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- (1) A proximal obstruction to the deep veins.
- (2) Incompetence of the valves in the deep veins.
- (3) Incompetence of the valves in the perforating veins.
- (4) Incompetence of the valves in the superficial veins.

The valvular incompetence, either primary or secondary was of particular importance. The primary cause of valvular incompetence is the damage of a venous valve by a thrombotic episode. However, secondary valvular damage was due to the dilatation of the vein which causes a valve that is basically normal to fail to close and therefore to fail in its valvular action.

Additional etiological factors exist such as the alteration in the thrombotic and lytic properties of the blood and the blood vessels. These may be responsible for the occurrence of deep and superficial vein thrombosis and may explain those episodes of painful thrombophlebitis that occur associated with varicose veins or the unexpected thrombophlebitis which occurs in the deep vessels either post operatively or even after insignificant trauma. (Fig. 1).

Associated with primary varicose veins there are often small arterio-venous shunts. The work of Vogler (1954) using radiotherapy has shown that these arteriovenous shunts are responsible for the low oxygen tension and nutritional changes that occur associated with varicose veins.

Hormonal changes can produce many of the venous disorders seen in women, e.g. varicose veins are three to four times as common in women and painful symptoms in varicose veins are confined almost exclusively to women. Both the appearance of varicose veins and the onset of pain are often cyclical and seem to be related to changes in the circulating hormone level. As an example Fegan records that many women develop varicose veins only during pregnancy and these regress soon after delivery. Pregnant women with varicose veins get severe pain in their veins very early in pregnancy. The condition of varicose veins in pregnancy deteriorates as the pregnancy progresses. A considerable proportion of patients experience pain just before menstruation and there is an increase in the venous distention with distensibility during the second half of the menstrual cycle. It is interesting to note that there is an abnormally low incidence of abortion amongst those women who develop varicose veins during pregnancy. (Fegan). The painful symptoms of veins may be alleviated by the administration of hormones and a small number of women experience painful varicose veins after sexual intercourse.

There is no doubt that there are hereditary and congenital factors involved in the formation of varicose veins. There are wide variations in the number of valves contained in any one long

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## Compression Sclerotherapy (Fegan's Treatment)

BY

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Over 20 year ago Professor George Fegan introduced a technique developed in Dublin which he termed "compression Sclerotherapy" for the treatment of varicose veins. Professor Fegan (1967) makes the point that only by rigid adherence to the basic principles involved and with proper attention to the technical detail, can results be obtained which compare favourably with those of surgery. The detailed anatomical and microscopic studies carried out by Professor Fegan and his team on the normal structure and micro structures of the veins have emphasised the function of the valves, the structure of the wall and the importance of the nerve supply to the veins. The applied physiology of the veins of the lower limb was correlated with this anatomical study, and the clinical pathology of venous insufficiency then related to normal venous findings. It became evident that the so called peripheral venous pump consisted in fact of regional groups of pumps as follows:—

- (1) The planter or foot pump.
- (2) The calf pump including the anterior tibial and peroneal pumps.
- (3) The thigh pump.
- (4) The abdominal pump.

It is well known that these pumps aid the circulation of blood through the limbs and the venous return to the heart. Disorganisation of venous return mechanism was ascribed to four principal lesions.

THE RATIONALE OF A COMPRESSION  
SCLEROTHERAPY

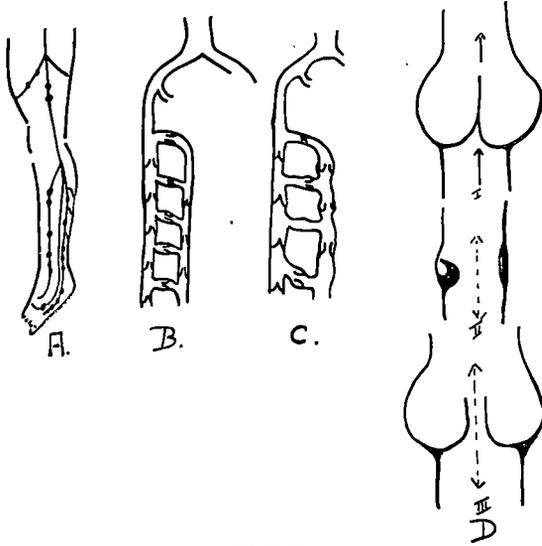


Fig. 1.—The vasular system of the lower limb.

Fig. 1(a)—The long saphenous system indicating the points at which communicating veins commonly connect with the deep venous system.

Fig. 1(b)—Diagrammatic representation of the valve systems of the long saphenous vein, the communicators and the deep veins of the lower limb.

Fig. 1(c)—With dilatation and tortuosity of the saphenous system as encountered in varicose veins, valves of the superficial system and of the communicating veins become incompetent.

Fig. 1(d)—Valvular defects:

Fig. 1(d) (i)—The normal valve in which the cusps meet in the mid line and there is unidirectional flow.

Fig. 1(d) (ii)—Thrombotic damage to a valve producing actual damage to the cusps with incompetence.

Fig. 1(d)(iii)—A varicose vein with dilatation of the vein. The valve cusps are normal but cannot meet in the mid line and as a result incompetence ensues. (After Fegan).

saphenous vein, and the variation is being described as being between 3 and 18 valves. Many families have a very marked family history of varicose veins. A finding common to all studies on varicose veins.

Possibly standing is a very potent factor in the production of varicose veins. People who are on their feet all day but moving about appear to be less likely to develop varicose veins than those who have to stand in a set position for most of the day. This is particularly notable with people like counter assistants and nurses standing at operating tables.

Basically sclerotherapy makes use of the denudation of the endothelium of the vessels together with fibrosis around the vessel and to the production of a clot in which layering does not occur. The material used for compression sclerotherapy is Sodium Tetradecyl Sulphate. In vitro experiments show the following properties:—

- (1) Combines rapidly with and denatures protein.
- (2) It causes haemolysis in vitro.
- (3) It inhibits coagulation.

Fegan has suggested that the thrombus appearing at the injection site is in fact not due to the action of the Sodium Tetradecyl Sulphate on the blood but a result of the damaging of the endothelial lining of the cells of the intima. Blood clot then forms upon the damaged intima as with any damage to the intima. The results of this action are two-fold. A clot may form within the vessel and this particular clot tends to form an even layer around the circumference of the vessel which when it fibroses will produce thickening of the vessel wall and contraction of vessel. Secondly, should adequate compression be applied to the vessel wall the walls of the vessel coming into contact should heal across and virtually obliterate that vessel. The fact that the injection of the superficial veins does not produce venous thrombosis in the deep vein is due probably to the inactivation of that sclerosant by the blood contained in the deep vessels and adequate dilution of the sclerosant. (Fig. 2)



Fig. 2.—The Commencement of Sclerotherapy. The veins have been examined and marked. In particular the site of communicating veins has been marked. A very firm 'blue line' or crepe bandage is applied from the foot upwards. A No. 26 needle has been inserted into the vein at the site of the communicator and vein emptied by elevation. A ½-1 cc. of Sodium Tetradecyl Sulphate is then injected into the site. The vein is kept collapsed by proximal and distal digital pressure.

The success of compression sclerotherapy is two-fold. (a) Adequate compression must be applied to the vessels to allow fibrosis to occur across the vessel and obliterate it; and (b) where a certain amount of blood is present the clot tends to be peripheral producing a thickened and sclerosed vessel wall rather than a layered clot which would retract and leave a thin vessel wall in the position of the old varicose vein. (Fig. 3, 4, 5).

#### THE TECHNIQUE AS APPLIED IN THE SALISBURY GROUP OF HOSPITALS

Case selection is extremely important for successful compression sclerotherapy. In the first instance there should be no history of deep venous thrombosis. Patients who possibly have obliterated the deep venous system should be investigated with venograms to make sure that an alternative route is available for venous return. In general contraindications described by Prof. Fegan have been adhered to within the Salisbury clinics.

These are:—

##### (1) *Fat legs.*

It is obvious that the dressings cannot be adequately maintained in position in a patient with fat legs.

##### (2) *Inability to Walk.*

Walking is an important and integral part of the treatment. Most patients are encouraged to walk an hour or two every day and certainly immediately after injection they are encouraged to walk for an hour and a half. Most patients find that carrying out their normal daily duties provides the adequate amount of mobility and that they are not immobilised as they are with other forms of varicose vein treatment.

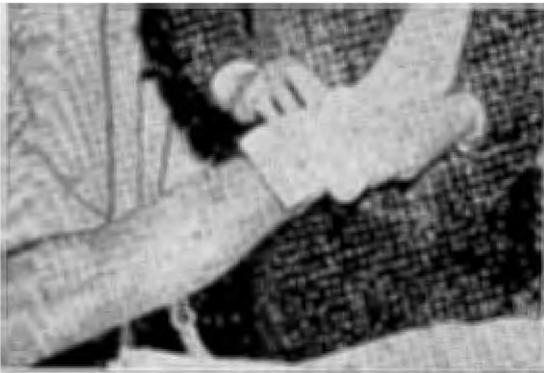


Fig. 3.—After 30 seconds of digital pressure a large sorbo-rubber pad is applied over the site of the injection and firmly bound in place by the 'blue line' bandage. The procedure is continued up the leg at the sites of communicating veins.

(3) Acute cellulitis or any other infection associated with ulceration should be given time to settle down before any sclerotherapy is carried out.

(4) Above the mid thigh it is almost impossible to compress the vessels and therefore the veins above this site are not usually treated by compression sclerotherapy.

(5) Particular note is made of the treatment being contra-indicated for cosmetic reasons only. The patient must realise that the vein treated will probably produce discoloration which may be permanent, although in this country we are lucky in that most patients can sun bathe and hide any discoloration.

(6) Allergic reactions. Allergy may occur if the Sodium Tetradecyl Sulphate acts as a haptene and subsequent injections may produce anaphylactoid shock. The patient must therefore be warned of the possibility of this shock and Adrenalin should always be immediately to hand to deal with such a situation.

(7) Hot weather was thought to be a contra-indication but most of our patients have been quite happy to have this treatment even in mid summer.

#### THE RESULTS OF FEGAN'S TREATMENT IN THE LAST HUNDRED CASES IN THE VARICOSE VEINS CLINIC, SALISBURY GENERAL HOSPITAL.

Fegan's treatment has proved extremely successful in the last hundred cases to pass through our clinic. Of the patients treated at the clinic, 65 were females and 35 were males.

Presenting complications were:—

- Ulcers — 8
- Associated Arterial Disease — 1
- Old Deep Vein Thrombosis — 2
- Obesity — 4
- Dermatitis — 18
- History of Allergy — 2

None of these cases was denied Fegan's technique despite the obvious difficulty of bandaging fat legs or associated ulcers. Fegan's method in fact proved decided benefit to patients who had ulceration.

Complications occurring during the treatment may be divided into immediate, intermediate and late. Immediate complications were:—

(1) Syncope due to the use of an injection. No patient has actually fainted in this clinic although several patients have required to be put in a full recumbent position and given a drink of cold water.

(2) Pain on injection. This is extremely rare. Some 70% of patients complain of stinging or tingling at the site of injection but very few patients indeed complained of any pain at the site of injection at the time of administering the sclerosant.

(3) Allergy. One patient after repeated injections for recurrent varicose veins following a venous stripping developed what appeared to be a minor form of angioneurotic oedema. This was in fact confined to the limbs and the chest and was not serious. The same patient had a long history of allergy to a great many chemicals and substances and she was watched closely during the whole treatment in case she did develop any allergic response.

#### THE INTERMEDIATE COMPLICATIONS

(a) Superficial venous thrombosis was quite common. This occurred where insufficient pressure was put upon a vein after injection of the sclerosant and venous thrombosis was obvious in the veins in the line of the main venous drainage. This was only severe in 3 out of a 100 patients and in one case the whole long saphenous vein thrombosed. There was however no suggestion of an embolus in this case. One other case developed deep vein thrombosis some four months after Fegan's therapy. He had had a previous history of deep vein thrombosis in the opposite leg and had had a previous pulmonary embolus. It was thought that this episode was unassociated with the feganisation process.

(b) Ulceration was divided into minor and major. Spill of the sclerosant at the site of injection frequently produced a small area of induration and in some cases slight blistering and



Fig. 4.—Once the bandage has been placed into position holding the sorbo-rubber pads firmly over the site of injection, the whole dressing is held in place with an elasticated stocking or Tubigrip.



Fig. 5.—The whole dressing is then covered using either an elasticated stocking or the appropriate size of elasticated stockinet. These dressings are left on for a week to three weeks after which the foam rubber is removed but the compression dressing is reapplied to complete the full treatment period of six weeks.

a very superficial loss of epithelium. This occurred in approximately five per cent. of cases. However, frank ulceration at the site of an injection was extremely uncommon. In only three cases did a large blood clot form which subsequently ulcerated through and formed a small ulcer which then had to heal. This is entirely due to the sclerosant as distinct from ulceration occurring in association with the varicose insufficiency. Most varicose ulcers healed extremely rapidly once the surrounding varicosities and the communicating vessels had been adequately treated by sclerotherapy. The ulcers that occurred as a result of spilled sclerosant also healed rapidly provided they were thoroughly cleaned and the slough removed from their centre leaving a crater which could granulate.

The late complications of Fegan's therapy are: (i) recurrence which occurred in five cases seen in the early days of the clinic. In these cases it is doubtful whether sufficient pressure had been applied and whether the bandages had been maintained under sufficient tension throughout the treatment. The recurrence was not serious in that the vessels tended to be thick walled vessels and did not take on the convolutions of varicose veins but appeared more to be normal vessels with a very thick wall. In the recurrences too it would appear that the valves were once again competent as a result of the return of the vessels to a normal diameter and that the process had indeed by its sclerosis and fibrosis healed the secondary valvular deficiency. The veins in these people were easily treated by using Fegan's method a second time.

## COMPLICATIONS:

Syncope	Pain	Injection Ulcer	Extravasation short of Ulceration
0	6	3	22
Pigmentation	Nerve Damage	Deep Vein Thrombosis	Failures
83	4	1	1 (from a clinic outside this hospital submitted to stripping immediately)
Pulmonary Embolism	Allergy to Sotradecyl	Failures	
0	1	5	

In the column marked "Failures" one patient presented having undergone Fegan's treatment elsewhere and it was decided that as he was a policeman it would be better to strip the long saphenous vein completely. This was carried out. The other five cases were failures probably due to improper technique. They were repeated later with apparent success.

## DISCUSSION

This treatment has proved to be extremely popular with the general population. It is a treatment which is logical. The aim is to obliterate portions of the superficial venous system but more than that to restore the function of secondary valvular defects which would decrease the tension in the superficial veins and allow a normal flow inwards to the deep venous system and upwards through the sapheno-femoral junction. In this way it tends to help to restore the calf and foot pump of the leg. The sclerosing of the wall also tends to restore the vessel to almost its original size and capacity. Anscombe (1971) has pointed out that the treatment of varicose veins must be directed towards repairing the breach between the deep and superficial systems and reducing the pressure in the superficial systems. He makes a very strong plea in his paper for the complete abolition of the present procedure of stripping of varicose veins. Anscombe further points out that with Fegan's treatment the perforating vessels are important together with the restoration of the valves in the perforating vessels, thus restoring normal anatomy and physiology of the limb.

It has been our experience that the patients are apparently cured in about 80 per cent of cases.

Henry (1971) claims a cure rate of 82 per cent. with a rider that in obese patients the cure rate is only 76 per cent. while in the non obese patient the cure rate rises as high as 89 per cent. It is probably too early in this clinic to claim a definite percentage cure rate but to date at least 80 per cent of our patients have been clinically cured. As the clinic has not yet run a full five years no claim for complete cure can be made.

It is a treatment virtually without danger although various complications can occur. Probably the most feared complication is gross deep vein thrombosis or even arterial damage with loss of a limb. Fortunately, this has not been recorded in Southern Africa as yet. Martin and Eastcoate (1971) point out the danger of intra-arterial injection of Sodium Tetradecyl Sulphate and quote a case of ensuing arterial damage. They also mention that there have been other reports of intra-arterial injection with disastrous results. This type of complication falls into that group of accidents that occur when any intra-arterial injection is carried out with a sclerosant or irritant material. Great care must be taken not to enter any artery and if there is any suspicion that this has occurred the needle should be immediately withdrawn. Deep vein thrombosis can be avoided by adequate mobility immediately after the injection of the Sodium Tetradecyl Sulphate and also by avoiding the use of more than approximately half to three quarters of ml at any one injection site.

This treatment so far has had no mortality and there is a definite diminution in morbidity of the patients. Although the treatment extends six weeks or more the patient is completely mobile and can carry out most normal activities. The patients become adept at bathing with one limb encased in dressings and though it does prevent the patient from undertaking certain sporting activities many of our patients have played tennis or cricket with no apparent limitation to their activities. None of these patients required admission to hospital except in the case of one patient who developed deep venous thrombosis sometime after his Fegan's treatment. Certainly the patients passing through the clinic would require admission if submitted to surgery, therefore this type of therapy relieves the hospital of a great strain on surgical wards. The patients are all grateful for immediate treatment and for the fact that they may return to work the same day and carry out full activity. There are virtually no scars present although the discoloration that occurs with the treatment may be quite marked in the early part of the treatment. However, as

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previously mentioned, with a little judicious sun tan these patients' discolorations are not noticeable.

Medically speaking, it is a great advantage not to have a waiting list of patients who require hospital beds and the alleviation of the bed problem for varicose veins patients is greatly appreciated. Compression sclerotherapy tends to save time and once the technique is mastered it is quite easy to do a number of cases in an afternoon.

Finally the improved results with this treatment speak for themselves. Even the injection of the telangiectatic form of lesion has produced very grateful patients. Patients who have minor ulceration have healed up very rapidly and there is only one patient who has a superficial scar.

The advantages to the community of this treatment are that it saves doctors and nurses' time together with hospital beds and their attendant expenses. It reduces the loss in earnings of the patient and it does not cause dislocation to industry or commerce due to the absence of key operators. This type of treatment does not cause a disruption of home life although some ribald comments have been made about wives with large bandages and dressings on their legs.

#### SUMMARY

Fegan's treatment in technique has been discussed and the results of a 100 cases through the clinic at Salisbury Central Hospital are noted. It is thought that this is a logical form of therapy with rewarding results.

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