Indian Journal of Plastic Surgery (1988), 21(1), pp. 1-6

ANTERIOR TIBIAL ISLAND FLAP IN THE MANAGEMENT OF TROPHIC ULCERS OF HEEL

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SUMMARY

The use of anterior tibial flap as a distally based island flap for the management of trophic ulcers of heel is being presented. The advantages and vascular bases have been discussed.

(*Key Words* : Island Flap, Trophic ulcer)

Trophic ulcer on heel is not an unusual complication in patients with sacral meningocele, leprosy and diabetes. The usual predisposing factors are thrust, friction, injury, corn and callositics. Acute ulcers are managed by splintage, drainage and antibiotics. Superficial chronic ulcers are best treated by plaster of paris cast for a period of 6-8 weeks (Fischer, 1955). Deep ulcers do not heel in plaster and require excision and resurfacing (Fritschi, 1971).

The heel being a major pressure bearing area, requires ideally a sensory flap cover to provide protective sensation as well as padding. Various techniques to provide sensory cover for heel have been described e.g. free sensory skin graft (Maquieira, 1974; Lister, 1978), free sensory lateral intercostal neurovascular flap (Bardan et al., 1984), first web neurovascular island flap (Gulyas et al., 1984), median planter neurovascular flap (Shanahan & Gingrass, 1978) and dorsalis pedis flap (Caffee and Haefflin, 1979; Gajwala et al., 1987). But these techniques are only applicable where sensations of the distal limb are preserved.

Cross leg flap (Hayes, 1962; Crikelair et al., 1966), fasciocutaneous flap (Ponten, 1981), musculocutaneous flaps (Feldman et al., 1978) have been extensively used for reconstruction of defects in the lower extremity and foot.

A fasciocutaneous island flap based on anterior tibial vessels has been recently described by Wee (1986). We have used this flap for reconstruction of heel defects in cases of trophic ulcers with exposed calcaneum in four cases successfully.

Vascular Bases of Anterior Tibial Flap

The skin of anterolateral region of upper leg is supplied by perforating vessels arising from the anterior tibial artery. The intermuscular septal vessels are of two types. The muscular pedicles which supply T.A. and E.D.L. (conforming to the type IV pattern of muscle blood supply of Mathes & Nahai, 1979) as well as fasciocutaneous pedicles which after giving of collateral muscular branches continue on to supply the deep fascia with a fascial plexus which in turn supply the overlying skin (Wee, 1986). The average number of fasciocutaneous vessels in each third of leg are: upper third—3; middle third—7; lower third—3 (Wee, 1986).

The arterial supply to the reverse pedicled anterior tibial flap is by retrograde flow through anastomosis between the anterior tibial and dorsalis pedis artery with the posterior tibial and peroneal artery. There are many levels of anastomosis between these vessels around the mellioli and in the midfoot through perforating arteries communicating with the planter arch. The connections provide adequate perfusion of the flap from a retrograde direction.

Venous drainage of the flap is by the venae commitantes accompanying the anterior tibial

artery. Drainage via deep veins occur against the direction of the valves which are rendered incompetent (Timmons, 1984) or cross over channels linking venae commitantes or by collateral superficial deep veins (Lin et al., 1984).

Flap Design

The dorsalis pedis and posterior tibial vessels are confirmed by palpation pre-operatively, absence of either vessel contraindicates the flap. The anterior tibial artery is marked on the leg by joining the mid point of the line joining tibial tuberosity to fibular head and another point midway between two mellioli. Pivot point of the flap is marked, which should be at least 5.0 to 6.0 cms proximal to the ankle. Length of the pedicle required is measured from the edge of the proposed defect to the pivot point allowing a further 2-3 cm for tension free transposition of the pedicle. Flap is marked preferably keeping the anterior tibial vessel in the center. The more distal the defect, the nearer will be the donor site to the knee and the more distal will be the pivot i.e. close to the ankle.

Flap Elevation

The surgery is carried out in a bloodless field. The anterior tibial vessels are exposed just above the extensor retinaculum at the ankle after incising skin and deep fascia and retracting the tendons of E.D.L. and E.H.L. from T.A. The vessel is exposed upto the inferior margin of the flap, deep peroneal nerve is encountered, and is separated from the vessels. The flap is incised all around including the deep fascia. The lateral edge of the flap is elevated medially including the deep fascia to the intermuscular cleft, which is widened by retracting E.D.L. and E.H.L. laterally. The delicate fasciocutaneous vessels are visualised. Vascular branches supplying E.D.L. and E.H.L. are ligated. The deep peroneal nerve is separated from the vessel from the superior edge of the flap to the pivot point. The anterior tibial artery and venae commitantes are ligated at the superior edge of the flap and severed. A strip of tibialis anterior 1 cm broad is incised throughout its full thickness to reach the interosseous membrane. This strip of the muscle is included in the flap and serves to prevent stretching of the fasciocutaneous vessels, supplying the deep fascia. Care is taken to include as much of the soft tissue around the vascular pedicle as possible and not to separate the veins from the artery (Wee, 1986). The pedicle is elevated from the interosseous membrane till the pivot point is reached. The flap is then transferred to the defect and inset. The intervening skin is incised and undermind to allow the pedicle to be burried. The donor defect is skin grafted, no attempt should be made to reduce the size of the donor defect by suturing the skin edges.

Material and Methods

Four cases of trophic ulcers of heel with exposed calcaneum (Table) were selected for the study. Pre-operatively dorsalis pedis and posterior tibial vessels were palpated. Post-operatively leg was immobilised in supportive plaster cast. Drain was removed after 48 hours and the sutures on the 10th day.

Table

No. of case	Age	Sex	Cause of ulcer	Size of the flap
1.	16 years	Male	Sacral meningocele	7 × 10 cm
2.	11 years	Male	Sacral meningocele	8 × 9 cm
3.	46 years	Male	Leprosy	7.5 × 8.5 cm
4.	19 years	Male	Sacral meningocele	6.0 × 7.0 cm

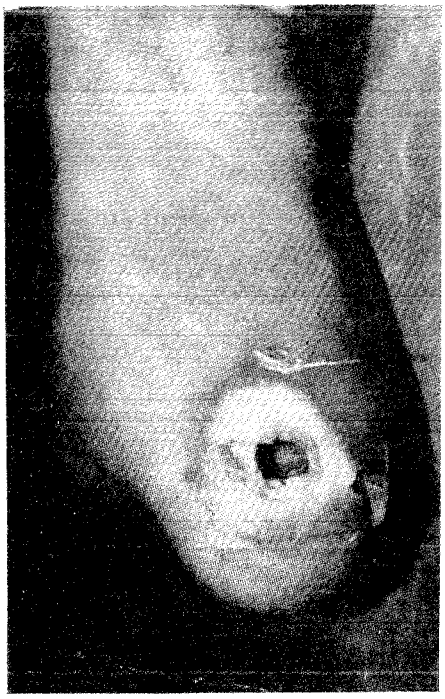

Fig. 1. A patient with deep trophic ulcer of heel.

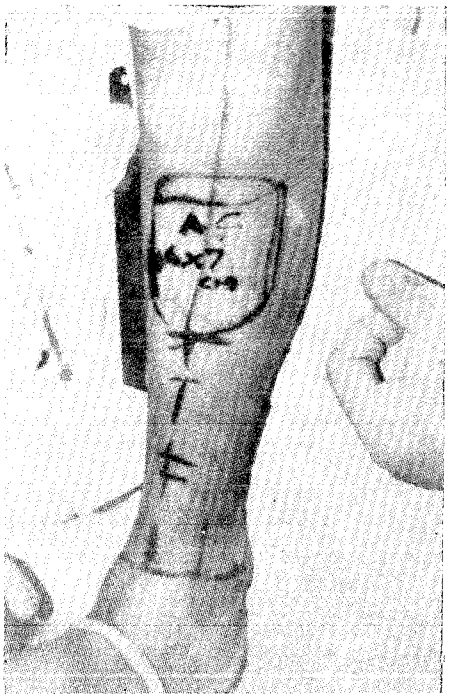

Fig. 2. Anterior tibial artery and flap marked.

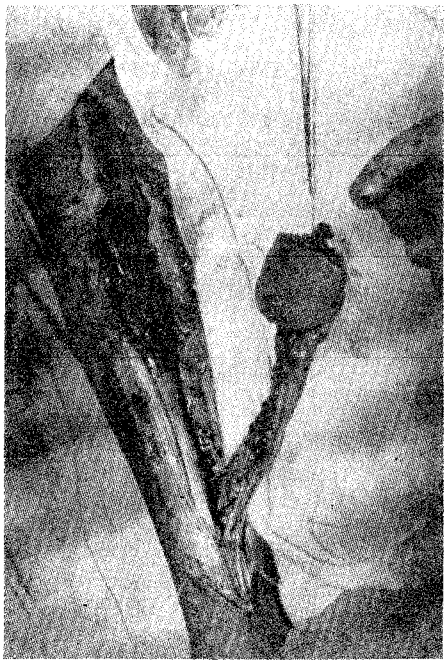

Fig. 3. Flap has been elevated and pedicle dissected distally.

Fig. 4. Subcutaneous tissue has been undermined and flap transposed.

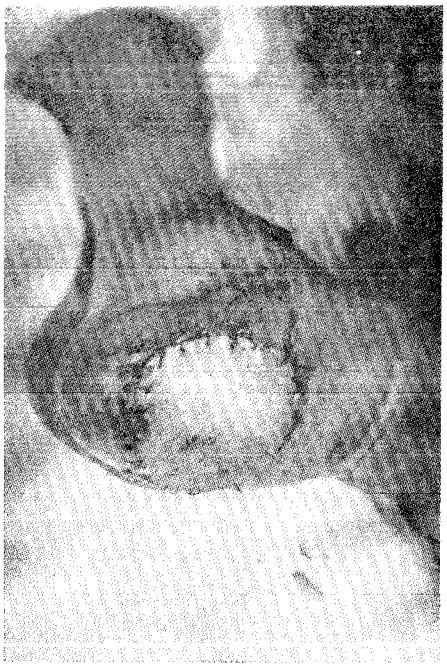

Fig. 5. Flap has been set in. Flap shows oedema.

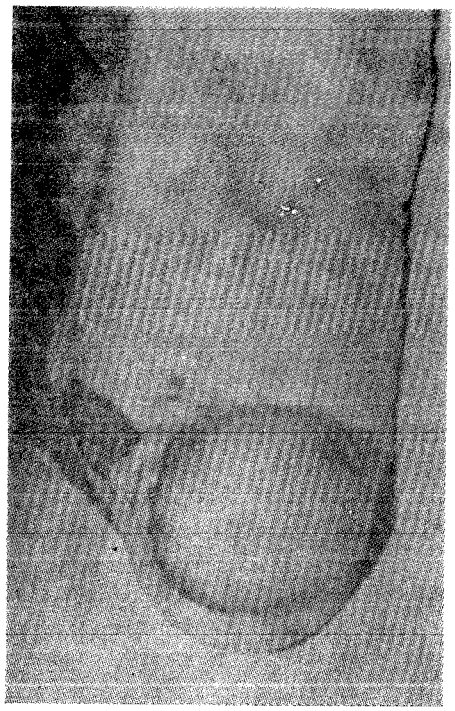

Fig. 6. Post-operative result after 6 weeks.

Limb was put in walking plaster for 6 weeks, when the plaster was removed and the patients were allowed to bear weight on the reconstructed heel.

Observations

In four patients with deep trophic ulcers of heel, anterior tibial island flap has been used to reconstruct the heel after its proper debridement (Fig. 1-6). Swelling of the flap was encountered (Fig. 5) in all patients but it reduced gradually over 3 weeks. No necrosis of the flap was encountered. No loss of graft over donor area was seen. Good functional results were attained by all patients.

Discussion

Defects of the heel have long challenged the skills of reconstructive surgeons. Successful repair requires a sensory flap to provide the padding and protection. Some grafts in the weight bearing area fail because of their inadequate resistance to repeated wear and tear and lack of padding.

Cross leg flaps require prolonged immobilizations in an uncomfortable position. The peroneal artery flap (Yoshimura et al., 1984) has a small pedicle and is unable to reach the heel defects properly. Local muscle flaps from the same foot viz. abductor hallucis and abductor digiti minimi flap (Mathes et al., 1974; Ger, 1975), flexor digitorum brevis flap (Hartrampt, 1980), can not be used for small defects. Dorsalis pedis flap (Caffee & Haefflin, 1979; Gajwala, 1987) can be safely used but it is associated with high donor area morbidity and secondly is not sensory in patients with sensory loss in the distal limb.

Distally based anterior tibial artery island flap is a reliable alternative. It offers a large area of skin with a larger pedicle. Flap can reach upto the tip of the toes. Secondary defect readily accepts split skin grafts with a minimal contour disturbance. Skin of the flap is thick, and padding can be increased by taking a part of extensor digitorum fascia and

muscle and thereby chances of ulcer recurrence can be decreased.

The flap does necessitate division and stripping of the proximal half of the anterior tibial artery and is contraindicated if either the anterior or posterior tibial vessels are not palpable at the ankle. If there has been a history of trauma in the upper 1/3 of the lower leg, an angiography should be done to evaluate the vascularity of the leg.

Conclusion

The anterior tibial flap is safe, versatile and does not require microvascular expertize. It can be easily elevated without much risk of necrosis. Fixation of the limb in an uncomfortable position is not required and early mobilization in a walking plaster is possible.

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