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Experience with the adipofascial turn-over flap

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SUMMARY. **Use of the adipofascial turn-over flap has been extended to cover such complex wounds of the extremities as defects over exposed joints and fracture sites. Experience with 10 consecutive cases and long-term follow-up confirmed that this flap is easy to plan and quick to raise, with minimum donor site morbidity and high success rate.**

Flaps of fascia and fat have been used to provide a vascularised bed for skin grafts. These flaps are either local, such as the galeal flap used in craniofacial surgery,[1] and the radial forearm fascial flap, used to cover hand defects;[2] or are free flaps, such as the temporoparietal fascial flap,[3] or the posterior calf fascial flap.[4] All the aforementioned flaps are axial pattern. Thatte has described a roll-over fascial flap of the calf.[5] The random pattern adipofascial turn-over flap has been described to cover defects of the hand and finger,[6] the foot,[7] and the elbow joint.[8] The usefulness of this flap was put to the test and in the present series its use was extended to cover defects over bone, joints and fracture sites.

Patients and methods

Ten consecutive patients with complex wounds of the extremities treated by random pattern adipofascial turn-over flap and split skin graft as a one-stage procedure, done by one surgeon, are included in this study. Details of the cases are given in Table 1.

Technique

All flaps were raised through a zig-zag incision in the skin as illustrated in Figure 1. The skin was undermined deep to the dermis. If there was a thick layer of subcutaneous tissue, this layer was split. Skin under-

Table 1 Clinical data of the patients

Case	*Age (years)*	*Sex*	*Site of the defect and pathology*	*Outcome of Operation*	*Duration of Follow-up (months)*
1. MP	46	F	Fracture lower third left leg. Skin necrosis. Failed distal part of free muscle flap.	Successful	20
2. WB	73	M	Failed Mitchell's osteotomy left great toe. Skin and bone necrosis.	Successful Desquamation of donor area	18
3. DC	76	M	Tri-malleolar fracture left ankle. Exposed lateral malleolus.	Successful	18
4. CB	82	F	Failed acromioplasty. Skin necrosis: Exposed right shoulder joint.	Successful	12
5. RB	29	M	Knee surgery, skin necrosis prepatellar area. (Infected wound)	Failed	12
6. JO	80	F	Multiple trauma. Degloving injury. Exposed lower third fracture tibia and fibula left leg.	Successful	12
7. CW	30	M	Traumatic hemi-amputation left hand. Contour deformity.	Successful Desquamation of donor area	10
8. JW	67	F	Exposed left shoulder following debridement of septic arthritis, previous radiotherapy.	Successful	12
9. BU	78	F	Infected non-union lower third fracture tibia and fibula left leg.	Successful	12
10. CW	71	F	Exposed shoulder joint following failed acromioplasty.	Successful	8

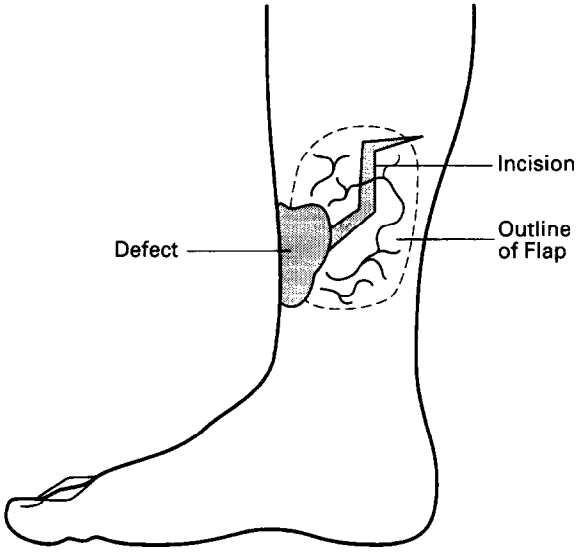

Fig. 1

Figure 1—Planning of the flap. Zig-zag incision in the skin.

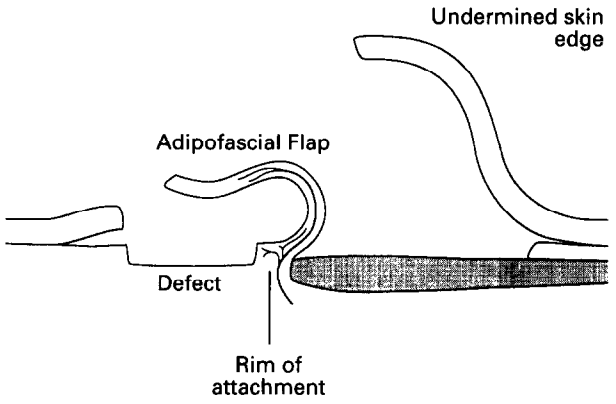

Fig. 2

Figure 2—Diagram showing the rim of attachment at the base of a flap.

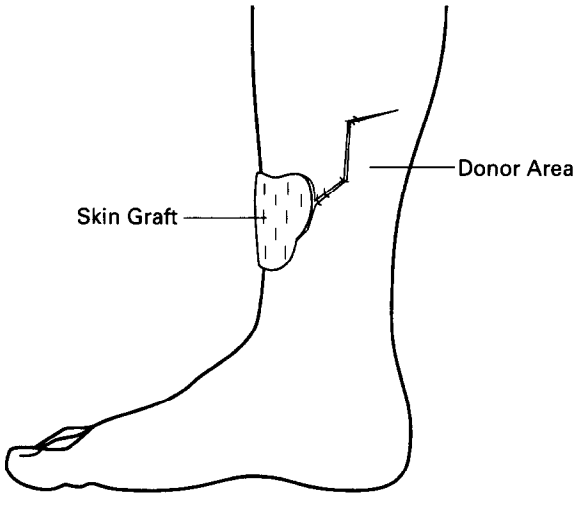

Fig. 3

Figure 3—The donor defect closed directly and a split skin graft applied to the turned-over adipofascial flap.

mining was started from the edge of the wound and carried out towards the periphery. The flap outline was marked and the flap was raised at a subfascial plane starting from the periphery. The dissection was continued towards the edge of the wound very carefully so as to leave a rim of tissue attached at the base, as shown diagrammatically in Figure 2. Little bleeding was encountered during dissection and the use of a tourniquet was rarely necessary.

The dimensions of the flap were made to keep the length and breadth ratio roughly equal; the rim of attachment at the base of the flap was kept between 1 cm and 1.5 cm wide, which could be narrowed if significant perforators could be identified within it. The size of the flap was kept 30–40% larger than the defect to allow turnover and overlap without tension. The excess portion was tucked underneath the undermined edges of the defect. The donor area was closed directly over a vacuum suction drain. A split skin graft was used to cover the turned-over flap (Fig. 3) and a very light dressing was applied.

Results

In our series, healing by first intention was achieved in nine patients. The repair failed in case 5 due to streptococcal infection.

Discolouration and superficial desquamation of the skin at the donor site was noted in Cases 2 and 7, where the donor area was over the foot and hand respectively. At the time of first graft inspection, usually on the 5th postoperative day, the flap and the skin graft appeared discoloured but viable. The appearance continued to improve subsequently. In Case 2, there was minor discharge two months after surgery. This healed with dressings and antibiotic treatment.

Case 1, a 46-year-old female, had a free rectus abdominus muscle transfer to cover a plate that was used to fix a lower third tibial fracture. The distal 5 cm of the transferred muscle was lost, resulting in re-exposure of the metalwork. An adipofascial flap based at the anterior edge of the wound was just sufficient to cover the defect. The flap and the skin graft were stable at twenty months follow-up. An intermittent discharge from one edge of the wound was noted, but the fracture showed radiological evidence of progressive healing (Fig. 4A–F).

Case 9 was a 78-year-old female with an open lower third tibial fracture. Her injury was managed by intramedullary nailing and split skin grafting. Three months following injury the site of an infected non-union was excised and the nail exchanged. The soft tissue defect was covered with an adipofascial flap based at the anterior edge of the wound. Healing was uneventful and the fracture showed radiological evidence of union with consolidation of the skin cover when reviewed at eight months (Fig. 5A–D).

Discussion

The random pattern turn-over adipofascial flap receives its blood supply from the narrow rim of

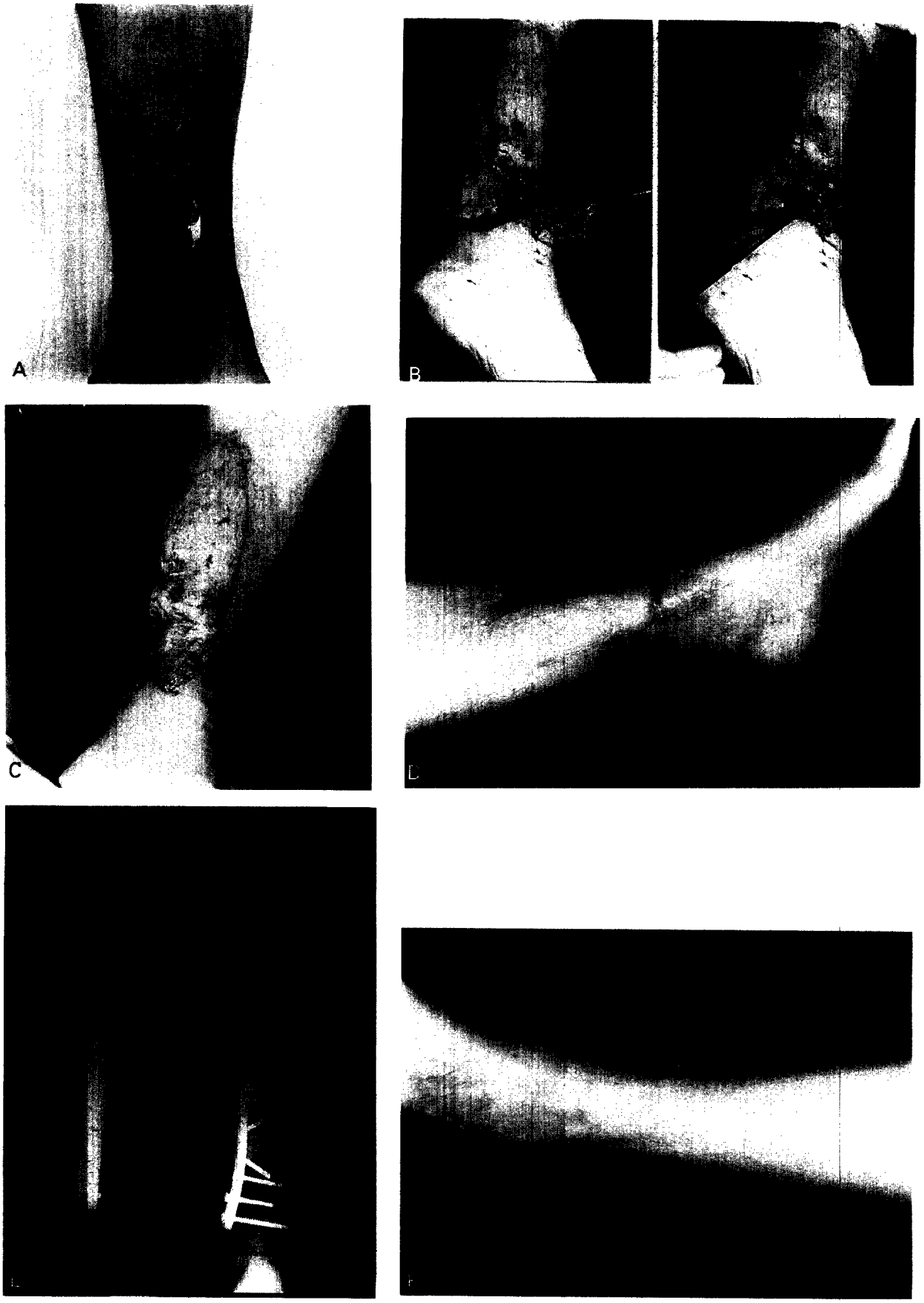

Fig. 4

Figure 4—(A) Case 1. 46-year-old woman. Exposed metalwork following plating lower third tibial fracture. (B) Distal loss of free muscle flap. Raised adipofascial flap (left), flap turned-over to cover the metalwork. (C, D) Flap with skin graft, 7th postoperative day, (C): 20 months follow up, (D). (E) Healing fracture. (F) Donor site. The scar above the lateral malleolus is barely visible.

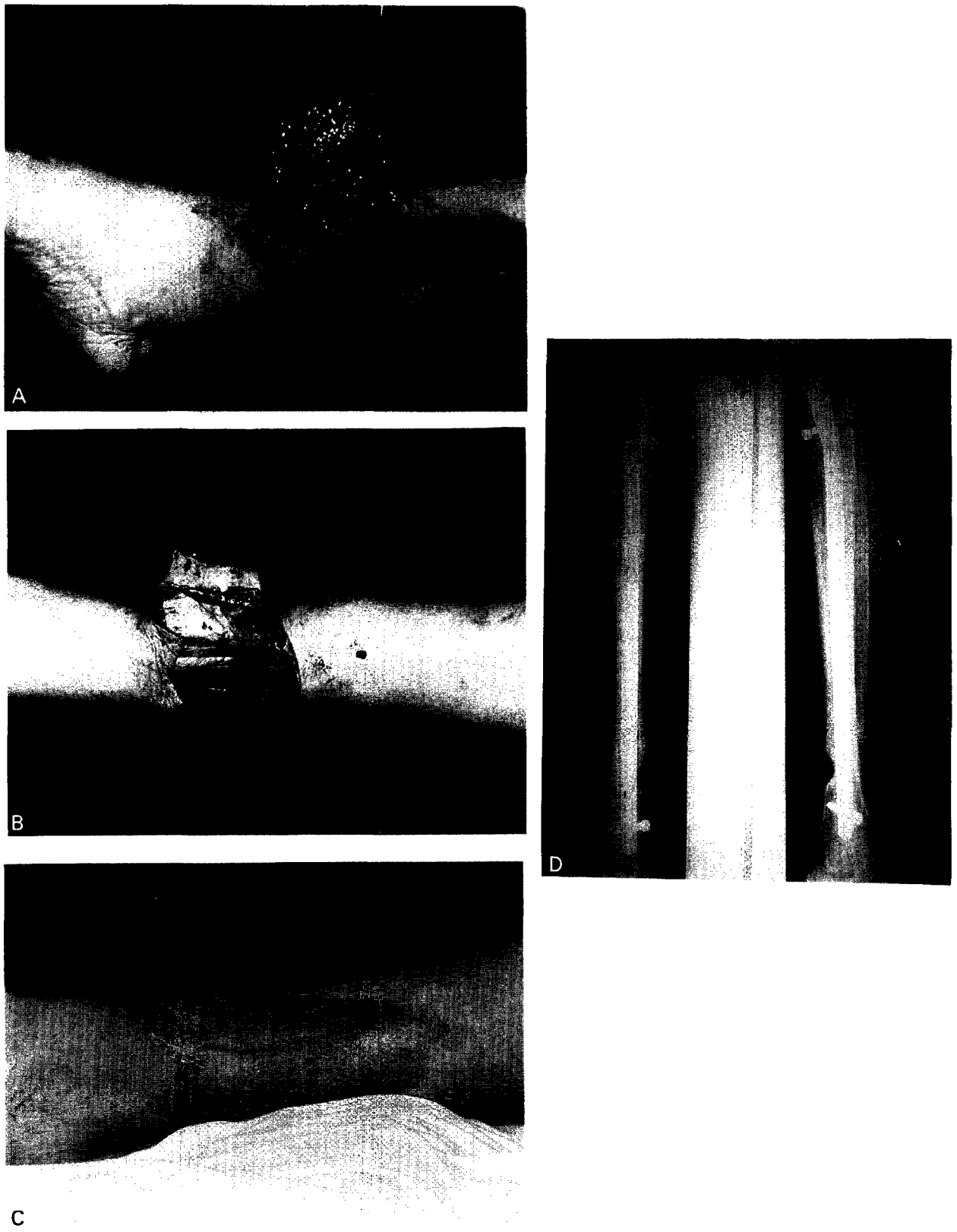

Fig. 5

Figure 5—(A) Case 9, 78-year-old female. Wide excision and exchange nailing was carried following infected non-union of lower third fracture. An adipofascial flap has been raised from the anterior edge of the wound. (B) Anterior view of the adipofascial flap showing the donor site. (C) Healing achieved by first intention followed by fracture healing (D).

attachment at its base adjacent to the soft tissue defect through which vessels pass from the fascial and subcutaneous plexuses.[7,8] Increased vascularity at the edges of a chronic or subacute wound may provide additional communicating channels.

The deep fascia, especially in the extremities, has

Fig. 6

Figure 6—(A) Case 4: an 82-year-old female with an exposed shoulder joint. (B) An incision made over the deltoid area and undermining of the skin deep to dermis. (C) Rim of attachment at the base of the flap. (D) Directly closed donor defect and the skin graft on the turned-over flap. (E) Result at 10 month follow-up.

significant vascular plexuses.[9,10] This is arranged as a minor sub-fascial plexus, insignificant vessels within the fascia and a dominant prefascial plexus. These plexuses receive blood from septocutaneous and musculocutaneous perforators and by retrograde blood flow from the subcutaneous plexus which is a rich vascular network.[11]

Inclusion of fat in this flap helps to maintain the integrity of the prefascial plexus. In addition, fat provides extra padding, a gliding surface and a tissue plane should the need arise to lift the flap.

There is some flexibility in planning this flap in that any location around the defect can be used as a base provided there is adequate adipofascial tissue, but preferably over a muscle and at the broad edge of the wound to keep the flap length to breadth ratio below 2:1.

Age is not a contra-indication for using this flap. In our series, six of the patients were above the age of 70. In this respect our experience differs from that of Lai *et al.*[7]

Three of our patients had exposed shoulder joints following failed acromioplasty. Pectoralis major muscle flap and a skin graft will provide a reliable and durable cover for the exposed joint, but in a female patient, as was the case in this series, this will leave a significant donor site morbidity. This may not be available as in Case 8, who had left radical mastectomy followed by radiotherapy. All of these three cases were treated successfully by the adipofascial flap. Case 4 is illustrated as a representative (Fig. 6A–E).

It would appear that the flap of fascia and fat is not as resistant to infection as muscle or fasciocutaneous flaps, and its use is not recommended in the presence of significant bacteriological growth. In Case 5, the only flap lost in this series, *streptococcus faecalis* was isolated on culture. The bacteriology of the wound was the same preoperatively, which went unrecognised.

Three patients in this series had compound fractures of the lower leg which were resurfaced successfully with an adipofascial flap and split skin graft. Other local flaps, such as a fasciocutaneous or a muscle flap, were considered to be untenable. In Case 1, the size and design of a fasciocutaneous flap was restricted due to previous surgery, therefore a proximally based flap was not feasible. During the free rectus transfer there was repeated cessation of anastomotic blood flow, which improved on heparinisation. The flap healed with loss of the distal portion. An exploratory incision was made but no suitable perforator found for a distally based fasciocutaneous flap to cover the re-exposed metalwork. The defect was too distal to be adequately covered by a gastrocnemius or a soleal muscle flap. In the second case, a fasciocutaneous flap was ruled out due to associated degloving injury to the leg. A free muscle transfer, though possible, was considered unsuitable because of age and other concomitant injuries (Case 6). An adipofascial flap was a relatively minor procedure and surgery did not increase the extent of trauma. The third patient in this set was a 78-year-old female, and a fasciocutaneous flap was not available due to skin loss in any potential donor area.

The de-epithelialised turn-over flap,[12,13] which was popularised by Thatte,[14] is an alternative. However, this can be difficult to turn over and is bulky in patients with thick subcutaneous fat. The donor site needs to be skin grafted and there is a risk of dermoid cyst formation,[6,7] especially when covering exposed metalwork. There is a considerable cosmetic deformity, particularly in the female patient. The adipofascial flap has none of these disadvantages.

In comparison, in the case of compound fracture of the lower leg, fasciocutaneous flaps[15,16] provide better cover and padding, and are easy to lift off the undersurface for further surgery, but may not be available, especially when there is a degloving injury, and the cosmetic deficit associated with the donor site is a significant disadvantage. Free tissue transfer, though another option available, is not as cost effective.

In conclusion, a local random-pattern adipofascial turn-over flap, which is a quick and easy one-stage procedure, is useful to cover small- to medium-sized defects in the absence of infection. The flap is available close to the defect and there is some flexibility in planning it. It has minimal donor site morbidity; it is a flap which gives something at the cost of virtually nothing.

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