Case 1.—A lady, aged 35, with a diffuse impulse which could be felt as far out as the mid-axillary line, had been kept in bed for three months and the heart condition diagnosed as dilatation. A carefully measured skiagram showed a heart of normal size, though somewhat displaced to the left by spinal curvature. Within a fortnight she was playing tennis.

Case 2.—An elderly, stout, stocky, emphysematous man, aged 68, complained of breathlessness on exertion, which his family attributed to increasing laziness, and urged exercise "to work off his fat." No impulse could be felt, no outline percussed, nor was there other evidence of disease. I did not think that the heart was enlarged, but a skiagram showed marked general enlargement, while the electrocardiogram had inverted T waves in Lead 1, accompanied by left ventricular preponderance. This case is easy to understand, but I know of no satisfactory explanation of the conducted impulse which is the common source of error.

Cardiac pain must, for want of space, be dismissed perfunctorily, though of all recent advances the recognition of coronary thrombosis is undoubtedly the most important. The idea of myocardial ischaemia as the essential cause of anginal pain, both in thrombosis and in the angina of effort, has been quickly grasped by the profession at large, while the conception of angiospasm as affecting the coronary circulation throws light on the anomalous anginas so common among "highly strung" women, though by no means confined to one sex.

Summary and Conclusions

Much work has been done in recent years on vascular questions to which no allusion has been made. A colleague suggested that I should concentrate on therapeutics, but to have epitomized recent work, some of it representing "advances," would have left no time for anything else; while, apart from generally known or easily accessible information, it is the therapeutics of individual cases which puzzles us and which is not capable of generalization. Yet in my disjointed remarks, picking and choosing among subjects about which whole treatises have been and will be written, there is a connecting link, and one which lies at the root of cardiac therapeutics. It might perhaps be called a plea for liberty. What is life worth without liberty? What diseases are there, compared with heart disease, real or suspected, in which liberty is so constantly curtailed by professional advice? The first stage of treatment in nearly all forms of definite heart disease, as in the case of fractures, is rest. But when is one to allow the fractured limb to be moved and when to be used? When, in heart troubles, is it safe to allow liberty, and to what extent?

Glancing over these notes we find peripheral troubles ascribed to heart disease, and rest prescribed; transient paresis in a limb due to angiospasm ascribed to cerebral lesions, and undue rest enjoined; people with high blood pressure, though perhaps in danger whatever may be done, cut off from every amelioration and interest in life and with no assured hope of commensurate benefit; the innocent irregularity of childhood with perhaps a tendency to faint regarded as a ban on games; patients with innocent murmurs told they must not marry or play games or climb mountains; people with "dilated hearts" (which are not dilated) kept in bed for weeks; patients with actual heart disease so kept for months where weeks would suffice; and those with a tendency to giddiness unduly alarmed. Of course, all this has been done in the past with the best intent. The question of when to make a move has always been difficult; but we are better equipped in the present state of knowledge than heretofore. Infected hearts get well, as do inflamed tonsils; at the worst the heart has a great reserve, and many damaged hearts can support the ordinary calls of life.

Lastly, the heart may generally be trusted to impose its own restrictions. If given a chance, twinges of pain or shortness of breath will, as a rule, pull the patient up before much harm is done. I have seldom had to regret allowing gradual liberty to the extent of what the patient could support with comfort, and it is encouraging to find that recent authorities take similar views.

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- ⁸ Lewis: *Loc. cit.*

TREATMENT OF LYMPHOEDEMA BY PLASTIC OPERATION

(A PRELIMINARY REPORT)

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In view of the general lack of success that has hitherto attended the treatment of lymphoedema, whether medical, physiotherapeutic, or surgical methods have been employed, the result in the case described below is of interest. The pathology of lymphoedema is still obscure in the great majority of instances, especially in those cases in female patients in which the onset is a gradual one about the time of adolescence. In the case here reported there was no evidence of acute lymphangitis, and although there were possible sources of infection the evidence for an inflammatory origin is not convincing. Probably it must be regarded as of the non-inflammatory type, without evidence of congenital or familial factors, and should be included in the group recently described by Allen¹ as "praecox."

Previous Case History

The patient is a female aged 28 years. She is of healthy parentage, being one of six children, of which one has asthma, one epilepsy, and one pulmonary tuberculosis. Following a healthy infancy and childhood she had an operation for acute appendicitis at the age of 17. This was followed by jaundice, and during the next four years by a succession of sore throats and of boils on the legs. When 21 she had acute tonsillitis and a severe hysterical attack, and many teeth were removed for pyorrhoea. At 22 the menstrual flow, which had commenced at 13 and had proceeded normally, apart from pain and the passage of clots, suddenly ceased. At 24 swelling of the right foot and ankle was noticed, and this gradually increased and spread as far as the knee: it disappeared with rest in bed and massage, but returned as soon as upright posture was resumed. A few months later the left leg commenced to swell. She was admitted to St. Bartholomew's Hospital nine months after the onset.

Examination.—On admission (January, 1931) she had an unhealthy appearance, with muddy complexion, coarse and dry hair, and acne on the face. Both legs were swollen to the lower third of the thighs, but the swelling was mainly about the ankles and on the posterior aspect of the limbs, where the skin was firm and stiff and felt thickened. About the ankles there was bluish-red discoloration, and pitting could be obtained, but with difficulty. There was slight tenderness on deep pressure about the ankles. No distension of veins; pulsation was felt in the arteries. Urine normal; no evidence of faulty renal functions. Slight reduction of haemoglobin (71 per cent.). Examination of pelvic organs under an anaesthetic disclosed no disease or cause of oedema. All other organs

and functions appeared healthy. Administration of thyroid caused no improvement, but injections of salyrgan, combined with ammonium chloride by the mouth, appeared to diminish the rapidity with which the swelling reappeared when the patient was up and about. She returned home to continue with injections of salyrgan. While there the swelling gradually increased unless she remained in bed, and by May, 1931, the legs were much larger, and the skin became red, cracked, and painful at the sides and back of the ankles; serous fluid oozed from the cracks, and warty excrescences developed.

Readmission.—She returned to hospital in November. The general condition was not altered, but the legs were much worse. She held them flexed at the knee, and could not straighten them; there were numerous septic ulcers and pustules in the area of the skin around the ankles, where the warty excrescences had developed. Rest in bed and local dressings for the ankles caused considerable improvement in the swelling and in the condition of the skin. Portions of the excrescences were taken for histological and bacteriological examination and showed the changes typical of lymphoedema, with small, scattered areas of inflammatory reaction; no organisms other than those commonly present on the skin were found. The warty elevations subsided and desquamated to some extent following treatment with soda baths, salicylic acid, and the local application of filtered x rays. The legs still swelled as much as ever when she was up and about, and attempts were made to connect the superficial with the deep lymphatics which might be patent by Kondoleon's operation on both legs (June, 1932). She returned home in July, but no improvement was seen, and she was confined to bed or to a chair.

Third Admission.—In June, 1933, she again returned to hospital: no change was noted, and she requested amputation of both legs. The warty excrescences were shaved off and the skin healed well. Sinusoidal current baths and elastoplast bandages all failed to control swelling.

Plan of Operation

In view of the crippled condition of the patient, of the failure of all forms of treatment that had been tried, and of the hopelessness of the outlook unless further measures could be devised, it was decided to attempt to restore lymph drainage from the legs to the trunk by means of grafts of skin and subcutaneous tissues. Before doing this the condition of the blood and lymph circulation was ascertained as accurately as possible.

The thermal responses of the limbs to raising the body temperature were ascertained by Mr. Paterson Ross, and showed the absence of organic vascular occlusion; the femoral vein was exposed on one side and appeared normal, and blood was drawn from it into a syringe; no distended superficial veins were observed, and pulsation could be felt in the superficial arteries in the usual sites. The excretion of phenol red by the kidneys was ascertained after subcutaneous injection into (1) the left upper arm; (2) the left thigh (12 cm. below great trochanter); and (3) the calf of the left leg. An injection of 2 mg. was made at each site, and the total quantities excreted in two hours were: (1) 1.65 mg.; (2) 0.92 mg.; and (3) 0.91 mg. This result was taken to be an indication that the obstruction was at the junction of the limb to the trunk, and that the lymph vessels within the limb were patent.

The possibility of implanting a strip of skin and subcutaneous tissues with its lymphatics, so as to bridge the obstruction and provide drainage of lymph from the limb to the trunk, was now considered. The success of such a procedure would depend upon the answers to the following questions:

1. Is the obstruction in the inguinal region, and are the lymph vessels of the limb patent as the test with phenol red suggested?

2. Can the existing lymphatics of the lower limb anastomose with another set if the two be brought into juxtaposition?

3. If union can thus be obtained, say, in the upper part of the thigh below the block, will that be sufficient to tap the whole system and relieve the oedema of the foot, or will it only effect a partial relief?

The ideal would be to join the upper thigh lymphatics with a system that was working perfectly in a normal direction. Such was available in the arm lymphatics. The forearm could easily be brought close to the upper and outer part of the thigh, and if two raw areas were made on the opposing surfaces, a large surgical union would take place, while if the lymphatics also anastomosed the lymph of the thigh would drain through the join and be carried via the arm lymphatics into the general system, the block being thereby side-tracked. If under these conditions no union of lymphatics occurred and no relief of the oedema took place, then it was difficult to conceive of any other surgical device of a plastic nature that could possibly work. If, on the other hand, it were successful, the theory of the inguinal block would receive surgical proof, and efforts could then be made to convert this crucial experiment into a plastic of a permanent nature, by removing, stage by stage, the arm skin with its lymphatics, and transferring it to the body so that the block would be bridged over and the lower limb system joined to the axillary.

Operation Notes

Four operations were carried out altogether, and an account of each is given below.

FIRST OPERATION

April 18th, 1934.—An incision was made seven inches long on the flexor aspect of the left forearm. Cross incisions were made at the extremities to enable two small flaps to be turned outwards and inwards respectively. The incision did not pass through the deep fascia. An exactly similar area was laid bare in the upper and outer part of the left thigh. Again the incision was not carried through the deep fascia, but was

FIG. 1.

made to coincide with the scar of the previous Kondoleon operation. The deep fascia of the forearm came to lie in contact with the subcutaneous tissue of the thigh, and the two small flaps were sutured on each side like wings. This method of approximation was carried out with the idea of exposing as much of the subcutaneous surface as possible to get lymph anastomosis. (See Fig. 1.)

April 31st.—Stitches out. The whole of the leg appeared to be smaller and the oedema less. Massage and movements instituted.

May 16th.—Slight pulling away of the flaps of the lower end.

May 17th.—Sitting up in chair yesterday evening. The left leg did not swell or show discoloration.

May 22nd.—Right leg very swollen between knee and ankle.

SECOND OPERATION

June 6th.—As the result of the anastomosis had been definitely satisfactory, a flap of skin was marked out on the inner flexor surface of the left arm which should contain the lymphatics now draining the leg so that it should be embedded into the side of the body and reach the axillary system in

the inframammary region. This long flap was made continuous at its lower end with the outer of the two flaps of the first experimental operation. To produce the necessary raw area on the body, and to cover the raw area made on the arm, a flap similar in size was cut with its base backwards. As much of the arm flap as possible was brought into position against the body; on the other hand, the body flap somewhat sagged away from the area it eventually covered. Mild infection followed. The oedema was further subsiding in the left leg.

THIRD AND FOURTH OPERATIONS

June 27th.—An operation was carried out to undermine the remaining portions of the flaps and to free adhesions which had occurred between the arm and body. This was a type of "delaying" the flap, or of partial division from the original blood supply, so that when the two were finally separated there would be no loss of skin. As the lower part of this arm flap had already adhered to the upper part of the thigh it was considered safe to release that portion of the flap at the same intervention, thus freeing the hand. Severe infection followed this undermining process.

July 4th.—Blood transfusion was carried out, and this had the effect of clearing up the sepsis and improving the general condition.

July 18th.—Discharged to the country. Arm still attached to the side; no recurrence of the oedema.

September 21st.—Readmitted to hospital. Patient had not been in bed, and had been active in housework and in walking out of doors. Left leg normal except for very slight swelling on standing. Right thigh and leg also less swollen.

September 26th.—In the fourth operation the two flaps were severed and interchange of arm, body, and leg skin completed.

Discussion

When the arm was joined to the thigh on the left side (first operation) the experimental lymphatic "tap" proved itself so efficient that the oedema definitely subsided after three weeks, and continued to do so even after the patient had learned to hobble about in the upright position. The other leg remained swollen.

Having thus proved that two superficial lymphatic systems could be surgically joined, it was only to be expected that if a strip of arm skin were taken of sufficient length to reach the axillary system, the lymph current would pass up this strip and so into the axillary. There was some technical difficulty in converting the experimental operation into a permanent plastic, but when it was completed, on September 26th (fourth operation), the union of the two systems of lymphatics proved adequate to keep all discomfort and practically all swelling from the operated leg since that date. There has, in fact, been no swelling of the left lower limb except in a very small patch of the calf since a few weeks after the original operation on April 18th.

Whether these findings can be corroborated in further cases remains to be seen. The experiment, however, appears to have proved to us that a lymphatic tap below the obstruction is sufficient to cure the whole limb. It is desirable that some simpler "tap" than the arm-flap plastic should be discovered. The cross-abdominal flap could be transferred by stages to by-pass the block, but one has hesitated to recommend this, for the line of direction of the lymphatics will not be either longitudinal or running towards the axillary end. On the other hand, one knows by experience of the tubed pedicle flap that the blood vessels can and do completely change their direction by the process of anastomosis and atrophy, and it is not impossible that the lymph vessels will do the same. The question of the lymphatic valves may be a deciding factor.

The principle having been proved, all kinds of simpler modifications of forming a bridge obviously present themselves. For instance, in Mr. McIndoe's case at the Hospital

for Tropical Diseases, in which he kindly invited one of us (H. G.) to co-operate, the arm skin was permanently transferred at the first operation, the arm flap, fifteen inches by four inches, being embedded from the thigh up to the inframammary region. A small secondary operation to release the arm is all that will probably be required in this case. The arm flap, as designed in the first case and carried out more directly in the second,

FIG. 2.

FIG. 3.

appears to be sound physiologically; it is not difficult to achieve surgically, and not likely to give trouble from trophic causes. (See Figs. 2 and 3.) As the body and thigh skin is transplanted into the place the arm flap was taken from, the deformity of the arm is confined to two long parallel scars. The position is slightly irksome to the patient, but good nursing alleviates this materially.

Result

Three months after the completion of the operative procedures there are no signs of swelling in the left leg except that a slight stiffening of the skin and subcutaneous tissues can be detected after the patient has been walking about or sitting in a chair for six hours. On December 13th the dye test was repeated: 2 mg. of phenol red were injected as before subcutaneously into (1) left upper arm, (2) left thigh (12 cm. below great trochanter), and (3) calf of left leg. The amount of dye recovered was (1) 1.35 mg., (2) 1.2 mg., and (3) 1.06 mg., showing a striking improvement on the figures obtained before the operations.

We wish to acknowledge our indebtedness to many colleagues at St. Bartholomew's Hospital for help, suggestions, and advice, and especially to Sister Evans for her skilful nursing.

REFERENCE

- ¹ Allen, E. V.: *Arch. Int. Med.*, 1934, lxiv, 606.

Dr. Fortescue Fox has now withdrawn from the active work of producing the *Archives of Medical Hydrology*, the quarterly publication of the International Society of Medical Hydrology, and the current number of that periodical contains a summary of the services he has rendered since his influence and exertions brought the society into being in 1921. Of this society he was the first president, and was appointed honorary editor of the *Archives*, which made their first appearance in 1922. He held this post almost continuously until a year ago. With the assistance of his daughter he built up the position of the society, and established the *Archives* as the main international medium for communications on medical hydrology and allied subjects. Dr. Fox was also chairman of the society's Committee on Rheumatism from 1925 to 1928, when it was absorbed into the International League against Rheumatism, with himself as first president, an office he still holds. He has been one of the most active members of the International Standard Measurements Committee. A warm tribute is also paid, in the issue of the *Archives* for January, 1935, to the energetic work of Miss Fox on behalf of the society and its publication.