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ON THE TREATMENT OF ELEPHANTIASIS OF THE LEGS BY LYMPHANGIOPLASTY.

*Being a Paper read in the Section of Tropical Medicine
at the Annual Meeting of the British Medical Association, Liverpool, 1912*

BY

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I. CLINICAL OBSERVATIONS.

MANY attempts have been made of recent years to devise a satisfactory method of dealing with elephantiasis of the legs; but, it must be admitted, the results of most of the new procedures have hitherto failed to confirm the expectations of their originators.

The most hopeful and, at the same time, the most rational and practical of the proposed methods appeared to be that first advocated by Mr. W. Sampson Handley in the *Lancet* of January 2nd, 1909, in a paper entitled "A Prospective Cure of Elephantiasis by the Operation of Lymphangioplasty." Mr. Handley elaborated his thesis and described his procedure in more detail in his Hunterian Lectures on the Surgery of the Lymphatic System, reported *in extenso* in the BRITISH MEDICAL JOURNAL of April 9th, 1910.

Enjoying rather exceptional opportunities for repeating Mr. Handley's experiments, we wish to record our experience of a short series of cases, which have yielded interesting but, on the whole, uniformly disappointing results. In effect, we have found that so long as the patient is kept absolutely recumbent after his operation the results are apparently most flattering; but as soon as he begins to be up and about the swelling rapidly returns, and in a short time the leg is just as swollen as it was before the operation. It does not matter how long rest is enforced, the result is the same once the action of gravity comes into play.

Mr. Handley, in his summary of the results of the operation, writes: "To my mind lymphangioplasty has

failed to establish its position in the treatment of elephantiasis." And again: "It would appear that in the lower extremity, as contrasted, for instance, with the arm, the strenuous opposition of gravity nullifies the effects of the operation as soon as the limb is allowed to hang down for even a short period daily. The operation, indeed, *does* supply the channels which are missing, but, as I have already insisted, it does not provide a motive force. It is unable to fight against the full vertical pressure of gravity in the lower limb."

While our clinical results are entirely in accord with these statements, our findings in and around threads, taken from the limbs two or three weeks after lymphangioplasty, and in others experimentally introduced into the subcutaneous tissues of guinea-pigs, appear to show that, quite apart from the action of gravity, the artificial lymph channels do not persist for any length of time; and that there is finally an obstruction to lymph return from the obliteration of lymphatics in the neighbourhood of the inserted thread. In all our cases Mr. Handley's technique has been carefully followed. The legs were prepared for a week before operation by painting them daily with a 2 per cent. solution of iodine in rectified spirit, after removing any specially thick skin by the application of salicylic acid and resorcin ointment. The patient was kept at rest during this time with the leg well bandaged over a mass of wool from the toes to the groins. The threads were introduced and ran up the inner side of the leg from the instep well on to the abdominal wall, and sometimes a second set were introduced on the outer side.

Record of Cases.

CASE I.

Yussef-el-Nahas, a young Egyptian fiki-preacher, aged 25, was admitted to Kasr-el-Ainy hospital from Faraskour, Lower Egypt, on April 26th, 1910, with well-marked elephantiasis of the right leg, which had started a year before, and had gradually increased with recurrent attacks of fever and swelling. *Filaria nocturna* were found in the blood. The foot and lower part of the thigh were much swollen and covered with rough thickened skin. After the usual preparation lymphangioplasty was performed on May 14th under stovaine anaesthesia. At the first dressing four days later the skin lay in folds and all the measurements of the limb had very considerably diminished and so remained till June 6th, 1910, when the patient was discharged. He was seen fifteen days later in the out-patient department, and the leg was just as swollen as before operation, if anything rather more so, especially on the dorsum of the foot.

CASE II.

Ahmed Mohammed Foada, aged 70, an Egyptian boatman from Damietta—one of the principal centres of elephantiasis in Egypt—was admitted on April 26th, 1910. Advanced elephantiasis left leg. Rapid onset and increase since first attack of fever six months ago. Some lymphangiectases below and varicose groin glands. No filaria found. Lymphangioplasty, May 14th; discharged sixteen days later, practically no swelling. Seen in out-patient department after a fortnight, swelling as bad as before, but skin more supple and not so thickened.

CASE III.

Charib-el-Sayed, an Egyptian fellah, from Giza near Cairo, aged 18. Admitted June 23rd, 1910. Elephantiasis of left foot and calf. *Filaria* absent. Operation July 2nd, followed by expected improvement which persisted till his discharge. He did not return to out-patient department, and could not be traced.

CASE IV.

Mohammed Ismail Khalil, an Egyptian pedlar, aged 22, from Boulac, Cairo. Admitted July 3rd, 1910. Had an inguinal abscess opened five years before and repeated attacks of fever and pain and an ever-increasing swelling in the left leg. No *filaria* found. Operation July 9th. Circumference of foot 26 cm., reduced after operation to 25.9 cm.; of calf 42.6 cm., reduced to 35.2 cm.; of knee-joint 44.4 cm., reduced to 39.4 cm.; and of thigh 48.2 cm., reduced to 42.5 cm. Seen in the out-patient department five weeks after operation, all the old measurements had returned and were even exceeded.

CASE V.

Mohammed Aly-el-Ashairy, an Egyptian café-keeper, aged 25, from Embabeh, near Cairo. Admitted August 2nd, 1910. Marked elephantiasis of the left leg, said to have followed a wound from a bit of glass on the sole of the foot. No *filaria*. Operation a week later and reduction of all measurements by 5 cm., but a month later, in the out-patient department, all his swelling had returned.

CASE VI.

Mohammed Farag, an Egyptian clerk, living in Cairo, aged 32. Admitted October 6th, 1910, with two years' history of elephantiasis of the whole of the left lower extremity. No *filaria*. Operation and results precisely similar to other cases.

CASE VII.

Hassan Ahmed El-Sakka, an Egyptian boy of 15. Admitted October 28th, 1910. Elephantiasis of right foot and leg. No *filaria*. After operation perfect result for ten days, when the boy got out of bed and walked a little. Almost immediate return of the swelling, which disappeared rapidly after the insertion of a second series of threads on the outer side. While still free from swelling, a strip of skin 17 cm. long by 3.3 cm. wide was excised from the middle of the calf and a narrower strip from the front of the ankle. The swelling slowly returned as soon as the boy began to walk, and but little ultimate benefit resulted.

CASE VIII.

Mohammed Mikhawi Suleiman, an Egyptian fellah, aged 25, from Bibeh, Upper Egypt. Admitted November 26th, 1910. Swollen left leg since an incision into a plague bubo in the left groin eighteen months ago. Swelling confined to the thigh and not like a true elephantiasis. Improved rapidly after operation, and, up to the time he was lost sight of, appeared to be more likely to derive permanent benefit from the lymphangioplasty than any of the other cases.

Many other cases could be quoted, but in all the swelling was temporarily reduced within a few days of the operation, but returned and persisted even after the first day's walking.

Our best thanks are due to Dr. Tewfik Omar, resident surgical officer, for the care he has taken in the preparation of these cases for operation and for his skilful after-treatment.

II. THE CONDITIONS AFTER LYMPHANGIOPLASTY IN A HEALTHY PATIENT.

To examine the condition of threads introduced into healthy tissues, the operation of lymphangioplasty was performed on a patient with a healthy limb by Dr. Aly Ibrahim; and twenty-one days later a block of tissue containing a portion of the thread and the surrounding tissues was cut out and examined. The piece of tissue was embedded in celloidin and sections cut out and stained by Professor A. R. Ferguson, who reports as follows:

The thread is seen in both longitudinal and transverse directions, more particularly in the former, the fibrils of the thread are slightly separated, and between them leucocytes have made their way from their margins inwards. Peripherally the thread is closely invested by an extremely cellular tissue in which are set considerable numbers of active phagocytes (giant cells). Some of them are pointing directly inwards towards the frayed-out margins of the thread. The tissue in which the giant cells lie is composed of young connective tissue corpuscles, and is crowded with polynucleated leucocytes. A few newly-formed blood capillaries occur in this tissue also. Externally to this layer is a well-defined concentric zone of comparatively dense fibrous tissue, which gradually merges into the surrounding fibro-adipose subcutaneous tissues. The few lymphatic channels seen in the neighbourhood of the smaller arteries of this region are the seat of a lymphangitis, as indicated by a leucocytic infiltration in and around their walls, of the same nature as that noted above at the site of the thread. From the dense tissue and apparently progressive nature of the reaction which has taken place round the introduced thread, it does not appear probable that anything of the nature of a lymphatic channel sufficient to maintain a permanent drainage of lymph from the surrounding tissues into the canal round the thread could occur.

III. CONDITION OF THREAD AND SURROUNDING TISSUES AFTER LYMPHANGIOPLASTY FOR ELEPHANTIASIS.

Our next experiment was to cut out a thread which had been inserted in the course of the operation of lymphangioplasty on a patient with elephantiasis of the leg. The line of the thread was marked at the time of the operation, and twenty-one days later a piece of tissue, 1 in. in length, consisting of skin, subcutaneous tissue, and the thread, was removed *en bloc* and examined. It was seen at once that the thread, apparently quite unaltered, slid up and down in a thick-walled canal of fibrous tissue, and was only with difficulty retained in its place in the section. Microscopical sections were cut with some difficulty owing to the looseness of the thread, and showed the following appearances. Professor Ferguson again reports:

When this piece of tissue was removed the thread, although *in situ*, was very loose, and during the preparation of sections, cut from celloidin blocks, has unfortunately dropped out. The section, therefore, shows a well-defined space surrounded by a cellular tissue, having essentially the same features as that described as existing round the thread in healthy tissue. The cellular reaction in degree, however, is much less, and the numbers of the giant cells in particular are much reduced. The surrounding lymphatics of the district are marked by collections of lymphatics; but in a considerable number of

sections examined no traces of these cells were found entering into the walls of the channel left by the thread; and it is highly probable that with the further development of fibrous tissue immediately around the site of the thread any already existing lymph channels in this area would be obliterated by pressure.

The vessels in this tissue, and particularly the medium-sized arteries, are the seat of chronic sclerotic changes especially met with in the new formations of elephantiasis.

IV. EXPERIMENTAL LYMPHANGIOPLASTY IN HEALTHY GUINEA-PIGS.

To further determine the fate of buried silk threads in the subcutaneous tissues the operation of lymphangioplasty was performed by Dr. Aly Ibrahim on a series of guinea-pigs, and the sections of threads and surrounding tissues subsequently examined by Dr. Anis Onsy. The details of technique were approved by Professor W. H. Wilson, Professor of Physiology, and the preparation and examination of the specimens controlled by Professor A. R. Ferguson, Professor of Pathology.

With the strictest aseptic precautions, a thread of No. 3 silk was introduced under the skin, and ran from the lower part of the abdomen through the subcutaneous tissues of the thorax into the axilla in each instance. Five hours before each animal was killed a small quantity of diluted Chinese ink was injected into the immediate neighbourhood of the distal end of the thread to test the permeability of the surrounding lymphatics. The axillary glands were subsequently dissected out, and were invariably found to contain black pigment granules in their substance.

After the animals had been killed, a length of tissue containing the thread was dissected out, and fixed in a 10 per cent. watery solution of formalin. The specimen was gradually dehydrated in alcohol, and then embedded in paraffin, whence sections were cut and examined microscopically.

The first guinea-pig was killed *two days* after the lymphangioplasty, and it was evident that very little change had occurred in the tissues along the track of the silk. The pigment granules were thickly massed around the thread, and became fewer and fewer from this centre outwards to the periphery of the section.

At the end of *four days* the second animal was examined, and now a cellular infiltration had begun in the immediate neighbourhood of the thread. This consisted mainly of a mass of round and polymorphonuclear cells. Small thin-walled, obviously newly formed, blood vessels had made their appearance, and the granules of pigment could still be seen lying in close contact with the thread. The third animal was examined *six days* after the operation, and considerable changes were apparent in the tissues. The thread was now surrounded by thin-walled blood vessels lying in a richly cellular infiltration, in which the polymorphonuclear cells were much less numerous than in the former section. The lymph spaces at the periphery only were black with pigment granules (Fig. 3). *Twelve days* after operation the fourth animal was killed, and at once it was remarked that an extensive fibro-cellular reaction had occurred, which had obliterated the pre-existing lymph spaces in the immediate neighbourhood of the thread. New vessel formation was very active, and there was no sign of pigment about the track of the thread.

From the animal examined after *fifteen days* the section showed that the thread was completely enveloped in a thick mass of fibro-cellular tissue containing but few blood vessels and

with very little cell infiltration beyond it. New connective tissue corpuscles of spindle shape were numerous, and there was no deposit of pigment for some distance round the thread, owing to the blocking of lymphatic spaces by the progressive development of fibrous tissue.

In the specimen removed from the animal *a month* after the operation the fibrous tissue encapsulating the thread was relatively thin and laminated, and contained many spindle-shaped cells. Trabeculae of connective tissue were seen passing inwards into the thread, and breaking it up into strands. These trabeculae contained numerous new blood vessels. The individual strands of the silk were enveloped in a dense cellular infiltration consisting mainly of round cells, and there was also some surrounding haemorrhage.

It is to be specially remarked that up to the sixth day after operation the pigment granules were most numerous around the thread, showing that the original lymphatics still persisted up to this stage. After six days and up to a month the granules were found only at the periphery and were entirely absent from the neighbourhood of the thread, which certainly seems to indicate that the lymphatic circulation along the course of the artificial lymphatic—the thread—becomes gradually blocked and finally ceases about fourteen days after the operation.

CONCLUSIONS.

1. Clinically, it is abundantly evident that lymphangioplasty fails to effect anything but a very temporary improvement in elephantiasis of the legs. The swelling is very markedly reduced within forty-eight hours after the operation; but the improvement persists only so long as the recumbent position is maintained. Within at most twenty-one days after the operation, or as soon as the patient begins to walk, the swelling invariably returns and no permanent improvement results.

2. The examination of the tissues surrounding threads introduced during the operation of lymphangioplasty in cases of elephantiasis, and also around threads introduced into healthy tissues of man and of guinea-pigs, supplies very adequate reasons for the failure of the operation.

Important as the action of gravity may be in contributing to the failure to maintain a new artificial lymphatic circulation, it appears that this want of success is due in far greater degree to definite reactive changes in the tissues immediately around the thread, which soon isolate the new lymph tube from the surrounding lymphatic areas and eventually completely obliterate it.

Briefly the series of changes in the tissues around buried longitudinal threads in the subcutaneous tissues are as follows:

1. For a short time the threads, by virtue of their capillary action, drain the surrounding tissues of the lymph contained in them.

2. The threads in the tissues soon excite a definite cellular reaction, which leads comparatively soon—from fourteen to twenty-one days—to the formation of a dense and progressively contracting fibrous tissue. This walls off the thread and crushes the adjacent lymphatics out of existence, and thus effectually prevents any absorption of fluid into the space immediately around the thread

itself. These fibrous changes, occurring around the ends of the thread, as well as along its whole length, eventually completely isolate it, and it may then perhaps be compared to a long worm lying within an impermeable sheath.

3. The thread is later penetrated by rows of cells, running in along its fibrils, which must eventually lead to its complete disintegration; and the formation of a solid column of dense fibrous tissue along which no absorption of fluid of any kind can possibly occur.

