

## Pretibial injuries in the elderly: a prospective trial of early mobilisation versus bed rest following surgical treatment

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**SUMMARY.** Pretibial lacerations are a common form of injury of the elderly population. With respect to graft healing, controversy exists regarding rehabilitation by early ambulation, following debridement and split skin grafting. In a prospective, randomised trial comparing early mobilisation ( $n = 21$ ) with the traditional method of a period of in-patient bed rest after surgical treatment ( $n = 40$ ), no statistically significant difference has been found in the percentage area of skin graft take at either 1 or 3 weeks postoperatively. The method of anaesthesia (local or general) has no significant effect on the outcome of healing. Prolonged bed rest has a detrimental effect on return to independent mobility in one third of cases. Complications related to the wound site are similar in both groups. Hospital stay averaged 12 days in those confined to bed, compared to an average of 2 days in those who were allowed to walk immediately.

Low velocity soft tissue injuries to the pretibial region in the elderly population remain a common source of referral to plastic surgery units despite controversy in the past as to whether they might be appropriately treated conservatively by accident and emergency specialists.<sup>1-5</sup>

Differences of opinion also exist in the plastic surgery literature as to the proper management of those patients who are deemed to require radical surgical debridement and split skin grafting. Traditionally patients have been confined in hospital, for a period of immobilisation and leg elevation, following surgery in an effort to maximise skin graft take. The requirement for a period of bed rest was first questioned by Bodenham and Watson,<sup>6</sup> having allowed their patients to mobilise at 48 hours postoperatively within the limits of the ward.

Gaze<sup>7</sup> reported no difference in the "observed healing" of a total of 30 patients undergoing such surgery, 16 of whom were allowed to mobilise early on the ward, the others remaining confined to bed. Hospital stay was said to be shorter in the former group although no figures were given. Ramnani and Weston<sup>8</sup> proposed two stages of intervention to allow early ambulation and the use of regional anaesthesia on an outpatient basis. This involved primary excision of the wound flap followed by delayed primary split skin grafting. Results of graft take were derived retrospectively from the case-notes, without a well defined end-point. 27 of 38 patients were discharged after an average 15 days with a wound sufficiently well healed to "allow bathing", whilst the remaining 29% were discharged after an average of 16 days with an "incompletely healed" wound.

In a key paper, Sharpe *et al.*<sup>9</sup> demonstrated favourable results in 49 cases of pretibial injury treated by debridement and mesh skin grafting under local anaesthesia, with immediate mobilisation at home in

compression dressings. 10% showed "some loss" of graft at the first dressing change. The size of this loss was not reported and no reference was made to the magnitude of losses at subsequent dressing changes, although the average time to "complete healing" was 24 days. More recently, Shankar and Khoo<sup>5</sup> also used a regimen of immediate mobilisation following a single stage excision and skin grafting procedure performed under local anaesthetic in the casualty department. The method of assessment of graft take was not referred to but 23 out of 25 cases (92%) achieved 100% initial skin graft take at 1 week, with "complete healing" at 1 month. An unspecified number of cases were affected by graft haematoma but the complication rate was quoted as zero.

It is clear from these studies that a period of enforced bed rest is unlikely to be an absolute requirement for a successful outcome following split skin grafting of the lower limb, although immobilisation has been and perhaps remains the common practice.<sup>10</sup> Despite this demonstrated potential for successful early ambulation, with its perceived advantages in terms of complications related to immobility in the elderly and a reduced financial burden related to hospital stay, the case has not been tested in a controlled trial of these two forms of postoperative care. Until the start of the study reported in this paper the policy of our unit for the treatment of such injuries in the elderly had been one of wound excision and split skin grafting, followed by a period of in-patient bed rest for a minimum of 7-10 days prior to mobilisation. It was felt that in the current climate of audit of process and outcome of common clinical problems, along with increasing demands on limited health resources, a prospective, randomised, controlled trial of early versus late mobilisation was required to substantiate the impression gained from earlier uncontrolled studies.

## Methods

Patients were recruited prospectively over a 2-year period according to a pre-defined protocol. All cases of typical pretibial lacerations/flap wounds were considered for inclusion. Children and younger adults were excluded and although an exact lower age limit was not defined this type of injury is self evidently one affecting the older generation. Specific exclusions were a pre-injury inability to walk, associated fracture requiring immobilisation, wounds over 100 cm<sup>2</sup> and other overriding social or psychiatric circumstances. At the conclusion of the trial period cases were also excluded if there were found to have been protocol failures where insufficient data had been recorded or data were missing. Eligible patients were randomised to one of the two trial groups according to the year of their birth—even years being allocated to the early mobilisation regimen, those born in an odd year to the bed rest regimen.

Operations were carried out under local, spinal or general anaesthesia depending on the wishes of the patient, their fitness for a given method and with some regard for the size of the wound. The local anaesthetic technique involved local infiltration at the site of the wound and the use of EMLA cream surface anaesthesia at the donor site (supplemented with a lateral femoral cutaneous nerve block if required). The operative technique was identical for both groups. Skin flaps and undermined or compromised skin edges were excised down to deep fascia. The wound was irrigated to remove blood clot and loose fat. Particular attention was paid to haemostasis. A thin split skin graft was harvested from the ipsilateral thigh and applied generously perforated to allow drainage of exudate. The graft was stabilised around the periphery using cyano-acrylate glue and dressed with Chlorhexidine impregnated paraffin gauze, saline gauze and crepe bandage. In patients to be mobilised the wound was further supported by double Tubigrip, whilst those in the bed rest group had a below knee plaster backslab applied over Velband, with the ankle in neutral. The size of the wound was recorded prior to the application of dressings by measuring the length and breadth of the excised wound and subsequently calculating the surface area.

Patients in the early mobilisation group were discharged the same day if time and social circumstances allowed and the procedure had been performed under local anaesthetic or the following day for those performed under general or spinal anaesthetic. In a small number of cases an early return home was not possible and these people were mobilised on the ward. Those in the bed rest group were confined to strict bed rest for 7 days, with administration of heparin 5000 units subcutaneously twice daily where this was not contra-indicated.

In all cases the dressings were taken down and the graft inspected at 7 days postoperatively. At that time an accurate clinical estimate of the percentage skin graft take was made by the member or members of the surgical staff present. In addition, a tracing was made, on acetate film, of the perimeter of the wound and all areas of graft loss. Any complications were noted,

including the presence of haematoma or infection. If any of these were present they were treated appropriately. Any requirement for the application of stored skin graft was also recorded.

Subsequently, the wounds were dressed as before and re-dressed in the clinic or on the ward as required. Patients in the bed rest group were allowed to mobilise thereafter if the condition of the graft allowed. For the purpose of the study the grafts were re-inspected at 3 weeks postoperatively and the clinical estimation and tracing procedures repeated. Graft take was calculated from the tracings by weighing them before and after removal of the area representing the graft loss, and expressing the difference in those weights as a percentage.

Other data collected included any history of corticosteroid use and an assessment of mobility before and after the accident and treatment.

## Results

Over a 2-year period, from January 1990 to December 1991, 82 patients underwent excision and split skin grafting of typical pretibial wounds at this unit. Of these, six wounds were too large for inclusion and five cases breached other protocol requirements. A further 15 were excluded because insufficient information had been recorded. The remaining 56 patients suffered a total of 61 separate and distinct lacerations for analysis. At the conclusion of the trial 21 of the procedures were found to have been randomised by the year of birth to the early mobilisation group and 40 to the bed rest group. Of those from the total not entered into the final figures, 14 would have been randomised into the early mobilisation group and 12 to the bed rest group.

A total of 58 (95%) procedures were in females and 3 (5%) in males. The bed rest group comprised 39 (97.5%) females and 1 (2.5%) male and the mobilisation group 19 (90.5%) females and 2 (9.5%) males. The two groups were comparable in terms of age and area of excised wound. The average age of the bed rest group was 74.2 years (range 50–92 years) and wound size an average of 38.8 cm<sup>2</sup> (range 2–99 cm<sup>2</sup>). In the mobilisation group the average age was 77.5 years (range 47–93 years) and the average wound area 28.5 cm<sup>2</sup> (range 6–99 cm<sup>2</sup>). Application of t-tests demonstrated no statistically significant difference in either of these parameters. In a total of 10 (18%) patients there was a history of corticosteroid use. This represented 6/40 (15%) procedures in those immobilised and 5/21 (24%) procedures in those mobilised early (Table 1).

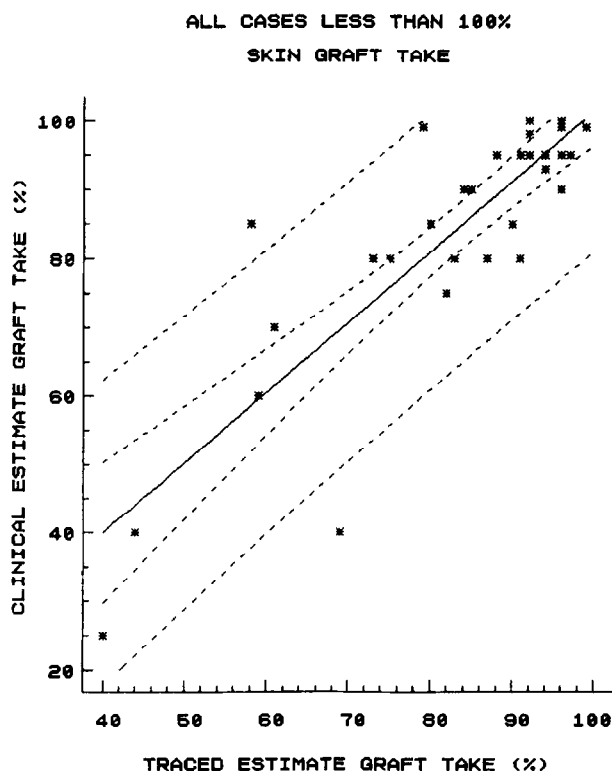
The assessment of split skin graft take, as discussed previously, was both by clinical estimate and by tracings on acetate film. Clinical estimates were available in all 61 procedures at both 1 week and 3 weeks. Adequate tracings were available in 44 procedures at 1 week and 39 at 3 weeks. Regression analyses demonstrated highly significant correlation between the clinical estimates and the tracings in both the immobilised and the ambulant groups, with *r* values of 0.89 and 0.91 respectively. The regression slopes demonstrated

**Table 1** Comparison of bed rest and early mobilisation groups

	<i>Bed rest</i>	<i>Mobile</i>	
Total	40	21	
Females	39 (97.5%)	19 (90.5%)	
Males	1 (2.5%)	2 (9.5%)	
Age-years average	74.2	77.5	p = 0.21 ns
range	50-92	47-93	
Area-cm <sup>2</sup> average	38.8	28.5	p = 0.14 ns
range	2-99	6-99	
Steroids	6 (15%)	5 (24%)	
Stay-days average	12.1	2.3	
range	7-21	1-8	

**Table 2** Regression analysis of clinical estimates on traced estimates of skin graft take (n = number of procedures, r = correlation coefficient, r<sup>2</sup> = square of correlation coefficient, slope = slope of regression line)

	<i>Bed rest</i>	<i>Mobile</i>	<i>Total &lt; 100%</i>
n	55	28	33
r	0.89	0.91	0.86
r <sup>2</sup>	78.8	82.0	73.8
Slope	1.13	0.95	1.02



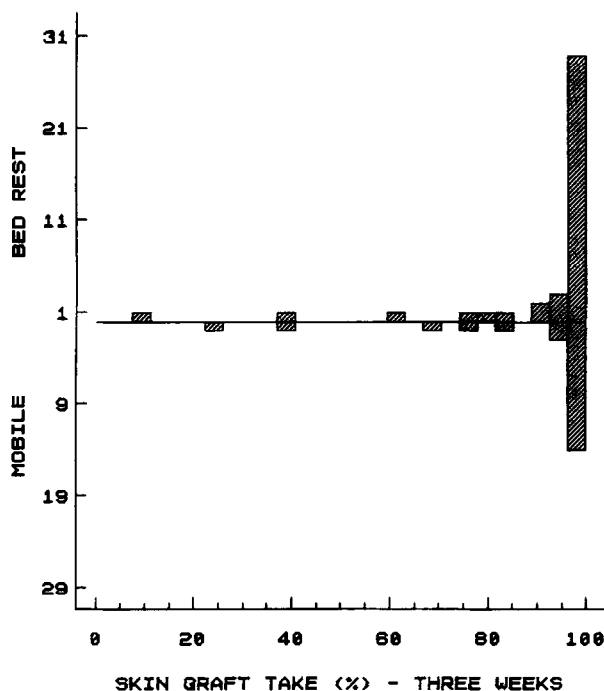
**Fig. 1**

**Figure 1**—Regression analysis graph in cases with less than 100% skin graft take only (excluding those cases where graft healing was assessed as perfect by both methods).

an over-estimate in the former (slope = 1.13) and an under-estimate in the latter (slope = 0.95) (Table 2). In order to ensure that these correlations were not unduly

**Table 3** Results of skin graft take (percentage area) in bed rest and early mobilisation groups

<i>Graft take</i>	<i>Bed rest Percentage area</i>	<i>Mobile</i>	
Average			
1 week	93.7	88.7	p = 0.29 ns
3 weeks	92.8	89.7	p = 0.55 ns
SD ±			
1 week	11.0	26.4	
3 weeks	18.1	21.0	
Range			
1 week	50-100	0-100	
3 weeks	10-100	25-100	



**Fig. 2**

**Figure 2**—Frequency histogram of skin graft take at 3 weeks in bed rest and early mobilisation groups.

biased by the large number of 100% graft takes on both clinical and traced estimates, a separate analysis was performed excluding those with perfect graft take. This confirmed the highly positive correlation with values of r = 0.86 and slope = 1.02 (Fig. 1). Based on these findings, further statistical analysis was performed only on the larger clinical estimate samples.

At 1 week, skin graft take in the bed rest group averaged 93.7% (SD ± 11.0%) and 92.8% (SD ± 18.1%) at 3 weeks. The early mobilisation cases demonstrated averages of 88.7% (SD ± 26.4%) at 1 week and 89.7% (SD ± 21.0%) at 3 weeks. Student's t-test p values were 0.29 and 0.55 at 1 and 3 weeks respectively, results not statistically significant at 95% confidence limits (Table 3). The distribution of graft take at 3 weeks is presented graphically in Figure 2.

For the purpose of documentation of length of stay 1 day was taken to mean a "day case" procedure, 2 days as an overnight stay and so forth. Those patients confined to bed averaged 12.1 days (range 7-21 days)

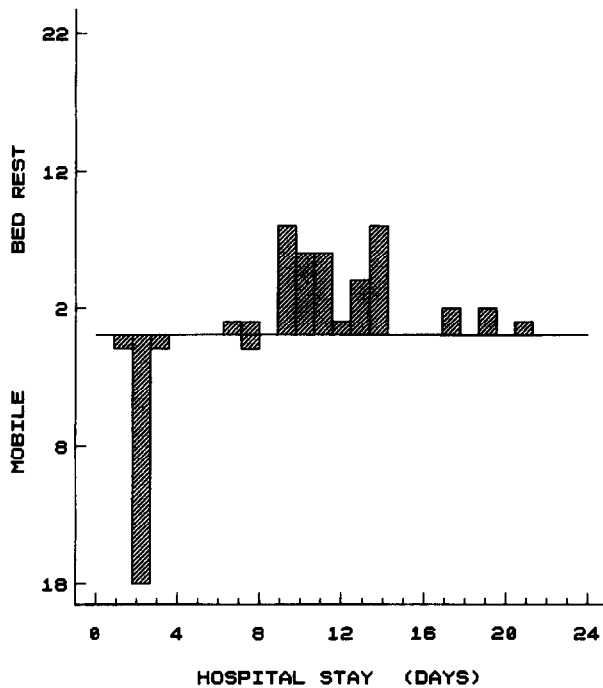


Fig. 3

Figure 3—Frequency histogram of hospital stay in bed rest and early mobilisation groups.

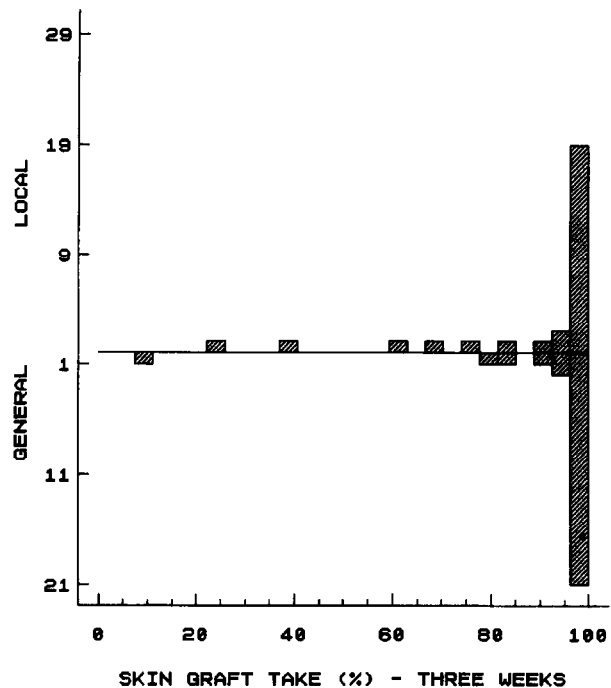


Fig. 4

Figure 4—Frequency histogram of skin graft take at 3 weeks for local anaesthesia and general anaesthesia groups.

Table 4 Comparison of sample populations and results of skin graft take according to method of anaesthesia

	General	Local	
Total	27	28	
Age-years			
average	73.4	77.4	
range	50-91	47-93	p = 0.15 ns
Area-cm <sup>2</sup>			
average	41.3	30.5	
range	6-99	2-95	p = 0.11 ns
Graft take	percentage area		
Average			
1 week	93.6	89.3	p = 0.40 ns
3 weeks	94.5	90.5	p = 0.43 ns
SD ±			
1 week	10.2	24.2	
3 weeks	17.6	19.4	
Range			
1 week	60-100	0-100	
3 weeks	10-100	25-100	

in hospital, those who were allowed to walk immediately 2.3 days (range 1-8 days) (Fig. 3).

The relationship between split skin graft take and the type of anaesthesia used has also been explored. A total of 27 procedures from both groups underwent a general anaesthetic and 28 procedures a local anaesthetic (six cases underwent spinal anaesthesia but this small group has not been further assessed). The ages, wound areas and hospital stay were comparable in both groups (Table 4).

The skin graft take averaged 93.6% (SD ± 10.2%) and 94.5% (SD ± 17.6%) at 1 week and 3 weeks respectively for general anaesthetic cases and 89.3% (SD ± 24.2%) and 90.5% (SD ± 19.4%) at the same times for local anaesthetic cases. These did not

represent statistically significant differences with p values of 0.40 and 0.43 for 95% confidence limits at 1 week and 3 weeks (Fig. 4).

With regard to the effect of prolonged bed rest on mobility, informal assessment and questioning of the patient at three weeks revealed diminished ease of activity compared to the pre-injury function in 10/31 (32%) of available cases in the bed rest group and 0/16 (0%) in the mobilisation group.

No serious complications were noted in patients mobilised early. There was one case of haematoma formation, one case of an infected graft and two other cases where stored skin was applied after partial loss. One patient undergoing immobilisation suffered mild haematuria with a low grade diffuse intravascular coagulopathy secondary to the use of subcutaneous low dose heparin thromboprophylaxis. Two cases of haematoma formation and two graft infections were noted, with three cases of stored skin graft having to be applied.

### Discussion

The results of this prospective, randomised, controlled trial of bed rest versus early mobilisation demonstrate the lack of any statistically significant difference in outcome with regard to healing. The slightly lower percentage skin graft take at both 1 week and 3 weeks in those who remain ambulant could reflect the greater proportion of patients on corticosteroids in this group. Those allowed home may also be less diligent with regard to leg elevation when at rest. Pertinent to the discussion on these two methods of rehabilitation is the type of anaesthesia employed. In early papers on the subject, the method used has not been stated and is

assumed to have been general anaesthesia.<sup>7,10</sup> More recently, those authors advocating early ambulation have used various forms of regional and local anaesthesia.<sup>5,8,9</sup> Analysis of the results of this study confirms that there is no difference in skin graft take as a consequence of either technique being employed. Given the potential hazards of general anaesthesia in the elderly and the benefits of a rapid return to mobility and the home environment, the use of local anaesthesia can be recommended.

Elderly patients prone to this type of injury are often precariously balanced on the edge of a rapid decline in their independence. Early ambulation has demonstrated benefits in maintaining this equilibrium with regard to mobility and our impression is that this also extends to their psychological well-being, although formal evaluation has not been possible. One third of patients confined to bed showed evidence of a subsequent reduction in their mobility.

The theoretical hazards of thromboembolic phenomena and other serious morbidity related to immobilisation were not seen in our patients, although one patient did suffer a significant complication as a result of a reaction to the routine thromboprophylactic regimen. It should be remembered that for a proportion of patients sustaining pretibial lacerations the injury is simply the end result of a more serious medical problem and therefore all of these patients require careful assessment if they are to be allowed home early appropriately.

The scale of the problem and therefore the potential economic consequence to plastic surgery units is likely to increase. Tandon and Sutherland<sup>10</sup> treated 26 patients as emergencies and 15 patients following delayed presentation, in the period 1963 to 1970. This unit has treated 82 patients as emergencies over a period of 2 years—a figure which does not include those with delayed presentation. The discrepancy in these figures could partly be explained by differences in referral patterns but against a background of an ageing population there is likely also to be a real rise in this type of injury of the elderly. The resource implications are considerable. Hospital stay can acceptably be reduced from an average of 12 days to an average of 2 days. In-patient hospital costs are approximately £200 per day. For 50 cases a year this represents a saving of the order of £100000 per annum. Drug costs will increase this figure although clinic visits may initially be more frequent in those mobilised early. If logistically possible, and when the patients' social circumstances allow, an in-patient stay can reasonably be avoided altogether.

In the past, early mobilisation has been considered a compromise solution.<sup>1</sup> Current trends towards reduced bed numbers and more efficient ward occupancy will increasingly mean that the traditional management of this type of trauma has to be reviewed. It is hoped that the findings of this study will permit a more informed decision to be made as to the expected outcome of a change of policy to early mobilisation, where this is not already practised.

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### References

1. Jones BM, Sanders R. Pretibial injuries: a common pitfall. *BMJ* 1983 February 12; 286: 502.
2. Marsden AK. (Letter) Pretibial injuries: a common pitfall. *BMJ* 1983 March 5; 286: 800.
3. Christian MS. (Letter) Pretibial injuries: a common pitfall. *BMJ* 1983 March 5; 286: 801.
4. Sutton R, Pritty P. Use of sutures or adhesive tapes for primary closure of pretibial lacerations. *BMJ* 1985 June 1; 290: 1627.
5. Shankar S, Khoo CTK. Lower limb skin loss: simple outpatient management with meshed skin grafts with immediate mobilization. *Arch Emg Med* 1987; 4: 187–92.
6. Bodenham DC, Watson R. The early ambulation of patients with lower limb grafts. *Br J Plast Surg* 1971; 24: 20–2.
7. Gaze NR. Early mobilization in the treatment of shin injuries. *Injury* 1978; 10: 209–10.
8. Ramnani SR, Weston PAM. Pretibial flap wounds: early grafting under regional anaesthesia as an outpatient procedure. *Injury* 1980; 12: 360–4.
9. Sharpe DT, Cardoso E, Baheti V. The immediate mobilisation of patients with lower limb skin grafts: a clinical report. *Br J Plast Surg* 1983; 36: 105–8.
10. Tandon SN, Sutherland AB. Pretibial lacerations. *Br J Plast Surg* 1973; 26: 172–5.

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