	Latissimus Dorsi + Scapular	18x12 - 30x15
2	4	M	RTA- degloving	Dorsum of foot and ankle	Scapular	11x7
3	22	M	Gunshot	Dorsum of ankle and foot	Scapular	18x10
4	66	M	Machine injury - degloving	Plantar aspect of foot/heel	Scapular	20x12
5	29	M	RTA- degloving	Groin to leg	Lat. Dorsi + Scapular	22 x13 - 30 x15 (LD)
6	32	M	RTA- degloving	Heel and leg	Scapular	29x13
7	27	M	RTA- degloving	Plantar & dorsum of foot	Scapular	18x10
8	28	M	RTA	Below knee amputation stump leg	Scapular	20x12
9	25	M	Gas gangrene	Gas gangrene and loss of skin around knee	Scapular	30 x 15
10	30	M	RTA	Syme's amputation stump	Scapular	18x12
11	35	M	Blast injury	Plantar aspect of foot	Scapular	15 x 12
12	39	M	Road traffic accident	Anterolateral aspect of ankle and dorsum of foot	Scapular	20 x13
13	40	M	Road traffic accident	Lower 1/3 of leg	Scapular	32 x 15

Table-2: Outcome of flaps

S. No.	Revision Of anaostomosis	Flap Survival	Cosmetic appearance	ROM of involved joint	Patient satisfaction
1	Nil	YES	acceptable	Full	Excellent
2	Nil	YES	acceptable	Full	Excellent
3	Nil	YES	acceptable	Funct.	Good
4	Nil	YES	Not accept	Funct.	Good
5	YES	YES	acceptable	Funct.	Good
6	YES	YES	acceptable	Funct.	Good
7	Nil	YES	acceptable	Funct.	Good

8	Nil	YES	acceptable	Full	Excellent
9	NIL	YES	acceptable	Full	Excellent
10	Nil	YES	acceptable	Full	Excellent
11	YES	Nil	NIL	Funct.	Good
12	Nil	Nil	acceptable	Full	Excellent
13	Nil	Nil	acceptable	Full	Excellent

Full: Full range of motion of involved joints
Funct: Functional; decreased but functional range of motion of involved joints without disability

A typical case was a twenty years old gentleman who had loss of dorsal tibial vessels, nerves and extensor tendons with loss of skin over dorsum of ankle and foot in road traffic accident. Initially managed outside our institution and wound covered with skin graft.(Fig.1) He had difficulty in walking due to loss of ankle dorsiflexion. Scarred tissue and skin graft over the dorsum of foot and ankle was excised, peroneus longus was transffered to midfoot to provide active dorsiflexion and defect was covered with scapular flap. Peroperative and postoperative result can be seen from Fig. 2-4.

DISCUSSION

The conventional treatment of large soft tissues defect has been expectant in form of wound dressings, healing with secondary intentions, multiple debridements followed by split thickness skin grafting. The staged management of wounds leads to poor functional out come, high morbidity, loss of job and financial burden to the patient. To avoid such complications, the wound coverage should be done primarily with free tissue transfer. Scapular flap provides adequate amount of free tissue to cover the large soft tissue defects.

Since its early description, it has been used for all sorts of anatomical defects in the body. Barkwick[6] had used this flap for weight bearing area and has reported delayed weight bearing without skin break/ ulcer formation. However we used scapular flap for weight bearing area in one case, which developed repeated skin breakdown and ulcer formation. He was given modified shoe wear to avoid ulcer formation.

We have used free scapular flap for defects of lower extremity, around knee, popliteal fossa, leg, ankle and foot. It provided a very good coverage in most of the cases. I consider extended free scapular flap [7, 11, 12] a versatile flap for lower extremity defects especially foot, ankle and around the knee joints.[2-4, 6] In two cases very large fasciocutaneous flap was used, the largest size, in length 30 cm keeping in view the work of Thoma et al.[12]

We used free scapular flap with latissimus dorsi flap in 2 cases based on the same pedicle (subscapular artery with circumflex scapular and thoracodorsal artery) as used by others[4,13]

In all our cases of lower extremities defects, scapular flap helped us to do an early reconstruction of neurovascular structures, tendons and bony injuries; thus facilitating early rehabilitation and recovery. The functional outcome improved in our cases, which would have been jeopardized otherwise. In conclusion scapular flap is a versatile flap which can be used for extremity defects.

The local or regional flaps have their own limitations. The local flaps sural artery neurovascular island and supramalleolar island flaps can be used for small defects around heel, ankle and foot but donor site requires skin grafting and cosmetically may not be acceptable to the patient. Large defects can not be covered with these flaps. Regional flaps like cross leg flap are two stage procedures and require cumbersome position of legs; unacceptable to patients. Although free scapular flap coverage of lower extremity defects requires microsurgical expertise, it is a single stage reconstructive procedure with good functional outcome.

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