

Layered shaving of venous leg ulcers

A. A. QUABA, R. A. W. McDOWALL and M. E. J. HACKETT

North East Thames Regional Plastic Surgery Centre, St Andrew's Hospital, Billericay and The London Hospital, Whitechapel

Summary—A method for the quick preparation of refractory venous ulcer beds for autografting is described. Irrespective of their clinical or bacteriological state, ulcer granulations and other products of frustrated healing are shaved in layers down to an even and surgically clean base using an ordinary skin grafting knife. Our experience with 32 consecutive patients (58 ulcers) is reported. The mean duration of hospital stay, the patient being completely healed on discharge, was 18.3 days. This represents a decrease of more than 3 weeks when compared to a previously used standard method. No investigation into the question of recurrence was carried out as available evidence, which is critically reviewed, indicates no significant relation between the method of grafting and the incidence of recurrence.

Venous ulceration is a common and often painful condition which accounts for considerable morbidity and extensive use of both out-patient and in-patient facilities.

Homans (1917) associated leg ulceration with deep vein thrombosis. The presence of phlebographic evidence of past thrombosis in 80–90% of ulcerated legs (Bauer, 1948) established the extent of this association. The ultimate cause of the post-phlebotic ulcer is still unknown. The role of incompetent communicating veins has been questioned (Arenander, 1956; Burnard *et al.*, 1976) and so has the place of surgical manoeuvres designed to eliminate them. Browse (1983) proposed that venous ulceration is caused by the depositing of an impermeable fibrin cuff around dermal capillaries.

The majority of leg ulcers will heal on conservative management carried out on an out-patient basis. Supportive leg bandaging is the corner-stone of such management. This may be supplemented with variable periods of bed rest and elevation. There remains, however, a significant number of patients in whom skin grafting must be carefully considered following failure of conservative treatment.

Some authors (Brown *et al.*, 1936; Pontén, 1972) have recommended radical excision of the ulcer before grafting on the assumption that such a procedure would remove incompetent perforators. A more conservative approach is to graft ulcer granulations following a period of topical care aimed at controlling bacterial microflora and improving the quality of granulations.

Topical care of the ulcerated leg in preparation

for skin grafting remains an unsolved problem. Anti-bacterials, desloughing agents and Dextranomer beads have been popular from time to time but there is no hard evidence of their efficacy. The use of biological dressings, believed to stimulate new vessel formation and decrease bacterial count, had been reported (Matthews *et al.*, 1981).

In a previously unpublished study, two of the authors (Hackett and McDowall) compared the effectiveness of two methods of ulcer preparation in 82 patients (122 ulcers). In half the patients the ulcer was cleaned with Eusol and paraffin four times a day until it was considered fit for grafting clinically; in the other half the ulcer was treated with lyophilised allograft whose adherence to the ulcer bed signalled adequate preparation and was followed by autografting. The length of hospital stay was regarded as the end point of the treatment. In the routinely treated patients the mean stay was 41 days compared with 29 days for the lyophilised allograft group.

However, the time needed to prepare unhealthy beds remains unacceptably long, with some ulcers proving refractory. Often there is only partial take of the skin graft, which necessitates further grafting and adds to the patient's morbidity and hospital stay. We would like to report our experience in the use of a different approach for the preparation of venous ulcers for skin grafting.

Patients and methods

Thirty-two consecutive patients (19 females and 13 males) with clinically diagnosed venous leg ulcers

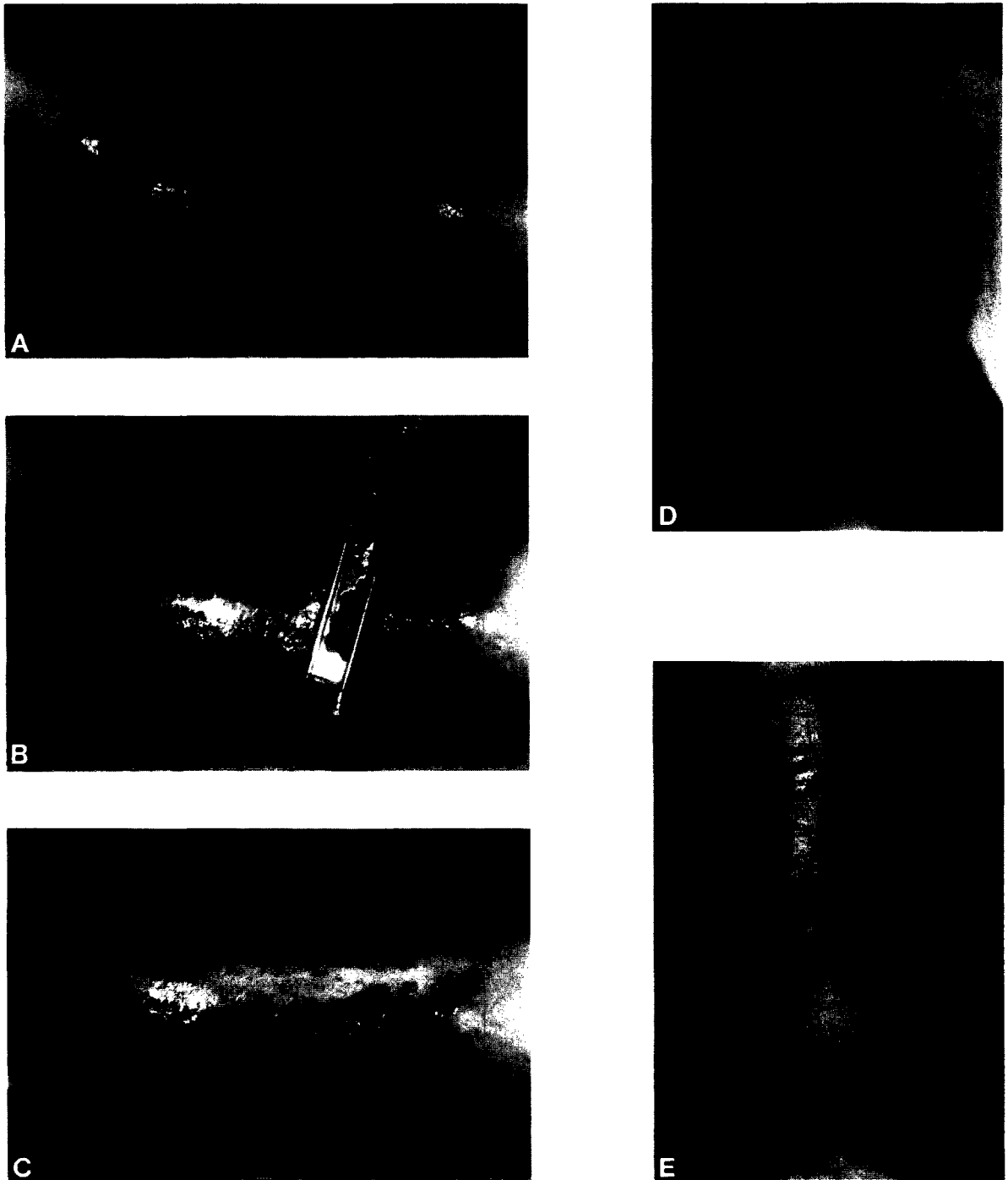


Fig. 1

Figure 1—Shaving under tourniquet: an 83-year-old lady with large circumferential post-phlebotic venous ulcer of 4 years' duration. Limbs are exsanguinated by elevation for 5 minutes. (A) Pre-operative appearance. (B) All skin layers become welded into a mass infiltrated with granulation tissue and haemosiderin. Shaving commenced on the antero-medial aspect of the leg. (C) Appearance of the antero-medial part of the ulcer after completion of shaving. (D, E) Complete healing after single application of grafts, 48 hours and 1 year after surgery.

were referred for skin grafting following failure of conservative methods to heal them. Due to their advanced age (mean 65.2 years) many patients had other conditions which could have affected the leg circulation; however, ulcers of clear ischaemic or diabetic origin were carefully excluded.

Thirteen of the patients (40%) had previous ligation or injection procedures for incompetent perforators and 14 of them (44%) had multiple or bilateral ulcers; the total number of ulcers treated was 58. Seven ulcers were circumferential but the mean ulcer size was 66.5 cm². The mean duration of ulceration was 10 years.

Method

Granulation tissue and other products of frustrated healing are shaved off in thin layers until a healthy base is reached. Ulcers are shaved regardless of their clinical or bacteriological state; acute cellulitis or the isolation of beta-haemolytic streptococcus Group A are the only indications to postpone surgery.

In theatre, the ulcerated leg is prepared with povidone iodine and the surrounding skin descaled. Shaving is carried out using a skin graft knife, the setting being that used for taking a medium-thickness skin graft. The ulcer bed, edge, and a margin of the surrounding unhealthy skin are shaved in layers to leave a smooth even and surgically clean base. Three to four "shaves" are usually necessary to achieve this. In the presence of multiple adjacent ulcers, the whole area is shaved to produce a confluent even base. Usually, the bleeding consists of capillary ooze which can be readily controlled by wet compresses. Unless absolutely necessary, no other form of haemostasis is employed. A tourniquet may be used to minimise blood loss when shaving extensive circumferential ulcers; all granulations and pigmented fibrous tissue are removed (Fig. 1).

Generous sheets of perforated medium-thickness skin graft are applied to the shaved areas; grafts are not sutured but must overlap the surrounding skin. Firm pressure with crepe bandages is applied over a dressing of tulle gras, gauze and cotton wool.

Post-operative dressings are taken down in 48 hours for graft inspection and trimming of excess skin. Grafts are then left exposed but dressings may be re-applied for circumferential grafts. Provided the graft take has been satisfactory, gradual mobilisation with firm support from toes to knees begins at 7 to 10 days and is completed in a further 3 to 4 days.

Table 1 Duration of hospital stay

<i>Hospital stay</i>	<i>Mean (days)</i>
Pre-operative	2.1
Post-operative*	16.2
Total	18.3

* Including day of surgery.

Results

The duration of hospital stay, the patient being completely healed on discharge, was the parameter used to assess the results (see Table 1). The mean pre-operative stay was 2.1 days. This would have come down to 1.4 days if three patients, whose surgery was postponed because of cellulitis, were excluded. Difficulties in arranging hospital discharge and delayed healing of donor sites prolonged the hospital stay by a mean of 1.7 days.

All patients except two had their ulcers healed after a single surgical procedure. A second operation was necessary in two patients following partial skin graft loss. All ulcers were shaved under general anaesthesia. The mean operating time was 30 minutes per patient.

A pilot study carried out on 8 patients comparing the effectiveness of this method with treatment with Eusol and paraffin followed by auto-grafting did not justify, ethically or economically, continuation of a trial on that basis as patients in the control group were in hospital for 3 weeks longer than those treated by layered shaving. Therefore, it was decided to compare the results with those of the control group in the allograft trial mentioned previously as the same routine and clinical assessment had been used by two of the authors. The mean length of stay of patients treated by this method was 18.3 days compared with 41 days and 29 days for the two arms of the allograft trial.

Discussion

Following a protracted period of out-patient and in-patient conservative treatment, a number of patients with recalcitrant venous ulcers are referred for skin grafting. *Direct grafting on ulcer granulations* after "adequate" preparation is a common practice in most plastic surgery units. Preparation aims at reducing the bacterial count and improving the quality of granulations.

All venous ulcers are contaminated and some are infected, usually by mixed bacterial flora. Although

bacteria play little or no role in the aetiology of venous ulcers, successful closure depends on the control of the tissue level of bacteria to 10^5 or less per gram of tissue (Robson and Heggors, 1984), the clinical appearance *per se* being deceptive.

Decreasing bacterial count is time-consuming and the way to achieve it is controversial. Anti-bacterials, Dextranomer beads (Frank *et al.*, 1979) and various biological membranes (Rundle *et al.*, 1976; Teh, 1979) have been tried with variable success rates.

Biological membranes, which are believed to have an angiogenic effect (O'Donoghue and Zarem, 1971) have been advocated to improve the quality of ulcer granulations. The preparation, storage and maintenance of allografts (Hackett, 1975) and human amnion (Burgos, 1983) is time consuming and difficult.

Despite what appears to be adequate preparation, partial or complete loss of grafts applied directly on ulcer granulations is not uncommon and leads to prolonged morbidity and hospital stay.

Immediate or delayed grafting may follow the *wide excision of venous ulcers* down to and including the "deep fascia", the rationale being to interrupt incompetent perforators which had been blamed for recurrences (Brown *et al.*, 1936; Pontén, 1972) and to provide a healthier bed for the skin graft. Radical excision of the skin in the gaiter area where layers are welded together and where the circulation may be compromised due to associated arterial disease (Ochsner, 1962) is a considerable undertaking in elderly patients. It can lead to increased morbidity and prolonged hospital stay and is difficult to justify since the role of the perforators in the pathogenesis of venous ulceration has been questioned:

Trier *et al.* (1970), in a long-term follow-up of 100 cases of venous ulceration treated either by direct grafting on ulcers, grafting after minimum debridement or grafting after radical excision, found that "neither the duration of pre-operative preparation nor type of surgery appeared to influence the success or failure of treatment." They reported a recurrence rate of 48% during the first year of follow-up. Comparable or higher rates were reported from other series (Linton, 1953; Ward and Bennett, 1984). Arenander (1956) indicated that ligation of incompetent perforators in the presence of damaged deep veins did not prevent the development of further ulceration. Burnard *et al.* (1976) reported a 100% recurrence rate of venous ulcers within 5 years of ligation of perforators in patients

with phlebographic evidence of deep vein damage and concluded that incompetence of perforators, like venous ulceration, is a result of deep vein dysfunction and not itself a cause of venous ulceration. Consequently elimination of perforators by wide radical excision of venous ulcers to prevent recurrences seems unjustifiable. It would appear that relief of obstruction and/or replacement of diseased valves in the deep venous system (Bergan *et al.*, 1982) is the only way in which surgery can help in the prevention of recurrences.

Until effective treatment of the underlying condition can be found, a number of patients with ulcers refractory to conservative treatment will continue to benefit from skin grafting and may remain free of ulceration for a reasonable period of time provided they are willing to co-operate post-operatively with conservative measures designed to keep the venous hypertension under control, *i.e.* elastic bandaging, elevation and, if necessary, curtailment of physical activity. In this group of patients a simple and practical way to achieve complete healing within a reasonably short period of time must be used. The technique described here has significantly reduced the length of hospital stay for our patients.

By layered shaving of venous ulcers the bulk of bacterial microflora, unhealthy capillaries and the products of frustrated healing are removed instantly. Most of the patients in this series had their venous ulcers shaved within 2 days of hospital admission irrespective of the clinical and bacteriological state of the granulations and without any special pre-operative preparation. Cellulitis or the isolation of beta-haemolytic streptococcus Group A were the only indications to postpone surgery.

The complete and consistent take of skin graft in an area of disturbed microcirculation can be attributed to a number of factors, the most important of which is the debulking of microflora and the use of atraumatic technique. The granulations are not scraped away by a blunt instrument but rather shaved with a sharp skin graft knife, leaving no devitalised tags behind. This, and the avoidance of diathermy burns and ligatures, would ensure that leucocyte phagocytic reserves are not expended in "internal debridement" thus maintaining their capacity for bacterial phagocytosis and killing in an area which remains potentially contaminated even after shaving. Suture fixation of the graft is not necessary and can be detrimental. The presence of a single silk suture has been shown to decrease the number of staphylococci necessary to produce

clinical skin infection in human volunteers from over a million to one hundred—10,000 fold decrease (Elek, 1956). Grafts stick firmly to the shaved base and accidental displacement is avoided by careful application of dressings and by the use of large single sheets whenever possible with generous overlapping at the graft junctions and periphery.

Immediate grafting is essential to avoid the formation of superficial slough. Capillary ooze is easily controllable. The multiple perforations in the graft and the firm bandaging are very effective in preventing significant post-operative haematomas. Thin haematomas are not infrequently seen on first dressings. No attempt should be made to evacuate them as experience has shown that they do not result in graft loss.

Meticulous attention to detail is essential in securing the complete take of skin graft in an area where "it is imperative that every millimetre of transplanted skin survives" as small defects grow into recurrences very quickly (Peacock and Van Winkle, 1970).

The use of the skin graft knife for shaving of various lesions was reported by Hynes (1959) particularly with reference to the treatment of chronic radiodermatitis. Janzekovic (1970) popularised early surgical removal of dead tissue in partial thickness burns by shaving and immediate skin cover. Thompson and Ell (1974) shaved the epidermis of healed venous ulcers in preparation for dermal overgrafting.

Layered shaving is best carried out under general anaesthesia or a regional block. Local infiltration is unsatisfactory.

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The Authors

- A. A. Quaba, FRCS**, Senior Registrar in Plastic Surgery, St Andrew's Hospital, Billericay.
- R. A. W. McDowall, FRCS**, Consultant Plastic Surgeon, Odstock Hospital, Salisbury.
- M. E. J. Hackett, FRCS**, Consultant Plastic Surgeon, St Andrew's Hospital, Billericay and The London Hospital, Whitechapel, London.

Requests for reprints to: Mr A. A. Quaba, FRCS, North East Thames Regional Plastic Surgery Centre, St Andrew's Hospital, Billericay, Essex.