# THE INJECTION TREATMENT OF VARICOSE VEINS *

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The varicose veins under discussion are those abnormally dilated, superficial veins of the lower extremity. These and conditions resulting from them are a frequent cause of disability in adult life, and any advance in their treatment is important.

The two saphenous systems are the most common to be involved. The great saphenous vein begins on the dorsum of the foot, passes just anterior to the medial malleolus, up the whole length of the medial aspect of the lower extremity to the fossa ovalis. The short saphenous vein passes behind the external malleolus up the posterior aspect of the calf to the popliteal space. These vessels may be multiple and are simply the main trunks of an elaborate network of superficial veins resting in the superficial fascia. It is easier, therefore, to refer to these veins as the greater and lesser saphenous systems. Most of the varices fall into one of these two groups. There are numerous communicating veins between these and the deep veins, especially below the knee. All these vessels are normally supplied with valves composed of single or double cusps, preventing the reverse flow of blood from the hydrostatic pressure in the erect position. Trendelenburg apparently was the first man to emphasize the backward flow of blood in varicose veins. The reflux of venous blood in these large varices without valves is apparently the underlying cause of the deficiency in the nutrition of the involved extremity. If the valves in the communicating veins are also incompetent, as is frequently the case, a vicious circle in the venous circulation is established. Blood escapes from the deep veins through the communicating to the superficial varices. Here, instead of passing upward, it again goes peripherally to be returned to the deep veins to continue the same cycle. It is obvious that this would deprive the superficial tissues of almost all normal circulation and nutrition. Obliteration of the varices breaks the cycle, and immensely improves the circulatory situation. Doctor McPheeters of Minneapolis has recently done some very interesting work on this reverse circulation by observing under the fluoroscope the course of intravenous lipiodol injections. There is no doubt that this is the situation behind many varicose ulcers, and explains the striking benefit often obtained by chemical sclerosis of the neighboring varices. A valuable advantage of this treatment is that one does not hesitate to inject a vein near an ulcer, while excision in such a field would be unwise.

The deeper veins have the support of the muscles. Without some complicating pathology such as phlebitis, back pressure from above, and so forth,

* Read before the Surgical Section of the New York Academy of Medicine, October 4, 1929.

they are rarely involved in the varicose condition of the superficial veins, which have no support. The compression effect of the muscular contractions on the deep veins with competent valves forces the blood towards the heart. This has been demonstrated to be one of the most important factors in the venous circulation of the lower leg, and, of course, is absent in the superficial veins.

The injection treatment of varices seems to date back to the invention of the hypodermic syringe in 1851 by Doctor Pravaz of Lyon. He and rather numerous subsequent workers did considerable work along this line, using strong coagulating and corrosive solutions, such as ferric chloride, iodotannic acid, alcohol and phenol. These solutions which coagulated the blood were early recognized as dangerous, and the treatment was never prevalent or accepted. Sixty years later, in 1911, Professor Linser, of the Tübingen Skin Clinic, noticed the 1 per cent. solution of bichloride of mercury injected in syphilitic patients frequently resulted in firm obliteration of the veins used. He used this solution to sclerose varices with considerable success, and despite its toxic effects, it is still used by a few. Professor Sicard of Paris about the same time used an aqueous solution of sodium salicylate with ideal results, and his work has done more to popularize the treatment than that of any other one man. In 1928 he published a series of 325,000 injections without a single pulmonary infarction. Within the last few years, the chemical obliteration of varices has been taken up by a great many men scattered all over Europe and this country. Its safety and value are now well established.

Numerous solutions have been introduced and which one is ideal is still disputed. Since 1923, 20 per cent. sodium chloride aqueous solution is used in the Tübingen Clinic instead of the original toxic mercuric bichloride solution. Concentrated sugar solutions are effective and popular. Doctor Genevrier in 1921 introduced a now extensively used mixture of solutions of the hydrochloride of quinine and urethane. We have used for almost all our work a 30 per cent. aqueous solution of sodium salicylate, which is made up and sterilized in ampules in the chemical laboratory of the Roosevelt Hospital. Our experience with the other popular solutions has not been sufficient to allow an authoritative discussion of their relative merits. We have been quite satisfied with our results from sodium salicylate. A 5 c.c. injection of 30 per cent. sodium salicylate almost never fails to give a good firm sclerosis of the vein for a very considerable distance even in large varices, and it is our impression that more can be accomplished in fewer injections with this solution than with any other. The obliteration of the vein is rapid, positive, firm and permanent. It has the distinct disadvantage of causing a severe cramp shortly after its injection, which lasts about one minute. Like most of the other solutions, it will cause a slough of tissue if it gets outside the vein in any considerable amount. Quinine and urethane solutions have the advantage of causing no pain following injection. Doctors Kern and Angle of the Johns Hopkins Clinic consider a mixture of equal parts of 50 per cent. glucose and 30 per cent. sodium chloride the ideal solution, because it will

not cause a slough if it gets into the tissues, but we have seen sloughs result from this mixture. None of these solutions coagulate the blood, but depend for their action on an irritative and destructive action on the intima of the veins.

Considerable study has been made of the pathology shown by sections of the veins excised at various intervals following injection treatment. The irritating solution causes a necrosis of the intima. A fibrin deposit, inflammatory cells, and blood clot obliterate the vein lumen in two to four days. A growth of fibroblasts into the fibrin and clot firmly organize it and eventually the vein is converted into a fibrous cord, almost nothing of the original vein structure remaining. The entire process requires several weeks.

Careful comparative studies have been made of the surgical excision and injection treatment of varices. Doctor McPheeters of Minneapolis and Doctor Kilbourne of Los Angeles have recently published extensive statistics, their information being obtained from the literature and questionnaires sent out to many clinics and surgeons. Doctor Kilbourne reported one death from embolism in every 250 cases operated upon, in a series of 4,607 cases. Doctor McPheeters reported almost the same proportion of fatal pulmonary emboli in 6,771 operated cases, and claimed other complications such as pneumonia, brought the operative mortality almost to 1 per cent. Only four authentic cases of pulmonary emboli have been found in injected cases, and almost 400,000 injections have been reported in the literature. Probably all of these four occurred in cases where the injection was done in the presence of a thrombophlebitis, the existence of which is a definite contraindication to the injection treatment.

The results of the chemical treatment are better. Doctor Kilbourne reports 30 per cent. unsatisfactory results in his reported operated cases and Doctor McPheeters about 20 per cent. Charges have been made that the injection treatment does not give a permanent sclerosis, but this has not been our experience. We have seen only four definite recurrences in our cases followed up to eighteen months. Doctor Kilbourne finds the recurrences in injected cases 6 per cent. New varices occur more often than this, but these are not recurrences of the old varices, and simply mean the underlying cause of the condition is still present. As they occur, it is a very simple matter to inject them, while a second operation is quite a different consideration. The injection treatment is, therefore, safer and gives better results than the surgical excision. No disability is involved in the chemical treatment. The patients continue with their regular work immediately as contrasted to hospital confinement for an average of 15.1 days and an average disability of 34.8 days. No anæsthesia is required, no scars result, the discomfort is less, and the relative cost is smaller.

The details of the technic we have used in our cases are extremely simple, and no special equipment is required. The same needles used to administer salvarsan are employed. They should be sharp and have a rather short bevel. A long bevel on the point predisposes to some leakage of the fluid into the tissues. The ampules of 30 per cent. sodium salicylate solution, a 10 c.c.

glass luer syringe and rubber tubing tourniquets complete the equipment. The site of injection is selected with some care. One must remember that if the leg is dependent, the blood current is reversed, and much of the sclerosis will be below the site of injection. We begin with the lowest varices. Usually at least six to eight inches of obliteration results from each injection of 5 c.c. of solution. If a group of varices involve the entire length of the lower leg, the first injection would be placed about midway between the knee and the ankle. The position of subsequent injections depends upon the results of this first. We have been giving only one injection at one treatment, and waiting to see its full effect before giving the next one. This usually requires almost a week, and it does no harm to wait much longer. Done in this way, rarely more than three or four injections are required to treat completely an extremely involved extremity.

The patient sits on the side of an examining table with the legs hanging over, and a tourniquet is placed loosely above the varices to make them distend further, and the solution is injected into them in the same manner as any intravenous medication is administered. To insure the needle is squarely in the lumen of the vein, it is a good plan to let a little blood flow back into the syringe several times during the injection. The salicylate solution does not coagulate it, and it does no harm to inject the mixture. While and after the needle is withdrawn, firm pressure is maintained at the site of injection to insure against leakage. In a few seconds, a severe cramp occurs, and its location gives some clue as to the diffusion of the sclerosing fluid. With the legs hanging over a table and a tourniquet above the varices, it is usually mostly below the injection point. As soon as the cramp sets in, we remove the tourniquet and allow the patient to lie down on the table. The cramp only lasts about a minute, and no further discomfort is felt by the patient except more or less soreness in the treated vessel until the process is complete. A firm bandage is applied to keep the veins collapsed and should be worn continually until the veins are well obliterated. This is an important point. If the veins are kept quite empty it is frequently difficult later to tell where they were, but if they are allowed to thrombose in the distended condition, they become hard, tortuous, tender swellings which feel like the veins of an infectious thrombophlebitis, and may be troublesome for a considerable period of time. Such a vein may be obliterated from the circulation, but it may be difficult for a time to persuade the patient they have not been made worse by the treatment. Eventually these cases get a good result, but it takes much longer than in those cases where the veins were kept collapsed in the early stages of the process.

The less blood in the vein at the time of injection, the more concentrated and thorough will be the application of the medication to the intima. For this reason, some have attempted to inject them in a collapsed condition. This can be accomplished by having the patient flat, and using tourniquets loosely applied a little above and below the varix under treatment. The needle is inserted with the vein distended. An assistant then evacuates the veins by pressure or elevation of the leg and applies the tourniquets before the injection

is made. Except in very large varices, this is not necessary, and it is much easier to get some leakage of salicylate solution when working with collapsed veins. Occasionally one encounters extremely large varices which are almost like blood sacs, and it is necessary to follow the above technic to get a good result.

The patient, after being bandaged, can resume his or her regular duties without restrictions. They complain of soreness in the treated veins, but no other disability.

We have treated up to date 218 patients, and have given about 500 injections in 306 legs. Forty-eight of these cases we have been able to follow more than a year, and in all these the sclerosis has been so far permanent and satisfactory. All the other cases were injected less than a year ago, or have been lost. Some have returned with new varices. This is hardly an indictment of the treatment, as it means simply that the original predisposing factors to varices are still present, and no one claims the treatment influences these factors. It is a simple matter to inject these new varices, as they are usually only one or two small groups after the main trunks have been removed. I have seen a small number of veins recanalize, nearly all in cases of large varices not well bandaged after treatment, so thrombosis occurred in the distended condition. These were all early cases in the series, and re-injection has given a good result.

Like all treatments, it has limitations and contraindications. It will accomplish easier and better than surgery the removal from the circulation of any superficial vein which we may wish to remove. The end result, as far as the circulation is concerned, is the same as surgical excision, and the procedure is so simple that it can be done with safety in all sorts of cases in which surgery would be undesirable. There are very few factors to be considered except what is to be accomplished by removing the veins in question. Age, general debility, infected ulcers, and so forth, contrasted to surgery, are not contraindications. It is universally agreed it should not be done in the presence of any infectious thrombophlebitis, new or old. The extremely rare reported instances of infarction occur in these cases. Large veins in such cases are frequently compensatory dilatation of the veins instead of true varices. In treating ulcers, it is always to be remembered that many other causes besides the varices are frequently present. Arterial disease, diabetes, syphilis, and so forth, are sometimes factors and they all should be considered before injecting, although none of these conditions are contraindications. Don't expect too much from simple obliteration of varices, if such complications are present. Extremities with chronic elephantiasis and hard, brawny œdema associated with deep extensive ulcers, frequently of years' standing, are little benefited by injection treatment. It is usually hard to find the varices in the thickened œdematous tissue. Sometimes considerable can be done with these cases by putting them to bed for a week to reduce the œdema before injecting, but they will rarely consent to this.

We have not done any work with very small varices. They are not large

enough to be of importance in the circulation. With the use of sheer stockings and short skirts, there is demand for the removal of these small superficial dilated veins for cosmetic reasons, and I do not see why this is not justified. In injecting sodium salicylate solution into veins which are so superficial that they are practically in the skin, there is a tendency for the resulting chemical phlebitis to involve the skin causing small eschared spots which develop into small ulcers which heal rather slowly. Less caustic solutions, such as the sugar and salt ones, are more desirable in this type of case.

We have done very little injecting much above the knee, although many of the men who have had considerable experience, do not hesitate to do so right up to the saphenous opening. Undoubtedly the pressure of extensive varices left above the knee, predisposes to the occurrence of new ones below the knee, but those above the knee do not cause the circulatory disturbances in the leg which are so common in the cases lower down.

Our only complications in the 218 cases have been ulcers, all of which result from faulty technic. I have found only six of these, and four of them were very small and resulted from treating veins which are practically in the skin. Small saccular dilatations in the veins which project almost through the skin, will sometimes give small ulcers even though there is no leakage of salicylate solution. Less necrosing solutions would avoid this difficulty.

The results in ulcer and eczema cases are very encouraging, sometimes dramatic, but not universal. In many so-called varicose ulcers, it is difficult to find the offending varices, and consequently impossible to accomplish much by injecting. When there are large varices present and there is no other complicating pathology behind the condition, the result of obliteration of the varices is sometimes striking. In our series, there are twenty-six cases with long-standing indolent ulcers, who have had prompt healing following the treatment, and have remained healed.

## CONCLUSIONS

Varicose veins of the lower extremity can be permanently obliterated by the injection method.

The method is safer and easier than the surgical excision, and has numerous other advantages making it preferable to the operative treatment.

The technique is simple, and no hospital confinement is required.

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