THE MODERN TREATMENT OF VARICOSE VEINS
in
GENERAL PRACTICE
with Records of Thirty Cases.
by
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BURTON-ON-TRENT.
THE MODERN TREATMENT of VARICOSE VEINS in GENERAL PRACTICE.

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The treatment of varicose veins of the lower extremities has lately passed a definite milestone by the substitution of local intravenous therapy for the older methods of surgery. This progressive step has carried the treatment, once the province of the surgeon, within the boundaries of the field of the general practitioner. I would compare this advance, in the treatment of this particular condition, with that made by the introduction of insulin therapy in diabetes mellitus. The innovation has not burst suddenly on the medical profession, but has developed during the last eighty years. The results of the modern method, I submit, warrant the careful attention of both the medical man, and the laity, wherever the condition of varicose veins is found.

In the following pages I have endeavoured to summarise, from the literature of the subject, the development and application of the treatment, and to illustrate with some results obtained in my own practice. In doing this, I have been necessarily guided by the views and methods of authorities on this treatment and its evolution.

Where the views of authors have been quoted, the appropriate references will be found in the bibliographical section, but these have not been given where accepted facts, such as surgical, anatomical,
2.

or pathological knowledge, are utilised in the text.

I now propose to open this thesis with a brief summary of the evolution of the method of treatment.

In 1841, Santos injected a solution of Iron Perchloride; his results were disappointing, for although there were a few successful cases, there were many cases of phlebitis, sepsis, and even gangrene (1). With a mild iso-amyl solution, in 1854, Decruesga (2) had six successful cases, and encouraged by these results, other observers experimented with fresh agents, such as ergot, alcohol, and carbolic acid. Although there were some successful results from one or other of these attempts, bleeding, sepsis, and recurrence were very common. Ollerue (2a) supported this observation, and went so far as to protest against the introduction of Trendelenburg's method, which at that time were becoming the accepted treatment...
Many workers, since the invention of the hypodermic syringe in 1850, by Pravaz, have attempted to effect the cure of varicose veins, by means of the injection into the diseased vessels themselves, of various agents which would produce by chemical action, an artificial thrombosis, resulting in obliteration of the lumen of the vein. Time and again, however, these early attempts resulted in poor, or even tragic, results, on account of sepsis, or the toxicity of the various agents used.

In 1851, Sentez injected a solution of Iron Perchloride; his results were disappointing, for although there were a few successful cases, there were many cases of phlebitis, sepsis, and even gangrene (1). With a mild iodo-tannic solution, in 1854, Desgranges (2) had six successful cases, and encouraged by these results, other observers experimented with fresh agents, such as ergot, alcohol, and carbolic acid. Although there were some successful results from one or other of these attempts, sloughing, sepsis, and recurrence were very common. Delore (2a) supported this observer, and went so far as to protest against the introduction of Trendelenburg's methods, which at that time were becoming the accepted treatment.
Little progress was accomplished until Zirn (3), commenced to apply sublimate of mercury to the treatment, and he met with some measure of success. In 1904, Tavel (4), after a preliminary ligature of the internal saphenous vein, injected carbolic acid in a 5% solution and Schiassi (5), followed in his footsteps, with a similar technique, but using 1% iodine in a 1% solution of potassium iodide. With this he reported good results in 60 cases; further, there were no local or general complications of treatment, and at the end of a month after treatment, the varices were transformed into fibrous cords; those cases which were accompanied by ulcer or eczema, were improved.

In 1910, Borcherds employed salvarsan, and a case in which he injected 300 c.c. was reported in 1927 to be well, and there had been no recurrence(6). Further reference is made to Borcherds in the following section.

A fresh agent made its appearance in 1913, in the shape of quinine, 10 grains of which were injected in 10 c.c. of water, by Hanschell (7), and he reported the cure of a case.

Prof. Sicard of the Necker Hospital, during the war, observed that certain novarsenical preparations when injected intravenously in syphilitic cases, led to the obliteration of the vessel used. Luargol, in this respect was noted in particular.(8)
As luargol contained free soda, scarring and subcutaneous irritation were common, and he adopted neutral sodium carbonate in 1918. Finally, he introduced sodium salicylate, injecting it in strengths of from 20% to 40%. In 1929, he announces that in using this agent in numerous cases, he has never had any untoward results. This would appear to be the period in which the modern method was placed upon a scientific basis. The other largely used agent at the present time, quinine and urethane, was introduced by Genevrier and Gibrie (9), who combined with a 13% solution of neutral quinine hydrochloride, with 6% urethane as an analgesic.

There are also used, although probably to a lesser extent, at the present time, sodium chloride, sodium morrhuate, and sodium chloride and calorose solutions. Mercurial preparations are not used much on account of their toxicity.

At the present time, sodium morrhuate is gaining in prominence and may become more general in use. The results which have so far been experimentally obtained are promising.
SECTION II.
PREPARATIONS FOR INJECTION.
Quinine and urethane, sodium salicylate, and sodium chloride would appear to be the most commonly used preparations in this country at present, by general practitioners.

Quinine and Urethane.

This preparation usually consists of Quinine Bihydrochloride, 0.26 gm., Urethane 0.13 gm., in 2 c.c. of distilled water, and is supplied in ampoules, ready for injection. It being an accepted fact that a personal idiosyncrasy on the part of the patient may exist, it is therefore advisable that a preliminary test for reaction be made before treatment is begun. This may be carried out by observing the reaction following upon the injection of .5 c.c. intravenously; or, by observing the reaction after injection of a minim or two intradermically; in the latter test, if an idiosyncrasy exists, a wheal appears at the site of injection, analogous to that seen in "protein-sensitisation" tests.

Reaction following the use of this agent may be either local or general. The local reaction, is of course, inseparable from the treatment as on it depends the result of the treatment. To prevent as much as possible a painful local reaction, the exhibition of urethane has been added, and has
given rise to a discussion as to whether this is desirable, as the escape of solution into the tissues could not be recognised.

The general reaction of quinine medication if present, may consist of, most commonly, buzzing in the ears; giddiness or depression. Derangement of the sense of sight, such as contraction of the visual field may also occur, while skin eruptions are also seen, especially in patients with an idiosyncrasy. (Cushny 10). The action of quinine on the uterine musculature is at once a contraindication in its use during pregnancy or menstruation. I would add, that, personally, I have not observed any idiosyncrasy in connection with intravenous treatment.

**Sodium Chloride.**

Sodium chloride is a normal constituent of the human body, and may be used in large quantities. Its action on the endothelial cells of the veins is, according to Barber, one of osmosis, "the cells shrivelling up and dying. (Barber 11)." It is, of course, an accepted fact that, a hypertonic solution of sodium chloride also produces, (by osmosis), shrinkage of the red blood corpuscles. Used in a concentration of from 15% to 20%, in 5 to 10 c.c. of distilled water, it may be either freshly prepared, or be supplied in ampoules.

A possible disadvantage to its use would be its
employment in a patient who is suffering from defective renal action; but the actual amount thrown into the circulation is so small that cumulative action of a serious character is unlikely. (Barber: 11).

A more substantial objection to its use, in my opinion, is the amount of pain following on injection, and also, that an escape of the solution into the surrounding tissues, might produce a severe slough.

**Sodium Salicylate.**

This agent is employed in the strengths of from 20%, 30% to 40% or even 50%, the total amount of solution (per injection), varying from 2 c.c. to 6 c.c.

According to Sicard and Gaugier, this agent may, if it has been kept, produce shock, and to obviate this the solution should be put up in ampoules of hard glass, as on this glass a solution of salicylate has no effect. (12). Colt, on the other hand, has used a hundred ampoules in which the solution was of a brownish shade, (due to iron contamination from glass), but noted that all the results from its use were good, and no untoward effects were observed. (13).

The general effects of sodium salicylate, if present after injection, are usually limited to
slight breathlessness, possible giddiness, and increase in the pulse rate. Head noises, or a sense of fulness in the head have been described by some observers, but I must admit that they have not occurred in any of my cases up to date.

Abortion has occurred with salicylates when given internally, (Cushny 14), but to the best of my knowledge, no case has been reported while undergoing treatment with this agent for varicose veins.

Mercury.
This agent is hardly mentioned in current medical literature in this country in regard to the treatment of varicose veins, such references to its use being of continental origin. Barber's suggestion as to its use in syphilitic cases is interesting, and he mentions the biniodide of mercury as being the safest of this group.

Borcherds, on the other hand, has recorded that in 1910 he discovered, when "606" was injected into a varicose vein of a leg, instead of the usual arm vein, that the varix completely disappeared. Acting on this experience, he has ever since used novarsenobillon, kharsivan, or neo-kharsivan with similar effect in all cases. He goes so far as to make the suggestion that all cases of varicose veins are syphilitic in origin; and also, that when the arm veins are selected for injection, the lumen is narrowed, but remains pervious. (15)
Maximum Doses.

These depend on the patient's general condition as ascertained by routine examination, and on the local and general reactions to injection. With regard to quinine and urethane, a simple test for possible idiosyncrasy has been described in the British Medical Journal (16). One drop of 1% quinine bi-hydrochloride is placed on the skin of the forearm, the skin then being scarified as in vaccination. A local reaction consisting of a wheal surrounded by an erythematous area, may appear in about ten minutes in hypersensitive patients. No such reaction taking place, it may be assumed that the patient has no idiosyncrasy to this drug.

The average dose with this drug is usually 2 c.c. but one occasionally has seen references to as much as 4 c.c. having been given, but in my personal work, the 2c.c. dose have not been exceeded.

Sodium Salicylate.

With this drug, up to 8 c.c. with 20% or 30%, and 4 c.c. in the case of a 40% solution, may be given.

Sodium Chloride.

Using a 20% solution, up to 20 c.c. may be given, and with 15% up to 45 c.c. (Barber).
Analgesics.

Some objection has been raised with regard to the use of analgesics, on the ground that the patient is unable to give warning, through pain sensation, of the escape of solution into the surrounding tissues, if the needle has not truly entered the vein. My personal view on this point is that, with the use of a suitable syringe, and care, this "mal-puncture" should not occur.

It is interesting to note that, in the treatment of haemorrhoids with sodium salicylate, Sicard and Gaugier produce a preliminary local anaesthesia with cocain hydrochloride, 5 cg., novocain, 5 cg., and distilled water 10 c.c. injected per anum with an ordinary hypodermic syringe (8). Further, they do not hesitate to inject some of this solution into the perivenous tissues.
SECTION III.
The Anatomy of the Superficial Veins of the Leg.

The main superficial veins of the leg are the Internal Saphenous Vein (Great Saphenous Vein), and the External Saphenous Vein (Small Saphenous Vein).

The Internal Saphenous Vein.
This vessel, the longest vein in the body, takes formation on the medio-dorsal aspect of the foot from the dorsal arch and plexus. Accompanied by the saphenous nerve, it ascends anterior to the medial malleolus and across the medial surface of the tibia. Passing over the posterior part of the medial aspect of the knee, and then coursing anteriorly and laterally through the medial region of the thigh, it pierces the fascia cribrosa and femoral sheath at the fossa ovalis, to terminate in the femoral vein.

Anastomotics and Tributaries.
Numerous anastomotics from the deep veins; the lateral circumflex veins from the anterior region of the thigh, and the medial circumflex veins from the medial region. One of the latter not infrequently connects the great saphenous vein with the small saphenous vein. Before piercing the fascia cribrosa, it is joined by three small subinguinal veins.
The External Saphenous Vein.

This vessel arises from the lateral end of the dorsal venous arch of the foot, and passes posteriorly to the lateral malleolus. Ascending the leg lateral to the tendo calcaneus, and winding over the posterior aspect of the leg, it reaches the distal part of the popliteal fossa, where it pierces the deep fascia, and enters the popliteal vein.

Tributaries and Anastomotics.

Small tributaries are received from the lateral surface of the foot, and posterior branches of the leg. At the upper third of the leg, it anastomoses with the deep veins of the leg and thigh.

Valves.

Of these there are two, one usually near its termination.

Valves.

These are numerous and variable in position.
The Etiology of Varicose Veins.

"The term varix, or varicose, may be applied to the condition in which the veins are so altered in structure that they remain permanently dilated, and at the same time lengthened and tortuous."

(Thomson & Miles: 19).

Two types are met with - one, in which dilatation of a large superficial vein is the most obvious feature; and the other type, in which bunches of distended veins develop at one or more points along the course of the vessel. (Thomson and Miles 19).

To the last condition, Virchow applied the name of angioma racemosum venosum. Any vein may be affected, but the condition is usually confined to the legs, spermatic cord and anal canal.

Causation.

(1) Varicose veins may be congenital in origin, or more fully, there may be a congenital deficiency in the number, size, or strength of the valves. This view of congenital origin was suggested by Virchow, and is supported by the large number of "hereditary" cases. Frequently the same vein is found to be affected in several members of the same family, and further it is frequently found among young people. (Thomson & Miles: 19).

(2) They may be acquired. This variety may include congenital cases which have been aggravated by
mechanical causes, the most common of which is increased intravenous pressure. Increase of pressure may be produced by several conditions, viz:
1. Portal obstruction, due to tumour, or cirrhosis.
2. Diseases of the heart or lung, whereby "back pressure" is produced, resulting in localised dilatation of a congenitally weak vein.
3. In women, pregnancy is frequently found as the starting point. The varices here may be permanent or temporary.
4. Pelvic tumour, by which direct pressure on a vein is caused.
5. Postural Causes, such as prolonged standing, or straining at work. Miners are frequent sufferers from varicose veins, and I feel convinced from personal experience, that the kneeling position of these men at work, brings about a mechanical source of partial venous obstruction at the knee joint.
6. Thrombosis of the deep veins of the leg would throw an increased strain on the superficial veins of the leg.

Age Incidence.

Although the ages of 30 to 40 years are the commonest as a general rule, they may be seen at puberty; and sex apparently makes little difference (Thomson and Miles, 19).

In the series of cases which I give, the average ages of patients are as follows:
Type of Varix: Congenital Type Acquired Type

<table>
<thead>
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<th>Women</th>
<th>Men</th>
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<tr>
<td>Age</td>
<td>30 yrs</td>
<td>47½ yrs</td>
</tr>
<tr>
<td></td>
<td>27½ yrs</td>
<td>40½ yrs</td>
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PATHOLOGY.
The pathology of varicose veins may be conveniently classified into Primary, Secondary, and Compensatory. (Treves-Barber, 20).

Primary.
Barber offers the suggestion that this class may arise from some congenital origin, and that they may be compared with congenital heart disease. Frequently noticed in early adult life, the chief feature is the absence or deficiency in valves, resulting in a state of incompetence. As this permits an increase in the pressure of the blood column, the already incompetent valves are pulled further apart by the distending walls, the sites of the valves then appearing as "swellings" in the vessel walls. Infection may subsequently take place, and the outer coats develop irregular proliferative changes, and the vein take on the characteristics of the secondary type. (Beattie & Dickson: 21).

Secondary.
This type is due to infection superimposed on a dilated and elongated vessel. The infection may arise from a local source, i.e. local wounds or
skin affection; or it may arise from a general infection, and be blood borne. One or other of the coats of the vessel may be affected i.e. endophlebitis and periphlebitis, and the condition may be either acute or chronic.

In the acute stage, the lumen is lessened as a result of the swelling produced by invasion of the vessel walls by inflammatory cells. The endothelium may become roughened, offering a ready site for thrombosis. If thrombi are formed, they may break down after infection and form septic emboli. (Beattie & Dickson: 21).

If the infection is blood borne, thrombosis is induced by bacteriological infection introduced into the vein and endophlebitis set up as the result of irritation. Infiltration by leucocytes into the vessel coats follows, and septic exudate is thrown into the blood stream, and multiple abscess formation may result (Beattie and Dickson, 21). Acute infection does not cause varix, but for this the subsequent changes are responsible. The walls are thickened, especially the inner coat, which in long standing cases may calcify in places, forming phleboliths. The weight and pressure of the blood column causes "sacculation," especially at the site of the incompetent valves. At these sites, thrombosis may occur, due to the disorganised endothelium, and the venous stasis. Lymphangitis and subcutaneous thickening may then produce œdema.
Compensatory.

If the cause of this condition is removed the varix may disappear; but if the cause persists, the same cycle of events as found in the congenital type may result, proceeding, if infection occurs later, to the changes found in the secondary type. (Barber).
SECTION IV.
The Physical Signs and Symptoms of Varicose Veins.

As stated before, varicose veins may be seen in the earlier ages of life, but are commoner in the middle decades in men, although they are very commonly found in women, and more especially in women who have borne children.

The type of vein has a bearing on the clinical appearances.

Appearance.
The first sign is frequently the appearance of a "new" vein as the patient often describes it, situated on the leg, and more commonly found on the anterior and medial aspects of the limb. Elongated, and tortuous, they are often raised above the skin, and may stretch from the ankle to the saphenous opening. More prominent in the erect posture, they tend to disappear or empty on lying down. The smaller tributaries may take part in the condition, the leg appearing to be surrounded by a net-work of dilated veins. Here and there, along their course, may be seen small bag-like prominences corresponding to the situation of the incompetent valves.

Palpation.
In the congenital type, the vessels are soft and elastic to the touch, while they are easily compressed. In the acquired type, there is a certain
amount of resistance on palpation, (Barber), and this, I suggest, is due to the changes produced in the vessel coats by previous attacks of phlebitis, and is analogous to the "phlebo-sclerosis" which is said to occur in some cases of syphilis.

The walls of the vessel on compression feel tough, and in some cases one is reminded of atheroma. If much oedema be present, the vessels may be more easily felt than seen, and if there be much periphlebitis, a ridge may be palpated along either margin of the vein. (Thomson and Miles 22).

Compensatory.
In this type, the veins, in the earlier stages, may present the tortuous and "full" appearance of the congenital type, while in the later stage, they may resemble those of the acquired type.

Symptoms.
In the earlier stage, varicose veins may present no symptoms at all. The symptoms, when developed, are at first, the sensation of discomfort, which depends, not on the amount of varicosity, but on the intra-venous pressure; this is borne out by the relief which is obtained when the limb is raised. (Thomson and Miles: 22). Worse at night, or after a long period of standing, the "heavy sensation" passes off with rest, and is usually gone on rising in the morning. Cramp-like pain may be experienced, and this, it is suggested, may be due to varix of
the deep veins, temporary anaemia of the muscles being produced. Proceeding a stage further, the next symptom is that of oedema of the foot and ankle, and which, like the preceding discomfort, is present at first at night, but, as the condition advances, comes to remain by day as well. The lower leg is now suffering from a condition of venous stasis and defective circulation. As a direct consequence, the door is now open for the entrance of complications and infection. A local vicious circle being established, the blood locally loses more and more of its oxygen, and ebbs and flows between the deep and superficial veins. From this condition, eczema may follow, and be accompanied by intense itching. (Thomson and Miles: 23). The skin is reddened and may be pigmented and thickened.

Ulcér.

One of the commonest complications of varix, ulcer formation may arise from injury such as a kick, or from the scratching resorted to by the patient to ease the intolerable itch. Infection of the eczematous patch is the precursor of the ulcer. Ulcer may also arise from the bursting of a small periphlebitic abscess, (Thomson and Miles: 24).

At first, small in size, the typical varicose ulcer, if untreated, becomes larger, both wider and deeper. They may be single, or multiple, and in the latter case, may coalesce in time. The edges are
indurated, inverted, and irregular. The base of the ulcer is covered by greenish-yellow granulations, giving off a thin purulent discharge. The course taken by such an ulcer may vary. It may, in the course of time, ulcerate into an underlying vessel and cause haemorrhage. This is stated to be uncommon, especially in a long-standing ulcer, as the vessels at the base of such an ulcer are frequently thrombosed. (Thomson & Miles: 24).

It may become the starting point of a septic embolus. Haemorrhage may be caused by the erosion of a vessel by the advancing skin edges. (Personally, I have had one case (untreated), where profuse haemorrhage arose from ulceration of a vessel at the base of a small ulcer).

Further, in poorer patients, where there is a combination of defective nutrition and neglect, a varicose ulcer may pass into the condition known as callous. The surrounding skin area is hard and indurated, and the skin edges are thickened; in time, the erosion may extend down to the underlying bone, which itself may become porous and thickened, as the result of periostitis and a superficial osteitis.

**Phlebitis.**

This complication may present general or local symptoms. It is a potent source of danger to the patient, as it may be the starting point of throm-
bosis, and emboli. An injury, such as a kick, to a varicose vein, may be the starting point of phlebitis. The vein is found to be reddened in appearance, and painful when touched; and there may also be œdema of the leg and foot. Thrombosis may then spread upwards, and in the case of large varices, the deep veins may become involved. (Thomson & Miles: 25). The temperature and pulse rate may be found to be elevated in severe cases.

Following upon the local reaction, and especially where the phlebitis is the result of a blood borne infection, as in the case of one of the continued fevers, the symptoms of a general infection may present themselves, later possibly giving rise to septicaemia and pyaemia.

Thrombosis.

Thrombosis may arise in varicose veins in situations where there is a fairly constant pressure on the vein, or where there is a mechanical obstruction to the blood flow. For example, I have noted this condition in colliers, who, while working at the coal face, occupy a kneeling position, producing an acute flexion at the knee joint, and also at the same time, having their weight bearing on the inner surface of the knee. The thrombosis in this case is, therefore, traumatic in origin.
ASEPTIC THROMBOSIS.
The condition of aseptic thrombosis is produced by aseptic intravenous injections of chemical agents, as in the modern treatment. It is convenient, therefore, to give some account here of the changes produced by these injections.

CLINICAL PATHOLOGY.
The clinical pathology of aseptic thrombosis is at present apparently little understood.

Hanschell (7) carried out some experiments in which segments of injected veins were dissected out and compared with segments similar in length and size, but not injected, to act as "controls." The results of this experiment may be summarised as follows:

(1) Ten to fifteen minutes after injection, no change in the vein wall and no clot present.

(2) Twenty-four hours after injection, intima swollen with damaged cell nuclei; round cell infiltration in peri-venous tissue; firmly adherent clot in lumen.

(3) Seven days after injection; clot, firmly adherent, and undergoing organisation.

McPheeters, (7a), studied the pathological changes following on injection of either calorose or sodium chloride solutions. Thirty-three segments of injected vessels were excised at intervals varying from one hour to one hundred and nine days
after injection; after fixation, these were stained with haematoxylin and eosin. His results may be summarised as follows:

In one hour, no changes were observed, beyond some thickening of endothelium.

After two hours, a thrombus was found in the lumen, and some red blood cells were entangled in fibrin adhering to the endothelium.

In five days, early organisation was indicated by the presence of capillaries and fibroblasts in the clot. The process of organisation was maintained in the seven, twelve, and twenty-one day specimens, except in one area, where normal clot was present.

In thirty days, organisation was less advanced than in the twenty-one day specimen, but haemolysis of the red corpuscles was noted, and in forty-seven days the organisation was practically complete.

At ninety days, organisation was complete, the fibrous tissue in the lumen containing a number of capillaries.

McPheeters noted, moreover, that the degree of organisation did not necessarily increase with the length of time following the injection. He offers the suggestion, as a possible explanation, that this may be due to:

(1) Poor nutrition of the vessel wall. Frequently, however, he found that organisation was as well advanced in an atrophic vein as in a normal specimen.
(2) The state of the vasa vasorum. As this could not be determined accurately, this explanation, he considers, is purely hypothetical.

(3) That organisation may take place more rapidly in one segment than another. He found that in the more constricted vessels, organisation tended to be complete with absolute obliteration, while in larger vessels, the lumen while decreased, was nevertheless, still patent. (I have occasionally demonstrated this patency in one or two of my own cases.)

In the vessel walls, themselves, degeneration of the muscular coat was noted, and few specimens showed elastic tissue. The fibrous tissue was much increased and in some there was noted the presence of new capillary formation.

Fifty per cent of the specimens showed inflammation of the adventitious coats, but McPheeters is of the opinion that this may not necessarily be the result of injection treatment, but was due in the first place to inflammatory reaction in the vessel coats previous to injection.

In the case of quinine and urethane, according to the majority of observers, there appears to be little or no naked eye change for the first hour after injection. The clot, once formed is strongly adherent. Meissen (26) noted that it was not separated by massage. In 48 hours, the
vein is contracted, and the endothelium covered with fibrin; in 72 hours, the endothelium is proliferating strongly. In a week, the clot is undergoing organisation, which is well established in a fortnight, and later it becomes a firm cord. (Cot 27). Douthwaite (38), states that the thrombosis produced by quinine does not advance rapidly, but that it may do so with sodium salicylate. With each agent, there is a different reaction, and often a different reaction with the same agent after each injection in the one case. For instance, there may be a reaction in one direction one week, in the other direction the next week, or possibly none at all. According to Colt (27), "the blood volume and the blood current at the point of injection, and which he calls the blood "variables," have a great influence in this direction. In a horizontal position, in a varicose vein, the blood may be either stagnant, or moving in either direction: in the vertical position, the flow is centrifugal. These facts have been confirmed by radiological means."

I have come to the conclusion, that in the larger veins at any rate, there is occasionally, after injection, a very small lumen remaining. If, after the vessel has become to all appearances, a fibrous cord, a needle be inserted into the vein; blood may be sometimes drawn into the syringe.
Thrombosis in these cases may consist of a thrombus organised only peripherally in the lumen, the centre remaining unorganised. (McPheeters: 7a).

**Embolism.**

When the modern method of treatment was first adopted, the dangers of embolism were strongly mooted, but it would now appear that these have been much over-estimated. One case was reported by Olson (28), where a woman died on the fifth day after the second injection of a salt and calororose solution. At the autopsy, the clot in the internal saphenous vein was found to have broken off, the cause of death being pulmonary embolism. Meissen (26) reports that up to January 1927, he had had but two cases of pulmonary infarction, out of a long series of injections.

I cannot find any published cases of embolism follow the use of quinine and urethane, sodium salicylate, or sodium chloride.

Excision of segments of veins, after injection with the various agents, would help to elucidate the nature of the intravenous reactions and to determine the differences, if any, between the nature of the clot produced by these agents.

I have noticed that old horses frequently show varicose veins on the inner surfaces of the rear legs and it has occurred to me that here is a possible source of material for experiment.
SECTION V.
The Diagnosis of Varicose Veins.
Superficial varices of the legs are easily diagnosed, but they may be confused with other conditions when found in the upper thigh, viz: enlarged glands, psoas abscess, femoral hernia, and aneurysmal varix. (Barber: 29)

Enlarged Glands.
Here one must look for the cause of enlargement, such as infection of the leg tissues, tubercle, or evidence of lymphadenoma etc. Inquiry into history and development, coupled with the presence of other symptoms of these conditions, will assist in the differential diagnosis.

Psoas Abscess
While both varix and psoas abscess expand on coughing, an abscess is not visibly affected by deep breathing. In addition, in the case of abscess, other signs of spinal caries are usually present, also flexion and eversion of the limb.

Femoral Hernia.
Both varix of the upper end of the great saphenous vein and femoral hernia are reducible, but a hernia increases in size from above downwards, and a varix from below upwards; at the same time, it reappears while pressure is maintained on the femoral canal.
Respiration has no effect on hernia, while a varix increases with expiration, and decreases with inspiration. This sign, it should be noted "extends down the vessel for some distance (Treves-Barber 29), and will help to differentiate between these conditions, even if they coexist."

Aneurysmal Varix.
In this condition there is almost always a history of trauma, and a thrill and bruit may be present, the dilated vein also pulsating with the entrance of arterial blood. Complications are suppuration, thrombosis, and phlebitis, while if the latter extends to the pelvic veins, abdominal symptoms, such as vomiting, constipation and meteorism, appear. (Ortiz & Salaber: 30)

Two most useful tests have been described by Treves-Barber (31), namely, the "breathing" and "percussion" tests.

The Breathing Test.
With this test it is possible to follow the course and ramifications of the smaller veins. With the patient standing, the vessels will be seen to dilate on expiration, and to contract on inspiration.
The Percussion Test.
The patient standing, pressure is made over the vein, expressing the underlying blood column. The vein below the point of pressure will be noticed to be dilated, but on quickly removing the finger, a distinct "shock", or wave will be seen to travel along the vein, down the main trunk and along the tributaries.

I have noted that this test is more easily demonstrated in the congenital type, than in the acquired type, possibly, on account of the rather greater elasticity remaining in the former type.

These tests are useful in determining and assessing the extent and direction taken by the sclerosing action following intravenous therapy.

The Diagnosis in regard to Type.
The Congenital Type.
As mentioned before, this type is found in young people, and the vessel walls are thin, dilated, tortuous, and very compressible.

The Acquired Type.
The vessel walls here are resistant to pressure and there may be signs of previous phlebitis. It is found at any age, and is common in women. It is an accepted fact that, on no account, must intravenous therapy be commenced until all signs of sepsis or sources of infection have been removed, in view of the possible and probable production of emboli.
According to some observers, the cases of emboli noted during intravenous therapy have been those in which a source of infection has been present at the time of treatment.
The Prognosis of Varicose Veins.

As the patient grows older, or when insufficient care has been taken, varicose veins tend to increase in size and number. Infection playing an important part, especially in the acquired type, dermatitis, lymphangitis, thrombosis, emboli, and ulcer formation are more to be expected in this type, than in the congenital type.

All of these sequelae are sources of danger to the patient, tending to open the door to other sequelae through infection. The patient may become neurotic and depressed.

Finding that his health and work alike are beginning to suffer, he is driven to seek advice, which, quite frequently, he seeks from quacks and patent remedies and appliances. Thus it is that these cases reach the doctor in an advanced state of sepsis, or partially incapacitated from work. When the results, and what for want of a better word, may be called the "convenience" of the modern treatment, are better known amongst the laity, practitioners will have the opportunity of carrying out treatment at an earlier stage of development. Already, in my own limited experience, I have found that cases in the earlier stages come forward more frequently for advice and to enquire if the "new treatment" could be applied to their particular case.
I submit, therefore, that the prognosis of varicose veins has undergone a change for the better; and that the sufferers will not be backward in submitting to injection treatment.

The contraindications are few in number, and I shall content myself by giving these only. Intravenous treatment should not be given:

1. Where the condition is due to obstructive causes, which may, or may not, be removable. Examples of irreparable obstruction are, inspissated necropsia, cirrhosis of the liver, and portal obstruction.

2. Obstruction due to ovarian cysts, pregnancy, and pelvic tumours is a removable obstruction. Other agreed contraindications are:

3. Acute or subacute phlebitis, where the venous circulation is not functioning (phlegmasia alba dolens), and finally, where idiosyncrasy to the drug used exists. This latter objection to treatment is probably very unusual. Alternative drugs would at once be indicated.

Lastly, pregnancy when present, must be allowed to terminate before commencing treatment. A colleague treated a single woman with intravenous quinine and ureana, and abortion at the third month ensued (after the third month), all possible risk of pregnancy being ceased at the time of treatment.
SECTION VI.

INDICATIONS and CONTRA-INDICATIONS of INTRAVENOUS TREATMENT.

The contra-indications are few in number, and I shall content myself by giving these only. Intravenous treatment should not be given:—

Where the condition is due to obstructive causes, which may, or may not, be removable. Examples of irremovable obstruction are, inoperable neoplasm, cirrhosis of the liver, and portal obstruction. Obstruction due to ovarian cysts, pregnancy, and pelvic tumours is a removable obstruction. Other agreed contraindications are:—

acute or subacute phlebitis: where the anastomotic circulation is not functioning (phlegmasia alba dolens), and finally, where idiosyncrasy to the drug used exists. This latter objection to treatment is probably very uncommon, and alternative drugs would at once be indicated.

Lastly, pregnancy when present, must be allowed to terminate before commencing treatment. A colleague treated a single woman with intravenous quinine and urethane, and abortion at the third month ensued (after the third session), all possible risk of pregnancy being denied at the time of treatment.
SECTION VII.
THE TECHNIQUE of TREATMENT.

Preliminary Examination of the Patient.
An ordinary routine examination of the patient is first made, and this should be quite complete. One must look for any possible cause of the varicosity with a view to any alternative method of treatment i.e. the existence of removable causes. Pregnancy in women is to be excluded; any varices which remain after the termination of pregnancy, may be treated at a later stage. The urine is, of course, examined for albumin and sugar. Septic and foul ulcers, where existent, are "cleaned" as much as possible, by rest, and the application of soaks of a 10% solution of Magnesium Sulphate. When clean, I have found that a wax preparation, such as "Granulogen" is most useful in assisting granulation, when any purulent discharge has ceased. When examining the varices themselves, the examination should be made in both the prone and standing positions. The ramifications of the smaller vessels may be demonstrated by the percussion and breathing tests, described in a previous section, and I have found these tests most useful in noting the effect of treatment.

The Syringe.
Various syringes have been placed on the market for use in this treatment. My own preference is
for one of the "all-glass" type of 5 c.c. capacity (which is made by Woolley & Sons, Manchester), and is fitted with a detachable curved mount, interposed between the needle and the syringe.

The bore of this mount is widened out to form an inspection "window". The purpose of this accessory is to enable the operator to know when he has entered the needle truly into the lumen, by the tentative withdrawal of a few minims of blood as far as the "window". The mixing of blood with the syringe contents in the syringe is thus eliminated. Further, the curved shape of the mount enables the injection to be made with the needle almost parallel to the surface of the skin, transverse puncture of the vessel being thereby almost eliminated. The syringe, mount and needle, are sterilised by boiling. The sketch will help to illustrate the syringe and its accessories.
Needles.

Special needles are also on the market, some of which have a lateral terminal "eye," thus allowing the stream of solution to play on the intima directly. Personally, I have found that short, sharp needles of the Record type quite satisfactory. I have also found needles of the "curved sickle" variety of use in this treatment. (This type of needle, I believe, is largely used for intravenous treatment in specific disease).

Position of the Patient.

The difference in technique between the intravenous injection in this treatment and the intravenous injection for other drugs is due to the fact that it is the intima which is to be attacked in the former, while in the latter, the drug is for general circulation. In varicose vein work, therefore, the drug must be injected in as concentrated solution as possible, and to aid in this, the walls of the lumen, at the site of injection, must be as closely approximated as possible, and enclosing the minimum amount of blood at this point. The patient may either stand, sit, or lie down during the actual injection.

Standing.

While standing, the vessel's walls are as far apart as they naturally can be, and the lumen is filled to capacity. The sclerosing agent, therefore, does
not reach the walls in as concentrated a solution as possible.

It will be understood, nevertheless, that, where the veins are very small, or difficult to see when prone or sitting, it is practicable to enter the needle with the patient standing, the latter then assuming the sitting or prone position for the actual injection.

The Prone Position.

This position, in my opinion, is the most convenient for both operator and patient. For the former, the light can be easily adjusted, the limb is at a convenient level, and can be easily raised, after the injection, by the patient. This elevation further reduces the blood volume, and assists approximation of the walls.

The one drawback, and in my view, a slight one, is that small veins are difficult to see in this position. A rubber tube tourniquet may, in such a case, be applied, (above the injection site), and released when the needle has entered the lumen, and before the plunger is depressed.

The Sitting Position.

This position is not quite so satisfactory as the prone but rather better than the standing position, at least, from the patient's point of view.

In my own practice, I have almost invariably adhered to the use of the prone position, when the
vessels remained visible in that position. When the vessels are small, however, it is convenient to enter the vein while the patient sits on the edge of the couch. Having entered the needle, the patient can easily assume the prone position.

**The Site of Injection.**

The site of the preliminary injection depends on several factors, namely, the size and number and situation of the varices. Most practitioners appear to advise that the first injection should be made in the region of the ankle, and that subsequent injections should be made at intervals upwards in the vessel's course, (that is, if the varicosity is found to extend as far as the ankle). Personally, I have found that it makes little difference whether the injections are made at "ascending" or "descending" sites, but that thrombosis takes place more commonly in an upward direction.

As a general rule, however, it has been found that it is more methodical, and more convenient, to commence operations as low down as possible, and to follow upwards with the subsequent injections.

When, as may be found in the very advanced type of case, varicose eczema, or ulcer, are present the injection should be made close to such a complication, but, to avoid sepsis, the puncture should be made through healthy skin. (Treves Barber).
The most difficult type of vein to enter, I have found, is the very fine vessel found below the malleoli, and further, that only a few minims may be injected into such vessels (on account of their small capacity). The type of vein which is embedded in an oedematous and brawny leg is also difficult to puncture, but the tourniquet may be employed here with great advantage. In certain cases of this type, the vein may be felt and fixed with the left hand, and puncture effected at the same time.

The Actual Injection.

The site of injection having been selected, the over-lying skin is cleansed with spirit, and then painted with tincture of iodine. It will be noted that the smaller vessels are more easily seen after painting with iodine. The patient being in position, the vein is steadied with the thumb and forefinger of the left hand, and the needle is pushed through the skin alongside the vein, which is then entered. Having proved that the needle eye is really within the lumen by the tentative aspiration of a minim of blood, the injection is made fairly rapidly. Most observers are agreed that too slow injection tends to cause early dilution of the agent, which of course, is not sought for. If, however, the vein walls appear to be thin, or poorly supported, as is found over
the tibial margin, the injection should be made more slowly, to avoid the possibility of rupture and the production of haematoma.

The agent having been injected, the leg is raised, and firm pressure, for at least five minutes, is made over the site of injection and the neighbouring course of the vessel, to assist in the close approximation of the intima, the needle, of course, having been withdrawn. Approximation of the vein walls may also be assisted if, while pressure is made at the same time, a certain amount of traction is made upon the vessel with the forefingers and thumbs. This action may be compared to that of stretching a rubber tube, the available purchase of course not being so great in the case of a vein.

Treves-Barber refers to veno-spasm, by which is meant the contraction of the muscular coat of the vein when a needle is introduced within its lumen. This observation is borne out by the statement of Sicard and Gaugier (32), who have observed, radiologically, that immediately following an intravenous injection, there is following this muscle contracture, an "aspiration effect" produced by the deep veins, and the injected solution is sucked from the superficial vessel. Pressure on the injected vein is therefore maintained for a
few minutes to obstruct, as far as possible, the entrances to the communicating vessels, and to assist in local reaction. When the pressure is released, the puncture may be sealed with a little collodion, and a pad affixed for a few hours with either strapping, or a bandage, to assist pressure.

The Use of the Tourniquet.

When a tourniquet is used to render small vessels more visible, I have found that a rubber tube placed round the thigh, and tied in such a way that a slight pull on one end releases it, is a convenient and efficient type. The arm bag of a sphygmomanometer, also, forms an efficient tourniquet, but the pressure cannot be released so quickly as in the case of the simple rubber tube.

Subsequent Injections.

As in other types of intravenous therapy, the periodicity, and dosage, of subsequent injections depends on the local and general reactions of the patient. If, following the initial injection, (which is a small dose), there has been no general reaction, and the local reaction has been confined to a local thrombosis, without pain or discomfort, the second injection, of greater strength or quantity, may be given at the level of the upper
limit of sclerosis produced by the first injection. The third and subsequent injections are given in a similar manner.

On the average, it has been noted by most observers, that intervals of about a week are the most suitable between injections, and this period appears to be generally adopted.

It is possible, with sodium salicylate, to obtain almost a complete sclerosis of the internal saphenous vein. (Colt: 33).

In this operation, the patient is recumbent, and wears a light tourniquet on the thigh. After the needle is within the lumen of the lowest accessible segment of the vein, the tourniquet is released, and the vessel is emptied of blood by the finger, which is then kept on the vein in the middle of the thigh. A solution of 30% sodium salicylate with 10% sodium chloride added, is injected to the amount of from 2 to 6 c.c. The limb is elevated for a few seconds, and then the patient slowly stands; the finger is removed, and the solution "falls" down into the saphenous vein. This stage is painful. If the patient again lies down, and the limb is again raised, more solution will reach the upper vein. A week after, the whole system is sclerosing from the lower third of the leg to the
middle of the thigh.

The Immediate Effects of the Injection.

The immediate effects of the intravenous injection vary with the agent in use.

**Quinine and Urethane.**

In cases which I have treated with this preparation, there has been little or no complaint of pain. Occasionally, and this was most common on the second day after injection, the patients in some instances, complained of a "tingling" or "burning" sensation in the region of the puncture-site, and a small hard lump would be felt at this point. The "burning" sensation passed off in a few hours, and did not return. Further, I noted that this sensation was more usually marked in cases where the injection had been made over the postero-medial area of the knee, and was not so noticeable when injections had been made elsewhere in the leg. I offer the suggestion that this is due to the fact that this part of the leg is very liable to slight trauma.

**Sodium Salicylate.**

Using a solution of 30% with 10% saline, pain, although never of a very severe character, was experienced by the majority of patients, and commenced within two or three minutes of injection. In some cases it was lancinating in character, in
others, it was described as being cramp-like; in a few minutes, however, the pain disappeared and did not recur.

I cannot find any explanation of this phenomenon, beyond tentative suggestions by some authors that it is due to muscular contraction set up by sympathetic system stimulation, and the absence of an analgesic.

**Sodium Chloride.**

My personal experience with this agent is limited to but two cases, and pain, experienced which was described as severe was by both patients, following injection of 5 c.c. of a 30% solution. The sensation was described as being like "pins and needles," of a severe type, and was felt for a longer period than that experienced with sodium salicylate.

**Complications of Intravenous Therapy.**

Although, personally, I have been up to the present, fortunate in not meeting with them, (except in one instance), one learns, either from the literature of the subject, or from the experiences of colleagues, of certain complications of this method of treatment.

If the syringe contents have not been completely expelled into the lumen of the vein, a few drops may escape into the local tissue on withdrawing the needle and a small slough may develop. (Barber 34.)
Colt (35) advises that

"Where solution has escaped from the vein, the best procedure is to enlarge the puncture wound with a knife point, and to promote evacuation of the escaped solution by gentle pressure."

In his opinion, this necrosis is due to solution travelling along the adventitia, and it may be dangerous if a large vein is involved. These small sloughs are accompanied by pain, and clear up with a few days' rest and local dressings, such as hydrogen peroxide, followed by zinc ointment. The formation of a haematoma, and perivenitis are also possible complications. (Barber 34).

"Haematomata, due to escape of blood from the vein, may be prevented by pressure over the puncture site after the needle is withdrawn. Perivenitis, due to accidental injection into the vessel coats, may be prevented by ensuring that the needle eye is within the lumen."

Rupture of a vessel is also a possibility, due to distension of a thin walled, or very small vein, by the injected solution (Barber 36).
SECTION VIII.

EMBOLISM.

This dreaded "accident" of intravenous therapy has been frequently mentioned as a possible contraindication of treatment, but actual cases on record are difficult to find. O.A. Olson (17), reported in 1927, a case of death following varicose vein injections, and in which a post-mortem examination was performed. The injections consisted of salt and calorose. When the left femoral vein was examined, no thrombi were found, but there were thrombi in the left vein in the tibial region. A thrombus was present in the right internal saphenous vein, and a "broken off end" was also found. The combined thrombotic mass and vein were further found to show the structure of thrombus and phlebitis. The cause of death was, (1), Varicose veins, (2) Phlebitis and thrombosis of the right internal saphenous vein, (3) Pulmonary Embolism. Sicard and Gaugier whose work has been practically confined to sodium salicylate injections, have had no case of embolism in thousands of cases (18). They further hold the view that the explanation of their success, or, rather, freedom from this complication, is due to the difference between the processes of obliteration produced by artificial means, and that produced by natural phlebitis. The former is a chemical, localised, and limited
phlebitis situated in the superficial veins. The latter is of septic origin, diffused and also attacks the deep vessels.
SECTION IX.
PERSONAL WORK.

I now propose to give my own results, and conclusions, derived from a series of cases, and I have endeavoured to reduce these results to figures. The individual cases are given in the appendix.

The total number of cases treated ............... 30
The total number of limbs injected ............... 52
The total number of injections
  (All agents combined) .................... 172

TYPES OF CASES

ACQUIRED GROUP

Total number of cases .................... 21
The Number treated by quinine and urethane ... 15
The Number treated with Sodium Salicylate .... 5
The Number treated with Sodium Chloride ...... 1

CONGENITAL GROUP.

Here the total number of cases ............... 9
The number treated with Quinine and Urethane .. 6
The number treated with Sodium Salicylate ..... 2
The number treated with Sodium Chloride ...... 1

TOTAL NUMBER OF INJECTIONS.

The Total number of injections of Quinine and Urethane ...... 137
The number of injections of Sodium Salicylate . 29
The number of injections of Sodium Chloride ... 6
Average Ages of Patients.  Congenital Type.  Acquired Type.

Male Cases 27½ years  40½ yrs.
Female Cases 30 yrs.  47½ yrs.

AVERAGE NUMBER OF INJECTIONS PER LIMB

With Quinine and Urethane .................. 4
" Sodium Salicylate .................. 2.9
" Sodium Chloride .................. 3

ASSESSMENT OF END RESULTS.

I have endeavoured to group the results from the clinical viewpoint into one of three groups, namely

VERY GOOD, GOOD, and FAIR.

VERY GOOD RESULTS.

A very good result is the term I have adopted for those cases where, three months after the last injection, there was no sign of the pre-existing varix except faint "streaks," combined with the disappearance of all symptoms, and where absence from employment had not been incurred.

GOOD RESULTS.

This result is defined as one, in which the limbs, while showing no signs of varix 3 months after treatment did not present a very good result from the aesthetic point of view, i.e. where very visible reddish coloured streaks marked the site of the sclerosed veins.
FAIR RESULT.

In this group, are those cases in which while there was some improvement in the previous condition, the perfect result was not attained, or the result was not so satisfactory as was anticipated, i.e. no improvement or healing of an ulcer. These results were as follows:

<table>
<thead>
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<th>TYPE of CASE</th>
<th>V. GOOD</th>
<th>GOOD</th>
<th>FAIR</th>
</tr>
</thead>
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<td>15</td>
<td>1</td>
</tr>
<tr>
<td>CONGENITAL (9)</td>
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<td>1</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>AGENT USED</th>
<th>V. GOOD</th>
<th>GOOD</th>
<th>FAIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUININE-URETHANE</td>
<td>13</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>SODIUM-SALICYLATE</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SODIUM-CHLORIDE</td>
<td>1</td>
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</tr>
</tbody>
</table>
SECTION X.

SUMMARY.

After considering the results of treatment of varicose veins by intra-venous therapy in these few cases, and in fresh cases which are always coming under treatment, I can come to no other conclusion than that here is a new and powerful weapon in the armamentarium of the practitioner, with which he can do much to alleviate a very common complaint. I submit that there is no question of the efficiency of this treatment; and that, it is now the accepted method of treatment. A significant fact is that it is now accepted by the National Health Insurance Committees in this country, and that its application is "within the range of treatment expected of the Panel practitioner."

When first introduced, many objections were raised; chiefly mooted being the possibility of sepsis and embolism. As agents and technique have improved, however, and clinical results have been noted and summarised, it appears that these dangers are now more supposititious than real. In this connection, Douthwaite, (38) has recorded that he has given over 6000 injections without embolic mishap; and he concludes that this is testimony to the intravenous treatment.

Literature on this subject is rapidly accumulating, but few, if any, of the authors give a guide to the
inexperienced as to the choice of drug. Each author appears to stress the claims and advantages of one drug to the almost total exclusion of others. To my mind, this point is one which requires more authoritative conclusion and research. From the standpoint of the general practitioner, no definite lead has been given in the methods of selection of the drug to be used. The modern treatment, having been introduced on the large scale, with quinine and urethane, and sodium salicylate, I have naturally used these agents in my practice, and in my opinion, this choice has so far been justified. The end-results of the exhibition of these has been equally effective in both instances.

The Effect of Treatment on the General Symptoms.

Without exception, I have found that all the patients who have undergone this treatment have reported that the sensations referred to the lower extremities, such as cramp, heaviness, and fatigue, have been cleared up completely. As a consequence, they have been fitter for their work, and have felt less fatigued at the end of the day. A feeling of improved well-being was reported by some of the patients, and it is my belief that this was due to partly the relief obtained from their previous symptoms, and also partly from the psychological effects of "treatment with a needle." It is interesting to note in this connection that Colt
makes the suggestion that "possibly, the obliteration of the varices may have a definite effect on the blood pressure, and especially on the diastolic pressure in older people" (37).

Itching and redness of the skin over varices definitely cleared up, and did not return, and this relief was described by the sufferers as being great. Further, as the direct result of treatment, oedema of the lower thirds of the legs disappeared. In three cases in which varicose ulcers were present, there resulted cure in two, and great improvement in the third. The latter was a case of many years' standing.

From the figures which I have given, it will be noticed that a greater number, on the average, of injections with quinine and urethane, is necessary to produce the same amount of sclerosis, as in the case of sodium salicylate. This experience I have also found to have been borne out by fellow practitioners. Another point, in my opinion, although it is a minor one, is that the total amount of fluid to be injected is smaller in the case of the former than the latter. Finally, it is my experience that, taken all round, the results with quinine and urethane are better than those obtained with sodium salicylate.

In the light of the available clinical pathology of the treatment, it is impossible to conclude
whether the extended action is due to the sodium salicylate itself, or to the larger body of fluid injected. There may be some difference in their respective actions which is controlled by the "blood variables" referred to by Colt (39), the blood volume and current at the point of injection. From a perusal of the literature of the subject, it is obvious that it is upon their high concentration in the vessels at the point of injection, that the efficiency of the results depend.

With this point in view, therefore, it is easy to appreciate the importance of keeping the walls of the injected vessel in as close approximation as possible, during, and after, the injection.

As regards the use of sodium chloride solutions, while Barber asserts that this drug does not produce pain, the two cases in which I used it, suffered sufficient pain to induce me to discontinue its use. I have further found this very limited experience to be borne out by other practitioners, who likewise have discontinued its use. This is an age in which pain, in association with medical and surgical treatment, is badly tolerated, by patients, who, naturally, look for its elimination, where possible. The inclusion of urethane with quinine solution has not in any of my cases led to mishap, and it is interesting to note that Sicard and Gaugier employ both cocain and novocain in a salicylate solution.
for the treatment of haemorrhoids. (8).

Up to the present, the use of quinine and urethane, or sodium salicylate, in my practice, has not been productive of any untoward results.

I think it will be agreed that, at the present time, at any rate, that the ideal method of standardising this treatment has not been produced. Also the ideal agent has yet to be discovered and the exact clinical pathology standardised.

Perhaps, in these days of instruments of precision, it is not too much to hope for the calculation of the relative volumes and carrying capacities of the deep and superficial veins, developed, as suggested by Colt (13) along the lines of the plethysmograph.

The merits of this intravenous method of treatment may be shortly summed up in the following:

1. The treatment is ambulatory, and the injections take up little time of either patient or medical man.

2. It does not require special apparatus.

3. If sufficient attention be paid to the technique, the treatment is a "safe" and practical method.

4. I have found quinine and urethane to be the most suitable preparation for use in general practice to date.

5. The treatment is an economic one; that is,
it is "prophylactic," as well as curative, in the vast majority of cases, as treatment may be commenced at an early stage of the condition; and the possible sequelae of varicose veins prevented.

6. The results are permanent.

7. It replaces the older methods of surgery with their greater risks.

I submit, therefore, that the time is not far distant, when the crippling and very prevalent condition of varicose veins of the legs, will become one which its sufferers will not tolerate as they do at present, and one for which they will quickly seek relief. To both the patient, and the doctor, the relief and satisfaction will be mutual.
SECTION XI.

Notes of Cases.

In this section, I have grouped together all the cases treated with quinine and urethane first, those treated with Sodium Salicylate second, and those treated with Sodium Chloride third. The syringe and needles used were of the type described in a previous section.

As mentioned before, the cases total thirty in number, but the similarity between cases of varicose veins of the legs, and the similar routine employed in the injection treatment, tend to produce somewhat dull reading. In an attempt at compactness, I have omitted all irrelevant facts concerning the general condition of the patient, unless any of these have actual bearing on the case. For the same reason, names have been omitted, and the patients' sex indicated by the capital M or F; the dates of treatment have been replaced by a statement of the number of injections given, with their intervening periods.

As regards the dosage of quinine and urethane, I would mention here that the same dosage was used throughout this section, namely Quinine Hydrochloride 0.26 grammes, Urethane 0.13 grammes, and distilled water 2 c.c. In each case, an initial injection of 0.5 c.c. was given to exclude the possibility of
idiosyncrasy, or abnormal reaction.

Cases treated with Quinine and Urethane.

A. The Acquired Group.

Case I.

Miner: aet. 32 yrs: General health good: previous history - nil.

Local condition: Left leg: A bunch of varices 2 ins. below the knee. Right Leg: A similar, but smaller, bunch below the medial aspect of the knee. Duration: five years. Slightly resistant to pressure, the vessels were quite palpable in the horizontal position. A large vessel extended from the mid-lower third of the left leg's medial aspect to join the "bunch" higher up.

Treatment: 0.1 G. Quinine hydrochloride, 0.05 G. urethane in 1 c.c. of distilled water, injected at lowest point of the vessel described. No immediate or delayed, local or general reaction.

Seven days later, there was noticed thrombosis as far as the upper third of the leg in the injected vessel. At this session, 0.2 G. of Quinine Hydrochloride and 0.1 G. of urethane, were injected in 2 c.c. of distilled water at the upper limit of the observable sclerosis. Two further similar injections were given at seven day intervals. One week after the
last injection, it was found that the entire varix was almost invisible save for some reddish streaks. A similar procedure was followed in the right leg, and here only two injections were necessary to produce obliteration of the lumen. Seen one month later, there were no signs of varices in either limb, and on palpation, thin, hard and incompressible "vessels" were felt, somewhat reminiscent of sclerotic arteries post-mortem.

**Progress.** He has had no re-appearance of vessels or symptoms. Previous to treatment, this man had been refused admission to the railway service on account of his varices, but since treatment, he has been accepted. **Total number of injections, six.**

**Result.** Very good.

### Case II.

Housewife aet. 40 yrs: G.C. Good. **Local Condition:** Right leg: Large and tortuous vessels of the great saphenous group. Oedema of ankle. Throbbing in foot at night. Left Leg: Small varix in middle third of the small saphenous Group. Elastic bandages worn.

**Treatment.** Quinine Hydro-chlor. 0.2 G., Urethane .1 G., distilled water 2 c.c. **Interval** Seven days - four injections
in the right leg, two in the left leg.

**Progress.** Disappearance of both varices. The oedema improved after the third injection and has not since returned. Bandages discarded and can stand "all day" without the fatigue of which she formerly complained at night. **Result.** Very good.

**Case III.**

**Silkworker:** M: aet 39: G.C: good.

**Local Condition:** **Left Leg:** A large varix (Gt. saphenous group) from int. malleolus to inner aspect of knee joint, accompanied on either side by two smaller vessels, not so varicose. **Right leg:** A small "bulbous" varix of the Gt. saphenous vein over the internal condyle of the tibia. Some oedema of the left ankle present.

**Duration:** Had always had a "big vein" on the left leg, but none on the right leg. Had become worse in the past two years his work involving the erect posture for seven hours daily.

**Treatment:** Quinine and urethane as before, with seven day intervals between injections. **Right leg:** four injections; left leg: one injection.

**Result:** Very Good, which has since been maintained.
Case IV.

Housewife: aet: 45 yrs; G.C.: good;

Local Condition: Since the birth of her last child, sixteen years ago, she had had "large veins in both legs." Both Gt. Saphenous veins were affected and very dilated and varicose vessels were noted. Both feet and lower legs oedematous, and she complained of "heaviness and aching", in both limbs from mid-day onwards; for three years she had worn elastic or crepe bandages.

Treatment: Quinine and urethane at seven day intervals. This case required four injections in each limb. After the last injection in the right limb, a small area of necrosis, the size, roughly, of a pea developed four days later. A small slough separated following dressing with hydrogen peroxide; healing was assisted with dressings of zinc ointment. Tenderness along the thrombosed area was noted, but below the site of injection. I formed the conclusion that in this case a small rupture of the vessel coats had taken place, as at the site, (over the tibial margin), the vessel was poorly supported.
Progress: Three weeks after the conclusion of treatment, the vessels had practically disappeared, and oedema was quite absent. Long walks could be taken with comfort.

Result: Good.

Case V.

Miner: aet. 33 yrs: G.C.: Good:

Local Condition: Right leg: Intern.Saphn. vein markedly varicose and much "thickened", the varix extending to about 3 ins. above the knee.

Had had a slight abrasion over the lower third of the tibia (ant. margin) about six weeks previous to consultation. This abrasion had never healed, altho' it was "clean" and there were no signs of sepsis. The Wasserman reaction was negative.

Treatment: The abrasion was thoroughly "cleaned up" with Eusol soaks and hydrogen peroxide. The initial injection of quinine and urethane was made about 2 ins. proximal to and in a downward direction to the abrasion, the total quantity being .5 c.c. The patient had neither local or general reaction, beyond slight smarting in the region of the ankle. Further
injections were made at seven day intervals, the total number being three, after which it was found that the abrasion had healed, and that the varix was satisfactorily sclerosed in its visible entirety. I have no doubt but, that without treatment, this case would have eventually become one of varicose ulcer.

Case VI.


Local Condition: Both legs were very swollen and the skin was thickened, especially over the lower thirds where it was slightly pigmented and showed evidence of scratching, the itching at night, when in bed, being severe. On the lower third of the left leg, a large and typical varicose ulcer was situated. The surface of the ulcer was studded with yellowish, unhealthy-looking, granulating "islets". The veins in this case were more easily palpated than visible, and were resistant and somewhat painful to pressure. In short, this was a case of typical old-standing varicose ulcer.
Treatment: As in the previous case, the ulcer was "cleaned up" as much as possible surgically, by a few days' rest and the application of Eusol and Mag. Sulphat. soaks. The first injection, of .5 c.c., was injected into two veins, one above, and the other lateral to the ulcer, and as close to the latter as healthy skin would allow. One injection was made weekly, and, in seven weeks, the ulcer, which, at its widest part, was about three inches in diameter, was reduced to a shallow area of less than one inch in diameter. Up to date, however, this area has not healed. Two injections were then made into the left leg, of 2 c.c. each.

Duration of Treatment. Eight weeks.

Result: Fair. Little more than this could be hoped for, on account of the poor general condition, and also because of the difficulty of finding veins, even with the patient in the erect posture. A certain amount of the oedema was relieved, and the itching was definitely lessened.
Case VII.


Local Condition: Right Leg: From a point in the middle of the calf of the leg to a point over the medial condyle of the femur, the internal saphenous vein ran a very tortuous course. This vein had "appeared during her last pregnancy" (8 years previously), but had become worse during the last year. The limb felt "heavy", especially at night.

On the lateral aspect of the left leg was a small varix, about four inches in length, (Ext. Saph. Vein), commencing about two inches above the lateral malleolus.

Treatment: 2 c.c. of Quinine and urethane at weekly intervals, three injections being sufficient to sclerose the left varix, and two the right varix.

Duration of Treatment: Five weeks.

Result: Heaviness and fatigue completely relieved, and altho' rather unsightly reddish streaks were left to mark the course of the veins, the entire result was very satisfactory.

Case VIII.


Local Condition: Left leg: a marked
varix of the int. saph. vein extending from the middle of the leg to the middle of the thigh. Very thickened to the touch, along its course could be felt small shotty swellings in the vessel coats, the result of an attack of phlebitis seven years before.

Treatment: In this case, five injections (of a total of 3.5 c.c.) were necessary to produce sclerosis. After each injection, there was some slight discomfort in the leg and transient swelling of the foot which persisted for two or three days, and then subsided.

Result: After five weeks treatment, a satisfactory result, although a rather prominent cord-like vestige was left.

Case IX.


Local Condition: Left leg: a large varix of the Int. Saph. Vein commencing three inches above the med. malleolus and ascending to the inner aspect of the knee, and joined by many fine tributaries from the posterior aspect of the leg.

Right Leg: A small bunch of veins over the med. condyle of the femur. Duration: since discharge from the Army in 1919.
Treatment: Right leg: Five injections of quinine and urethane each of 2 c.c's.
Left Leg: Two similar doses.
Duration of Treatment: Seven weeks.
Result: Good — with the exception of some of the finer vessels.

Case X.

Housewife: aet. 51 yrs: G.C.: with the exception of Chronic asthma, nothing of note.
Local Condition. Both legs showed a knotted bunch of veins situated in their upper and inner aspects. No oedema, but some itching and fatigue out of proportion to her work.

Treatment: Four injections in each limb.
Duration of Treatment: Eight weeks.
Result. Good. There was complete disappearance of both itching and fatigue, although the reddish vestiges of the veins were left. Three months afterwards, however, these streaks also had disappeared.

Case XI.


Local Condition. Left leg: A large int. saph. varix from medial condyle of femur to saphenous opening. Developed since confinement (two years previously).
Treatment: The initial injection of 1 c.c. in this case produced sclerosis for a distance of nearly three inches. Two further injections were sufficient to obliterate the varix.

Result: Good, although after the second there was slight tenderness and redness in the middle portion of the vein and which persisted for four or five days before subsiding.

Case XII.


Local Condition: Both legs showing thickened and tortuous vessels of the int. saphenous group, varices were more marked on the left leg than on the right.

Duration: About five years, but fatigue had become considerable of late, especially at night.

Treatment: After three injections, the condition of the left leg was equally improved, and in four weeks, the right leg, also, had improved. Duration of Treatment: Eight weeks.

Result - Good, but rather unsightly thickened cords marked the course of the vessel.

Fatigue, however, was removed.
Case XIII.

Local Condition: Right Leg: Varices extending from medial malleolus to medial condyle.
Left leg: A small vessel running for about three inches over the posterior aspect of M. gastrocnemius, and having a well marked ampulla in its course. Had no symptoms but had had mild phlebitis following an injury.

Treatment: One injection of 1 c.c. Quinine and Urethane produced thrombosis in the left leg vessel. This injection was followed by pain and slight redness on the second day, but at the end of the first week, this had cleared up. The right leg was then treated, with four injections, after which these varices were well sclerosed.

Duration of Treatment: Five weeks.
Result: Good.

Case XIV.

Local Condition: Left leg: very marked oedema of the lower third with thickening
and redness of the skin thereon. In short, a leg in the pre-ulcerous condition.

Right leg. Also markedly oedematous, but the lower int. saphenous vein only was varicose.

Treatment: Quinine and urethane - four injections necessary in each limb, with slight local reaction in the case of the left leg following the second injection.

Duration of Treatment: Nine weeks.

Result: Disappearance of itching and oedema. The skin remained thickened.

Case XV.


Local Condition. Left leg: A single varix (int. saph. group) from lower third of leg to middle of thigh, and very tortuous indeed.

Right leg: A smaller int. saph. varix situated below the medial condyle.

Treatment: Left varix: three injections of Quinine and urethane. Right varix: one similar injection. Duration of Treatment: Six weeks.

Result: Good.
I will now conclude the "Quinine and Urethane Cases," by giving the series of Congenital Cases treated with this agent.

Case I.

Local Condition: Left leg: A prominent varix from the medial malleolus to the mid-leg.
Right leg: a smaller vessel running from the lower margin of the knee to the medial condyle.
Both varices soft and easily compressible.
Treatment: With the former procedure and dosage, four injections produced thrombosis in the left leg, and three in the right leg.
Result: Very Good; two months from the last injection, both legs were normal in appearance.
Duration of Treatment: Eight weeks.

Case II.

Local Condition: This man's legs presented an extraordinary appearance. Down to the lower third of each leg, the appearance was normal. At this point, the lower legs and ankles were equal in circumference to the calves. The skin was bluish in appearance, but not pigmented. A small "punched-out" ulcer was situated over the lateral
malleolus of the left leg (which, he said, was the result of a kick).

The base was granulating, but unhealthy. A small ulcer also was found on the medial malleolus of the same leg. The veins of both legs were enlarged and turgid, but not in the true sense, varicose. They were soft and easily compressible. The case was suggestive of Bazin's Disease; the general health was good and the Wassermann Reaction was negative.

Treatment. After six injections in the left leg, and five in the right, there was a marked improvement in both legs. The swollen ankles and both ulcers, after three months were reduced in size to almost normal proportions. The smaller ulcer healed rapidly — in two weeks — but the larger ulcer was barely closed in six weeks from the first injection. Since then it has closed, and to date, has remained so. During treatment, the patient did not miss a day's work.

Duration of Treatment: Three months.

Result: Good. This man's sister (who is not a patient of mine,) had, he informed me, "a similar pair of legs", and also, his mother had "suffered from them all her life."
This would appear to be a case of heredity. As his work involved a cycle journey of 6 miles daily, his condition in a few years would have probably been serious.

Case III.


Local Condition: Both legs showed large and tortuous veins on both posterior and medial surfaces. He had "noticed the first" when about the age of 17.

Treatment: The amount of sclerosis produced in this case by each injection, was small and as a result seven injections were required in the right leg, and three in the left leg. Some pain in the knee region of the left leg was reported on the second day following the second injection.

Duration of Treatment: Two and a half months.

Result. Very Good.

Case IV.


Local Condition: On the inner aspect of both legs, and also on the postero-lateral area of the lower third of the left leg, were three or four very dilated vessels, which were also tortuous.

Treatment: Right leg: from injections.
Left leg: five injections.

Duration of Treatment: Eight weeks.
Result: Very Good.

Case V.


Local Condition: A large dilated int. saphenous vein from medial malleolus to medial condyle of the right leg, very prominent in the erect posture and almost invisible when prone.

Treatment: Thrombosis of the whole vessel obtained by their injections at weekly intervals.
Result: Very Good.

Case VI.

Collier. aet 27 yrs. G.C.: Good.

Local Condition: A large vessel from ankle to middle of the medial surface of the right leg.
On the left leg, a similar vein from the medial condyle to the upper third of the leg.

Treatment: Right leg: five injections.
Left leg: four injections.

Duration of Treatment: Ten weeks.
Result: Very Good: on the left leg was left a thickened vestige similar to those
seen in the acquired group, but which disappeared eventually.

This concludes the series of cases treated with Quinine and Urethane, and I will now present those treated with Sodium Salicylate. Totalling seven, five belong to the Acquired Group and two to the Congenital Group. The solution used in all cases was of 30% concentration (10% Saline) the amount injected varying from 3 c.c. to 6 c.c. according to the size of the vessel.
Acquired Group.

Case I.

Collier age 47 yrs: G. C.: Good.

Local Condition: In each leg, both internal and external saphenous veins were varicose and much thickened. There was itching and swelling of both ankle regions. The varices were more severe in the case of the external saphenous veins.

Treatment: Within one minute from the first injection, (3 c.c.) a "stinging" pain was felt in the calf muscles, but which disappeared in the following few minutes. Seen one week later, thrombosis was found from malleolus to a point midway up the leg. A second injection of 5 c.c. at this point produced thrombosis as far as the mid-thigh. A momentary pain was again felt immediately following this injection. The following week, the external saphenous vein varix was sclerosed by a single injection of similar concentration and volume. The Right leg was treated in a similar manner, and six weeks later, both limbs were normal in appearance.

Total Number of Injections: Six.

Result: Good.
Case II.

Collier. aet 41 yrs. G. C.: Good.
Local Condition: Right leg: varicosity of Int. saphenous vein from internal malleolus to inner aspect of knee.
Left Leg: Smaller in size, the varices were situated mostly on the medial surface. Since discharge from the Army, the veins had "become larger."
Treatment: Injections of 5 c.c. of 30% solution at weekly intervals, each followed by slight pain.
Result: Good.
Number of Injections: Five - three in the right leg, and two in the left leg.

Case III.

Had been confined to bed for a month following her last confinement (16 years previously).
Local Condition: Right leg: A thickened and varicose vein running from internal malleolus to medial condyle. Lower leg and ankle was somewhat oedematous.
Left Leg: The condition here was confined to the middle leg and to some very fine vessels over the anterior surface of the ankle.
Case IV.

Local Condition: Right Leg: A single varicose vein, (int. Saph. v.) form a point above the medial malleolus to the centre of the thigh.
Treatment: Four injections of 4 c.c. each.
Result: Good – a very thickened and tough vestige was left.
Total number of Injections: Four.
Severe pain after first injection, but little after remaining three.

Case V.

Local Condition: Right Leg: The lower third was very swollen and somewhat oedematous and the skin thickened and reddened – the pre-ulcerous condition. The veins were easily felt, but almost invisible.
Left leg: A similar condition existed here but there was not so much oedema. Much fatigue was felt at night.
Treatment: Right leg: Three injections
of 4 c.c. each were given, and after each there was pain of a stinging smarting description, but which passed off within an hour after injection.

Left leg: One injection.

Result: Good. In this case, fatigue disappeared, and the redness of the skin on the lower leg cleared up, but there was only slight improvement in the size of the lower legs.

Total Number of Injections. Four.

Congenital Cases.

In the two following cases, only one limb was affected in each case.

Case I.


Local Condition: Right leg: A prominent varix extending from medial malleolus to medial condyle, disappearing in the prone position, but very prominent when erect.

Treatment: 4 c.c. of a 30% Solution was injected and was followed by stinging pain of a transitory nature. A second injection was given one week later.

Result: Good.

Number of Injections: Three.
Case II.

Local Condition: Left leg: A varicose internal saphenous vein from medial malleolus to hind-thigh. Varicosity more marked below the medial condyle, while the remainder of the vein was diluted and the walls were thin, and easily compressible.
Treatment: Using a 30% solution three injections of 5 c.c. were 9 min. Pain here was moderate.
Result: Good.
The two cases which I have treated with Sodium Chloride now follow. In both cases, a 30% solution was used.

Case I.

Local Condition: A large and prominent varicose vessel appeared at the junction of lower and middle thirds of the left leg, and extended to the medial condyle. The external saphenous vein was not affected. This man's work entailed many hours of standing and physical effort in a stooping position.
Treatment: 5 c.c. of a 30% solution of Sodium Chloride were injected into the lowest accessible portion of the varix. Pain was felt within thirty minutes and a sensation of recurrent cramp was described. This manifestation persisted for three hours, and gradually passed off. The vessel was painful on pressure at this time. Two further injections of 5 c.c. each were given in the following fourteen days, and pain was experienced after each injection. There was no sign of local sepsis, or escape of solution.

Result: The vessel was thrombosed, but an ugly vestige was left.

Duration of Treatment: Three weeks.

Case II.

Collier: aet. 27 yrs.: G. C. : Good.
Local Condition: The left leg showed a varix of the congenital type - a soft dilated and slightly varicose vein. It "had always been prominent."

Arising just proximal to the medial malleolus this varix of the internal saphenous vein terminated in the thigh just above the medial condyle.

Treatment: Three injections of 5 c.c.'s each
of a 30% solution were given at weekly intervals. The pain which followed the final injection was quite severe in character, while there was also considerable discomfort after the preceding two injections.

Result: The end result was good, but in this case the patient had to cease work for one day following the final injection.

Duration of Treatment: Three weeks.
SECTION XII.

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