

# THE CONSERVATIVE MANAGEMENT OF VENOUS ULCERATION

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Venous ulceration of the leg is the most serious of a number of sequelae that may follow disease of the veins of the lower extremity. The sequelae—oedema, induration, pigmentation, eczema, and ulceration—are a result of capillary hypertension. This usually follows venous hypertension brought about by valvular destruction or incompetence in the deep venous system of the lower limb. The valvular deficiency may be the result of recanalization of a segment of thrombosed vein, or the congenital absence of valves in the deep veins.<sup>15</sup> It may possibly be due to other factors such as chronic cough, constipation and pregnancy, causing dilatation of the veins of the lower extremity.

When the abovementioned sequelae follow an episode of deep venous thrombosis, they are collectively known as the 'post-thrombotic syndrome'.

Various estimates of the incidence of leg ulceration have been made in a number of countries—5,000 - 15,000 cases in Denmark,<sup>19</sup> 10,000 - 30,000 in Sweden,<sup>4</sup> more than 50,000 in the British Isles,<sup>6</sup> and 300,000 - 400,000 in the USA.<sup>14</sup> In Sweden the disability caused by leg ulcers exceeds that of diabetes mellitus and tuberculosis of bones and joints.<sup>5</sup> During the second world war, nearly 10% of the patients admitted to the Emergency Service Hospitals of Great Britain were sufferers from varicose-vein disease and its complications;<sup>16</sup> 45% of patients with this condi-

tion were incapacitated for about 2 weeks and 11% for about 13 weeks. 5,900,000 workdays are lost in one year in the USA by sufferers from venous disease.<sup>7</sup> About 4% of cases of the post-thrombotic syndrome have some permanent decrease in working capacity; about 5% have to change employment and 12% suffer a reduction in earnings.<sup>12</sup>

It is clear from the foregoing facts that the post-thrombotic syndrome, and in particular venous ulceration, have important medical, social and economic implications. In fact, Foote<sup>9</sup> has stated that venous ulceration is a 'problem of national importance' in Great Britain.

It is probable that at the present time, the most satisfactory treatment of the post-thrombotic syndrome is ligation of incompetent communicating veins, followed by the long-term use of elastic stockings.<sup>1</sup> However, it is inadvisable to perform an operation of this type in the presence of an unhealed ulcer. To heal the ulcer before operation is the main indication for conservative treatment. Conservative measures are indicated in patients who refuse surgery and those in whom there exists serious concomitant disease that contraindicates surgery.

## MATERIALS AND METHODS

The information contained in this study was obtained from the treatment of more than 100 cases of venous



ulceration by conservative methods. The patients were White and attended the Venous Ulcer Clinic at the Johannesburg General Hospital.

Accurate measurements of the areas of the ulcers were made in 42 cases. Of these, 21 were treated by bed rest only and 21 by ambulatory methods. In the bed-rest cases measurements were made at weekly intervals and the dressings changed as required. In the ambulatory cases compression treatment was used. The bandages were changed at weekly intervals and the measurements made at the same time.

In general, dressings were of a bland non-irritating type, consisting of gauze impregnated with a minimum of white vaseline or commercially prepared plastic material containing a water-in-oil emulsion. Pain was controlled in both groups with aspirin, phenacetin and codeine.

### 1. Method of Determining the Area of the Ulcer

The skin surrounding the ulcer was gently scraped with a wooden spatula to remove the moist cornified layer of skin, so that the edge of the ulcer was clearly discernible. The ulcer was then cleaned with sterile physiological saline and dried with sterile gauze. Over the ulcer was placed a piece of celluloid (X-ray film from which the emulsion had been removed), which had previously been soaked in 70% alcohol and dried. A tracing of the outline

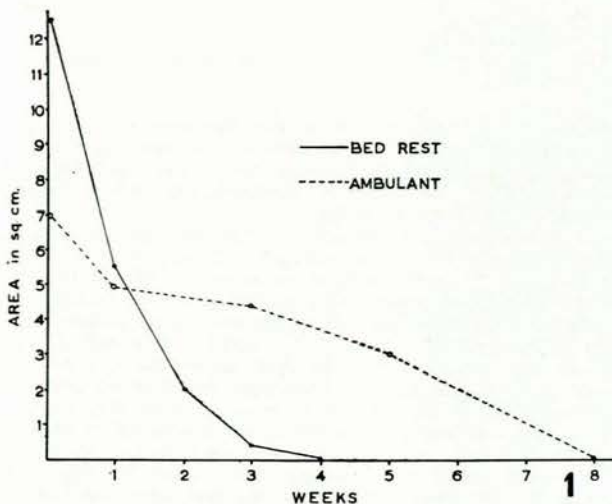


Fig. 1. Graph showing the effect of bed rest and ambulant treatment on ulceration.

of the ulcer was made upon the celluloid with a sharp wax pencil. From the tracing thus made the area was determined with a planimeter. A graph was constructed for each ulcer by plotting the area against the time (Fig. 1). By this means it was possible to determine the progress of the ulcer.

### 2. Method of Selecting Patients for Treatment

The main factors used in the selection of patients in this series for bed-rest treatment were (a) pain in the ulcer, (b) gross oedema of the calf and ankle region, (c) inability to walk, and (d) the state of the peripheral arterial circulation.

The pain in an ulcer is not necessarily proportional to its size. It is more often associated with the extent to which the ulcer overlies a bony prominence such as a malleolus or the anterior surface of the tibia. It is over these parts that a compressive bandage exerts its greatest pressure and thus aggravates the pain. A patient with severe crippling pain and marked oedema of the calf is unlikely to tolerate compression treatment and is therefore best treated by bed rest until the oedema has subsided and the ulcer has begun to heal. Inability to walk, whether caused by ulceration or other factors, necessitates bed-rest treatment. Patients with venous ulceration in whom there is concomitant arterial deficiency should be treated cautiously with compression bandages to avoid possible ischaemia of the foot.

In general, all but a few patients may be treated in an ambulatory fashion with satisfactory results. The particular advantages of ambulatory treatment are that loss of working time is eliminated and home arrangements are but little dislocated; but in some cases it has to be continued for a long time. With bed-rest treatment, on the other hand, while the patient has to be off work, pain and oedema subside rapidly and healing is accelerated (Fig. 1).

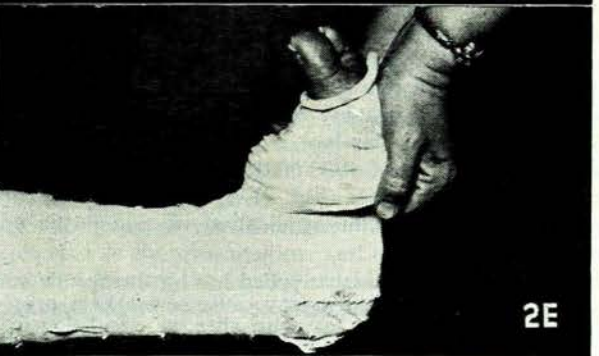
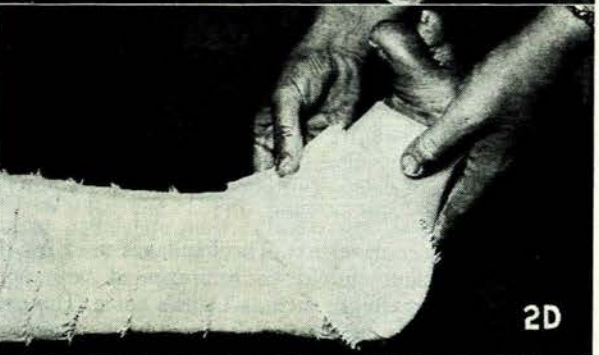
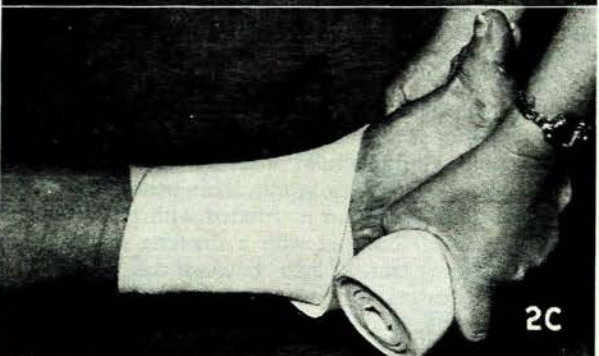
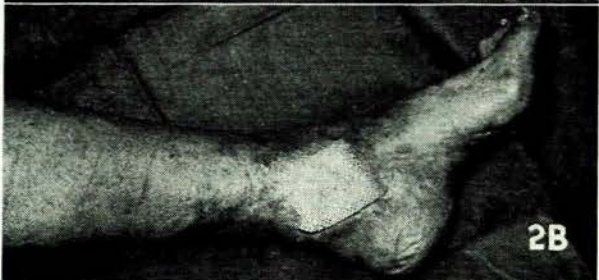
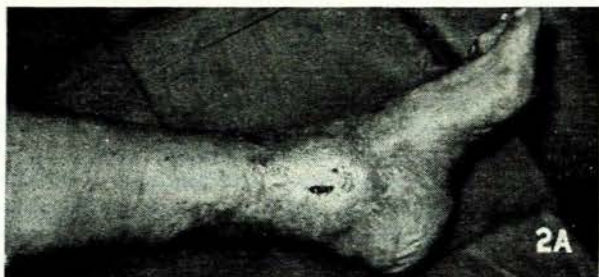
### 3. Ambulatory Method of Treatment

If there was an excess of moist keratinized epithelium surrounding the ulcer, it was scraped away to expose the underlying smooth epithelium. The ulcer was then cleaned with saline and dried with swabs. This procedure reduced to a great extent the odour associated with the ulcers. The ulcerated area was covered with a dressing not extending for more than about  $\frac{1}{2}$  inch beyond the edge of the wound. The dressing was not applied to a large area of skin, because this has the effect of causing softening of the skin. The dressing was covered with a pad of cellulose sponge or foam rubber that exceeded the dressing in size by about 1 inch. In many cases a roller of cellulose sponge was substituted for the pad (Fig. 2). The leg from the metatarsal heads to just below the knee was covered with the compression medium. Two types of compression were used—non-elastic and elastic. The main indication in this series for the use of elastic compression was the inability to tolerate non-elastic compression.

(i) *Non-elastic compression.* The bandages used for this type of compression should be impregnated with some form of adhesive material, such as Unna's paste. The paste has little therapeutic value but it provides a means of preventing the bandage from slipping down the leg. The paste gradually dries to a fairly rigid consistency and this further prevents the material from sliding down the leg. The application of two roller bandages of the compression material creates a suitably thick stocking around the leg. The moist adhesive bandage is then covered with a crêpe bandage or a tube of stockinette to prevent the adhesive from soiling the clothes (Fig. 2). The following are noteworthy points about the application of non-elastic compression:

(a) A bandage too loosely applied has no therapeutic value, but if too tightly applied it may cause severe pain over the ulcer and the malleoli. It may also alter the circulation in the limb, causing swelling, blueness and paraesthesiae in the toes. The resulting difficulty in walking, coupled with the pain, soon





causes the patient to remove the bandage. It requires considerable experience to judge the tightness with which the bandage should be applied. In view of possible adverse effects, all patients are advised to remove the bandage if it feels too tight on getting home, and to return to hospital next day for re-banding.

(b) In the lower calf there is normally a depression on the medial and lateral sides between the bones and the tendo calcaneus. To eliminate the oedema properly it may be necessary to place strips of foam rubber between the malleoli and the tendon.

(c) Care should be taken not to form creases in the bandage while it is being applied, especially in the layer next to the skin. The bandage should be applied with the ankle held at a

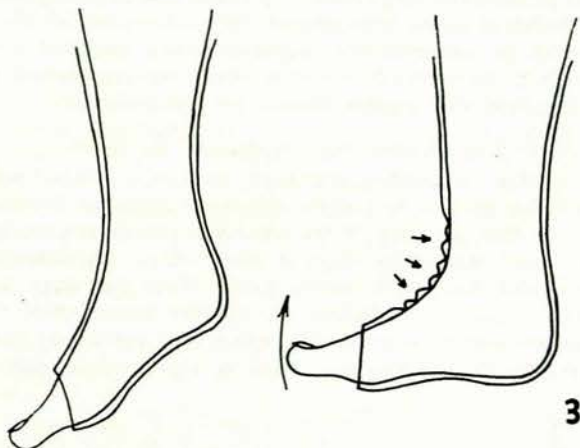


Fig. 3. Creases are produced in an adhesive bandage by dorsiflexion of the foot.

right-angle; otherwise it may cut into the dorsum of the ankle on movement and cause excoriation of the skin (Fig. 3). Some degree of creasing of the bandage may occur over the tendo calcaneus when the ankle is plantar-flexed and it may be necessary to pad this area also.

(d) Occasionally a patient cannot tolerate a bandage containing adhesive paste and yet still requires non-elastic compression. A useful method of achieving this is to apply to the leg two or three well-stretched (i.e. old) 6-inch crêpe bandages. The technique of application is as follows: The ulcer is cleaned and dressed and covered with a pad of gauze or cellulose sponge. The roller bandage commences over the lower part of the leg and first fixes the dressing and pad. After two or three turns it is brought over the ankle to enclose the heel and foot as far as the metatarsal heads. It is then carried back over the heel and ankle to the ulcer area. This usually takes one bandage. The second bandage commences at the lower part of the leg and, after one or two turns, it is carried up the calf in such a way that each turn overlaps the previous turn by 4-5 inches. A third crêpe bandage may be applied to cover the first two. The end of each bandage is fixed with a safety pin. The bandages used for this procedure *must* have been well stretched. This sort of crêpe bandage has just enough elasticity to enable the heel and other curvatures of the leg to be covered without creases. New crêpe bandages are entirely unsuitable for this technique.

Fig. 2. Series showing method of application of compression bandage. In this instance the non-elastic bandage is applied over a roller of cellulose sponge, but this may be replaced by a single pad over the ulcer.

- (A) The ulcer.
- (B) The dressing.
- (C) The cellulose sponge roller.
- (D) Covering the heel with the non-elastic bandage.
- (E) The whole is covered with stockinette, which is fixed above and below with adhesive plaster.



The advantages of this method are: (i) the patient can be taught to apply the bandages safely and effectively, (ii) the tension and position of the bandages may be adjusted by the patient when necessary, (iii) the wound may be dressed daily if the discharge is profuse, (iv) the bandages may be removed at night while the patient is in bed, and (v) the method is inexpensive. To be effective the bandages are applied with a fair degree of pressure, and the patient soon discovers the correct degree of tension with which the bandages should be applied.

(ii) *Elastic compression.* One of the most commonly used materials for elastic compression is 'elastoplast'. It adheres firmly to the skin and forms a good compression bandage. However, when the skin perspires freely, as in hot climates, the adhesive may separate from the skin and the 'stocking' then slips down the leg. Occasionally, a patient's skin is sensitive to the adhesive material and a rash or eczematous eruption develops under the bandage. For this reason it is advisable to ascertain beforehand whether or not the patient is sensitive to the material, or whether the patient is subject to eczematous attacks.

Although elastoplast has good elastic qualities, it should not be applied too tightly. Dodd and Cockett<sup>8a</sup> have described a method of holding the roll to obviate applying it too tightly. By holding the inner cardboard roller between thumb and middle finger, the correct tension may be obtained by pressure of the fingers on the ends of the roll. The layers of a new roll of elastoplast may be very adherent, requiring considerable force to separate them. When this is so, a dangerous degree of tension may be created, even by using this method of holding. To obviate this, new rolls of elastoplast are unrolled and then re-rolled to reduce the adhesiveness, so that the elastoplast can easily be applied at the correct tension.

Elastoplast may be applied directly to the skin as a roller bandage, or over strips applied longitudinally to the leg. The precaution of holding the ankle at a right angle is necessary during the application of this material.

*The elastic bandage.* This is another commonly used and fairly successful form of elastic compression. One type has a loop at one end and this arrangement has two advantages—the loop gives the bandage a good anchor so that it may be applied easily, and it provides a means whereby slipping of the bandage is reduced to a minimum. The bandage should be applied with the ankle held at a right angle and each turn should overlap the previous one to a considerable extent, so that even pressure is exerted over the whole area of the application. The patient is taught the method so that the tension may be adjusted at any time. The bandage is removed at night after the patient is in bed and is replaced in the morning before rising and at any other time the patient adopts the upright position.

#### 4. Bed-rest Treatment

The patients who require this type of treatment are usually (i) those who have a painful ulcer over a bony prominence and cannot tolerate compression treatment, and (ii) those who have gross swelling of the leg and are unable to walk.

*Position in bed.* The lower extremities should be raised by elevation of the foot of the bed. Ideally, the ankle regions should be raised above the level of the heart (Fig. 4), and the patient should be encouraged to use only one pillow for the head. Ordinarily, the patient should not be allowed out of bed and should sit up only when using the bedpan. However, many of the patients with venous ulceration are elderly and may have some degree of cardiac decompensation; they cannot tolerate the reclining position and they should be allowed to sit up in bed with the foot of the bed raised on 6-inch blocks or the affected

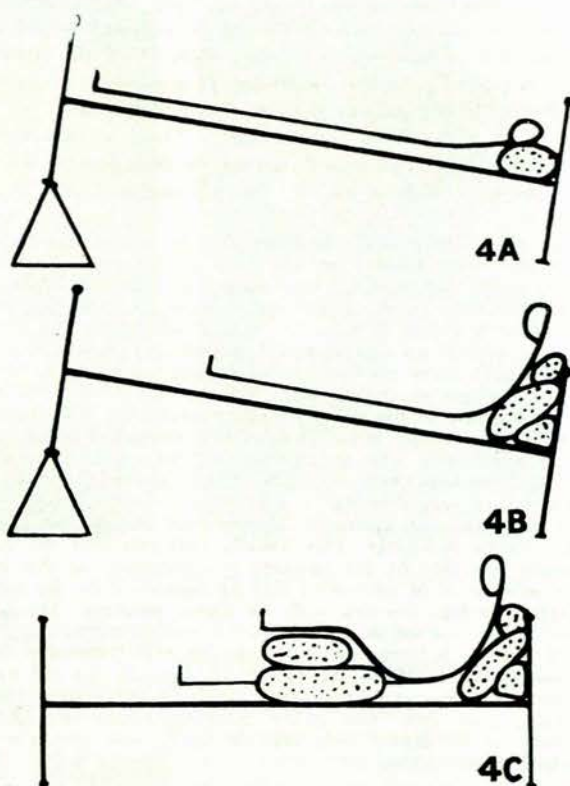


Fig. 4. Positions for bed-rest treatment. (a) Ideal, (b) Not permitted, (c) Permissible if patient cannot tolerate (a).

leg raised on pillows (Fig. 4C). With this regime ulcers generally heal well.

*Management of bandages in bed.* Patients having bed-rest treatment require the dressings to be retained by bandages, which often become disarranged by movement in bed, particularly if the dressings are changed only at intervals of 2-3 days. A simple method of preventing this, and therefore of saving labour, is to cover the bandages with an old nylon stocking.

#### 5. Treatment after Healing

If, after the completion of ambulant treatment, an operation is contemplated, it is advisable to continue with compression until the patient is admitted to hospital; if operation is not intended, non-elastic compression should be changed to elastic compression. If a patient is having bed-rest treatment and an operation is contemplated, it is advisable to operate before the patient is allowed out of bed; if surgery is not required the patient should be fitted with elastic stockings before being allowed up. Because of the risk of recurrence of ulceration, all patients in the 'after-healing' phase of treatment should observe the rule that *walking without compression is prohibited.*

Probably the best form of elastic compression after the ulcer has healed is the *elastic stocking*. Some patients who have become accustomed to the use of elastic bandages may wish to continue with them, but most patients seem to prefer elastic stockings. To achieve satisfactory com-



pression, stockings should be strong, tight, and well fitting. In fact, an elastic stocking should be tailored to the leg. A good test of tightness is the ease with which the stocking may be pulled onto the naked leg. If it goes on easily it is too loose. If the patient struggles to pull the stocking on, then it is very likely tight enough. Once a satisfactory stocking has been obtained, it may be pulled onto the leg over an old nylon stocking, which reduces much of the friction.

Generally, there is no necessity for the elastic stocking to reach above the knee. It should have no toe-cap and no welt at the upper end, and the heel should be covered. Tight toe-caps may cause or aggravate ingrown toenails and this limits the patient's ability to walk. A welt at the upper end of the stocking acts as an undesirable localized constriction and the lack of heel cover predisposes to oedema of the heel. Moreover, the edges of the material may be forced into the skin by the pressure of the shoe and cause ulceration. The stocking should be 'one-way stretch', stretching circumferentially and not longitudinally. This arrangement allows a fold to be sewn into the stocking with ordinary thread so that it may be tailored to a very thin leg.

In some patients ulceration recurs even though the patient wears elastic stockings. This usually indicates that the compression provided by the stocking is inadequate. In the early days, recurrence of ulceration may be controlled by the use of a crêpe bandage covered with an elastic stocking. The technique of application is as follows: A well-stretched (i.e. old) crêpe bandage is firmly applied to the leg over a dressing, from the metatarsal heads to the middle of the calf. An old nylon stocking is drawn over the crêpe bandage and a tight elastic stocking over this. The nylon stocking allows the elastic stocking to be drawn onto the leg easily and prevents the bandage from rucking up.

**Care of elastic materials.** As with other materials that are in constant use, elastic materials wear out, particularly tight elastic stockings if they are subject to damage when being pulled on. Well-fitting elastic stockings last longer if they are drawn on without injury over nylon hose. Elastic materials also suffer harm from strong soaps, detergents and oils; they are best washed in a good-quality neutral white soap, and after washing should be wrung out in a dry towel and placed in a horizontal surface to dry.

A patient with one leg affected should have at least two elastic stockings to wear alternately and should be instructed to get new stockings before the old ones become completely unserviceable.

Elastic bandages should be washed and dried with the same precautions as elastic stockings and should not be hung up or stretched when drying.

**Camouflage of elastic stockings.** This problem does not arise in men, who have long trousers to cover the legs. In women, however, it is important, and the advice to wear an elastic stocking for a long time may cause a great deal of anxiety. Elastic stockings are usually made in a pink or brownish colour and ordinary nylon hose are too thin to camouflage the appearance. The use of crêpe stockings of the correct colour effectively alters the appearance and makes the two legs almost indistinguishable. A nylon stocking under the elastic stocking and a crêpe stocking over it do not cause appreciably more heat or perspiration in the leg than an elastic stocking alone.

#### OBSERVATIONS

With the methods of treatment described above, the healing progress of ulcers was observed by plotting the area of the ulcer against the time at weekly intervals. The shape of the curve showed the rate of healing and the periods when healing was accelerated or retarded. Typical healing curves of ulcers in patients receiving ambulatory and bed-rest treatment are shown in Fig. 1.

In the whole series of cases studied by measurement, the average size of the ulcers at the beginning of treatment in the patients on bed rest was 22.75 sq.cm. and in the ambulatory patients it was 5.1 sq.cm. The average healing time

TABLE I. SHOWING DIFFERENCE IN HEALING TIME IN VENOUS ULCERATION ACCORDING TO METHOD OF TREATMENT

	<i>Bed-rest treatment</i>		<i>Ambulant treatment</i>		
	<i>Size (sq.cm.)</i>	<i>Healing time (days)</i>	<i>Size (sq.cm.)</i>	<i>Healing time (days)</i>	
Mrs. K.	24.0	38	Mrs. R.	22.0	49
Mrs. H.	12.8	21	Mrs. L.	13.0	49
Mrs. S.	12.5	26	Mrs. F.	12.8	56
Mrs. P.	12.0	28	Mr. N.	12.1	63
Miss S.	5.0	21	Mrs. S.	4.8	56
Mr. M.	3.5	14	Mrs. G.	3.3	56
Miss R.	1.9	12	Mrs. A.	2.0	63
Mrs. M.	1.6	19	Mrs. N.	1.5	28
Average time in selected sample	—	22	Average time in selected sample	—	52

for the patients on bed rest was 29 days and for the ambulatory cases it was 53 days. This is a remarkable difference, particularly as the initial sizes of the ulcers in the two groups were so different.

In order to make a closer comparison, ulcers of comparable size in the bed-rest and ambulatory groups were selected and the healing times compared. The details are set out in Table I, from which it is evident that there is

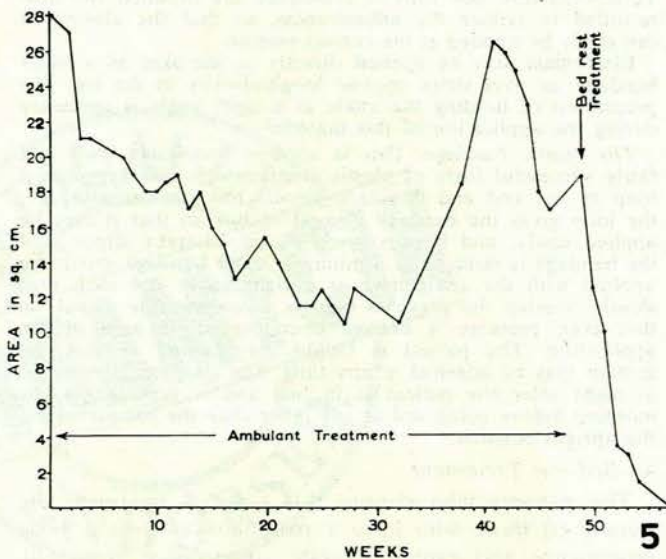


Fig. 5. Graph showing the effect of bed-rest treatment after protracted ambulant treatment. Case Mrs. K.

a relationship between the healing time and the method of treatment used, bed rest resulting in quicker healing than treatment by ambulatory methods. This was borne out in individual cases who had received both forms of treatment (Fig. 5).

In the group receiving ambulant treatment, the average healing time for ulcers having an initial size of 5 sq.cm. or less is 51 days and for ulcers of 12 sq.cm. and greater the average healing time is 54 days. In the group receiving bed-rest treatment, the average healing time of ulcers of 5 sq.cm. and less is 16 days and of ulcers of 12 sq.cm. and



more it is 28 days. This indicates that a great advantage in time is obtained by treating an ulcer by bed rest when it is small in size.

The method of measurement was used also to determine the effect on healing of preparations containing cortisone. Fig. 6 shows the effect of the application of substances containing cortisone to ulcers. The method was used in two cases in which the ulcers were bilateral, symmetrical,

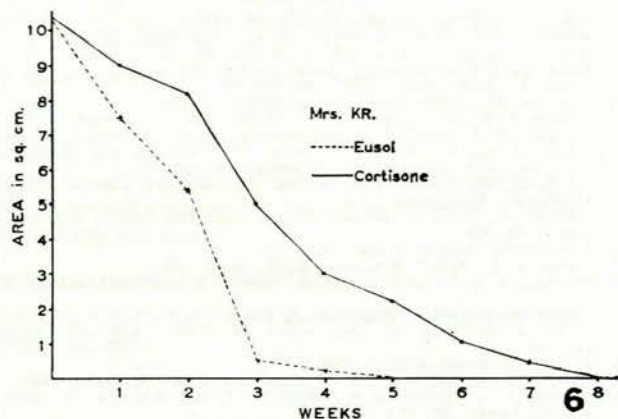


Fig. 6. Graph showing the effect of cortisone on ulcers. Cortisone application has retarded the healing. Case Mrs. K.R.

present simultaneously, and of almost equal sizes. The patients were treated by bed rest. One ulcer was dressed daily with half-strength eusol and the other daily with a preparation containing 1% cortisone acetate in water-soluble base. In both cases the healing of ulcers treated with cortisone was delayed for 3 weeks as compared with the other ulcer.

#### DISCUSSION

By the use of a precise method it has been possible to establish firmly the fact that venous ulcers heal more rapidly with bed rest than with ambulatory treatment. It is necessary to consider the reasons for this, since both methods are thought to act by reducing the oedema of the skin and subcutaneous tissues.

Gravity plays a fundamental role in vascular pressures in the lower extremity, and therefore in the fluid interchange in the ulcer-bearing area. When the upright position is adopted a loading pressure almost equal to the height of the right atrium above the ankle, is applied to the veins and the capillaries of the ankle. Normally the hydrostatic pressure in the capillaries forces the fluid out into the tissue spaces. Some of this fluid is returned to the capillaries by the osmotic action of the plasma proteins and the remainder, together with some protein from the tissue spaces, is absorbed by the lymph capillaries and transported back to the blood circulation.

Under normal circumstances tissue fluid is bound to the connective-tissue fibres and the ground substance, and is therefore not free fluid. When excessive pressure causes fluid to accumulate, it becomes free fluid and the part shows the physical signs of oedema. This is true also in a person who remains motionless in the upright position,<sup>2</sup> when the hydrostatic pressure in the capillaries is con-

stantly in excess of the osmotic pressure, and filtration therefore exceeds reabsorption. Since the osmotic pressure of the plasma proteins is a relatively constant quantity in the normal individual, the only means of counteracting the abovementioned situation is to reduce the hydrostatic pressure. This is brought about by the contraction of the calf muscles as in walking; and not only does muscular action reduce the venous and capillary pressures, but it assists in the removal of lymph.<sup>23</sup> The effective reduction of venous pressure by muscular action depends largely on the presence of efficient valves in the deep, superficial and communicating veins of the leg.

It has been shown by many authors<sup>8, 13, 17, 18, 21, 22</sup> that in the normal leg the hydrostatic pressure falls on exercise from about 80 mm.Hg to 25 mm.Hg or less. In a leg with idiopathic varicose veins the pressure falls to about 45 - 60 mm.Hg, and in the post-thrombotic syndrome it falls only slightly or not at all, or may even rise on exercise.<sup>8</sup> From this it is clear that a reduction of venous and capillary pressure is an essential part of the mechanism of normal venous return in the lower limb. As such, it is instrumental in controlling the normal process of fluid interchange in the tissues. When this reduction of pressure cannot be achieved, tissue fluid accumulates because the filtration pressure is constantly greater than the osmotic pressure.

The surest means of reducing the hydrostatic pressure in a case where the effect of exercise is negligible is to eliminate the loading pressure imposed by gravity. This is best achieved by bed rest, where the feet are elevated above the level of the right atrium. As shown above, this induces rapid healing of an ulcer because the oedema is quickly eliminated. On the other hand, the patient with venous ulceration who is unable to have bed-rest treatment must necessarily suffer to a varying degree from an inability to reduce the gravity loading pressure created by the upright posture.

In the post-thrombotic syndrome, where the pumping action of the calf muscles is inefficient owing to deficient valves in the deep venous system, free fluid collects in the skin and subcutaneous tissues, mainly in the papillary layer of the dermis, where the capillaries are housed and where the connective tissue is relatively thin. When this occurs, the epidermal layer of the skin becomes the sole restraining influence on the accumulation of fluid. It follows, then, that pressure applied to the skin from without will assist it in its role of preventing fluid accumulation. Because external pressure on the skin cannot reduce the loading pressure to the levels that would be reached with an efficient calf-muscle pump, filtration continues to be in excess of reabsorption. However, the application of external pressure may reduce the difference between the loading pressure and the colloid osmotic pressure of the blood. In this way, the difference between filtration and reabsorption is lessened and the accumulation of fluid is reduced. It is likely that the compression enables the muscles to massage the skin and subcutaneous tissues against a firm surface, thus facilitating removal of tissue fluid *via* the lymphatic channels.

Because the pressure gradients are reduced much less by compression treatment than by bed rest, the excess of tissue fluid disappears much more slowly with the former.



ambulatory treatment with compression is, therefore, a more protracted matter than treatment by bed rest. Lack of efficient compression may result in the rapid increase of an ulcer in the area, and it is thus evident that the greater part of the success of this treatment depends on proper compression. The nature of the dressing to the ulcer is of minor importance except, perhaps, when gross infection is present.

The adverse effect of cortisone on the healing of venous ulcers may be due to its effect upon the general regenerative powers of the skin. Locally applied cortisone has a depressant effect on the regeneration of hair follicles,<sup>3</sup> and it has been suggested that its action may be attributable to disturbances in the dermis<sup>10, 11</sup> and that retardation of wound healing may be due to its depressant action on the formation of hyaluronic acid and chondroitin sulphuric acid.<sup>20</sup>

It would appear that elimination of oedema is an essential prerequisite for the healing of a post-thrombotic ulcer and that this process is achieved in both methods of treatment, the one being less efficient than the other.

#### SUMMARY

- 1. The management of venous ulceration by bandaging and by bed rest is described and compared.
- 2. Healing of ulcers is accelerated by bed rest.
- 3. Treatment by bandaging, although less swift in obtaining results than bed rest, enables the patient to

remain at work.

4. The pathophysiological factors responsible for the different responses to the two methods are discussed.

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