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## NERVE DECAPSULATION IN LEPROSY PATIENTS

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By nerve decapsulation is meant the total removal of the thickened, adherent sheath of a swollen nerve affected by lepromatous or tuberculoid inflammation in leprosy patients. The word neurolysis is also used, but less correctly. There is not lysis or loosening of the nerve, but removal of the thickened connective-tissue "rind" which is causing pressure on the nerve filaments, thus releasing the filaments from pressure, as in decapsulating the kidney one tries to relieve the pressure in this organ when it is acutely swollen.

Not only is the outermost sheath (the epineurium) removed, but one also tries to take away, or at least to split, the perineurium that surrounds the individual nerve bundles which make up the nerve, when that structure is affected. This can be done only if the outermost capsule is first removed totally, contrary to the procedure of "splitting" the nerve sheath in inflamed nerves of leprosy patients that used to be advised.

I started decapsulating nerves of patients of the Donorodjo leprosarium in 1938, because of an article by Lowe (2) on nerve abscess. He advised the active opening of abscesses, combined with removal of the thickened sheath. The beneficial effects of the simple procedure of decapsulation of inflamed nerves on the general condition of the patients that I observed gave reason for performing this operation much more frequently than most leprosy workers have done. Previously to the recent World War I had performed about 15 decapsulations, but after 1950 I did more than 170, while my co-worker, Dr. Aminoeddin, had performed this operation more than 50 times by April 1953.

### INDICATION FOR THE OPERATION

The reason for the operation is that the paresthesias and pain experienced in peripheral neuritis in tuberculoid or lepromatous cases are caused by pressure on the individual nerve fibers. In the tuberculoid form this pressure is caused by the swelling of the diseased nerve bundles themselves, which are caught in the unyielding sheath; in the lepromatous form

it is caused by the swelling of the epineural-perineural structures, which are inflamed and thickened, and exert pressure on the filaments. Sometimes we see constrictions in the nerve caused by firm, "woody" scars, usually encircling the nerves, which are the final result of a previous inflammation of the sheath, usually lepromatous. This pressure—which is not necessarily present in all swellings of the nerves—not only causes the unbearable paresthesias and extreme spontaneous pains or hyperesthesia that sometimes exist, but it may also be the reason for the progressive paralysis of the muscles supplied by the particular nerves involved.

Although the immediate result of the operation is relief of the paresthesias and pain, the ultimate aim is to combat the progressive paralysis, a purpose which is especially important in young patients who as yet have no atrophy. In tuberculoid leprosy the operation can have effect only in those cases where there still is swelling of the nerve; in those tuberculoid cases in which the atrophy of the muscles is caused by degeneration of the nerve tissues themselves, decapsulation would be of no use.

According to Muir (3), splitting of the sheath, and sometimes its removal, are mainly indicated in tuberculoid cases in reaction; one then often sees painful swelling of nerves, later followed by progressive paralysis. Cochrane (1) is of the opinion that removal of the complete diseased nerve sheath is reasonable only in such cases, i. e., in the acute reactive neuritis of tuberculoid leprosy. He also maintains that mere sheath splitting gives insufficient results. On the other hand, he believes that decapsulation is of no use in treating the neuritis of lepromatous leprosy.

It is my opinion that the indications for decapsulation of thickened nerves should be greatly extended, not only because of the somatic complaints but also for psychological reasons. The operation should be done on the following grounds: (a) acute spontaneous pains, local or radiating; (b) chronic tenderness, spontaneous or on light pressure; (c) nerve enlargement with pain, spontaneous or on pressure, and paresthesias in the region of distribution; (d) abscess in or around the nerve; (e) beginning or progressive paralysis (mostly in hand or leg); (f) "heavy, tired feeling" in the extremity; (g) the patient's wish that it be done.

This last point should be explained more fully. Generally it is not correct to do something simply because the patient wants it. But anyone with much experience with leprosy patients knows that conditions in a leprosy hospital differ from those in the usual hospital. Until recently we really have had little to offer them, and even now the help we can give them is slight as compared with the possibilities given us in treating other diseases. In our experience such patients cling to the hope that this operation will help them.

On these grounds, I think, one is justified in some cases in performing decapsulation of thickened nerves which give little or no actual trouble,

or even when an existing paralysis has become irreversible. It gives the patient the feeling that something is being done for him. Furthermore, whether *post hoc* or *propter hoc*, I have sometimes seen so much objective improvement in such cases that I hesitate to attribute it to suggestion alone.<sup>1</sup>

It should also be realized that decapsulation is practically the only way of treating hypertrophic neuritis. Cochrane has advised injections of alcohol, a painful procedure that is only temporarily very helpful, and that in my opinion is by no means harmless. Local or intravenous injections of novocaine abolish the pain only for a few hours or a day. Heat, diathermy or X-ray therapy are uncertain in their action, also, the necessary apparatus is usually lacking; and in any case it is only a purely antiphlogistic therapy.

Through the years I have gradually formed the opinion that, apart from those cases in which there is an objective reason for decapsulation, all those patients who appear to think they are troubled by their hypertrophic nerves should be operated upon, especially if paresthesias or pain can be provoked by firm pressure, or if beginning atrophy is present. The main drawback of this liberal point of view is that the treating physician is burdened with a great deal of operative work in addition to his normal activities. We discovered to our amazement that the patients literally queued up outside the operating room to have their turn, and that occurred in a population which is certainly not as operation-minded as Western men.

During the period 1950-1953 I performed decapsulation on the following nerves, in order of frequency:

(1) Ulnar (mostly proximal to the internal condyle, although repeatedly the part of the nerve in the sulcus was thickened and painful, and several times the distal part had also to be decapsulated) .....	108 times
(2) Peroneal (in the popliteal fossa, down to the capitulum fibulae) .....	37 times
(3) Posterior tibial (mainly the retromalleolar portion, partly under the transverse ligament and more distally towards the sole of the foot) .....	15 times
(4) Median (along the tendon of the palmar muscle at the wrist) .....	5 times
(5) Radial (at the point where it courses forward around the humerus) .....	2 times
(6) Great auricular .....	2 times

#### TECHNIQUE OF DECAPSULATION

The most typical operation is decapsulation of the ulnar nerve, which will be described here. Contrary to the opinion of Cochrane, local anesthesia gives such good results that general anesthesia, which always

<sup>1</sup> On one of our patients, Dr. Aminoeeddin and I have performed decapsulation in nine different places, sometimes at the request of the patient because he said that the particular nerve was painful on pressure.

carries a certain risk, is never necessary. The only drawback is that the tourniquet cannot be used, and the duration of the operation is therefore lengthened a little by the necessary careful hemostasis, but it does not exceed three-quarters to one hour. Even in a case of painful neuritis, 20-25 cc. of a 1 per cent procaine-adrenalin solution is always sufficient.

After the usual preparation and infiltration, a curved incision is made on the inner aspect of the upper arm, a little lateral to the palpable nerve. This incision is extended high in the axilla, to the level where the nerve is of normal caliber and not painful on pressure. Distally the incision reaches the internal condyle, and it may be extended farther, with a curve around the internal condyle, if during the operation the inflammation is found to extend that far.

A primary need is careful hemostasis. Especially in acute neuritis, there are liable to be extensive adhesions between the nerve and the surrounding muscle and fat tissues which are very vascular. Usually the nerve can be seen easily through the fascia; sometimes it is deeply imbedded in the triceps muscles, but it can be found on palpation. The fascia is split and the nerve freed from the surrounding tissues. Usually, many small vessels must be cut and should be ligated carefully. All layers of connective tissue should be removed, and this tissue should not be mistaken for the nerve sheath.<sup>2</sup>

The nerve is stretched on two S-shaped hooks and incised longitudinally with a very sharp-pointed knife. Usually the incised sheath gapes at once, with diffuse hemorrhage. This troublesome bleeding, which also occurs in smooth little swollen nerves, cannot be controlled by ligatures but usually stops spontaneously after a time. The diseased sheath is usually thicker than one thinks, and it should be incised down to the proper depth. As long as the incision is longitudinal, damage to the nerve need not be feared. As soon as the nerve bundles themselves are touched the patient experiences pain. One now injects 1-2 cc. of 1 per cent procaine-adrenalin into the nerve proximal to the part to be decapsulated. All pain sensations are now abolished. Sometimes the nerve is so hard that intraneural injection is difficult; in that case the anesthetic must be infiltrated into the sheath only.

If the proper layer cannot be found in the swollen tissues, one should start decapsulating proximally, where the nerve is normal. It is always simple to find the proper layer there, and one peels the sheath off downward. I cannot agree with Cochrane's advice to insert the point of an aneurysm needle under the sheath and separate the latter by moving the needle along the nerve. At most only a part of the connective tissue is removed in this way. An adherent sheath can only be removed by sharp

<sup>2</sup> Sometimes the operator thinks that decapsulation has been done, while in reality only fibrous tissue caused by the paraneuritis has been removed.



dissection, just as in an anatomical preparation, and this takes much care and patience. One is very likely to find that only the outermost layer of connective tissue has been dissected off, and that the actual epineurium is still intact. Gaping of the edges should always be looked for; it is the most reliable sign that one is in the proper layer.

In tuberculoid neuritis the nerve tissue is often found to be dull and yellow instead of white and shiny, and occasionally among the bundles a few or many small collections of caseous material are found. In such places it is sometimes impossible to remove the epineurium totally, and one has to be content with taking off the remains of the capsule in small flakes. The caseous collections should be scraped out, and the cavities closed *per primam*. In lepromatous neuritis the nerve tissue is smooth and white, sometimes slightly edematous; abscesses are never found in this form of the disease, but the finding of firm scar tissue is common.

When the thickened sheath has been completely freed, artery forceps are placed on the proximal and distal ends of it, the tissue between is cut away, and the stumps of the healthy epineurium are tied.

We now come to the second phase of the operation. The nerve is again stretched, and the separate bundles are inspected to see if the perineurium surrounding them is affected by the inflammatory process. Sometimes all bundles are involved, sometimes only a few. Often one can remove the perineurium of these separate bundles, but if this is not possible it should at least be split longitudinally.

The third phase is the proper imbedding of the nerve. With Peán forceps the edges of the fascia are fixed and sutured with continuous catgut. The ulnar nerve can be transplanted to the anterior aspect of the internal condyle. In theory this should be an advantage, but in practice I found that, once the pain has disappeared, placing the nerve normally behind the condyle does not give rise to any new complaints. On the other hand, the subcutaneous situation of the nerve at the skin fold on the volar aspect of the elbow may have its drawbacks. The closure of the skin, in my opinion, should be done with many interrupted silk sutures.

The operation on other nerves is done in precisely the same manner, the only difference being that the hemorrhage is usually less. The location of the nerve may present difficulties only in the case of the radial. Orientation should be done previously, and the nerve freed from among the muscles.

*Complications.*—There are only a few complications of this operation. Most troublesome have been hematomas occurring after decapsulation of the ulnar. These were probably due to the fact that most patients, contrary to instructions, did not immobilize the arm sufficiently. It is, therefore, inadvisable to perform the operation on both sides in the same sitting, but the decapsulation of an ulnar and a peroneal can be done at the same time.

Twice a threatening paresis of a peroneal nerve developed into a paralysis after operation, but in both cases it cleared up completely after half a year. Sometimes paresthesias occurred, probably caused by postoperative swelling of the tissues around the decapsulated nerve. They always disappeared after a few weeks.

Anatomical variations in the position of the nerve must be kept in mind, especially the peroneal, which may branch high up in the popliteal fossa. Slight variations in position in relation to the vessels occur in the ulnar. These never presented difficulties during operation.

*After-treatment.*—The arm operated upon should be immobilized in a mitella and wire splint. Complete rest in bed would be best, but because of the mentality of most patients and the conditions in most leprosy hospitals, with their lack of nurses, this cannot always be realized. After decapsulation of the peroneal nerve the knee should be fixed in slight flexion. If the apparatus is available it is advisable to commence, as soon as healing of the wound is complete, with galvanic and faradic stimulation of the diseased nerve and paralytic muscle, and to combine this with passive and active massage.

#### RESULTS OF OPERATION

As has been indicated, distinction must be made between immediate and long-term results. To the former belong the disappearance of the pains, the paresthesias, and the heavy feeling of the affected limb, and the partial recovery of muscular power. The long-term result sought for is the arrest of the progressive paralysis.

*Immediate results.*—As regards disappearance of pains and paresthesia, one may count on spectacular results. The acute pains disappear at once; the chronic pains and tenderness usually improve or disappear completely. The paresthesias usually disappear in most patients, but in some the results are dubious; in one or two of my cases there was no improvement whatsoever. In one patient the paresthesias disappeared only after the operation, which had been done down proximally to the epicondyl, was repeated and extended distally to below the joint in the forearm, to where the ulnar nerve gives off its muscular branches.

As regards restoration of muscle function, I repeatedly observed its return in the forearm and hand, with improvement of atrophy. This last could be checked by half-yearly measurements of circumference of both arms. Increase of 0.5-1.0 cm. was repeatedly seen. Most patients also said that the heavy, tired feeling in the arm or leg had disappeared. It is naturally possible that this can be ascribed mainly to suggestion. The psychological effect in patients is very marked indeed, and always in a beneficial manner. Repeatedly a patient who had an operation on one nerve has refused to be discharged until his other sick nerve had also been treated. The opposite condition, i. e., a patient refusing to have another diseased nerve operated upon, was never seen.

*Long-term results.*—The long-term results, as seen after 5 years or more, are more difficult to judge. I have been fortunate in being able to examine some of the patients on whom I operated shortly before the second World War, about 12 years ago. The data and results are shown in Table 1, and they are discussed briefly here.

TABLE 1.—Data on seven of the patients operated upon up to 1941, showing the immediate results (pain and paresthesia), the long-term results (paralyses) to 1952, and the condition of the disease in that year.<sup>a</sup>

Patient	Decapsulation operation				Results of operation and final condition							
	Year done	Type of leprosy	Nerve done	Indication <sup>b</sup>	Pain		Paresthesia		Paralysis			Type of leprosy
					Before	After <sup>c</sup>	Before	After <sup>c</sup>	Before	After	Final <sup>d</sup>	
Sub.	1938	L2	Ulnar, rt	} Pares., paral.	—	—	2+	—	1+	—	2+	L3dp
Jum.	1939	L2	Ulnar, rt Ulnar, lt	} Pares., pain	2+ 2+	— —	3+ 3+	— —	1+ 1+	1+ 1+	2+ 2+	L3d
Usm.	1940	L2N2	Peroneal, rt Peroneal, lt	} Pares., wkns } Pares.	— —	— —	1+ 1+	— —	2+ —	2+ —	2+ 2+	L3dp
Rac.	1940	L2	Ulnar, rt Ulnar, lt	} Pares., wkns	2+ 1+	— —	2+ 2+	— 1+	1+ 1+	— —	2+ —	L3dp
Mur.	1941	L2	Ulnar, lt	} Pares., paral.	1+	—	2+	—	1+	—	2+	L2p
Sug.	1941	L2N2	Ulnar, rt Ulnar, lt Peroneal, rt	} Paral., (slt)	1+ 1+ —	— — —	— — —	— — —	2+ 2+ 2+	1+ 1+ 2+	2+ 2+ 2+	L3dp
Njo	1941	L2N2	Ulnar, rt Ulnar, lt Median, rt Median, lt Peroneal, rt Peroneal, lt	} Pares., paral.	2+ 2+ 1+ 1+ 1+ 1+	— — — — — —	3+ 3+ 2+ 2+ 2+ 2+	— — — — — —	2+ 2+ — — 2+ 2+	— 1+ — — — —	— (+) — — — —	Tip

<sup>a</sup> Treatment during the interval between operation and the final observations was symptomatic only.

<sup>b</sup> Pares. = paresthesia; paral. = paralysis; wkns = weakness.

<sup>c</sup> After operation, up to 1952.

<sup>d</sup> Final examination, 1952.

To summarize, it is to be seen that all of the patients were relieved of their pains and paresthesias, and that these have not returned. All of the patients mentioned at first, after the decapsulation, that the power in the limb operated upon had improved, and in some of them it has remained good. It was only after periods of from 3 to 10 years that the paresis became worse again. During the interim between operation and final observation these patients had received nothing but symptomatic treatment.

All these operations were performed in a period when the indications were not as broad as they are now, and only the severe conditions were operated upon. Since I have learned that it is desirable to decapsulate in earlier cases, with relatively slight complaints, I believe there is every reason to expect an increased percentage of cures among such cases that have been done, especially since all these patients are also under sulfone

treatment, which is especially beneficial in the lepromatous form. Be that as it may, there is reason to be satisfied with the results that have been obtained. Mention may be made of one spectacular case (N. K. F.). At first (1939-1940) the patient had to use a wheelchair. Now he is working as a healthy man, with only slight atrophy of the left hypothenar.

The reacquisition of the power of a hand or foot, even if it be for only a number of years, is in my opinion an enormous gain and psychologically for the patient it is an important event, one which is not wiped out by relapse of the paralysis afterward. It is a striking fact that patients with relapse ask to be operated upon again. The discomfort of the operation is less important for them than the advantage they hope to gain, in the loss of pain and paresthesias and the paralysing "dumb" feeling in the extremity.

I have described the operation in such detail because I am of the opinion that many doctors who are in charge of leprosy patients, often in lonely regions, without special surgical training and with only simple instruments, can perform this operation.

It is true that decapsulation is often unable to avert paralysis of an extremity, but in more than 90 per cent of cases it is a sure remedy against the pains and paresthesias, which may be so severe and chronic that they rob the patient of the desire to live. This is highly important, because no other form of therapy of which I am aware gives satisfactory results. My conclusion is that decapsulation in the hypertrophic neuritis of leprosy is a rational therapy for the *pains* and *paresthesias*. In the prevention of *paralysis* in early cases—those in which the neuritis has existed not longer than 3 to 6 months—the postoperative results as judged from patients which were operated upon one to two years ago were satisfactory. However, if no other therapy is given, or if reactions occur, one may unfortunately expect relapse of the paralysis in many of the cases.

ADDENDUM.—Since this paper was submitted for publication I have seen [THE JOURNAL 22 (1954) 232] an abstract of an article by Guadagnini in *Leprosy Review* 24 (1953) 147-155, on the subject of nerve lesions in lepromatous leprosy. He is said to have stated that the tenderness and hypertrophy of certain nerves is due to their passage through ligamentous tunnels which press upon them, and that the enlargement always occurs proximal to the compressed portions of the nerves. My experience is different. One often observes swollen nerves inside and also distally to the ligamentous tunnels.

#### SUMMARY

An operative treatment is described for the thickened painful nerves of leprosy patients, which consists of the removal *in toto* of the fibrotic epineural sheath of these nerves, i. e., decapsulation. The operation, which can be done under local anesthesia, should be performed in as many cases as can possibly benefit from it. There is practically no danger of complications.

The technique of the operation is described in detail so that it may be



performed by doctors working in remote leprosy hospitals who have had little surgical training, because in practice the beneficial effects on the patients are so great. Pain and paresthesias disappear in nearly all cases. In the presence of threatening paralysis and slight atrophies, a prolonged if temporary halt may be expected. The psychological effect is profound.

#### RESÚMEN

Descríbese un tratamiento quirúrgico para los nervios adoloridos y engrosados de los leprosos, que consiste en la extirpación total de la vaina epineural fibrosa de dichos nervios, o sea, en la decapsulación. La operación, que puede ejecutarse bajo anestesia local, debe llevarse a cabo en cuanto caso pueda beneficiarse con ella. No hay casi ningún riesgo de complicaciones.

Descríbese con todo pormenor la técnica de la operación, a fin de que puedan ejecutarla médicos que ejercen en hospitales de lepra alejados y que han tenido poca preparación quirúrgica, por ser tan notable el efecto beneficioso en los enfermos. El dolor y las parestesias desaparecen en casi todos los casos. Cuando amaga la parálisis y hay leves atrofas, cabe esperar un estacionamiento prolongado, aunque temporal. El efecto psicológico es profundo.

#### REFERENCES

1. COCHRANE, R. G. *Practical Textbook of Leprosy*. London, New York and Toronto: Oxford University Press, 1947, p. 146.
2. LOWE, J. A further note on nerve abscess in leprosy. *Internat. J. Leprosy*. **2** (1934) 301-304.
3. MUIR, E. *Manual of Leprosy*. Edinburgh: E. & S. Livingstone Ltd., 1948, pp. 137-138.