classified them into eighteen groups, and record them as follows in order of frequency.

700 Consecutive Cases Certified as "Blind Persons."

	No. of Cases.
Cataract	205
Atrophy of optic nerves	78
Glaucoma	75
Iridocyclitis and keratitis	54
Corneal opacities	45
Retinitis pigmentosa	43
Choroido-retinal atrophy	42
Congenital defects	33
Detachment of retina	27
Myopia	20
Phthisis bulbi	17
Choroido-retinal vascular disease	14
Diabetes	12
Ophthalmia neonatorum	9
Sympathetic ophthalmia	9
Trachoma	9
Buphthalmos	5
Injury (double)—two gunshot and one explosion ...	3

Cataract.—We are not surprised to find cataract at the top of the list. More than a sixth of the number were secondary, and these should be included under some inflammatory or degenerative disease. Of the ordinary senile cataracts over 37 per cent. were certified as operable, but so far as I know this in no way affects the granting of the pension. Neither do I know what may happen if such a patient gets his cataract removed and regains sufficient vision to enable him to do work for which eyesight is essential.

Atrophy of the optic nerves, coming second in the list, is unexpectedly high; 13 per cent. of these were of specific origin, and 10 per cent. were due to cerebral disease; the others were of unknown origin.

Glaucoma is a close third. Most of these appear to have been primary, only ten being recorded as secondary. About 10 per cent. of the former had been trephined.

Keratitis and iridocyclitis were mostly of specific origin (50 per cent.). In view of the fact that a number of the cases of atrophy of the optic nerves and choroid could also be ascribed to the same cause, it is obvious that syphilis constitutes the chief venereal factor in the causation of blindness in old age. It is to be hoped that modern preventive and curative treatment will do much towards reducing this high proportion of blindness from syphilis.

Corneal opacities form a rather ill-defined group. Most of them were of unknown origin. Some were associated with nystagmus, and were probably due to ophthalmia neonatorum. Some appear to be cases of interstitial keratitis, and a good many were associated with cataract.

Retinitis pigmentosa, amounting to over 6 per cent. of the cases, is a disconcerting item. Those of us who act as ophthalmic surgeons to blind institutions may have been under the fond impression that most of these cases were institutional, and that their marriages were thereby restrained. On reflection, however, it must be obvious to us that many contract marriage in ignorance of their ocular trouble. Night blindness is frequently insignificant during adolescence, or if noticeable it is tolerated with marked patience or indifference. There are others who refuse to be advised on a matter that they regard as purely personal, and have no wish to count the cost to their progeny or the State.

Choroido-retinal Atrophy.—I have had no means of establishing the causative agent in these cases. Probably the majority were syphilitic. A few also showed nystagmus and suggested infantile disease.

Congenital Defects.—About 50 per cent. of these were cases of congenital cataract, many also showed nystagmus, and in a few the lenses were dislocated.

Detachment of the retina in 27 cases is not exceptional, in my opinion. Nine showed evidence of cataract. One case only could be ascribed to high myopia. Of course, some of the cases with complicated cataracts may have been primarily high myopes.

Myopia (20 cases) was recorded as a cause of blindness, chiefly owing to choroido-retinal degeneration and secondary cataract. Few of these are noted as "high," but none had detachment of the retina.

Phthisis Bulbi.—Origin unknown in most cases. Some may have been due to ophthalmia neonatorum. Some were post-operative.

Vascular Disease of the Choroid and Retina.—Of these 14 cases, 11 were due to macular disease—senile macular degeneration, retinitis circinata, central exudative retinitis—due primarily, I think, to disease of the choroidal vessels. The three cases due to retinal vascular disease were two of venous thrombosis and one of double arterial thrombosis or embolism. It would appear, therefore, that retinal vascular degeneration does not often lead to blindness, or that those afflicted by it do not live long enough to be able to claim a blind pension.

Exception might be taken to this statement in the case of *diabetics*, the cause of the blindness in their case being equally divided between haemorrhagic retinitis and cataract (6 cases each).

Ophthalmia neonatorum forms rather a small class when one considers the frequency of the disease. Possibly the number should be slightly increased from the cases classified under congenital defects and corneal opacities.

Sympathetic ophthalmia claims 9 cases, one only of which was post-operative, the rest being the result of injuries. These 8 cases may be regarded as the toll of industrialism. The number is higher than it ought to be, but it is impossible to apportion the blame between the patient or his friends, surgical judgement, and inefficient therapeutics. I think the future holds out a distinct hope that this disease may be practically eliminated, if the public can be made to recognize the gravity of ocular injuries and be taught to seek advice promptly.

Double injury (gunshot wounds and explosion) accounted for 3 cases.

Trachoma was recorded in 9 cases, and in 5 cases buphthalmos of unknown origin was the cause of blindness. Some at any rate were probably due to congenital defects.

I apologize for the "scrappiness" of this paper, based on such a small number of cases, but I hope it may stimulate others to record the results of more extended and exact observations as further material becomes available. I also hope that it may have the effect of drawing the attention of members of the profession, as well as that of public authorities, to some unsatisfactory features in the certification of the blind, and to the desirability of some agreement among the certifying surgeons with regard to procedure in the issuing of certificates.

PAIN AS A GUIDING SYMPTOM IN THE INJECTION TREATMENT OF VARICOSE VEINS.

BY

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It is possible to prophesy with a considerable degree of accuracy the extent of the endovenitis which follows the injection of a solution of sodium salicylate into a varicose vein. Solutions of this salt when so injected almost invariably produce pain of varying degrees of severity, depending on their concentration. The pain is not felt immediately unless the solution is escaping extravasously. Immediate pain limited to the site of the injection and continuing some time constitutes an important danger signal. It is coincident with the escape of the first drop of solution, and is fortunately becoming more and more rare with improvements in technique and with practice. It is to the secondary pain that attention should be drawn—namely, the delayed pain. The onset is variable within small limits, beginning about twenty seconds after the first few drops of solution enter the vein, rising to a maximum in about sixty seconds, and disappearing, usually completely, in two or three minutes. Its course follows the veins in whichever direction the flow occurs, but, as it spreads and becomes more intense, the counter-irritation in one part so distracts the patient's attention that the exact course cannot always be followed in any one vein. The course of

the pain can, however, be followed with accuracy in the particular area that is being treated, and it is this fact which makes the observation so very useful.

The fact that the pain caused by this chemical cauterization of the endothelium is not felt immediately would seem to show that the endothelium is devoid of nerve endings acutely sensitive to pain. Schafer¹ says of the larger arteries and veins that

"nerves are distributed to the muscular tissue of the middle coat after forming a plexus in the outer coat. Most of the nerves are non-myelinated, but there are a certain number of myelinated fibres intermingled with the non-myelinated and passing to end in localized arborescences partly in the adventitia, partly in the intima. These myelinated fibres are doubtless afferent, the majority of the non-myelinated are probably efferent and derived from the sympathetic (vasomotors). . . . The capillary vessels also receive non-myelinated nerve fibres which have nuclei upon them and form a fine plexus of fibrils in close contact with the endothelial cells of which the walls of these vessels are composed."

The contraction of the vein frequently noticed by those who practise the treatment may be connected with the stimulation of the arborescences. So far it has not been possible to establish a definite connexion between the contraction and the onset of pain; first, because the pain moves onwards and becomes diffuse and the position of the patient's limb is changed accordingly, as will be described later; and secondly, because the colour of the partially empty vein, as seen through the skin, alters when the colourless solution enters it. A further complication is caused by the alteration in blood content when the tourniquet is removed. These three factors combine to make any accurate observation on this point difficult.

The nature of the delayed pain has been described by the patient afterwards as stinging, burning, cutting, boring, lancinating, shooting, cramp-like, creeping, cooling, and by one patient as the feeling he had experienced when a dentist injected his gums. Usually it is simply pain, and seems to be independent of the temperature of the solution. As a rule its onset can be noted with ease, and each patient is told about it beforehand and asked to say or to indicate where it is travelling, and at what rate. When the pain is sudden and severe every effort is made to dilute the solution with blood by a rapid change in position, according to Brodie's² (Trendelenburg's³) description, because this sudden onset often means an excessive and diffuse inflammation in the tissues round the vein at a later date. In such a case the veins are apparently easily permeable, but not necessarily very thin-walled. On the other hand, when the pain is of slow onset and slow cessation the change of attitude may be made correspondingly slowly; the solution may, as it were, be nursed along the course of the vein, even milked along it by the fingers. The ultimate result in the latter type of case is invariably the best obtainable. Moreover, it is particularly in this type that one can guide the course of the solution upwards or downwards, inwards or outwards, or in a combination of these directions. One may notice that a tributary area has been missed and be able to fill it with the solution still left in an adjacent vein. It occasionally happened that such an obviously missed area, which remained free from pain, was found later to have no occlusion of its veins. This observation suggested the great importance and the constancy of the deep communicating vein just above the knee, and so led to an alteration in the technical application of the method. It will be remembered⁴ that in this method the solution is injected (when the case is suitable) into the saphena in the thigh with the vein empty and the patient recumbent; the patient then rises slowly and the solution travels down. Sometimes it misses one of the main tributaries just below the knee. Often it either misses, or its dilution has become too great to cauterize, the endothelium of the important loop or loops formed in the lower third of the leg between the internal and external saphena veins.

The bolus method has therefore been altered, and the injection is now more often given into a suitable vein on the inner side of the lower third of the leg and allowed to travel upwards. In the course of about forty to sixty seconds the patient indicates that it has reached the middle

of the thigh; the limb is inclined downwards, over the side of the couch, and he says, "It is going down now to the ankle, foot, toes." Then the limb is placed horizontally again or elevated slightly, and we know that the solution at that moment is in the internal saphena from the middle of the thigh to the ankle. These alterations are made quickly or slowly, and of greater or less extent in exact accordance with the signs given by the patient. If by chance the patient is able to show quickly that one area has been missed, the limb may be re-inclined and the patient made to stand up, and if necessary to cough, in order to blow the now rather dilute solution into the mouth of the missed tributary. On the other hand, when it is evident that the solution is not travelling up the thigh, but only as far as the knee, the limb is elevated more and more and with an increasing degree of rapidity until it is vertical. If there is then no pain in the thigh the patient is quickly told to breathe out deeply so as to suck the solution up the thigh, a practical expedient based directly on Barber's⁵ observation. In one patient with an enormous collection of varicose veins of the internal and external saphena systems the onlookers clearly saw the respiratory excursions in a vein over the patella. In slighter cases the movements may be shown by shining up the skin with glycerin, just as one may easily demonstrate a doubtful pulsation in a cranial defect, or the pulsation of one's own superficial palmar arch. Failure of the bolus method appears to be entirely due to the deep communicating veins sucking away and diluting the solution, and it is here that a previous acquaintance with these veins in the dissecting room, and especially an operative experience, is so valuable. When Gray's modification⁶ of Babcock's extraction method was used the tributary sites were easily seen and counted on the extractor. Next in importance to the single deep connexion just above the knee, if not actually more important, is the one just below it, which joins the inner sural veins. This latter connexion may be multiple.

During extraction operations (or during the excision of a varicose ulcer) under fairly deep general anaesthesia the blood flows from the ruptured communicating veins and tends to form large collections in the subcutaneous tissues. It was therefore common practice to press on these areas after the extractor had been removed and thus to limit the flow. When the conscious patient uses his muscles, even feebly, it is highly probable that the blood flows in these junctions from the superficial to the deep system; x-ray observations are said to confirm this. Once in the deep system the dilution is excessive, both on account of the total area of the cross sections of the veins and of the rate of flow of the blood. No pain is felt nor is any obliterating effect produced. In no case has the patient later suffered from an added cramp, and in only three cases from cold feet, as a result of the treatment. In the majority of patients these two symptoms when present have invariably been cured, as have also the other symptoms of tiredness, weight, and the sense of fullness and bursting. Blueness of the limbs improves rapidly, but seldom entirely disappears. It appears, therefore, that the entrance of the solution into the deep veins is a matter of no importance except possibly medicinally. Its dilution in this way will account for any failures to produce thrombosis. There is no need to blame the solution.

It is said that the brown solutions of salicylate must on no account be used, but the reasons are not clear. The colour is sometimes due to a slight iron contamination from the glass, with possibly an added oxidation. On one occasion a hundred ampoules were found to contain brown solution, some of which was a very dark brown; all this solution was used with perfectly good results.

Another argument may be employed to show the absence of sclerosing effect on the deep veins. A history of white leg is quite rightly regarded as a contraindication to any obliterative treatment of varix, though not an absolute contraindication. After a time there may be evidence of a re-establishment of the deep circulation, and the oedema may partly subside. In such a case, if varicose veins develop, it is a question whether or not these veins should be treated by sclerosing methods, wholly or in part. If

the symptoms are increasing or an ulcer is forming, it is advisable to make a preliminary test with a course of Unna's paste bandages applied from foot to knee with the limb emptied of blood—that is, after it has been elevated to 30 degrees for, say, twenty minutes with the patient's trunk and head horizontal. This is in all cases by far the most efficient way of applying the casing. It may at first seem puzzling that the foot never becomes strangulated. If the experiment is tried with an elastic bandage it will often be found to cause strangulation; in perhaps half an hour the foot will become painful, and then numb, blue, and cold. The Unna's paste bandage, being in no sense elastic, but forming a semi-rigid casing, does not contract on to the limb or exert greater pressure as the swelling increases. It exerts only a constant pressure, probably rather greater than the diastolic pressure, on the surface of the limb, and this is insufficient to compress the deep veins. In such circumstances the oedema subsides in a few months, and the skin becomes supple, especially round an old ulcer. At this stage it is safe to discard the Unna's paste for a lightly applied open-woven elastic webbing of a good but slight degree of elasticity. Two or three months later, if the improvement is maintained, it may be taken as an indication for sclerosing the main portions of the varix. Three such cases have been treated in this way, and as a result there has been considerable improvement in the tone of the water-logged limbs. Had the solution caused further deep thrombosis the results would have been bad.

The pain caused by the solution of salicylate decreases in severity as the fluid in its passage becomes more dilute. This is well seen in the multiple ladder pattern veins at the back of a thigh. In a case of multiple telangiectases the patient first described the sensation as painful, and then as a "creeping outwards" into the finer tributaries. The pain varies greatly in intensity in different patients and in different veins in the same patient. It may differ in veins of apparently the same size and in similar veins on each side. Wherever it is felt sclerosing changes inevitably follow, and where it is not felt it is uncommon for more than a local thrombosis to occur. In a few exceptional cases a considerable length of vein may become obliterated when little or no pain has been experienced, and it is noteworthy that the process is then relatively slow. In cases of telangiectases, especially in those arranged in separate clusters, the immediate effect is often most striking and the subsequent spread of the sclerosing effect convincing. As the blood volume of an injected vein decreases so the pain of a further injection becomes more severe. It may travel further and may last slightly longer. By observing the effect at fortnightly intervals it is apparent that sclerosis continues actively for at least nine weeks.

The solution used when the method was first tried (20 per cent. sodium salicylate, 10 per cent. saline) was apt to produce a thickened vein and not an obliteration, except in the smaller veins, or at the site of injection, and for a few inches only. Sometimes it would produce thrombosis in the bays of the varicosities, where the current was sluggish, and leave the main stream liquid. A 25 per cent. solution (10 per cent. saline), given also in larger quantities, was found to yield better results, and to-day the standard first dose for a medium-sized vein is 5 c.cm. of 30 per cent. solution (10 per cent. saline), and for a vein of large blood volume 7 c.cm. of 40 per cent. solution (10 per cent. saline), each given with the limb emptied of blood and usually from below upwards. Dr. R. D. Macrae, when he was a dresser, suggested putting segments of the vein on the stretch in one direction during the injection so as to snaffle the communication to the deep anastomotics. This method is most useful in the thigh, where it is not infrequently followed by a somewhat delayed but sudden onset of sharp pain. One might expect this phenomenon from a study of the loops which are present in this situation and which are so well shown in Gay's plates. These loops hold the solution and then allow it to pass into the superficial veins, where it produces pain. It may, however, pass away rapidly, or slowly and painlessly, into the deep circulation. The not uncommon failure of the

bolus method from above downwards, and its great and frequent success when employed from below upwards, are also partly accounted for by this peculiar anatomical arrangement.

When most of the leg veins have become obliterated, and parallel anastomotics alone require injection, a useful means of access may sometimes be found in the dorsal veins of the foot. One should, however, be cautious in using veins in front of the ankle-joint or at the back of the knee where movement is frequent, because necrosis seems to be more readily caused in these situations. Injections into the external saphena should also be more dilute, or used in smaller quantities and more slowly than into larger veins. Throughout it is important to remember that the surface area of a cross-section of vein varies with the square of the diameter.

Technique.

In difficult cases the injection may be given with the patient standing or sitting, and into almost any part of the vein, remembering that in the smaller veins the valves are usually still efficient and the blood current towards the trunk. In the great majority of cases, however, the injection has been given with the patient recumbent. A good light, preferably an overhead one, is essential. For the particular method used it is convenient to have a low couch (18 inches high) on which the patient can stand for inspection, and from which, when lying, he can easily tilt himself up and stand on the floor. This height is also convenient for the injector when the limb is raised to empty it of blood. The patient stands, a band tourniquet is lightly applied and clipped, and he lies down. The lowest easily available vein is chosen and entered, and blood is allowed to float up to the plunger. The tourniquet is then loosened, the limb raised, and the injection given. By injecting the spare blood at the end of the plunger there is less risk of withdrawing salicylate solution through the puncture hole. The needle is withdrawn and pressure made over the spot. The changes in posture are then carried out as already described. Only one injection is given at each attendance. The limb should be kept bandaged *night and day* with a light elastic webbing for a fortnight or longer. The results since this procedure was adopted have been much better than formerly; there are fewer and smaller lumps afterwards, and what may be called the *stiction effect*, or immediate obliteration, is more often obtained. In the bolus method a large needle naturally gives a better result than a small one, the object being to spread the solution rapidly over the whole system before dilution occurs. In medium and small veins, however, the differences are not great, and here even a small injection, such as the quinine solution administered slowly, may, in a sluggish vein, give a thrombosis from ankle to groin. Usually, however, the thrombosis produced by the quinine solution seems to be only a few inches long. Many injections are required, and there is no definite means of controlling the extent of any one of them or of guiding it to the required distribution.

The salicylate-saline effect can, in the main, be judged after a fortnight. When both limbs are affected the injections may thus conveniently be made weekly and alternately; this allows time for the reaction to subside on one side before it begins on the other, and no great inconvenience is felt. In three cases only have the patients been off work—in one case for three days, in another for a week, and in the third for ten days. All were able to walk during these periods. When it appears that the case will be successful the patient should cease attending for an interval of two or three months. The result can be judged better in this way, and any further injections can be given later if necessary. The stiffness in the fibrous cords may take up to about six months to disappear, especially at the knee.

Necrosis.

Should solution escape from the vein the hole may be pricked at once with a Bard-Parker blade and gentle pressure made at a little distance around it to promote evacuation of the solution. The patient should rise to encourage bleeding, for if bleeding occurs necrosis is unlikely. Apart

from lack of skill there are many causes of a faulty injection, the most frequent, in my experience, being a blunt needle and a horizontal instead of an overhead light. A blunt needle may lead to imperfect puncture, or, if the guarding finger allows it, to a double puncture. In the latter event the operator, when dealing with a large vein, may wait for the distal hole to close and give the injection slowly, or he may safely give the injection in another part; but in dealing with a small vein it is safest to use the Barber⁸ needle with a lateral eye. A lateral tributary may rupture from slight pressure (Barber¹⁰); a partially thrombosed vein also is often difficult to puncture, even with a small needle, and so is a very mobile one.

Necrosis of the vein itself may occur at or near the site of puncture from too long contact with the solution. Here again the Barber needle will help, because it can be rotated and thus used for spreading the solution over different parts of the wall. It is probable that necrosis of the vein wall, especially in thin veins, often occurs without being seen. In relatively superficial veins it is visible through the skin, and takes about three months to fade. Necrosis into the wall of a large vein is apt to be dangerous; one such case has been heard of in which severe secondary haemorrhage occurred. Necrosis into a vein occurred twice in this series, the longer being $1\frac{1}{4}$ inches, presumably due to the solution travelling along the adventitia. The vein in each case was firmly thrombosed, and no anxiety was felt in allowing the patients to work and the necrosis to run its ordinary course, whereby it exfoliated and the ulcers healed. The necrosis, like dry gangrene elsewhere, is easily treated by the patient with boric powder. When a line of demarcation begins a few drops of glycerinum acidi borici twice a day, on boric lint, until the ulcer is clean, followed by red lotion or a brilliant green dressing, is all that is necessary. Klapp's suction cup seemed to help in one case at the stage of separation of dead tissue.

In one case, not included in this series, excision under local analgesia was tried, with no gain in time to the patient. If, however, a plastic operation is possible as well, the gain in time in healing a large necrosis might be considerable. In the leg it is seldom possible to excise a large necrosis without producing deformity, and excision of a small necrosis may not be considered worth while. Though no evidence is advanced, excision is perhaps more dangerous than leaving well alone. In this series the duration of the necrosis has been approximately proportional to its volume; healing times (in months) have varied from $5\frac{1}{2}$ months to about a fortnight. Fortunately necrosis is generally painless and is becoming uncommon, but the possibility of its occurrence is the chief drawback to using salicylate solution at the present time. By ascertaining as far as possible that the whole of the eye of the needle is in the vein, by injecting only when there is an entire lack of resistance to the needle and absence of pain, by watching for blanching and thickening in the surrounding tissues, and above all by practice, the risk may be considerably reduced and the extent of the extravasation kept down. But in spite of everything going well an apparently inexplicable necrosis may mar an otherwise good result.

Results.

The results in the first consecutive series of completed cases treated by me at the Aberdeen Royal Infirmary by the bolus method (chiefly from below upwards) may be set out as follows. First the expected result of each injection, as indicated by the pain, is recorded in one of three divisions: maximum effect, good, and partly. A negative effect in these observations becomes a positive one in recording the result, because when there is no pain no thrombosis is expected. The observations for each limb are then added up and the total expected result recorded. At first the importance of pain as a guide was not appreciated, and in consequence the individual injection records are incomplete in a very few cases. This fact does not materially affect the total expected results. Secondly, the final result is given. For this purpose the limbs have been grouped into those in which the veins were enormous, very severe or very large, severe, marked, medium, and slight. While the symptoms often correspond with the signs, this

is not always the case, and as at present we are estimating the sclerosing effect only, the signs have been taken as the guiding factor in assessing the results.

Number of patients treated	...	...	...	150
Limbs injected	...	...	...	243
Necrosis cases	...	...	...	24
Stiction effect	...	...	...	15
Patients previously operated on for varicose veins...	...	...	...	4

Degree of varicosity and number of injections:

Very severe	...	5 limbs, requiring a total of 24 injections
Severe	...	31 " " " 152 "
Marked	...	98 " " " 284 "
Medium	...	82 " " " 174 "
Slight	...	27 " " " 27 "

Totals ... 243 limbs, requiring a total of 661 injections

Average number of injections per limb 2.7.

Results indicated by the pain experienced:

Maximum effect	...	...	...	101
Good effect	...	...	...	100
Partly	...	...	...	42

243

Final Results.

Condition.	Perfect.	Excellent.	Very Good.	Good.	Fair.	Total.
Very severe ...	2	3	—	—	—	5
Severe ...	6	17	8	—	—	31
Marked ...	34	56	7	—	1	98
Medium ...	38	33	9	2	—	82
Slight ...	16	9	2	—	—	27
Totals ...	96	118	26	2	1	243

It will be seen that for the very severe type of varix about five injections are necessary, and the same is true for a slightly less severe case. In these cases the veins are of large volume, tortuous, show a marked impulse to the ankle on coughing, and are very numerous. In the worst type the varicosities evidently join the deep veins at short intervals all over the limb, and more than the average number of injections are necessary. Thus in three such cases the numbers and strengths of the injections have been as follows:

	Right.	Left.
Case I ...	Six (20%), seven (30%), two (40%)...	Four (30%)
Case II ...	One (30%), one (40%)...	{ Five (30%) Five (40%) }
Case III ...	{ Five (20%), three (30%) } { Four (40%) }	... Three (40%)

In each of these cases the degree of varicosity appeared much the same on the two sides, yet the number of injections differed greatly; they were the only cases in which numerous injections were required. One can sometimes surmount the difficulty by stopping the venous circulation both above and below with two band tourniquets while directing the distribution of the solution. There is an element of chance in this type of case which is difficult to get over. It is clear, therefore, that the best course is to try to prevent the occurrence of the severe types with multiple deep connexions by treating the limbs while they are in the earlier stages of varicosity.

In the marked type not more than about three injections are needed, in the medium type two, and in the slight type only one. It appears that the number of injections required in comparable limbs when other methods are employed is much greater than by the controlled method described.

In general, the symptoms have disappeared with the obliteration of the veins, but in some cases they have gone first; in a very few cases symptoms have persisted in minor degree after the veins have become firmly sclerosed. Mostly, however, the patients are greatly relieved and are better able to work. They often say that their shoes feel loose or that they require a smaller size than formerly. In some cases there is a distinct stage of slight swelling of the ankles which persists for about two months and gradually goes away as the new

circulation becomes efficient; this process is accelerated by using an elastic bandage locally at night. The feet may be swollen in the morning and the swelling subside after a day's work, thus affording interesting evidence of the action of the muscles on the deep circulation. The muscular tone improves greatly, but it has not been actually measured. Measurements by a tape on different days are apt to be misleading, but are sometimes useful if, on the same day, a comparison is made between a treated and an untreated limb. When all symptoms and signs are absent and the health is improving the final result has been assessed as perfect; then follow excellent, very good, good, fair, and failure. A family history of varix does not seem to affect the result, but varix when familial tends to increase. Speaking generally, in the severe types the older the patient the better the result. The oldest male to be treated was 75, and the oldest female 74. The man had enormous multiple varicosities from groin to ankle, and said that he had spent £170 on elastic stockings during the last thirty-five years; his work as a blacksmith had been hard on them. Eight injections cured the right and four the left limb.

Curious coincidences have been noticed here and there—for example, symptoms of dizziness, deafness, and light-headedness, especially in old persons, have cleared up. Whether the obliteration has a definite effect on the blood pressures or not, especially on the diastolic pressure as one would expect, will require to be worked out. If it has, then the method may have a wider application than it has at present.

Two cases in this series merit attention.

CASE I.

The patient, a man aged 56, was treated for varicose ulcer of the right leg, and an enormous condition of varicosities of the whole of both lower limbs. The ulcer at this time was nearly healed. Six injections of 40 per cent. salicylate (10 per cent. saline) from January 2nd until April 4th resulted in complete obliteration of the varices on the right side. On April 27th the first injection of 40 per cent. salicylate (10 per cent. saline) was given on the front of the left leg. A maximum immediate effect was produced. The patient went to work for a week. On May 5th he had pain in the back and chest and did not go to work. There was no cough or sputum, and no history of shivering. He remained in and out of bed, and on May 9th was admitted to a medical ward suffering from acute bronchitis, which was considered to be influenzal in origin as there was an epidemic at the time. Moist sounds could be heard over the whole of the chest. The patient died on May 10th. No post-mortem examination was allowed.

CASE II.

This patient, an unmarried woman of 32, was under treatment for a medium degree of varicosity of the left side. On February 23rd and March 9th injections of 40 per cent. salicylate (10 per cent. saline) were given. A medium immediate effect was obtained. On March 13th the patient had a right-sided hemiplegia from which she has made a good recovery. A sister had previously also had a hemiplegia. There was no gross cardiac disease.

These two are the only cases in the series in which any serious complication could be considered as possibly due to the treatment.

Conclusions.

Finally it appears in the light of the clinical results that the descriptive anatomy requires amplification. We want to know from injections and sections of the limbs in the dead subject the relative blood volumes of the superficial and deep veins in health and in conditions of varix. A plethysmographic record in old cases of white leg would help to tell us the carrying capacity of the deep veins. The pain seems to be due not to the saline in the solution but to the salicylate alone. If those who use the saline method would try it with small additional strengths of salicylate added, it might be possible to find an ideal solution which would produce the maximum sclerosis, and only a slight but definite tingling at the time of injection.

In my experience the results of using local analgesics in the salicylate solution have, while allowing as far as possible for the unknown factors in the deep circulation, been entirely negative. As Barber¹¹ points out, their use might prevent the recognition and rapid evacuation or dilution of an extravasation. At present it seems clear that no

great advance will be made until we have records of consecutive cases kept by different injectors on some comparable system and observed at greater leisure than is usually possible in busy hospital departments. The fact that in the majority of cases we can give in advance an approximate estimate of the number of injections required and can tell the probable distribution of the sclerosis makes the salicylate-saline method a very good one.

REFERENCES.

- ¹ Schafer: *Essentials of Histology*.
- ² Brodie: *Lectures on Pathology and Surgery*, London, 1846.
- ³ Trendelenburg: *Beitr. z. Klin. Chir.*, 1890, Bd. vii, ii, i, S. 195-210.
- ⁴ Colt: *British Medical Journal*, September 22nd, 1928, p. 525.
- ⁵ Barber: *Ibid.*, 1928, i, 594.
- ⁶ Gray: *Medical Magazine*, May, 1909.
- ⁷ Gay: *Varicose Disease*, London, 1868.
- ⁸ Barber: *Lancet*, February 9th, 1929, p. 288.
- ⁹ Colt: *Brit. Journ. of Surg.*, viii, 32, 1921.
- ¹⁰ Barber: *The Treatment of Varicose Veins by Injections* (Bristol, John Wright and Sons, Ltd., 1929), p. 94.
- ¹¹ Barber: *Loc. cit.*, p. 47.

SOME OBSERVATIONS ON BERI-BERI.

BY

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THE following conclusions have been formed as a result of two years' research work on over six hundred patients of Chinese nationality, and more than eighty post-mortem examinations, as well as animal experiments.

1. Beri-beri is a syndrome of the Orient, confined to Orientals, chiefly males; seasonal in occurrence; prevalent during the wet season; partly infectious; a rice "disease"; and is brought about by three factors. They are: (a) water-soluble vitamin B deficiency; (b) a bacterial infection, closely resembling or identical with the *Bacillus asthenogenes* of Bernard (1919); and (c) endocrine organ disturbance.

2. A low cholesterol content of the blood is also essential to the occurrence of this syndrome.

3. The diagnosis and prognosis can be assisted by x-ray examination.

4. The pathology is specific.

5. Bernard's complement fixation test is a valuable aid to diagnosis.

6. Beri-beri may be either acute or chronic. The "dry" and "dysenteric" beri-beris are really camouflaged forms of malaria, as proved by the invariable findings of the specific malarial parasite on every careful examination.

7. The blood pressure and the cerebro-spinal fluid pressure have definite constant variation. In acute cases the blood pressure is always below normal, about 80, and the cerebro-spinal fluid above normal, about 200.

8. Magnesium sulphate, given daily in doses amounting to 150 grams, administered as twenty-four half-hour doses during the twelve waking hours of the day, and repeated, if necessary, on the two following days, together with 1/2 c.cm. of pituitary extract (B.W. and Co.) twice daily; also hypodermic injections of 1 c.cm. of a 5 per cent. solution of cholesterol in olive oil, given on alternate days for six to ten injections, bring about speedy amelioration of the symptom and sign complex; and, with the addition to the diet of vitamin B, complete the cure. Bernard's serums can also be used with good results.

9. Patients with beri-beri can take a large amount of sugar without it appearing in the urine, their capacity being about twice that of a normal individual.

10. The syndrome occurs almost solely in males; there are a few exceptions to this, as to every rule, but they are very rare. It comprises the following manifestations:

(1) Swelling of the feet: in China the complaint is known as "ker' k'i," meaning humidity of the feet.

(2) Swelling of the face: especially under the eyes, as in kidney disease (acute parenchymatous nephritis does occur).

(3) Swelling of the abdomen—ascitic.

(4) "Swelling" of the heart: detected by clinical methods and x rays (Reinhard, 1916).