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Elective Surgical Decompression of Nerves in Leprosy— Technique and Results: A Preliminary Study

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Elective surgical decompression by extraneural and medial longitudinal epineurotomy was carried out in 45 patients. The ulnar nerve was the commonest, followed by the lateral popliteal, median and posterior tibial which comprised 69 nerves which were biopsied. The maximum period of follow-up was up to 3 years with a mean of 25 months.

Thirty-three patients showed sensory recovery, 3 failed to recover and only 1 deteriorated. Motor recovery was less predictable and seen in 26 patients. Seven failed to show any improvement and 1 deteriorated. Six patients with no sensory and 9 with no motor loss showed no adverse effects when followed for 3 years. The recovery was better seen in the group seeking early treatment and at an earlier age.

It is felt that the beneficial effects may have resulted from the increased vascularity and improved venous return due to relief from the extraneural and intraneural compression.

Introduction

The idea of decompression of nerves is not new. Most procedures tried so far have been primarily used to obtain relief from pain or for evacuation of abscesses. With the help of plastic surgical training in microneurosurgery, we undertook a comprehensive study to ascertain if early elective surgical decompression could be beneficial in preventing any long term deformities. This paper deals in detail with our surgical technique and also briefly mentions the results achieved.

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Babcock (1907) was the first to suggest endoneurolysis, by multiple longitudinal incisions. Lowe (1942) recommended desheathing, Callaway *et al.* (1964) suggested external neurolysis with anterior translocation and resection of the thickened sheath. Carayon *et al.* (1964) recommended fascicular neurolysis with excellent results. Palande (1973) described external neurolysis with other procedures and Enna (1974) neurolysis and transposition. Vaidyanathan and Vaidyanathan (1968) advocated division of fascial roof and excision of fibrous arch.

Most procedures were probably too drastic and could interfere with the vascularity of an already inflamed nerve (Babcock, Lowe, Callaway, Enna etc.); while some (Vaidyanathan and Vaidyanathan) appeared too inadequate.

Our technique is simple, can be easily performed in any leprosarium and can achieve the desired results with least interference to the vascularity or the anatomy. The technique is similar to the one described by Said *et al.* (1973) with some modifications. It is carried out with meticulous care and microsurgical technique so as not to damage the inflamed tissue or the vascular pattern. Extraneural decompression to relieve the external, and medial longitudinal epineurotomy to relieve internal pressures throughout the involved segment were carried out. We hoped, in turn, that this may help to retrieve some of the sensory and motor damage and further minimize and/or prevent deformities. The medial side was chosen as it was least likely to damage the vessels (Smith, 1966).

Surgical Technique

The surgical procedure was carried out using a tourniquet, consisting of the inflated cuff of a sphygmomanometer wrapped around the upper arm. Local anaesthesia was preferred for single nerve while general anaesthesia for multiple nerves. The operative time varied from 20 to 30 min. Two times magnifying spectacles were employed during the dissection and especially while undertaking nerve biopsy.

The ulnar nerve at the elbow was exposed through a 10 cm incision placed 7 cm above and 3 cm below the medial epicondyle and running midway between the medial epicondyle of the humerus and the olecranon process of the ulnar. The skin and subcutaneous tissue were incised and the deep fascia of the anterior medial compartment of the upper arm exposed (Fig. 1). This was usually thickened, congested and opalescent and found to compress the enlarged nerve lying underneath. It was divided longitudinally, and when adherent to the epineurium of the underlying nerve had to be dissected off (Fig. 2). The fascia was divided up to the mid-arm with a partially open pair of scissors. This at times had to be carried up to the point where the nerve entered the arm and pierced the medial inter-muscular septum. The nerve may be compressed at this point. A compressing effect of the fascia on the underlying nerve can be demonstrated by the flattened nerve assuming a more rounded shape. Further extraneural decompression was obtained by dividing the roof of the fibro-osseus tunnel formed by the fibrous band connecting the medial epicondyle to the olecranon (Fig. 3). Due care had to be exercised here if the nerve was found adherent to the inner surface of the roof. Division of the

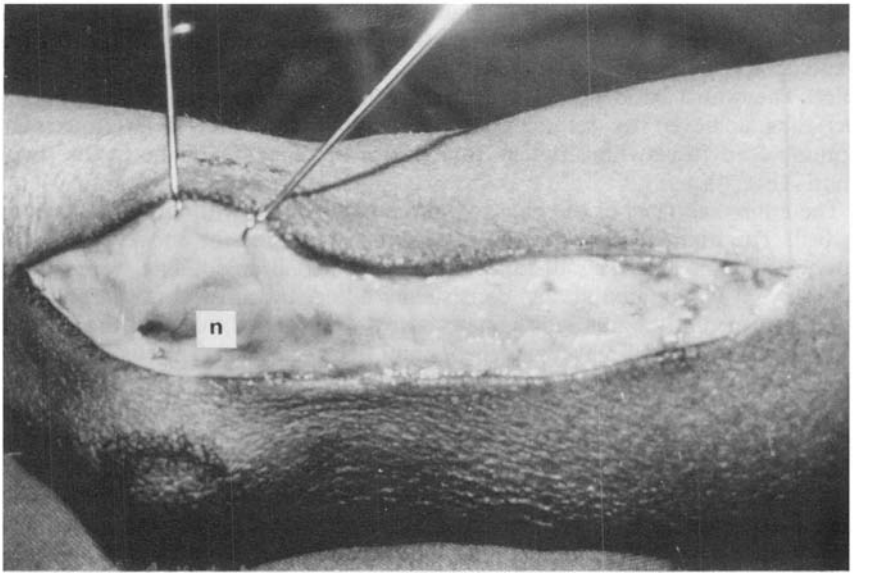


Fig. 1. A tear in the deep fascia of the arm exposing the ulnar nerve (n).

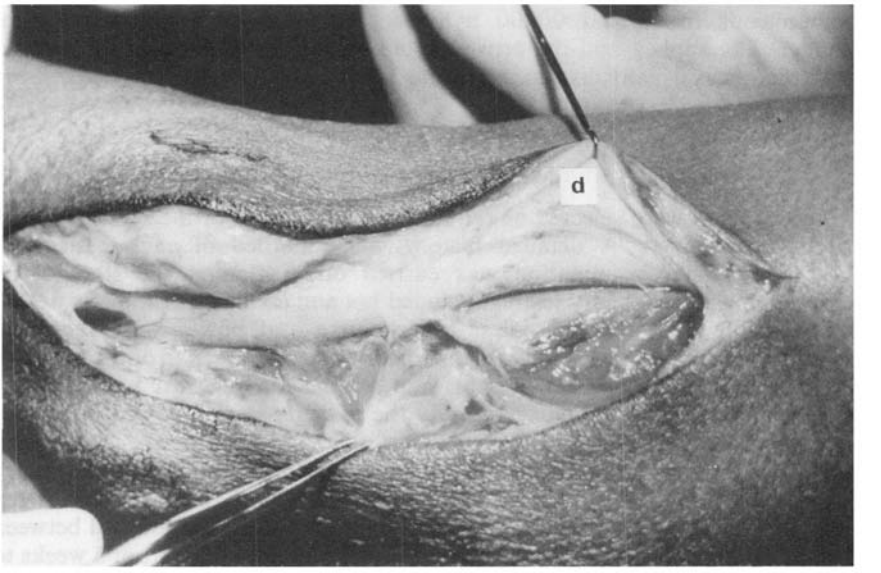


Fig. 2. Division of the deep fascia (d). Note the flattened nerve.

overlying tendinous fibres of the origin of the flexor carpi ulnaris provided a release of the nerve from the constricting effect produced by these fibres. Two branches to the flexor carpi ulnaris from the ulnar nerve are given off at this point. They must be identified and preserved. The extraneural decompression was thus achieved by releasing the pressure due to medial intermuscular septum, deep fascia, fibro-osseus tunnel and the 2 heads of the flexor carpi ulnaris (Fig. 4).

The entire segment of the exposed nerve was cleared without lifting it from its bed. The diameters at the site of maximal enlargement as well as at the narrowest point and their distances from the medial epicondyle were noted. The nerve was palpated and its consistency noted. Intraneural decompression through a medial longitudinal epineurotomy was carried out with the help of fine non-tooth watchmakers forceps and iris scissors. The technique of epineurotomy was simple. The epineurium on the medial side was carefully slit at a relatively avascular area at the site of maximal swelling (Fig. 5). This was extended proximally as well as distally to include the entire involved segment. The epineurium was generally found to be thickened, opaque and inelastic. Due care was taken not to damage the overlying vascular network. This medial longitudinal epineurotomy had an added advantage in not disturbing the vascular supply which came through the mesoneurium on the lateral side of the nerve. As this was completed the nerve seemed to open out exposing the tightly compressed nerve bundles (Fig. 6). Wider opening indicated higher intraneural tension. No attempt was made to separate individual funicules. If an abscess was encountered, it was gently evacuated.

Whenever indicated, a full length of the most involved and diseased funicule was biopsied. The wound was closed in 2 layers using 0000 plain catgut for subcutaneous tissue and 00000 nylon for the skin. A firm compression bandage was applied and the arm elevated during the post-operative period. The patient was usually discharged the next day.

Material and Methods

The patients were selected at random and the nature of the treatment was carefully explained. A detailed history was recorded of each patient. A thorough clinical examination was carried out, including the state of all peripheral nerves. Sensory testing included hot and cold temperature as well as No. 5 and graded nylon studies. Muscle tone and power were recorded. Routine smears, by slit and scrape method, were taken from ear, nasal scraping and skin patch (if present) and stained for acid-fast bacilli by the Ziehl-Neelsen method. Post-operatively the patients were followed at regular intervals.

Neurolysis was performed in 69 nerves from 45 patients (38 males and 7 females) varying from 13 to 50 years old. Thirty-five suffered from tuberculoid, 7 borderline and 3 from lepromatous types. The interval between the appearance of symptoms and the surgical treatment varied from 5 weeks to 5 years. Tingling and numbness were the commonest presenting symptoms in 24 patients; 8 patients had early claw deformity while 7 had dull ache at the

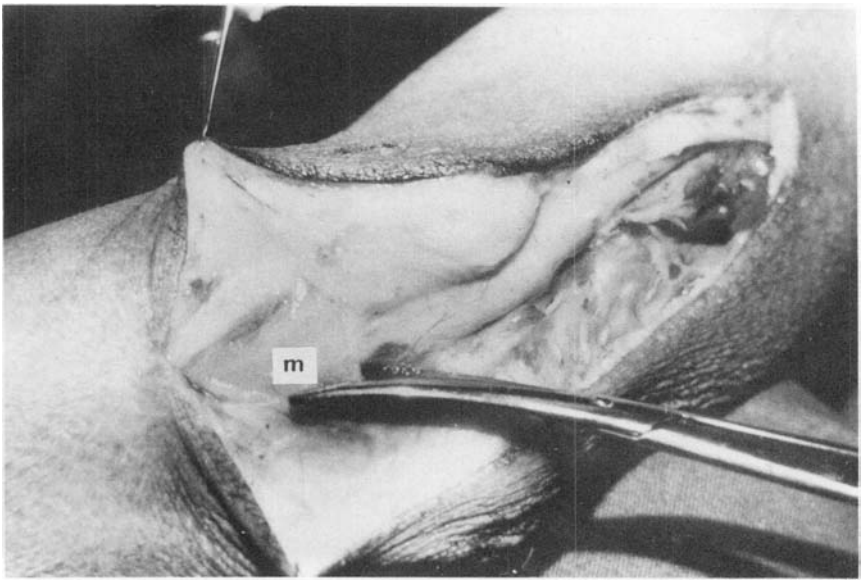


Fig. 3. Division of fibrous tunnel roof and the tendinous origin of the 2 heads of flexor carpi ulnaris (m).

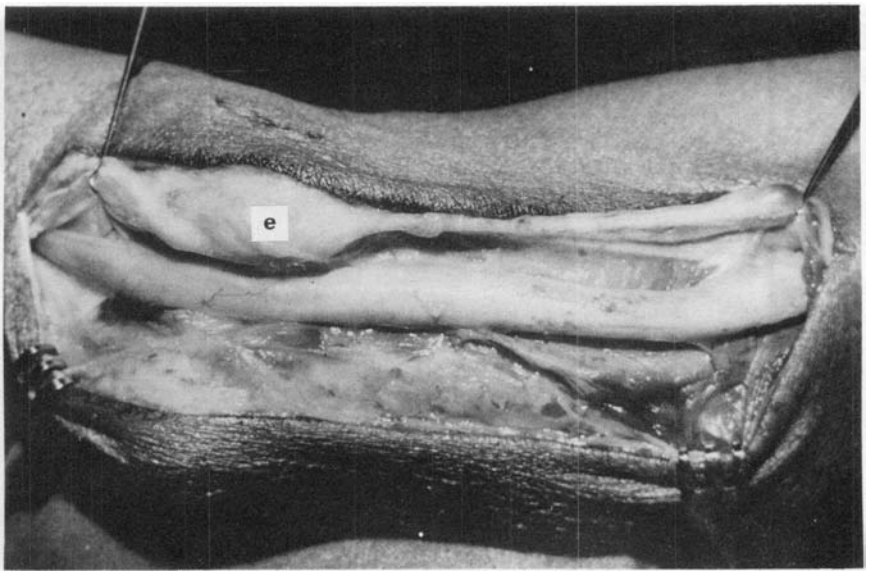


Fig. 4. External neurolysis completed. Note the rounded nerve with thickening extending from the lower arm to the heads of flexor carpi ulnaris. (e) medial epicondyle.

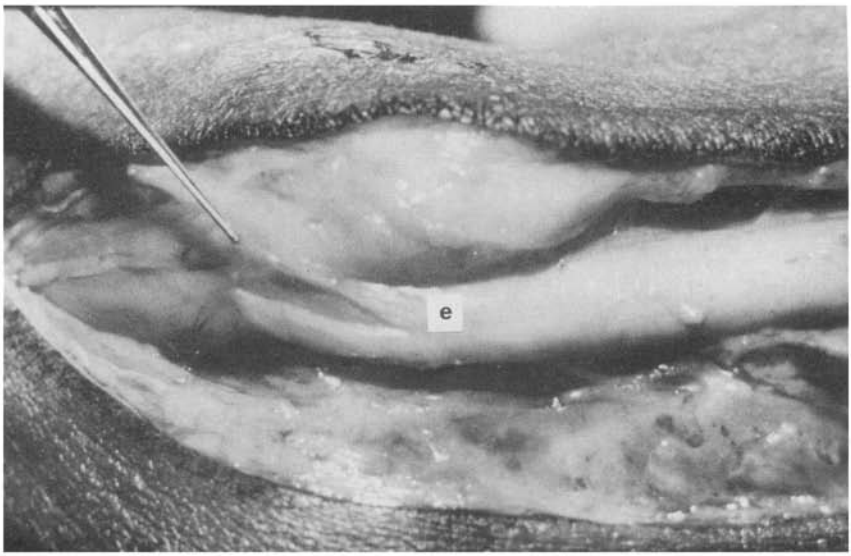


Fig. 5. Epineurotomy—note the thick, opaque epineurium (e).

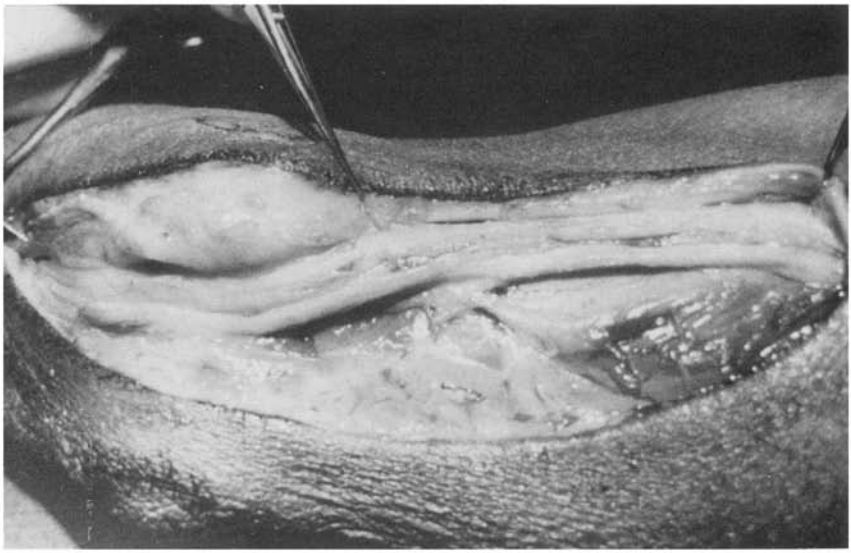


Fig. 6. Medial longitudinal epineurotomy completed. Note the open nerve exposing the bundles.

site of entrapment. Multiple symptoms were seen in 9 patients while pain, experienced by only 4, was not the predominant symptom in our series.

Forty-nine ulnar nerves at the elbow, 9 lateral popliteal at the knee, 7 median at the wrist and 4 posterior tibial at the ankle were decompressed. Post-operative follow-up was maintained at regular intervals.

Findings

The deep fascia of the anterior medial compartment of the upper arm was thickened, congested and opalescent in 35 cases and found to compress the underlying nerve. The thickening of the nerve varied from a minor enlargement to gross thickening of up to 18 mm diameter. A part or sometimes even the entire segment of the exposed nerve was thickened. Nineteen nerves had diameters varying from 6 to 10 mm, 21 from 11 to 15, and 5 more than 15 mm at the level of maximum enlargement. The swelling was generally spindle-shaped, the maximum thickness being located about 4 to 6 cm above the medial epicondyle. The thickening was mostly restricted to the lower third of the arm but in 8 cases extended up to the middle of the arm and downwards into the ulnar groove and between the 2 heads of flexor carpi ulnaris. The thickened portion of the nerve felt firm but palpation of the nerve above the swelling generally revealed a normal, soft consistency. Occasionally the swelling extended within the ulnar groove where it was compressed by the fibrous band connecting the medial epicondyle to the elecranon. When this extended above and below the fibro-osseous tunnel, a dumb-bell effect was produced. This was observed in 11 cases.

After the completion of longitudinal epineurotomy, the nerve bundles could be visualized. Separate funiculi could be identified in most cases while in a few they were found to be pale, matted together and fibrous. Intraneural abscess was found in 4 cases. These were all gently evacuated.

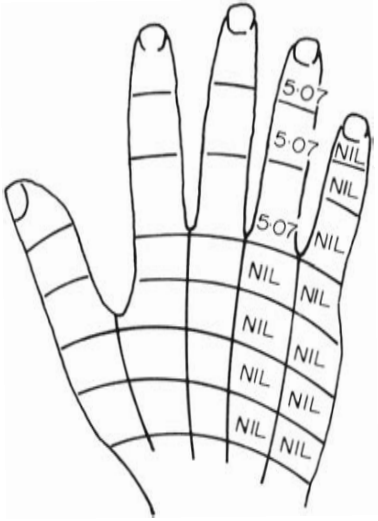
Funicular biopsy was obtained from 39 cases, comprising 30 ulnar, 8 lateral popliteal and 1 median nerves. In early cases, single nerve bundles could be dissected out using the magnifying loupe. In more advanced cases, a wedge-shaped biopsy specimen of the nerve was removed from the site of maximum thickening, including a few of the matted funiculi.

Follow-up

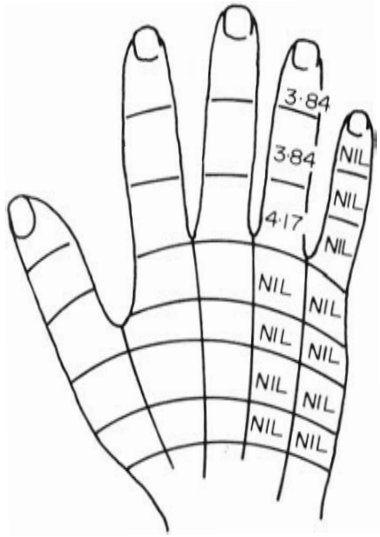
Forty-three patients were followed up for a period varying from 3 months to 3 years with an average of 25 months. Two patients were lost to follow-up.

Pain in all cases when present, was the first symptom to be completely relieved. Sensory improvement was expressed as a percentage of the pre-operatively involved area. Sixteen patients had excellent sensory recovery (75% or more), 5 had very good (50 to 75%), 6 had good (25 to 50%) and 6 had satisfactory (under 25%) recovery. Three patients did not improve and only 1 worsened. Six patients had no preoperative sensory loss and showed no deterioration 3 years after surgery.

Motor recovery was assessed from the patient's comments and also by estimation of tone and power changes in the affected group of muscles, and was



K.P. 14 yrs 4-12-72
RT. DORSAL
Pre op.



K.P. 14 yrs 11-1-73
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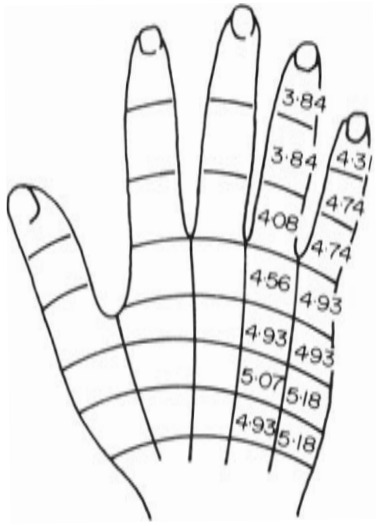
Post op.



K.P. 14 yrs 6-3-75
RT. DORSAL

Fig. 7. K. P. Right hand dorsum. Sensory charting with graded nylon.

expressed as a percentage of pre-operative level. Excellent motor recovery (50%) was seen in 4 patients while 3 showed good (31 to 50%), 19 satisfactory (0 to 30%) and 7 no improvement at all. Nine patients who had no pre-operative motor involvement showed no deterioration after 3 years, while only 1 patient got worse.

It was observed that the recovery was better when treatment was sought within 6 months of the origin of the symptoms and also in the younger age group.

Discussion

Our study was conducted in order to carry out surgical decompression electively with a view to alter favourably the progress of the disease and also possibly minimize and/or prevent the ghastly deformities associated with the disease. This was achieved through meticulous surgical technique with the least disturbance of the anatomy and in particular, its vascularity.

Inflammation of the nerve results in oedema. This leads to compression of the nerve bundles as well as interference with blood circulation leading to hyperaemia and further oedema. The resulting ischaemia promotes fibrosis. Partial ischaemia causes a reversible paralysis without Wallerian degeneration. If, however, the ischaemia becomes absolute or lasts longer, the nerve will be destroyed and the paralysis is then irreversible. The constricting effect of fibrosis due to ischaemia makes this worse. Hence surgical decompression is effective at an earlier stage of the disease when the intraneural oedema is primarily responsible for the yet reversible damage. Once fibrosis has set in, surgery is of little use. The beneficial effects of surgery in our cases can be attributed to this early elective procedure. Thus the extraneural decompression would provide relief to the surface network while medial longitudinal epineurotomy would similarly relieve the interfunicular, perineurial and intrafunicular networks. Weir Mitchell (1872) emphasized the importance of preserving the blood supply of the peripheral nerves.

Early elective extraneural decompression and medial longitudinal epineurotomy has given good results for 3 years. Further work along this line is continuing firmly to establish the importance of this form of surgery in order to influence favourably and minimize the damage to the affected nerves.

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