

THE PLACE OF PHYSICAL MEDICINE AND
ORTHOPÆDIC SURGERY IN LEPROSY

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The surgeon and physical therapist have three important objectives in the field of leprosy. The first is the prevention of deformity; the second is the correction of deformity when it has occurred, and the third is the rehabilitation of the crippled patient. These will be considered only in their relation to the crippled hand.

Prevention: In order to prevent deformity, we need to understand exactly how and why deformity occurs in leprosy and then find out how the various factors in its causation can be overcome. These causes of deformity, for the sake of simplicity, can be summarized in three main groups.

Group I. Causes which are associated with paralysis of the motor nerves,

Group II. Causes which are associated with paralysis of the sensory nerves, and

Group III. Causes associated with the direct effect of leprosy on the tissues of the hand.

There are two important deformities of the hand in leprosy. One is the limitation of movement and stiffness of the joints, and the other is the absorption and destruction of the fingers. We will discuss the cause, and prevention of each of these separately, and under the group headings mentioned above.

Joint Limitations: Motor paralysis causes a limitation in the range of active movement of the joints. The only common paralysis affecting the hand in leprosy is a high ulnar nerve palsy and a low median nerve palsy. This causes clawing of the fingers and inability to oppose the thumb. We do not know of any certain way of preventing this paralysis. The operation of nerve decompression is sometimes of value, especially in cases of acute swelling of a nerve. In the case of the ulnar nerve the operation consists in stripping of the sheath in the swollen segment, leaving the sheath in continuity beside the nerve. It may also be of value to transpose the nerve to the front of the elbow and bury it in muscle. The operation on the median nerve is a stripping of the sheath from the lower three inches above the wrist and the division of the flexor retinaculum over the carpal tunnel.

In spite of all medical and surgical treatment, however, paralysis will frequently occur, and clawing of the hand will follow. It is important to know therefore the limitations of this palsy.

The forearm muscles that close the fist are only rarely paralysed and the power of the grasp is therefore usually good. The small muscles of the hand are commonly paralysed, and this causes an inability to open up the finger joints and to oppose the thumb to the fingers.

The patient is thus able to hold an object which is pushed into his hand but finds it difficult to open his fingers in preparing to grasp the object. This is the limit to which motor paralysis alone will cause deformity to a hand. The joint stiffness which frequently follows is due to the disuse of the fingers which follows paralysis. If the fingers are never fully opened, the skin on the palmar surface will slowly contract until finally the fingers cannot even be pulled open, and they become stiff in flexion.

The prevention of this disuse-stiffness is simple. If the patient is instructed to exercise his fingers daily and gently to pull them straight by using his other hand, he will never develop disuse stiffness, and a muscle balance operation will be able to restore his range of active movement.

Group II. Anaesthesia is not a direct cause of joint stiffness. It removes however the great safety factor of pain and temperature sensation and thus allows a constant succession of burns and injuries to the fingers. These injuries are mostly on the palmar surface of the fingers and heal by scars which pull the fingers into flexion deformity. Other injuries become infected and may cause supuration in and around the joints leading to ankylosis or limitation of movement. This type of deformity is difficult to overcome by exercises and operation.

Most of these burns and injuries are avoidable if patients are trained to alertness against the common sources of injury. They should also be shown the importance of treating any small injuries that will occur in spite of vigilance.

The third and least frequent cause of joint deformity is a damage to the joint by the disease of leprosy itself. This usually takes place during a phase of acute reaction, and may take the form of a softening and osteoporosis of the sub-articular cancellous bone. The articular cartilage is then a shell unsupported by rigid bone beneath it, and may collapse under the slightest strain, giving a distorted joint. Such a joint may become completely stiff, or else have a limited and eccentric movement.

This softening of the sub-articular bone in the fingers seems to be most marked during the phases of reaction in lepromatous leprosy. It is a reversible condition and reossification may take place in the softened bone providing the articular cartilage has not collapsed in the meantime.

If the fingers are splinted during the phase of reaction, then the cartilage will not have any strain placed upon it and the joint will survive until reossification takes place. For the splinting we suggest a simple wooden splint, made of half a cocoanut shell placed on a straight wooden splint. The hand grasps the cocoanut shell, with the fingers surrounding it and the thumb beside it, and then the hand and forearm are lightly bandaged to the splint. The splint may be removed occasionally for gentle movements and for meals. The difficulty is to decide how long this splint should be worn. It is probably only necessary to wear it during acute reaction when the finger joints themselves are either swollen or painful.

Finger absorption: Group I.

Motor paralysis is not a cause of finger absorption. In fact it may be said to exert a protective function. If claw-hand occurs early in the disease before anaesthesia has been present for long, the ends of the fingers are curled up into the palm and the hand is not used. The fingers therefore do not encounter the same hazards that they would encounter if the hand were strong.

Group II. By far the greatest proportion of finger absorption is secondary to the trauma and burns which follow anaesthesia. There seem to be two types of injury which result in finger absorption. One is the frank open wound or deep burn which becomes secondarily infected and in which the infection deepens to involve the bone. A sequestrum is formed and extruded and then the shortened finger heals.

The second type of injury may occur in the absence of an open wound and is due to the summation of a larger number of small injuries and stresses which would not damage a normal hand. In an anaesthetic hand without normal powers of adaptation and recovery this causes scarring of the soft tissues and a fine fragmentation and absorption of the bone.

If one wants to prevent finger absorption from these causes one must not only train the patient to be alert to prevent gross injuries and burns, but must also guide him in the selection of an occupation. There are many occupations which are within the capabilities of the neural leprosy patient, but which involve a degree of stress and violence to the hands which is not justifiable for these patients.

The real trouble has been that in the past too many patients, and doctors too, have thought that finger absorption was inevitable and that therefore special care was scarcely worth while. We have been able to show that if an occupation is carefully selected, and if patients are instructed in detail in the way to use their hands in the every day tasks of eating and working and cooking, it is

possible for even the most advanced neural case to lead an active life without losing his fingers.

Group III. There is no doubt that the *M. leprae* invade the bone marrow and at certain stages of the disease may alter the structure of the phalanges, making them more liable to injury or hindering their recovery from injury. We do not believe that this direct effect of leprosy is a very significant cause of finger absorption. If care is taken of the fingers during acute reaction, and if fingers are splinted in the position of function when they are swollen or tender, finger absorption will be uncommon.

In concluding this section, we would emphasize that providing reasonable preventative care is taken with regard to these secondary changes that follow anaesthesia and paralysis, it should be possible for the vast majority of neural leprosy patients to keep their hands intact and active to the end of their days even although they may have some disability from paralysis. *This statement is true even in the absence of any operative surgery.*

Surgical reconstruction of the hands.

In every case active exercises and physiotherapy should precede surgery so that the maximum mobility of joints may be achieved before operation. The range of movement of a joint may increase after operation, but in general it may be stated that we are not able by operation to increase the total range of passive movement of a joint. What we are able to do is to give the patient the ability to use his fingers by his own muscles in the whole range through which they could previously be moved passively by the doctor. If the finger joints can be pulled open to an angle greater than right angle, then that hand is probably suitable for a tendon transplantation operation. The flexor sublimis tendons from the front of the fingers are transplanted backwards to act as lumbricals to extend the fingers, giving the patient the ability to open out his hand for grasping.

If the fingers are not able to be pulled open beyond right angle, then probably the hand is not suitable for tendon transplantation, but its usefulness may be improved by having the fingers opened to a right angle and fixed in that position by a joint fixation operation. This allows the patient to grip with the fingers against the palm, and a strong and useful grasp may result. The thumb in a paralysed hand usually lies beside the palm and can only be used in a sideways pinch between the thumb and the edge of the base of the first finger. If this is so, it is nearly always possible to do a tendon transplantation which will allow the patient to draw this thumb in front of the palm so that it will meet the other fingers for picking up small objects in a pinch movement or holding large objects between

the thumb and the fingers. Sometimes when a thumb has been paralysed for many years, the web of skin between the thumb and the hand becomes so contracted that the thumb cannot be pulled forward to oppose the fingers. In these cases sometimes the patient can help by stretching the skin in this web daily. If this is not successful, a preliminary operation may be necessary to graft new skin into the web so as to allow a greater range for the thumb.

For this brief review the surgical reconstructions have been over-simplified. There are actually about 15 different operations in regular use at this centre for hand reconstruction in leprosy.

We may summarize by saying that where the chief disability of the hand is due to *paralysis and weakness* rather than to stiffness, we are able to restore a good active hand movement by surgical operations. Where the chief trouble is *stiffness* and shortening of fingers, then the physiotherapist is likely to do much more good than the surgeon.

Having considered the reconstruction of the hand, we now have to recognise that the hand is only the tool of the mind. The mind which has lost hope and which sees no reason for effort is not going to make use of even a good pair of hands, and it will not be long before those hands are again damaged by disuse and carelessness.

Our ultimate object must be nothing less than the total rehabilitation of the patient until he is able not only to care for himself and to earn his own living, but to do it with pleasure and with enthusiasm.

The Rehabilitation Programme. The rehabilitation programme should begin at the very beginning of the patient's treatment and continue until he is settled in his home environment. When the patient has realized that he has leprosy, he is usually overwhelmed with despair.

The longer this despondency continues and the longer the patient believes that he will never be able to take his place in an active society, the more difficult will his rehabilitation become. If he can have immediate contact with a hopeful and enthusiastic group of social workers, technical instructors and physiotherapists, who clearly regard his return to activity as a foregone conclusion, and if he is allowed to work with a group of men who are already demonstrating that they can earn their living, then his mental outlook will change and the most difficult task in the rehabilitation programme will have been completed. After this, the tasks are mainly technical. They involve the assessments of the patient's ability and the selection of a trade which is within his capabilities and which will be unlikely to harm his hands.

We have made it a policy in Vellore that while men are staying in the Rehabilitation Centre as free patients the money that they earn by their trades is not paid directly to them, but accumulates to their credit until they are ready for discharge. From this fund they may claim a certain small proportion as pocket money from time to time, but the main bulk of the money is for the purpose of equipping them with the tools and raw materials of their trade when they finally leave. They purchase from the Rehabilitation Centre the same tools that they were using, at second-hand rates, and the Centre becomes responsible for seeing them established in their new work and for sterilising and marketing their products together with those which have been made at the Centre.

The Rehabilitation Instructors themselves must be fully convinced of the value and effectiveness of the method they are using. If a patient accidentally cuts or burns himself in the course of his work, the Instructor should show an immediate deep concern and treat the situation as a major calamity. He should dress the wound immediately, and with care. He should then take the patient straight back to his work bench, and find out *exactly* how the injury was caused and at once institute measures which may prevent the recurrence of such a happening. This may involve teaching the patient a new way to hold his tools. It may involve changing the shape or length of the handles of his tools, or altering the entire procedure of making the article concerned. When the patient sees that somebody with knowledge and experience is prepared to take a lot of trouble to prevent even the smallest cut or burn, he himself will have a greater respect for the fingers which everybody is trying to improve and preserve.

The measure of success should not be gauged by whether the patient is usefully occupied while in the sanatorium, but the question must be asked " Is this patient learning a way of life which he can continue in his own village environment after discharge? Will he be able to earn a reasonable living and still continue to preserve and improve the usefulness of his hands and his feet? Will he be independent of public charity and be able to develop his own personality, his faith, and his adjustment to his fellow men? " Anything less than this is not true rehabilitation.

We wish to acknowledge the help received in this investigation from the Indian Council of Medical Research, and we must also pay tribute to the vision of R. G. Cochrane who saw the possibilities and importance of these aspects of the treatment of leprosy long before he was able to get an Orthopaedic Surgeon or Physiotherapist to co-operate with him and work them out.