Management of Painful Neuromas in the Hand*

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ABSTRACT: A new treatment for painful neuromas in the hand was used on thirty-three patients. Fifteen of them were partial amputees and the others had unreparable lesions. The treatment was transfer of the stumps to an unscarred site where the neuroma would not be under pressure when the hand was used. Excellent results were achieved in 82 per cent of patients.

Symptomatic neuromas are a frequent cause of major disability of the hand. A single hypersensitive neuroma in an amputation stump of a finger may impair the function of the whole hand. The hypersensitivity is generally attributed to the scar around the enlarged end of the nerve, especially when it is subjected to repeated local trauma. To date, treatment of painful neuromas has not been completely satisfactory. The methods described for prophylaxis or treatment of painful neuromas include embedding the nerve ends in bone 3,11; injecting them with alcohol 16, phenol 6, steroids 17, formalin 21, or cerebrospinal fluid 14; repeatedly percussing them; or crushing or cautering the nerve end 12 and ligating it 13 (with or without alcohol injection 18,21). Recently described techniques of treatment include injecting the neuroma site with triamcinolone acetonide 6, resecting the lacerated nerve 12, and having the patient wear protective devices 6. Prophylaxis includes covering the cut nerve end with a silicone cap 5,9,11, applying a Silastic cuff around a nerve repair 6, and applying abdominal pedicle flaps to the scarred area 4.

There is no constant correlation between the size of a neuroma and its ability to cause symptoms. The majority of published treatment techniques include resection or some modification of the symptomatic neuroma. All such techniques, however, are subject to much the same unknown influences which resulted in the development of symptoms in the initial neuroma.

Since 1967 we have used a technique of treatment in which every effort is made to keep the neuroma intact with its mature encapsulating scar, while transposing it en bloc to an adjacent area that is free of scar and not subjected to repeated trauma. The present report is an analysis of our results.

Operative Technique

Under tourniquet hemostasis, the neuroma with its fibrous capsule is carefully isolated. A proximal area that is free from scar and away from local pressure or trauma is selected, preferably deep to a muscle, in a web space, or between shafts of the metacarpals. A dorsal site is preferable to a volar location that might lead to pressure on the neuroma with manual activity such as the gripping of tools.

The neuroma in continuity with its nerve is then carefully dissected proximally until the neuroma bulb can be transferred to its new location without tension on the nerve. A 5-0 catgut suture is then placed through the capsule (not the neuroma) and tied. A second knot is tied three to four millimeters distal to the neuroma, creating a small obstruction in the otherwise smooth length of the free suture end. The free ends of the suture are then tunneled subcutaneously and passed through the skin with a straight needle proximal to the location selected for the neuroma. This suture is drawn through the skin until the obstructing knot contacts the dermis. The free end of the suture is then tied subcutaneously and passed through the skin with a straight needle proximal to the location selected for the neuroma. This suture is drawn through the skin until the obstructing knot contacts the dermis. This maintains a three to four millimeter separation between dermis and neuroma. The free end of the suture is then tied subcutaneously (Figs. 1-A through 1-C). The nerve trunk is carefully examined to make certain that no tension exists along its path. A similar technique is utilized when the neuroma is buried in muscle. For neuromas in the finger stumps we preferred to transfer the nerve end into the web space; for neuromas in the palm the nerve ends were transferred to the bottom of the hand between the metacarpals.

Methods and Material

We operated on fifty-four patients with painful neuromas in the hand. Of these, thirty-three patients, with a total of fifty-seven painful neuromas, were available for follow-up.

The patients were divided into two groups: those who had had amputation and those who had not. Of the fifty-seven neuromas that were treated, thirty-eight were in amputation stumps of fingers and nineteen were the result of other injuries. The average age in both groups was forty-one years (range, ten to sixty-one years). The duration of symptoms averaged twenty months (range, two to eighty-four months), and the average follow-up was thirty months (range, four to eighty months).

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Figs. 1-A, 1-B, and 1-C: Operative technique in which a large neuroma of the radial digital nerve of the amputated index finger is transferred to the dorsum of the hand.

Fig. 1-A: The neuroma in continuity with its nerve trunk is dissected proximally.

Fig. 1-B: A catgut suture is secured to the fibrous capsule of the neuroma.

Fig. 1-C: A pair of scissors is passed through the hand creating a tunnel through which to pass the neuroma.

the hand as fully as possible, initially avoiding trauma to the area of the relocated neuroma.

Criteria for Evaluation

Each patient's result was rated both subjectively and objectively. The subjective criteria were pain, stump anesthesia, and patient acceptance. The grading systems for pain and stump anesthesia were the same: Grade 1 -- none; Grade 2 -- mild, no interference with daily activities; Grade 3 -- moderate, patient works but has some limitation in use of the hand because of pain or numbness; Grade 4 -- severe, cannot work or use hand. The grading system for patient acceptance was: Grade 1 -- improved, no interference with daily activity, no disability; Grade 2A -- improved, interference but patient can work, mild disability; Grade 2B -- improved, interference and patient unable to work, mild disability; Grade 3 -- no change; Grade 4 -- worse. The patients were graded preoperatively and postoperatively.

The objective criteria included Tinel's sign and function. Tinel's sign was graded as follows: Grade 1 -- none; Grade 2 -- mild, slight tingle; Grade 3 -- moderate, very uncomfortable; Grade 4 -- severe, patient unable to use hand because of any stimulation of the neuroma. Function was graded as follows: Grade 1 -- normal, no interference with activity, full range of motion and strength; Grade 2 -- interference with heavy or delicate work secondary to location of the neuroma; Grade 3 -- patient unable to use hand. Pinch and grasp were measured on standard spring gauges.

Results

All cases of neuroma in the amputee group except one were the result of industrial accidents. Of the patients in the non-amputee group, fifteen (72 per cent) had had industrial accidents and the other four had had iatrogenic injuries; that is, injuries that occurred at the time of surgery.

Crush or avulsion injuries were the most common, accounting for all the injuries in the amputee group and for three in the non-amputee group. In the non-amputee group lacerations were responsible for sixteen nerve injuries.

The dominant hand was injured in 53 per cent of the amputee group and 61 per cent of the non-amputee group. In the amputee group all of the neuromas involved digital nerves except one (which involved the radial sensory branch at the level of the thumb metacarpal). Fifteen of the thirty-eight neuromas involved the ring finger in this group and multiple fingers were injured in 20 per cent. The long, ring, and little fingers were most commonly injured; the thumb was injured in only three cases. In the thumb, painful neuromas involved the radial digital nerve in two cases, the ulnar digital nerve in two cases, and the radial dorsal sensory branch in one case. In the index finger, the ulnar digital nerve was involved in three cases and the radial digital nerve, in two cases. In the long finger, the ulnar digital nerve was involved in three cases and the radial digital nerve, in four. In the ring finger, the ulnar digital nerve was involved in seven cases and the radial digital nerve, in seven. In the little finger, the ulnar digital nerve was involved in three cases, the radial digital nerve in three, and the ulnar (digital) dorsal sensory branch in one case.

In the non-amputee group the dorsal sensory branch of the radial nerve was the most commonly injured nerve (seven cases). The ulnar sensory branch and the palmar cutaneous branch of the median nerve were injured in one case each. The palmar cutaneous branch was injured during a carpal-tunnel release. The ulnar digital nerve of the thumb was injured in three cases: two iatrogenically, one with a trigger-thumb release, and another during removal of a foreign body. The final iatrogenic lesion was an injury to the radial digital nerve of the index finger in a patient who had incision and drainage of an abscess. We treated no patient in this series with injury to the dorsal radial sensory nerve. This nerve can easily be lacerated during release of the first extensor compartment for de Quervain's tenosynovitis. Only one patient in the non-amputee group had two nerves injured: two branches of the dorsal radial sensory nerve were lacerated by glass from a broken window.

Subjective Evaluation

Subjective evaluation was based on pain, anesthesia,
and the patient’s opinion of the surgical result. Pain was significantly relieved in twelve patients (thirty-two neuromas) in the amputee group and in seventeen patients (seventeen neuromas) in the non-amputee group. These patients said that they had no interference with their daily activities (Grades 1 and 2 in function). In no patient was the hypersensitivity made worse by the operation. One patient in the amputee group had relief of pain in five neuromas (Grade 1) but no relief in two others (Grade 4). This patient had a diffuse, moderately severe post-traumatic sympathetic dystrophy. He did not return to work and refused to use his hand even to eat; his wife helped him with most daily activities. One patient with a severe avulsion injury had no relief of pain and had two additional operations of unknown type by other surgeons without improvement. Two patients, following successful transfer of highly sensitive digital neuromas, became aware of moderate pain in the remaining neuromas. Neither patient, however, was troubled enough to consider having additional operations. The final patient initially had relief from preoperative stump pain. However, two months after the transfer, he noted sensitivity of a neuroma distal to the original relocation site. It was thought that tension had been present in the nerve trunk at the time of surgery and that with lysis of the catgut fixation suture, the neuroma had migrated. Such tension is created if the nerve trunk is looped around Cleland’s ligament or any semiflexible strand in the path of transfer from the volar to dorsal compartments.

In the non-amputee group, six patients had moderate hypersensitivity after neuroma transfer (Grade 4 preoperatively and Grade 3 postoperatively). Of these, four cases were iatrogenic. The remaining two patients had neuromas involving the dorsal sensory branch of the radial nerve, one following a severe crush injury. Five other patients with painful neuromas of this particularly troublesome nerve had good or excellent results following transfer of the painful neuromas.

Anesthesia distal to the neuroma, as expected, did not change in any of the patients in the amputee group. All cases were rated as either Grade 1 or Grade 2. In no patient was anesthesia so bothersome that it limited daily activities. In the non-amputee group fifteen patients had no change and three felt that the numbness was improved. We cannot explain this finding except to state that it was the patient’s subjective opinion. It may have been the result of the proximal neurolysis that occurs with the transfer.

The over-all surgical result as evaluated by the patients themselves (subjective patient acceptance) was judged excellent in 86 per cent of the transposition procedures. Two patients in the amputee group and two in the non-amputee group felt that there had been no change with surgery. No patient was made worse.

Objective Evaluation

Two-point discrimination did not change following transposition. However, five patients in the amputee group (28 per cent of the neuromas) had two-point discrimination of five millimeters or less at the amputation stump, presumably due to dorsal skin flaps included in the resurfacing. The remaining patients had two-point discrimination of 1.5 centimeters or greater.

Pinch and grasp strength determinations were not considered pertinent. Most hands had differing degrees of tissue loss which made meaningful comparison impossible.

There was improvement postoperatively in hand function; that is, in such simple tasks as buttoning a shirt, picking up coins and keys, and opening a door. Thirty of the patients (fifty-two neuromas) showed this improvement. One case demonstrates this particularly well: The patient had undergone amputation of the little finger through the base of the fifth metacarpal following a crush injury. The resulting neuromas were so sensitive that he could not hold objects in the hand. Following the transposition operation he was overjoyed to report that for the first time in two years he was able to hold a bar of soap and wash his hand.

Over-all Results

The conclusions based on the subjective and the objective evaluation were as follows: Results were considered excellent when the test criteria were Grade 2 or better. By these criteria, results in 82 per cent of cases in the amputee group and 63 per cent in the non-amputee group were excellent. No patient who initially had a successful transfer of the neuroma had recurrent symptoms after prolonged follow-up.

In the amputee group fourteen of the fifteen patients were Workmen’s Compensation cases and in this difficult group of patients all but three returned to work. In these three patients persisting neuroma symptoms were not the reason for failure to return to work. All had suffered mutilating injuries with extensive loss of tissue that precluded return to their jobs. Eleven patients returned to work within one or two months after transfer of the neuromas. Twenty-two per cent had returned to work within one month after surgery. The remaining patient returned to different work one year after injury.

In the non-amputee group of patients with industrial injuries the average time from neuroma transfer to return to work was three and a half months (range, two weeks to thirteen months). Four had not returned to work at the completion of this study. These were drug addicts, one was in jail, and two were on institutional programs. The fourth patient had a severe crush injury to the dorsal sensory
branch of the radial nerve and had extensive scarring in the area. This patient had an unsatisfactory result and a palpable, sensitive neuroma was noted just proximal to the scar. Another nerve transfer was planned for this patient.

Discussion

Painful neuromas are frequently a cause of major hand disability. A variety of techniques have been described for their treatment, the most common being resection of the hypersensitive neuroma. The results have been unpredictable since the new neuroma, which must form inevitably, may be as sensitive as the original. Recent use of silicone capping by Frackelton and associates, Biddulf, and Swanson and co-workers has been demonstrated to minimize neuroma formation after a nerve has been divided, but the cap must fit well to prevent an outgrowth of axons forming a neuroma proximal to the cap. A recent report on the use of triamcinolone injections by Smith and Gomez was encouraging, but many patients required repeat injections and the treatment failed in almost one-third of the patients.

Brown and Flynn recently reported a technique of using abdominal pedicle flaps to cover scarred areas and to create a soft-tissue bed for the involved nerves. They stressed the importance of placing the nerves in a bed where they will not be constricted or restrained by scar tissue. The same protection of the neuroma can be accomplished more simply by the transposition described here.

Our technique of atraumatic transfer of the mature encapsulated neuroma eliminates the unpredictability of other operations and the formation of a second neuroma. By relocating the bulbous nerve stump in a well nourished, well padded, minimally traumatized area the previously hypersensitive neuroma appears to undergo a change and lose much of its hypersensitivity. In 28 per cent of the neuromas transferred no sensitivity to percussion could be elicited and in 73 per cent there was absent to mild sensitivity to direct percussion at the new location. Seven patients had developed recurrent symptomatic neuromas following previous resections, one patient having had three such procedures. An additional patient had been treated with narcotics in a pain-control clinic for two years prior to having a successful operation. These eight patients were relieved of their symptoms and returned to work.

The discrepancy between the results in the good-to-excellent category in the amputee as opposed to the non-amputee group is difficult to explain. Both groups were composed mainly of industrial accident cases, but in the non-amputee group 21 per cent were iatrogenic lesions and in general these patients did not do well after the transfer procedure. Both groups of patients stated that the pain was not made worse by the surgery and the grading of patient acceptance was similar in the two groups. The seven patients with poor results included three with iatrogenic lesions: injury to the palmar cutaneous branch after carpal ligament release, ulnar digital nerve injury during operation for trigger thumb, and injury resulting from an operation to remove a foreign body from the thumb. There were two cases of injury to the radial sensory branch, a neuroma known to be difficult to treat. (Five other patients in this series had good to excellent results.) One patient had concomitant symptoms with claudication. The patient was relatively pain-free from the preoperative symptoms, but had moderately severe limitation of hand function because of symptoms secondary to arterial injury in the forearm. If this last case and the iatrogenic lesions are eliminated from the series, the good-to-excellent results are similar to those in the amputee group, that is, 86 per cent. One of the patients with injury to the dorsal sensory branch of the radial nerve had the nerve sectioned more proximally in the forearm on two different occasions with no relief of pain.

Experience has shown that two details of technique are particularly important. In those digital amputation stumps which are diffusely dysesthetic, with one predominantly palpable and sensitive digital neuroma and another that is not palpable, one should transfer both neuromas. Several patients in this series noted mild to moderate symptoms from the remaining neuroma even though the predominant symptoms in the first neuroma were relieved. Secondly, particular care must be taken to avoid tension on the nerve as the neuroma is drawn proximally to the site of relocation. Unless the nerve trunk is completely relaxed, the neuroma will either be drawn away from the optimum site as the catgut suture is absorbed or the persisting tension will cause traction on the neuroma, producing pain particularly with finger motion.

We need to know more about neuroma formation. Not all sectioned nerves form painful neuromas. It is not uncommon to find that in the same amputated digit stump, one nerve, the ulnar digital nerve for example, may produce a painful neuroma while the radial digital nerve does not, even if both have received identical primary treatment. Until we understand neumoramas better the technique of atraumatic neuroma transposition should be considered, having been shown to be successful in more than 75 per cent of a series of painful neuromas found in the hands of predominantly industrial workers.

References

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