**Compression therapy for venous leg ulcers**

Nicky Cullum, Alison Fletcher, Anna Semlyen, Trevor A Sheldon

This paper summarises the findings of a recent issue of *Effective Health Care* Vol 3. Leg ulcers are areas of “loss of skin below the knee on the leg or foot which take more than six weeks to heal”. They are a common chronic, recurring condition which is a major cause of morbidity, suffering, and health service costs. About 1.5–3.0 per 1000 population have active leg ulcers and prevalence increases with age up to around 20 per 1000 in people older than 80 years. Leg ulceration is strongly associated with venous disease; however, arterial disease is present (alone or with venous problems) in about 20% of cases.

Leg ulcer disease is typically chronic and patients with active ulceration for more than 60 years have been documented. There is wide variation in recurrence with reulceration rates of 26%, to as high as 69% at one year being reported. Variation in recurrence rates and the chronicity of leg ulcers partly reflect the uneven quality of care. Surveys have shown wide variation in their clinical management and numerous types of wound dressings, bandages, and stockings are used in treatment and prevention of recurrence.

This paper summarises the findings of a recent issue of the *Effective Health Care* bulletin based on a systematic review of research on the effectiveness and cost effectiveness of different forms of compression in the treatment of venous ulceration on interventions to prevent recurrence; and on methods of diagnosing venous ulceration. The review was based on a search of 18 databases including MEDLINE, CINAHL, and EMBASE with no restriction on date or language. Relevant journals and conference proceedings were handsearched and experts consulted. Published and unpublished randomised controlled trials which measured ulcer healing were included. More details are given in the Cochrane library.

**Diagnosis**

Careful assessment of all patients is important, particularly as considerable damage can be caused by inappropriately applying high compression in patients with arterial and small vessel disease. However, a survey reported that 50% of nurses made a diagnosis of the cause of the ulcer based on visual assessment alone. There is debate about how arterial status should be assessed and whether this assessment should be undertaken routinely by nurses. Arterial disease of the leg is most commonly detected by combination of general clinical examination and either manual palpation of foot pulses or by the use of hand held Doppler ultrasound together with a sphygmomanometer to measure the ratio of the systolic blood pressure at the ankle to that in the arm (the ankle to brachial pressure index, ABPI). An ABPI ratio < 1.0 is viewed as indicative of some arterial impairment. The cut off point below which compression is generally not applied in clinical practice is often quoted as 0.8; however, many trials use the higher cut off of 0.9.

There is generally poor agreement between manual palpation of foot pulses and ABPI. Two large studies have shown respectively that 67% and 37% of limbs with an ABPI < 0.9 had palpable foot pulses, with the consequent risk of applying compression to people with arterial disease. Even though ABPI measurement seems to be better than manual palpation for excluding arterial disease, it has been shown to be unreliable when carried out by inexperienced operators. Reliability can be considerably improved if people are highly trained.

**Compression for treatment of leg ulcers**

Below the knee, graduated compression from toe (highest) to knee (lowest), in the form of bandaging or stockings, is viewed as a key component of treatment when venous leg ulceration occurs in the absence of relevant arterial disease. A range of compression systems are used, which apply varying levels of compression, with different materials with varying degrees of elasticity. There is considerable uncertainty, however, as to the most effective method. The preferred treatment for leg ulcers in the United States is Unna’s boot, in parts of Europe other than in the United Kingdom short stretch bandaging is more popular, whereas four-layer bandaging is increasingly advocated in the United Kingdom. Twenty randomised controlled trials evaluated different forms of compression bandaging on venous ulcer healing in a wide range of age groups. Two of these incorporated economic evaluations and two compared compression stockings with compression bandages and two evaluated intermittent pneumatic compression.

**COMPRESSION VERSUS NO COMPRESSION**

Six randomised controlled trials assessed whether compression therapy was better than no compression. These showed that compression provided either by Unna’s boot...
**Table 1  Randomised controlled trials of elastic high versus low compression bandaging**

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients and interventions</th>
<th>Initial ulcer size and duration</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callam et al 1992</td>
<td>Male and female&lt;br&gt;11: Elastic compression: Softban + Tensopress + Tensoplast &lt;br&gt;12: Non-elastic compression: Softban + Elastocrepe + Tensoplast forsure</td>
<td>Mean ulcer area (cm²)&lt;br&gt;1: 11.0&lt;br&gt;2: 11.3&lt;br&gt;Complete healing 1: 35/65 (54%); 2: 19/67 (28%)  (p = 0.01)</td>
<td>Follow up: 3 months&lt;br&gt;Healing patients were only followed up for 12 weeks at this point 12 patients were almost healed&lt;br&gt;Attrition: 11; 8; 12: 20</td>
</tr>
<tr>
<td>Northeast et al 1990</td>
<td>106 Patients presenting to outpatient clinic&lt;br&gt;11: Three-layer bandage (Calaband + Elastocrepe + Tensoplast) &lt;br&gt;12: Four-layer bandage (Calaband + Tensopress + Tensoplast)</td>
<td>Mean ulcer area (cm²)&lt;br&gt;1: 7.1&lt;br&gt;Complete healing 1: 11 (58%); 2: 7 (35%)  (p = 0.01)&lt;br&gt;Healed or progressed 1: 8/17&lt;br&gt;Attrition: 7 Patients (10 ulcers)</td>
<td>Not stated&lt;br&gt;(patients were only followed up for 12 weeks)</td>
</tr>
<tr>
<td>Gould et al 1993</td>
<td>39 Ambulatory patients (46 ulcers) from general practices attending outpatient clinic&lt;br&gt;11: Elastic compression (Setopress)  + meditated paste bandage + elasticised visco stockinette&lt;br&gt;12: Inelastic bandage (Elastocrepe) + meditated paste bandage + elasticised visco stockinette</td>
<td>Mean ulcer area (cm²)&lt;br&gt;1: 13.9&lt;br&gt;Complete healing (ulcers)&lt;br&gt;1: 40%; 2: 44%; 3: 23%&lt;br&gt;Attrition: none</td>
<td>Follow up: 16 weeks&lt;br&gt;One week before treatment patients wore Setopress bandage</td>
</tr>
<tr>
<td>Duby et al 1993</td>
<td>67 Patients (76 legs)&lt;br&gt;11: Orthopaedic wool + short stretch bandage (Comprilan) + Tricofix net covering&lt;br&gt;12: Four-layer bandage (orthopaedic wool + crepe bandage + Elset + Cobas)</td>
<td>Mean ulcer area (cm²)&lt;br&gt;1: 13.1&lt;br&gt;Complete healing (ulcers)&lt;br&gt;1: 40%; 2: 44%; 3: 23%&lt;br&gt;Attrition: none</td>
<td>Follow up: 6 months&lt;br&gt;One week before treatment patients were bandaged with short stretch bandage</td>
</tr>
</tbody>
</table>

**Table 2  Comparing different multilayer high compression systems**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>McCollum et al 1990</td>
<td>232 Patients from community leg ulcer services&lt;br&gt;11: Original Charing Cross four-layer&lt;br&gt;12: New proprietary four-layer (Profore system)</td>
<td>Percentage &lt;10cm²&lt;br&gt;1: 82%; 2: 84%; Complete healing 1: 82%; 2: 84% (p = 0.05)</td>
<td>Follow up: 6 months&lt;br&gt;Follow up: 12 months&lt;br&gt;(patients were dressed with ulcer size)</td>
</tr>
<tr>
<td>Wilkinson et al 1997</td>
<td>35 Legs in 29 patients recruited through district and practice nurses&lt;br&gt;11: Charing Cross four layer bandage&lt;br&gt;12: Trial bandage: Tubfast + separate strips of lint applied horizontally + Setopress + Tubfast (to secure bandage)</td>
<td>Mean ulcer area (cm²)&lt;br&gt;1: 11.2; 2: 11.2; 8.6; Complete healing 1: 8/17 (47%); 2: 8/18 (44%)&lt;br&gt;OR 1.1; 95% CI 0.2 to 5.2&lt;br&gt;Attrition: 11: 4; 12: 2</td>
<td>Follow up: 3 months&lt;br&gt;(patients were dressed with ulcer size)</td>
</tr>
</tbody>
</table>

**High compression versus low compression**

Three randomised controlled trials comparing elastic high compression three-layer bandaging (two with Tensopress and one with Setopress as a component) with low compression (with Elastocrepe) showed that more patients were healed at 12–15 weeks with high compression (odds ratio (OR) 2.26; 95% confidence interval (95% CI) 1.4 to 3.65; table 1). The advantage of higher compression was confirmed in another randomised controlled trial in which patients with either four-layer or short stretch bandaging healed faster than those who received a paste bandage with outer support.29

**Different types of high compression**

Several types of high compression systems are available, some of which have been compared directly in randomised controlled trials. The original “Charing Cross” four-layer bandage has been compared with both a kit that provides all the constituents to make up a four-layer bandage, and a regimen adapted to achieve similar levels of compression with materials available on prescription.26 No significant difference in outcome was found in either study, although the second trial was very small (table 2).

Four-layer bandaging has also been compared with short stretch26 31 and with Unna’s boot26 32 in four randomised controlled trials. No differences were found in the healing rates. However, because these studies were small, this does not mean that there are not clinically important differences in effectiveness (table 3).

The advantage of multilayer high compression systems over single layer systems is shown by one large and three small trials which found more ulcers healed at 24 weeks with four-layer bandaging than were healed using a single layer, adhesive compression bandage (table 4).36-38 Even though three-layer, two-layer, and other compression bandages have been shown to be effective, they seem not to have been directly compared with four-layer bandaging in randomised controlled trials, although trials are in progress.

Compression stockings have also been used to treat current ulcers.26 A combination of two

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21 two-layer, 22 four-layer, 23 short stretch bandages improve healing rates compared with treatments with no compression. One study showed that compression therapy was more cost effective because the faster healing rates saved nursing time.22

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Table 3  Randomised controlled trials of elastic high compression bandaging versus inelastic compression

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients and interventions</th>
<th>Initial size and duration</th>
<th>Results</th>
</tr>
</thead>
</table>
| Daby 1993<sup>6</sup> UK | See table 1  
- 30 Ambulant patients  
- Four-layer bandage (orthopaedic wool, crepe, Elast. Coban)  
- Short stretch (orthopaedic wool, short stretch, Coban) | Median ulcer area (cm<sup>2</sup>)  
- I1: 12: 4.8; 2.8 | Healing rate  
- II: 60%; I2: 60%  
- Attrition I1: 4 |
| London and Scriven<sup>1</sup> UK |  
- Modified Unna’s boot (paste bandage + Elastocrepe + Elastoplast + class II compression sock)  
- Four-layer bandage (Profore) (4LB)  
- Lycrafoam dressing + Setopress compression bandage | Median ulcer area (cm<sup>2</sup>)  
- I1: 7; 12; 9; 13; 20  
- Median duration (months)  
- I1: 12; 24; I2: 10; I3: 12 | Complete healing:  
- II: 6/10 (60%)  
- I2: 7 (70%)  
- I3: 2 (20%)  
- Mean bandage costs in IRL  
- £28.54  
- £66.24  
- £58.33 |
| Cogan et al<sup>7</sup> Ireland | 30 Patients at routine venous ulcer out patient clinic  
- Modified Unna’s boot (paste bandage + Elastocrepe + Elastoplast + class II compression sock)  
- Four-layer bandage (Profore) (4LB)  
- Lycrafoam dressing + Setopress compression bandage | Median ulcer area (cm<sup>2</sup>)  
- I1: 7; 12; 9; 13; 20  
- Median duration (months)  
- I1: 24; I2: 10; I3: 12 | Complete healing  
- II: 6/10 (60%)  
- I2: 7 (70%)  
- I3: 2 (20%)  
- Mean bandage costs in IRL  
- £28.54  
- £66.24  
- £58.33 |
| Knight and McCulloch 1996<sup>6</sup> USA | 10 Patients randomly chosen from patients at a wound care centre  
- Four-layer bandage (Profore)  
- Unna’s boot | Not stated | Average rate of ulcer healing  
- (cm<sup>2</sup)/week  
- I1: 1.14; I2: 0.34  
- Attrition: not stated |

Table 4  Randomised controlled trials of multilayer high compression systems versus single layer bandage systems

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients and interventions</th>
<th>Initial ulcer size and duration</th>
<th>Results</th>
</tr>
</thead>
</table>
| Nelson et al 1995<sup>6</sup> UK | 200 Patients referred by GPS and community nurses, age > 18 years, attending leg ulcer clinic  
- Four-layer bandage (orthopaedic wool + crepe + Elast. Coban)  
- Single layer bandage (Granuflex adhesive compression bandage)  
- (Primary dressing randomised to knitted viscose dressing or hydrocolloid dressing)  
- Patients were also randomised to oxpentifyline (or placebo) | Mean ulcer area (cm<sup>2</sup>)  
- I1: 7.8; 12; 12.4  
- Mean duration (months)  
- I1: 15.5; I2: 12 | Complete healing  
- II: 6/10 (60%)  
- OR 2.4; 95% CI 1.3 to 4.3  
- Attrition: greater in I1 than I2 |
| Kralj and Koseck<sup>6</sup> Slovenia | 40 Inpatients and outpatients  
- Four-layer bandage (Profore)  
- Single layer bandage (Porelast) + hydrocolloid dressing (Tegaderm) | Mean ulcer area (cm<sup>2</sup>)  
- I1: 18.6; 12; 17.2  
- Mean duration (months)  
- I1: 7.9; I2: 6.9 | Complete healing  
- II: 7.20 (44%); I2: 8.20 (44%)  
- Attrition: I1: 4; I2: 2 |
| Travers et al 1992<sup>6</sup> UK | 27 Patients attending leg ulcer clinic  
- Self-adhesive one layer bandage (Pandolast Acryl)  
- Three-layer bandage (Calaband + Tensopress + TENSOGRIP) | Mean ulcer area (cm<sup>2</sup>)  
- I1: 31; 12; 23  
- Mean duration (months)  
- I1: 23; I2: 23 | Reduction in ulcer area  
- II: 86%; I2: 83% (NS)  
- Bandage costs equivalent  
- Attrition: none |

Table 5  Randomised controlled trials of compression stockings versus compression bandaging

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients and interventions</th>
<th>Initial ulcer size and duration</th>
<th>Results</th>
</tr>
</thead>
</table>
| Hendricks and Swallow 1985<sup>6</sup> USA | 21 Patients attending outpatients’ clinic  
- Unna’s boot + Kerlix roll + elastic bandage  
- Open toe, below knee graduated compression stockings  
- Follow up: 18 months | Median ulcer area (cm<sup>2</sup>)  
- I1: 2.55  
- Median duration  
- I1: 4.5y | Complete healing  
- II: 7.10 (70%); I2: 10.14 (71%) but three of these were transferred from I1  
- Patients cross between arms depending on progress  
- No intention to treat analysis carried out |
| Horakova and Partsch 1994<sup>6</sup> Austria | 59 Patients attending a dermatology clinic  
- Short stretch bandage (Rosidal K)  
- Thrombo stocking + compression stocking (Sigvaris - removed at night)  
- Follow up: 3 months | Median ulcer area (cm<sup>2</sup>)  
- I1: 3.2; I2: 6.0  
- Mean duration (months)  
- I1: 2.12; I2: 5 (p<0,05) | Complete healing  
- II: 13.25 (52%); I2: 21.25 (84%)  
- Attrition: I1: 6; I2: 3 |

Compression stockings (Thrombo plus Sigvaris 503) has been shown to increase the rate of healing compared with a short stretch bandage (OR 4.9; 95% CI 1.3 to 18.3; table 5).<sup>6</sup> Prevention of recurrence of leg ulcers

**COMPRESSION STOCKINGS**

No randomised controlled trial was found which compared recurrence rates achieved with and without compression stockings in...
people with healed ulcers. One trial, however, showed that 35 year recurrence rates were lower in patients who used strong support from class 3 compression stockings (21%) than in those randomised to receive medium support from class 2 compression stockings (32%) (p=0.034); class 2 stockings, however, were better tolerated by patients (table 7).

### Table 6 Randomised controlled trials of intermittent pneumatic compression treatment

<table>
<thead>
<tr>
<th>Study</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Coleridge Smith et al 1990⁴⁴</td>
<td>45 Patients (48 ulcers) attending venous ulcer outpatient clinic 11: Graduated compression stockings 11: Intermittent sequential gradient pneumatic compression used daily in the home Follow up: 3 months</td>
<td>Median ulcer area (cm²) 11: 17.3; I2: 49.8 Median duration (y) 11: 3.5; I2: 3.9</td>
<td>Completely healed 11: 1/24 (4%); patients: I2: 10/21 (48%) patients p=0.009 I2 contained patients with 2 ulcers Attrition: none</td>
</tr>
<tr>
<td>McCulloch et al 1994⁴⁴</td>
<td>22 Patients attending vascular surgery clinic 11: Unna’s boot only 12: Intermittent one cell pneumatic compression applied for one hour, twice a week after cleansing Follow up: 6 months</td>
<td>Median ulcer area (cm²) 11: 0.4–59.4 I2: 0.4–45.0</td>
<td>Completely healed 11: 8/10 (80%); I2: 12/12 (100%) Attrition: none</td>
</tr>
</tbody>
</table>

### Table 7 Randomised controlled trials of prevention of recurrence of venous ulceration with compression stocking and venous surgery

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Franks et al 1995⁵⁵</td>
<td>166 Patients from community leg ulcer clinics with newly healed ulcers, mean age 72 y 11: Class 2 below knee stockings (Medi, UK) 12: Class 2 below knee stockings (Scholl) New stockings prescribed every 3 months</td>
<td>Median ulcer (cm²) 11: 3.3; I2: 3.5 Median ulcer duration (months) 11: 5.7; I2: 2.0 Mobility (chairbound: walk + aid: walk freely) 11: 4 (4%); 27 (29%); 61 (67%) I2: 1 (1%); 23 (31%); 50 (68%)</td>
<td>Recurrence rate at 18 months 11: 24% I2: 32% Adjusted RR = 1.16, 95% CI 0.65 to 2.04 Attrition: none stated Overall 83% all day wear (no difference)</td>
</tr>
<tr>
<td>Harper et al 1995⁵⁵</td>
<td>300 Patients with newly healed venous leg ulcers 11: Class 2 stockings 12: Class 3 stockings Refitting and supply of new stockings every 4 months Follow up: 5 y</td>
<td>Not stated</td>
<td>Recurrence within 36–60 months 11: 32%; I2: 21% (p=0.034)</td>
</tr>
<tr>
<td>Stacey et al 1988⁵⁵</td>
<td>30 Patients with 41 previously ulcerated limbs attending surgical outpatients 11: Surgery - ligation of incompetent communicating veins and ablation of incompetent superficial veins plus permanent below knee elastic stockings (Sigvaris) 12: stockings - below knee stockings (Sigvaris) NB limbs rather than patients were randomised Follow up: 1 y</td>
<td>I1: 8 Had evidence of past DVT I2: 10 Had evidence of past DVT</td>
<td>Ulcer recurrence 11: 1 (5% limbs); I2: 5 (24% limbs)</td>
</tr>
</tbody>
</table>

### Table 8 Randomised controlled trials of pharmacological interventions for the prevention of recurrence of venous ulceration

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Lagotella et al 1995⁵⁵</td>
<td>136 Patients with healed venous ulcers attending outpatients clinic 11: Stanozolol 5 mg twice daily for 12 months plus compression stockings 12: Surgery - ligation of calf perforating veins plus compression stockings Follow up: 5 y</td>
<td>Not stated</td>
<td>I1: 10/42 Recurrences (24%) I2: 13/41 Recurrences (32%) Life table analysis: increased ulcer-free survival in surgery group (NS) Attrition: I1: 9; I2: 13</td>
</tr>
<tr>
<td>McMullin et al 1991⁵⁵</td>
<td>48 Limbs with healed venous ulcers out of a total of 85 limbs in 60 patients being treated for lipodermatosclerosis 11: Stanozolol 5 mg twice daily + below knee class 2 graduated compression stocking (Venasan, Swiz) 12: Placebo tablet + stockings as in I1 Follow up: not stated how much beyond 6 months of treatment</td>
<td>Not stated</td>
<td>Recurrence of ulceration: I1: 7/25 limbs (20%) I2: 4/23 limbs (17%) (p&gt;0.6) Recurrence of ulceration: I1: 7/25 limbs (20%) I2: 4/23 limbs (17%) (p&gt;0.6) Attrition: I1: 6/30; I2: 3/30</td>
</tr>
<tr>
<td>Stacey et al 1990⁵⁵</td>
<td>68 Limbs of 54 patients with healed venous ulcer 11: Stanozolol 5 mg twice daily for 9 months + below knee graduated stockings (Sigvaris) 12: Ligation of the incompetent communicating veins and eradication of all visible varicose superficial veins + stockings as I1 (stockings worn continuously and replaced every 6 months) Follow up: not stated</td>
<td>Number of limbs with normal deep veins I1: 9/49; I2: 13/49 Number of limbs with post-thrombotic changes I1: 15/49; I2: 12/49</td>
<td>Limbs in which ulcers recurred within 12 months I1: 6/24 limbs (5/17 patients) I2: 1/25 limbs (1/20 patients) Attrition: I1: 8; 12.9</td>
</tr>
<tr>
<td>Wright et al 1991⁵⁵</td>
<td>138 Patients with recently healed venous ulcer recruited at first follow up appointment 11: Oxygen (Pavon, Zyna, UK) 500 mg twice daily + below knee class 2 graduated elastic stockings 12: Identical placebo + stockings as in I1 Stockings replaced where necessary at 3-monthly intervals, equal numbers in each group randomised to surgery Follow up: 18 months</td>
<td>Mean duration (months) I1: 8.9; I2: 8.8 Additional illnesses No significant differences between groups</td>
<td>Cumulative recurrence at 18 months I1: 34%; I2: 32% Cumulative recurrence at 18 months I1: 34%; I2: 32% (p = 0.93 log rank test) Attrition: not stated</td>
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### Table 9 Randomised controlled trials of compression from trained nurses and/or specialised clinics versus usual district nurse treatment

<table>
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<tbody>
<tr>
<td>Morrell et al(^a) UK</td>
<td>233 Ambulant patients from 8 clinics who had suspected venous ulcers I1: Four-layer bandaging delivered by project nurses in clinic I2: Usual care from district nurses at home Follow up: 1 y</td>
<td>Mean ulcer area (cm(^2)) 11: 16.2; 12: 16.9 Mean duration (months) 11: 27.5; 12: 29.7</td>
<td>Complete healing at 12 months 11: 65%; 12: 55% Difference in percentage healed = 11; 95% CI = -0.02 to 0.24 Overall there is a statistically significant difference in healing rate (p = 0.03 log rank test) Attrition: 11: 16; 12: 13</td>
</tr>
<tr>
<td>Taylor et al(^a) UK</td>
<td>30 Patients referred to the clinic by GPS Community setting I1: Four-layer bandage I2: Conventional treatment (FP10 non-compression)</td>
<td>Mean ulcer area (cm(^2)) 11: 5.4; 12: 4.2 Mean duration 11: 7 ulcers &lt;6 months; 9 ulcers &gt;6 months 12: 9 ulcers &lt;6 months; 5 ulcers &gt;6 months</td>
<td>Complete healing 11: 12 (75%); 12: 3 (21%) (p = 0.003) Median time to healing (days) 11: 55; 12: &gt;84 (p = 0.003) Total average weekly treatment costs and cost of district nursing time were less in I1 (p = 0.04)</td>
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</tbody>
</table>

### Pharmacological and Surgical Interventions

Two drugs have been investigated for their effects on recurrence of leg ulcers: stanozolol, an anabolic steroid which increases fibrinolysis; and rutoside (Paroven), an oxerutin which is said to decrease capillary permeability (table 8). These drugs have been compared with placebo in two randomised controlled trials in which all patients also received class 2 compression stockings.\(^{47,48}\) Both trials found that neither drug reduced recurrence.\(^{47,48}\)

Surgery in which incompetent communicating veins are ligated and varicose veins are eradicated has been compared in two small trials with the drug stanozolol (both combined with compression stockings; table 8). These gave conflicting results; one showing a lower recurrence rate with surgery within one year\(^49\) and the other a reduced recurrence with drug treatment at five years.\(^50\) One trial seemed to show a moderately reduced rate of recurrence when surgery was carried out as well as the use of elastic stockings; however, the study was small and poorly reported.\(^51\)

### Organisation of Care

Two trials have evaluated community leg ulcer clinics (table 9). A recent trial in Sheffield, England, showed that delivering care in leg ulcer clinics, by trained nurses who followed a treatment protocol which included use of "Charing Cross" four-layer bandaging resulted in better healing at one year (65%) than in patients who continued their usual treatment at home provided by a district nurse, who did not routinely have access to four-layer bandages (55%).\(^46\) The clinic was also more cost effective. Improved healing associated with specialist clinics with four-layer bandaging was also shown in a second small trial.\(^22\) It is possible, however, that similar improvements in healing could be achieved without the use of clinics or other high compression treatments.

Surveys have found that district nurses' knowledge of the assessment and management of leg ulcers is often inadequate. Large variability in the way bandages are applied and the pressures achieved has been found. More experienced or well trained bandagers obtain better and more consistent pressure results.\(^52\) Training of nurses can result in an improved bandaging technique, but there is some evidence that maintenance of good practice requires monitoring, feedback, and supervision.\(^53\)

### Conclusions

Diagnosis of arterial status (to determine eligibility for compression treatment) is more accurate when trained operators use the ABPI than manual palpation of foot pulses alone. The most effective intervention for the treatment of venous leg ulcers is high compression provided by four-layer or three-layer (multilayer) or short stretch bandages. Unna's boot, or compression stockings, possibly with the addition of intermittent pneumatic compression. The use of compression stockings should be encouraged for the prevention of recurrence. However, there is little evidence to support the use of drug treatment with stanozolol or oxerutins. The role of surgery in preventing recurrence of leg ulcers has not been adequately studied.

Routine application of one of these high compression techniques in people with venous ulcers should have a considerable impact on healing rates and save time spent by community nurses. Whichever high compression approach is used, it is important that it is used correctly so that sufficient (but not excessive) pressure is applied. Community nurses and other practitioners should be better trained in assessment of patients and application of bandages. Systems should also be put in place to monitor standards of care as measured by structure (for example, the proportion of appropriately trained staff) process (for example, the proportion of patients whose arterial status has been determined by ABPI measurement), the proportion with uncomplicated venous ulcers receiving high compression therapy, and outcome (for example, the prevalence of active ulceration, proportion of patients healed, rates of healing, and adverse outcomes due to incorrectly treated arterial disease or excessive compression).

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