USE OF FASCIOCUTANEOUS FLAPS FOR DEFECTS OF LOWER EXTREMITY

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SUMMARY

The fasciocutaneous flaps were raised in 12 patients who had obstinate skin defects in the leg. The undelayed transposition, cross leg and bipedicle advancement fasciocutaneous flaps were planned and executed. These are simpler and safer flaps in comparison to myocutaneous and free flaps. A safe length-base ratio is 3:1. The blood vessels in the deep fascia enter through the intermuscular septum. The fascial septal perforators carry the main blood supply to the deep fascia and the overlying skin. Patients with crush injury of the leg with complicated fracture and bruising in the donor area were associated with oedema and haematomas in various surgical planes of the leg. One should be cautious in designing fasciocutaneous flap in such cases.

There have been considerable advances in plastic and reconstructive surgery, still at times we find difficulty in closure of the skin defects. In choosing the type of skin coverage for a large and difficult defect one should proceed from simpler to complicated procedure, i.e. skin graft, local skin flap, distant skin flap, myocutaneous and a free flap. Sir Gillies began to close the large skin defects with, tube pedicles in early 1960. During 1960's Dr. Stuart H. Milton utilized scientific methods for evaluation of the blood supply of skin flap. It was McGregor and Morgan (1973) who proposed two groups of skin flaps—axial and random pattern flap. McCraw and Dibbell (1977) began to explore the blood supply of myocutaneous flaps.

The limitations of random pattern, axial pattern, compound and free flaps are well known. Ponten (1981) described safer and simpler flaps for the leg defects. He included deep fascia in the flap and described it as fasciocutaneous flaps.

The review of the literature reveals that most of the skin flaps in the leg have been raised superficial to the deep fascia and have gained the reputation of being unreliable. Although the inclusion of the deep fascia in the flap has been described by a number of surgeons including Bakamjian (1960) and Bowen et al. (1981), the discovery of undelayed fasciocutaneous flap of unconventional dimensions which could be used with confidence to cover exposed bones and tendons is a major breakthrough. It has not only reduced the time and the cost of treatment but surgeons have been provided with a safe and an effective new technique for better management of cases.

Material and Methods

The fasciocutaneous flap in leg have been raised in 12 patients. Table 1 shows the type of fasciocutaneous flaps, number of cases and the result.

Transposition Fasciocutaneous Flap: The maximum length-base ratio was 3.35:1 in transposition fasciocutaneous flaps of the leg as shown in Table 2. This flap was raised and transposed to cover skin defects following excision of the unstable scar over shin (Fig. 1). The maximum length of the fasciocutaneous flap was 27 cm (Fig. 2). Three fasciocutaneous

Table 1. Fasciocutaneous flap (F. C. F.) in Leg

Type of F. C. F.	No. of cases	Length/Base Ratio	Result			
			Good	Fair	Poor	Bad
1. Transposition	8	1.5-3.4:1	4	3	1	—
2. Cross leg	3	1.8-3:1	2	1	—	—
3. Bipedicle	1	3:1	1	—	—	—

Good—No complication; Fair—Epidermal loss; Poor—Skin loss with intact fascia; Bad—Complete necrosis of skin and deep fascia.

Table 2. Transposition Fasciocutaneous flap

Diagnosis	Size of defect (cm)	Size of flap (cm)	Length/ Base Ratio	Complications
Unstable scar shin	22×7	27×8	3.35:1	Distal epidermal loss 2 cm^2
Non-healing ulcer posterior aspect of ankle	13×7	16.5×7.5	2.2:1	—
Unstable scar shin	13×9	22×9	2.4:1	Distal epidermal loss
Post-traumatic ulcer with exposed tibia	20×10	23×10	2.3.:1	Distal 2.5 cm^2 skin loss with viable fascia
Post-patellectomy exposed knee joint	10×7	15×10	1.5:1	Distal epidermal loss 0.5 cm^2
Post-patellectomy exposed knee joint	15×6	20×8	2.5:1	—
Post-patellectomy exposed knee joint	14×5	18×6	3:1	—

Table 3. Cross Leg Fasciocutaneous flap

Diagnosis	Size of flap (cm)	Length/Base Ratio	Complications
Congenital constriction ring leg with complicated syndactyly.	15×5	3:1	Epidermal loss tip
Non-healing ulcer heal with scarring	21×10	2.1:1	—
Traumatic loss of tibia with circumferential scarring	22×12	1.8:1	—

flaps were based high up in the popliteal fossa to cover the skin defect in front of the knee joint (Figs. 4-5). Out of 8 cases, three had epidermal loss varying from 0.5 to 2 cm^2 at the distal end of the flap (Fig. 2). These patients did not require any secondary procedure (Fig. 3). One case had distal skin loss leaving deep fascia viable, hence split skin grafting was done as a secondary procedure.

Cross Leg Fasciocutaneous Flap: This was tried on three cases out of which one had a non-healing ulcer over the heel with scarring (Fig. 6). The size of the flap was 21 cm×10 cm (Fig. 7). Patient with traumatic loss of tibia with circumferential scarring had 22 cm long and 12 cm wide fasciocutaneous flap. Both patients had an uneventful post-operative recovery. The patient with a wide congenital

Fig. 1. A pre-operative view of an unstable scar shin region with multiple ulcers.

Fig. 2. Post-operative view. Transposition fasciocutaneous flap. Epidermal loss at the distal end of the fasciocutaneous flap. Length/Base ratio 3.35:1.

constriction ring had distal epidermal loss.

Bipedicle Advancement Fasciocutaneous Flap for Compound Comminuted Fracture Tibia: Initially a transposition fasciocutaneous flap was planned. The incision line on the posterior aspect of the leg had little bleeding that is why the plan was changed to a bipedicle advancement flap. Post-operatively, there was no complication.

The deep fascia is quite thick and easily recognized in the leg. The surgical plane in the leg is deep to the deep fascia. The deep fascia could be easily lifted off the leg muscles without much of bleeding. Four to five fascial septal perforators were ligated at 4-5 cm distance in the intermuscular septum between tibialis anterior and extensor digitorum longus. Similar pattern of septal perforators were found in the fascial septum between extensor digitorum longus and peroneal compartment. Fewer number of septal perforators were present between peroneal and posterior compartment of the leg. Fascial vascular net work was seen on the deep surface of the deep fascia. The split skin graft take was very good over the leg muscles.

Discussion

The fasciocutaneous flaps in the leg have been of great help in closing the soft tissue defects of the leg. In the present series, length/base ratio ranged from 1.5-3.4:1. Out of 12 cases of fasciocutaneous flap, four had minor problem of distal epidermal loss which did not require any secondary procedure. In one case, there was distal skin loss but the deep fascia was viable. This patient required split skin grafting over

Fig. 3. Fifteenth post-operative day distal epidermal loss has healed.

Fig. 4. Post-patellectomy infection of left knee joint, leading to skin loss anteriorly.

the deep fascia as a secondary procedure. The skin loss was probably because of poor vascularity and oedema of the deep fascia resulting from crush injury of the leg. There was associated patchy sub-fascial haematoma. Similar findings were noted in bipedicle advancement fasciocutaneous flap. In the latter patient, probably poor vascularity of the deep fascia was the reason for poor bleeding from posterior incision of the initially planned transposition fasciocutaneous flap. Ponten (1981) noted three minor problems of skin loss and three major problems of flap loss out of 23 cases. The length/base ratio of the flaps were 2.5:1. Tolhurst et al. (1982) had 4 failure out of 59 cases. Maximum length/base ratio in their series were 5:1 without any complication.

The main feeding vessels in fasciocutaneous flap of the leg are fascial septal perforators at the base of the flap. Lamberty and Cormack (1983) confirmed that the forearm skin is preferentially supplied by fascial septal perforators and not by perforators arising from the muscle. In the same year they have raised an antecubital fasciocutaneous flap based on inferior cubital septal perforator, a branch of the radial artery. Similarly, if a fasciocutaneous flap is raised to include a number of anastomosing vessels arising from different septal perforators then the same axial behaviour would be expected provided that there is a vessel of sufficiently large diameter at the proximal end of the flap. Lamberty and Cormack (1982) concluded that the fasciocutaneous flaps may be designed to achieve maximum length/base ratio by incorporating axially running fascial vessels.

There is a relatively avascular plane deep to the deep fascia. The musculocutaneous per-

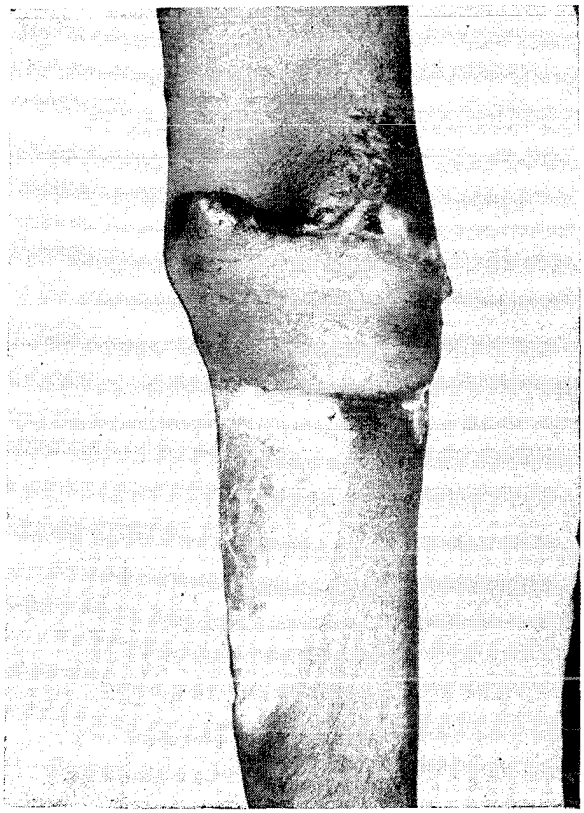

Fig. 5. Post-operative view. Transposition fasciocutaneous flap posteromedial aspect of the left leg.

Fig. 6. Left heel region showing multiple small ulcers in skin grafted area with scarring.

Fig. 7. Cross leg fasciocutaneous flap from posterolateral aspect of right leg. Flap is 21 cm long and 10 cm wide.

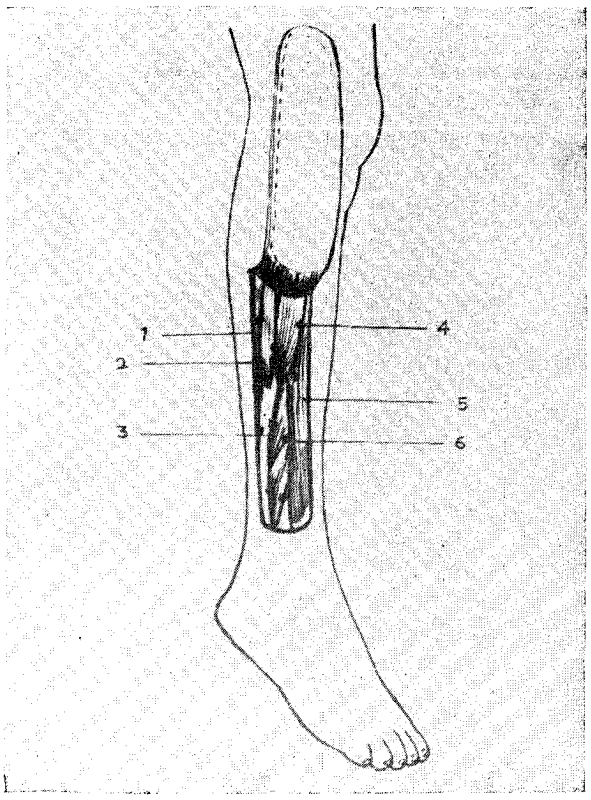

Fig. 8. Extensor, peroneal and posterior compartment with intermuscular septum of the leg:
1. Posterior compartment, 2. Intermuscular septum between Peroneal and posterior compartment, 3. Peroneus longus, 4 & 6. Black dot indicate ligated septal perforator artery, 5. Tibialis anterior.

forators arising from the leg muscle give little blood supply to the skin. These are the fascial septal perforators which are carrying the main blood supply to the deep fascia and skin of the leg. It was observed that the spurting bleeders ligated were the intermuscular fascial septal perforators. The number of fascial septal perforators were 4-5 between extensor digitorum longus and tibialis anterior. The same number of fascial septal perforators were observed at 4-5 cm distance through the intermuscular septum between extensor and peroneal compartment. The same number of fascial septal perforators were ligated between peroneal and posterior compartment (Fig. 8).

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