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A Post-Graduate Lecture ON THE TREATMENT OF VENOUS THROMBOSIS MAINLY FROM THE SURGICAL ASPECT.

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GENTLEMEN,—The point at which medical treatment in thrombosis ends and surgical treatment begins is a very difficult thing to determine. For thrombosis is one of those conditions which show quite clearly that a surgeon, if he is to effect much useful purpose, should be something more than a mere operator, to which there is rather a tendency to reduce him at the present time, because as much medical knowledge is required in its treatment as surgical, even when it is approached from the surgical aspect.

In considering thrombosis in the abstract, we must, of course, go back to the old and well-recognized fact that the two main factors in its occurrence are the state of the blood on the one hand and the state of the vessels in which the blood circulates on the other. Thrombosis, then, in normal veins is, in the absence of injury, for practical purposes, due to constitutional causes; that is to say, it is the result of the abnormal tendency of the blood to coagulate in normal vessels. On the other hand, in the case where the vessels are abnormal, it is, for practical purposes, a local condition, inasmuch as the coagulation of the blood is determined by abnormality of some kind in the vessels themselves. Whilst that is in itself a true enough statement, it is liable to certain limitations, for the following reason, and a very important reason it is. Given an abnormal condition of the veins, say, sacculatation or roughness of the walls, blood in a normal state would be less likely to coagulate at that point than blood which is in even a very slightly abnormal condition so far as the tendency to coagulation is concerned. You cannot, therefore, in a condition of this kind, dissociate entirely, for practical purposes, the local condition on the one side, and the constitutional condition on the other, because the two conditions may to some degree coexist. In a large number of cases there may, in fact, be something at fault in both the vessels and the blood, and this must be borne in mind when considering the subject even from the surgical aspect.

The main conditions leading to an increased tendency to coagulation of the blood are hardly a subject for consideration here. You will find the tendency ascribed to many states, principally to "gout," though even in these times I hardly think we have an adequate idea of what gout is. There is a condition, no doubt, in which the blood becomes abnormally coagulable, and that condition can be modified, or negated altogether, by certain treatments which are supposed to be good for what is called gout. But how far the condition itself is gouty, and how far it is not, I cannot pretend to say.

Thrombosis in normal veins is, all other things being equal, a more dangerous condition than thrombosis in a venous arrangement which is not normal, for the obvious reason that, supposing coagulation occurs in a vein which is normal, there is, seeing that the defect is in the blood, no reason why it should not increase to any extent or occur in veins in any part of the body. But supposing there is in any part a defective vein, rough or irregular, blood which is only slightly above the normal inclination to coagulability may clot on that local focus when it would show practically no tendency to clot elsewhere. So that in phlebitis of really normal veins there is always a possibility, and sometimes a probability, of the process occurring in some other, perhaps in several, parts of the body at the same time. When due to local conditions the chances are that the manifestation will be local, and that it can be dealt with by local means.

TREATMENT BY OPERATION.

This leads us to the following important point in connexion with the surgical treatment of thrombosis. In dealing with a case of thrombosis occurring in different parts of the body, or in different parts of the same limb, taking for example a case confined to the lower extremity, it is clear that the chances of doing away with the subsequent probability of clotting by any local treatment are small. If, on the other hand, the clotting takes place at one focus, and if when it recurs it comes at the same spot, or at least so near to it that it may be said to come within the area of the original phlebitis, it may be regarded as a local condition, and the tendency to further recurrence may be obviated by getting rid of the original focus of the clotting, which can only be done effectually by removing the portion of vein concerned, although it is said that the same result may be attained by opening up the vein at the spot and turning the clot out—a statement open to doubt. It seems, then, at first sight that the actual surgical treatment of thrombosis is narrowed down to a somewhat limited application, for the ideal case must be one in which the clotting is local and limited, and if in a case in which recurrence has happened, the thrombosis must be in the same place, or at all events in the immediate neighbourhood of the original attack. Under those circumstances there is no doubt that the tendency to recurrent thrombus can generally be obviated by removing the abnormal veins which originally excited the clotting of the blood in that situation.

There is another class of case of extreme interest in which although the indication for operative treatment is not so logically clear it can be adopted with much advantage.

It will occasionally be found that when a limited thrombosis (say, for an example, in the leg) is followed after apparent complete recovery by the occurrence of thrombosis in other parts, the first indication which the patient receives of coming trouble is some slight pain and tenderness in the spot originally concerned. The initial recurrent trouble is in fact at the site of the original thrombosis.

What the relation as to cause and effect may be between the slight recrudescence at the original site and the formation of thrombi in other parts it is unnecessary for my present purpose to inquire, but it seems to be a fact, and a very important fact, that in such cases further recurrences of clotting in distant parts may be avoided by removing the area originally attacked.

Some other cases, in themselves more grave but less

common than those just mentioned, occur in which surgical interference in thrombosis is not only justifiable but imperative.

There are two sorts of thrombi—originating as purely local conditions—which are dangerous. One (the kind which I have called “creeping thrombus”) occurring in some superficial vein, will gradually travel towards the central parts—for instance, from the calf to the knee, from the knee to the thigh, and from the thigh, through the femoral vein, into the abdominal region. Under these circumstances, the vein being generally the internal saphena, if the creeping thrombus is allowed to get above a certain point, it will probably pass the saphenous valves and lead to complete blocking of the femoral vein, with all the troublesome disabilities and risks connected with it. The other dangerous condition is in connexion with the detachment of emboli; both of these types of case are at times amenable to surgical treatment. Let us suppose in any given case that a thrombus occurring, say, in the calf of the leg, extends rapidly towards the knee, and runs past the knee up to the thigh towards the saphenous opening, the question must arise as to the means available for preventing its passing further onwards and creeping through the saphenous opening into the femoral vein. The progress of such a thrombus may be rapid, in spite of medicinal and the usual local measures. In such circumstances operation may afford the only means of checking the extension. And, under certain conditions, operation is more urgently called for than in others. The creeping thrombus—“creeping” is a term which well describes it—is when occurring in a normal vessel checked in its progress for a short period at certain points, namely, at the valves of the vein. Operation in a general way is therefore not urgently called for until the increasing clot approaches the valves at the junction of the vein concerned with the deeper vessels. At the same time, if a thrombus of this kind is found to be travelling quickly, and seems to take less notice than usual of these valvular stops, it is without doubt the best thing for the patient that the vein should be at once interrupted on the proximal side of the clot, in order to prevent its progress upwards. It is a very good and simple operation, associated with no danger in itself; and in an ordinary case of clotting of the kind which I have in my mind it will, in the vast majority of cases, entirely stop the progress of the clot, and so render the patient safe from two possibilities—the creeping of the clot into the deep veins, and the possibility of the separation of a thrombus when the clot first pokes its nose into the rushing current of blood in the large vessel deep down in the limb. All this applies in the case of a normal vein.

In the case of thrombosis in a varicose vein the matter is somewhat different. The essential point of the ordinary varicose vein is inefficiency of its valves—the valves do not work properly, and may, indeed, for practical purposes, be non-existent; the flaps are not large enough, and, as a matter of fact, are often mere excrescences from the wall of the vein. In such a vein, large and valveless, extending, for instance, from the knee into the groin, the danger of the rapid upward progress of the clot is greater than that in a vein of which the valves are efficient. If in such a vein there exists a thrombus—as is not uncommon in the lower extremity—passing rapidly towards the groin, the best interests of the patient will lay with an interruption of the vein above the upper margin of the clot, keeping well clear of it, by dividing it between two fine catgut ligatures if there is sufficient room for so placing them, the thrombosed portion of the vessel being at the same time removed if it is not too extensive. I have, on more than one occasion, however, stopped the progress of the clot by merely placing a ligature around the saphena at its junction with the femoral vein, although the clot has been apparently almost projecting into the deep vessel; there has not been more than $\frac{1}{2}$ or at the most $\frac{1}{4}$ in. between the ligature and the upper end of the clot. An operation of that kind is only suitable for passive or non-septic clottings occurring in dilated and defective veins. The remarks just made must be held to apply generally to thrombosis which is not septic, in the ordinary sense of the word, and before leaving the consideration of this type let me remind you that any operation of this kind is inadmissible in cases due to anaemia, or after excessive loss of blood, in consequence of the

liability of extensive clotting on the proximal side of the ligature.

When a thrombus occurring in a superficial vein is obviously septic, it should at once be removed with the portion of the vein concerned; but if this has not been done, and it commences to extend towards the central parts, immediate measures for stopping its progress become imperative, a matter which is not so easy as in non-septic cases for the following reasons: In non-septic thrombosis the vein wall is normal on the proximal side of the clot to within a very short distance of it—so short a distance, in fact, as to be almost inappreciable; hence a ligature may be applied almost if not actually touching the clot without producing a harmful thrombus on its proximal side. In septic thrombosis, on the other hand, the vein wall is involved in changes for a considerable distance above the clot; for an example, in the saphena in the thigh this implication would generally be not less than $\frac{1}{2}$ in. beyond the proximal end of the clot and in other vessels to a degree proportionate to their size, the larger the vessel the more extensive the area of implication of its lining membrane. Hence, in dealing with such cases by operation, a large interval must be left between the clot and the nearest ligature, for if this be applied around the portion of the vessel involved in the septic changes, the clot which forms on the proximal side of the ligature will almost surely be septic, which need not be the case if the ligature has been applied sufficiently far from the thrombus to include only a healthy part of the vessel. In all septic cases the thrombosed portion of the vein should be removed at the same time, the mere division of the vessel above the affected spot not being deemed enough unless the local conditions or other circumstances of the case render the larger operation unjustifiable.

OPERATION IN THROMBOSIS WITH EMBOLISM.

The most striking example of the effects of well-advised operation in thrombosis is sometimes seen in cases, usually septic, in which a thrombus is giving off emboli to the grave peril of the patient.

I have in my own experience had certainly three very remarkable cases in illustration of this. The first occurred in a man of middle age, who was the subject of a very large varix of the left internal saphena, which suddenly became blocked from the knee upwards for about 4 in. without any particular constitutional symptoms. Three attacks of dyspnoea occurred, the last of which was almost fatal. Each attack was followed by evidences of pulmonary infarct. As soon as possible after the third attack the saphena was ligatured, and the thrombosed portion rapidly removed; the patient made a capital recovery without further attacks of dyspnoea. The second case was somewhat similar, the thrombosis being situated in a large cystic development at the upper part of the external saphena below the popliteal space. Two attacks of severe dyspnoea happened—the thrombosed part was removed, and no further symptoms followed. The third was a septic case in a vein of the forearm following upon whitlow; two very slight attacks of dyspnoea occurred, and pneumonia followed. A third more severe attack of dyspnoea led to the interruption of the vein above the septic thrombus by operation, and no further evidence of embolism happened. It may, of course, be contended that the cessation of detachment of emboli in these cases was coincidence rather than the result of the treatment. Be that as it may, from what I have seen of cases of this kind, I should strongly advise radical measures in dealing with thrombosis of accessible veins under similar circumstances.

It is obvious that the treatment of thrombosis with embolism by operation must, excepting cases in which the internal jugular is concerned, be limited for the most part to superficial veins; the ligature, for an example, of the common iliac vein in femoral or iliac thrombosis may be regarded as outside the limit of rational surgery at present. The question must therefore from time to time arise as to the best means for dealing with those cases which are not amenable to surgical methods. Setting aside the use of vaccines, etc., in certain cases—the consideration of which is beyond the scope of this lecture—the most potent means of those suggested for the prevention of embolic detachments has been in my experience the free administration

of lactate or chloride of calcium, preferably the former. The treatment, it is true, of a condition due to abnormal clotting by a means which promotes further coagulation may seem at first sight paradoxical, but the good arising from the production of a more cohesive clot, although it may increase in size to some extent, is obvious, as the detachment of emboli is due to a certain brittleness or want of cohesion in the original thrombus which varies with the constitutional tendency of the patient and with the cause of the primary thrombosis.

THROMBOSIS NOT NECESSARILY SERIOUS.

It is well to understand that a thrombus is not necessarily in itself a matter of great consequence. The fear, amounting almost to terror, in the minds of the laity of "a clot of blood" in a vein is quite remarkable, and to allay this feeling is not always an easy matter.

Thrombosis occurring in a normal vein is always more or less serious, for reasons already indicated. On the other hand, in veins which are sacculated or pouched a clot may form which is of little importance apart from the discomfort which it causes and the occasional liability to localized suppuration. The most interesting point in this respect is the frequent occurrence of harmless clots in the veins of old people, especially in the legs. These thrombi generally form suddenly without the knowledge of the patient; they cause neither pain nor discomfort, although they may exist in considerable numbers.

An acquaintance with these "quiet thrombi" of old people is of some importance, as occasionally, either by accident or in consequence of some vague discomfort in the lower limb, or perhaps in the scrotum, a lump is found which if pressed sufficiently hard is tender, and which is clearly in a vein. Those unacquainted with the common occurrence of these quiet thrombi in the aged may attach unnecessary importance to them and possibly put the patient to bed or prescribe complete rest, when there is no necessity to interrupt the usual habits of life—a highly undesirable thing.

SOME POINTS RELATING TO THE GENERAL TREATMENT OF THROMBOSIS.

It is of course common knowledge that recovery from thrombosis so far as the local conditions are concerned occurs in one of three ways: By complete resolution of the clot, leaving the vessel concerned for practical purposes unchanged; by permanent obliteration of the vessel by organization of the clot which becomes a fibrous cord; and by temporary obliteration by organizing clot, the lumen of the vessel being subsequently more or less restored by canalization. The first of these is naturally the most satisfactory, but is open to the objection that during resolution of the clot, if very rapid, there may be a distinct danger of embolic detachment, especially in large vessels.

Whether the lining membrane of a vein becomes quite normal again after thrombosis is a matter for speculation, but seeing the undoubted tendency to recurrence of thrombosis at the same spot as the original development the presumption is that a complete return to normality is not the rule at all events.

Complete permanent obliteration is practically confined to small vessels, and in cases of varix is distinctly advantageous, as it may go far to modify in a favourable way the general varicose condition. In a case of complete obliteration of 4 in. of the internal saphena in the thigh which came under my notice, the result upon the condition of the limb was precisely the same as that which follows upon resection of a portion of the vein at the saphenous opening; and I have on two occasions known a varicocele to shrink to nothingness after thrombosis produced by injury. Moreover, whilst the rough surface on the lining membrane of a vein often left after the clearing up of a clot provides a focus for a further deposit of thrombus, I have not known thrombosis occur at the seat of permanent spontaneous obliteration of a vessel. Partial occlusion of large vessels after canalization of organized clot is common; it largely accounts for the bulky limbs following many cases of thrombosis after enteric and other fevers, and explains the persistence of aggressive distended collaterals in such cases; which, as I shall presently show, are manifestly unfitted for any operative treatment.

Granting the correctness of these remarks, the question arises as to the best means to promote rapid resolution of clot, and, although various methods have been advanced with confidence, I still find the older plan of compresses of lotio plumbi c. opio locally, with the internal administration of iodide of potassium or sodium with alkalis and a minute dose of opium, accompanied by the free consumption of fresh lemon juice, the most satisfactory measures. The popular local applications containing belladonna do not, in my experience, seem to afford any result at all proportionate to their messiness and unpleasant smell.

An apparently trivial, but in reality a very important, matter is the use of a proper judgement as to the kind of support for a limb when the patient first begins to put it to the ground after an attack of thrombosis. A support of some kind is generally necessary, at all events for a time. The characteristic of a limb under these circumstances is the rapidity with which it changes in bulk after having been dependent for a short time.

The support of all others to be avoided for a limb subject to much change in bulk in different circumstances is an elastic stocking; there are few contrivances which do more harm, unless used with discretion, than this; a very large percentage of cases of thrombosis, and of increase of varicosity in ordinary cases of varicose veins, are due to the ill-advised use of elastic stockings.

The best support for these limbs after thrombosis is a well ventilated bandage of the crêpe Velpeau kind, which can be applied without "turns" like a puttee, and can at any time be adjusted to meet the varying tension of the part. A rubber bandage is inadmissible, in consequence of the tendency to eczema, etc., caused by its impermeability to perspiration, although the objection to it is to some extent mitigated if it is perforated and worn over a thin cotton stocking. The mistake usually made in the use of these appliances is that they are put on too tightly. In connexion with this matter the following points are of some clinical value. When a limb which has been affected with thrombosis is first put to the ground or allowed to be dependent, the foot will either become red, altering to a mottling of red and white, which, after some time, may change to a dusky bluish colour, or it will become immediately bluish in aspect. In the former case, it will probably become icy cold in a very short time as the mottled look appears; in such a case care should be taken to avoid using anything in the least degree tight about the limb; the indication is rather to keep the part warm with the slightest possible pressure. When the aspect of the foot is immediately blue, there is usually some warmth, and uniformly applied soft bandage pressure will soon enable the patient to get about. The convalescence in the former type of case is always more prolonged. Some apology may seem necessary for such trivial details. These trivial matters are always, I think, more difficult to get information about than those of great importance, and I am sure that, as a rule, the greatest errors of judgement are made in the management of the convalescent stages of illness. It is rare to meet with a practitioner who cannot deal with a serious disease, especially if it be acute; but it is by no means so common to find every one so well acquainted with the various minor matters which contribute so largely in the convalescent stage to the ultimate recovery of the patient.

VARICOSITY CONSEQUENT ON THROMBOSIS AND ITS TREATMENT.

The immediate sequence of thrombosis is the establishment of a collateral circulation. In the case of the smaller superficial vessels the direct interference with the circulation by the thrombus may not be sufficient to produce oedema, and the attack may pass off without leaving any appreciable difference in the vascular apparatus of the parts.

Blockage, however, of main venous channels—say, for instance, the femoral vein—necessarily leads to immediate oedema of the parts below, which remains until either the collateral circulation is fully established or the lumen of the blocked vessel is sufficiently restored. In a considerable percentage of cases, either in consequence of the inability of the collateral circulation to meet the requirements of the case or because the restoration of the lumen of the blocked vessel is incomplete—in many instances no

doubt these two factors are combined—permanent oedema, or at least a tendency to it, remains.

The establishment of this collateral circulation involves, of course, extensive dilatation of the various anastomotic veins, which have no chance of regaining their normal calibre unless the lumen of the blocked vessel is rapidly restored, as it is a fact that veins, especially if superficial, when much distended for more than a very short period do not regain their normal condition, but remain tortuous and dilated, although the obstacle which led to their distension primarily has been removed. The degree of the varicosity thus arising will therefore depend upon two main factors—(1) the length of time during which the collateral channels have been subjected to obstructive tension, and (2) the amount of incompleteness in the restoration of the normal lumen in the blocked vessel. These two factors have very important bearings on the question of treatment. The amount of varicosity dependent upon the blocking of a large main vein cannot be determined until the oedema resulting from the obstruction has disappeared. It is very doubtful whether—rare instances being excepted—in complete blocking of a large vein like the femoral the natural lumen is ever completely restored, it certainly is not so unless the thrombus clears up rapidly. For practical purposes, therefore, it may be assumed that, in cases of varix following thrombosis, in addition to the results of distension during the complete blocking of the vessel there remains the necessity for some increased capacity of the collateral channels, because the vessel in which the blockage occurred has not resumed its complete carrying power. The most characteristic example of this type of varicosity is that which forms over the pubic and inguinal region after thrombosis of the iliac veins following upon enteric fever.

My excuse for dwelling upon these elementary points must be that it enables me to emphasize the fact, which seems sometimes to be overlooked, that dilated and tortuous veins, commonly called varicose, following upon thrombosis, are rarely suitable for operative treatment, since, as they are almost without exception acting as collaterals, an operation is invariably followed either by the appearance of similar veins or by the occurrence of a hard oedema of a very intractable kind. If this were generally recognized, patients would be saved from much disappointment and a good deal of uncomplimentary criticism of surgical methods would be avoided.

Speaking generally, the only conditions in varicose veins of this kind which can be operated upon with advantage are three—localized thrombus in some pouch or dilatation; trophic changes occurring in the skin about a sacculated or tortuous vessel; and localized pain such as sometimes occurs when a nervous filament becomes stretched or irritated by inflammation or rapid increase in size of a vessel with which it is in relation. In either of these conditions the removal of the portion of the vessels involved is a rational proceeding, which may indeed sometimes be urgently called for.

The position of massage in relation to the treatment of these cases is not, I venture to think, fully understood. As soon as the more acute stage of the condition in a case of acute blocking of a large main vessel has passed, when pain, local heat, and general pyrexia have disappeared, gentle shampooing, the part being raised, is an admirable method for hastening the disappearance of the oedema, and later on gentle skilled massage, to improve the general circulation of the part, is sound in principle and practice; but to attempt to reduce by vigorous massage the size of the dilated veins carrying on the collateral circulation is neither good in theory nor in practice, because although it may for the time being empty the obvious collaterals on the surface of the part, it necessarily causes so much tension on the deeper vessels running directly to the seat of obstruction that it leads to their further dilatation, and in the end increases the tendency to general varicosity of the limb. As a matter of fact, the most benefit derivable from massage in these cases is when it can be applied on the proximal side of the point of obstruction, as by increasing the vigour of the circulation the natural suction action of the venous current is increased, and the blood flows more freely from the parts below. In this way the tension in the collateral channels may be to some extent

relieved without exercising pressure on their already weakened walls.

The treatment, then, of these cases after the patient is in a condition to be up and about largely resolves itself into the employment of gentle support afforded by well-applied bandages which should not be too tight, the blood flow being stimulated by voluntary movements and moderate exercise. In cases in which obvious oedema finally disappears, leaving the limb merely large, the supports, if they can be dispensed with comfortably, should be discontinued, and the general condition of the limb improved by intelligent massage.

In all instances of the kind under discussion the progress to as complete a recovery as is compatible with the circumstances of the case is vastly expedited by a course of douching, etc., at certain Continental watering places, of which Bagnoles de l'Orne is, in my experience, the most efficient.

In cases in which thrombosis occurs in a limb already the seat of varicose veins the relation of massage to the treatment is rather different. In such cases blocking of the deep main channels is comparatively rare excepting when thrombosis of a superficial vein is allowed to invade the deeper part. Thrombosis in cases of varicose veins is commonly confined to the superficial vessels, the deep channels being free; the use of massage, therefore, may be under these conditions used more freely than in the class of case just dealt with, because, the return of blood through the deep channels being unobstructed, damage to the smaller vessels is hardly likely to happen unless the vigour of the massage exceeds all reasonable limits.

But whether the case be one of thrombosis of a previously normal vessel, or of a part already varicose, no complete massage, in the ordinary sense of the word, can properly be used unless a free channel for the return of blood in the deep parts exists; to attempt to force a channel by massage in any way must, of course, be bad.

Technically, the best way to determine whether a case has arrived at a stage when massage can be safely employed with advantage is the following:

If, the patient having been previously in the upright position, when the part is placed in the horizontal posture the dilated veins empty themselves immediately—behaving, in fact, as they would do in an ordinary case of varicose veins—massage may be used with impunity.

If, however, the emptying of the distended vessels is slow, requiring, perhaps, gentle pressure with the hand to complete it, massage should be used with caution. If, after the part has been horizontal, or, better, a little raised on an inclined plane, for ten minutes or thereabouts, the dilated veins still show themselves distinctly, there is much obstacle to the return of blood through the deep vessels, and the case is one for very gentle shampooing only and bandage pressure.

NOT long ago we gave a short account of the results of certain researches on the etiology of beri-beri conducted by Drs. Henry Fraser and A. T. Stanton at the Institute of Medical Research in the Federated Malay States, which showed that a polyneuritis analogous to beri-beri could be induced in fowls by feeding them upon polished rice, but that this could be prevented if a certain proportion of the "polishings" was added to the rice, and they went on to discuss whether it was not possible that the disease was due to deficiency in organically combined phosphorus as suggested by Dr. Schaumann. In a recent paper in the *Lancet* (December 17th, 1910, p. 1755) this research is continued, with the result that analysis of the polishings of rice show that phosphorus was present in the form of phytin, the calcium magnesium salt of an organic acid containing phosphorus. They, therefore, prepared phytin, and added it to the polished rice, with the result that the fowls so fed developed polyneuritis, just as if they had received the polished rice only. They next found that when the polishings were extracted with 0.3 per cent. hydrochloric acid, and this extract was added to the polished rice, polyneuritis did not occur; and, further, when the phytin had been precipitated from the hydrochloric acid extract, the residue mixed with the polished rice prevented the occurrence of neuritis; but, so far, they have not been able to identify the active agent which averts the disease. It is apparently not a living ferment, as cooking the polishings in no way hinders their prophylactic efficiency.