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Case Report

Treatment of Neuroma of the Dorsal Branch of the Ulnar Nerve With Transfer to the Distal Anterior Interosseous Nerve

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Painful neuromas of the dorsal branch of the ulnar nerve may be difficult to treat. Proximal transposition is the standard treatment, but pain may recur. Sensory-to-motor nerve transfer as an evolution of targeted muscle reinnervation is a recently described technique to reduce neuroma formation in the treatment of painful neuromas. This report describes sensory-to-motor transfer of the dorsal branch of the ulnar nerve to the distal anterior interosseous nerve to treat a painful neuroma.

Neuroma formation is a frequent response in peripheral nerves after anatomic disruption. If the axonal growth is not directed to a distal nerve segment, the disordered sprouting of axons into scar tissue results in a neuroma.[1] Direct percussion or pressure on a neuroma causes discomfort in most cases. Painful neuromas are usually related to a superficial location or scar encasement of the nerve end, although cortical central factors also have a role in neuroma-related pain.[1]

The myriad of treatments described in the literature for painful neuromas reflect the complexity of the problem and the lack of a uniformly effective technique.[2,3] The dorsal branch of the ulnar nerve (DBUN) is an infrequent location of painful neuromas and literature about this specific entity is scarce.[4] However, the proximity of the DBUN to some common surgical approaches to the wrist makes it vulnerable to injury. The subcutaneous ulnar side of the forearm is also susceptible to minor trauma during daily living, so neuromas of the DBUN often result in pain.

Sensory-to-motor (STM) nerve transfer, in which a sensory nerve (after resection of a painful neuroma) is coapted to an expendable motor nerve, has recently been described for the treatment of painful neuromas, with favorable midterm results.[5] This concept is an extension of the previously described targeted muscle reinnervation, initially devised to increase the degrees of freedom of myoelectric prostheses in upper-limb amputees.[6] The observed associated improvement in chronic pain and phantom limb syndrome prompted its use to treat these painful conditions in amputees.[7] The regenerating sensory axons would enter the distal endoneural tubes of the distal motor nerve and reach the neuromuscular plates, where they are thought to stop and remain quiescent, thus avoiding neuroma formation.

This case report describes STM nerve transfer of the DBUN to the distal anterior interosseous nerve (AIN) to treat a painful neuroma of the DBUN.

Case Report

A 49-year-old woman presented with persistent pain (visual analog scale score of 8) and painful Tinel sign consistent with a painful neuroma of the DBUN 13 months after resection of a ganglion at the distal radioulnar joint. Two previous attempts at neurolysis performed elsewhere were unsuccessful in relieving pain. Surgical exploration was performed through a separate volar-ulnar skin incision; a neuroma-in-continuity embedded in extensive subcutaneous scar was found. The neuroma-in-continuity was resected. A nerve repair with an interposition nerve graft was not indicated because of the extensively scarred bed and the subcutaneous ulnar location of the injury. A proximal transposition of the DBUN into forearm muscles was also discarded because of unpredictable results in the senior author's experience. An STM nerve transfer was thus indicated. The AIN was identified directly over

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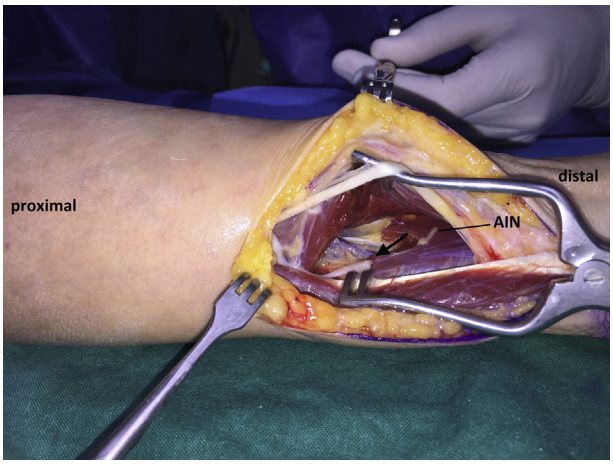

Figure 1. Left forearm. The DBUN (arrow) has been dissected proximally and mobilized. The AIN has been divided under the proximal edge of the PQ.

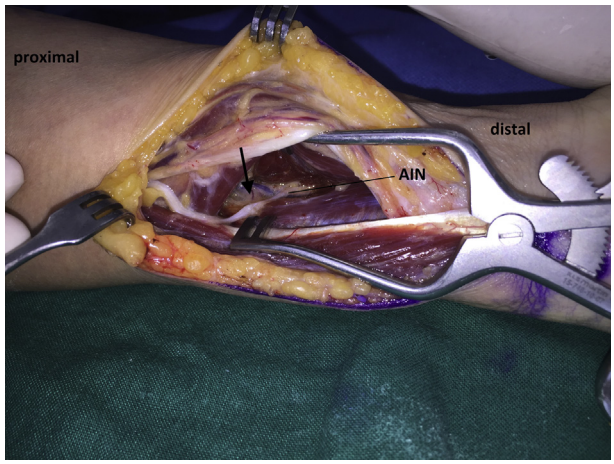

Figure 2. Transfer of the DBUN to distal AIN. The arrow points to the nerve coaptation.

the interosseous membrane deep to the flexor digitorum profundus mass, and it was divided at the proximal edge of the pronator quadratus (PQ) muscle (mainly motor nerve with an articular sensitive component). The DBUN was dissected proximally and mobilized to allow tensionless epineural suture of the proximal DBUN to the distal AIN with 10-0 nylon under the microscope (Figs. 1, 2). The wrist was immobilized with a short-arm orthosis for 2 weeks and progressive passive and active motion were allowed afterward.

The postoperative evolution was uneventful with resolution of the pain. Loss of sensation in the distribution of the dorsal branch of the ulnar nerve was discussed with the patient before surgery; it was accepted and well-tolerated. At the last follow-up visit, 12 months after surgery, the patient had minimal pain (visual analog scale score of 3). She had resumed her normal activities and was not taking pain medication. She reported no loss of pronation force or wrist joint discomfort.

Discussion

According to the literature, up to 30% of painful neuromas do not improve with surgical treatment.[8] Surgical options in the treatment of painful neuromas mainly depend on the availability of a distal target for reinnervation. Other factors such as scar tissue, location, and the number of previous surgical attempts are also important. When the distal segment of the damaged nerve is available, interposition nerve grafting is the treatment of choice, because most growing axons are redirected to their cutaneous physiologic targets. In scarred wound beds, nerve grafts yield unpredictable results and are best avoided, especially if the sensation of the skin area supplied by the nerve is not functionally critical, as it is in DBUN neuromas. Axons escaping a technically correct microsurgical repair may be a source of pain in the presence of a scarred bed in an area prone to minor trauma. Proximal transposition of the resected painful neuroma into muscle is the most frequent treatment, and although it does not prevent recurrence of the neuroma, it may avoid daily minor trauma causing pain.

When a suitable distal segment of the severed nerve is unavailable or its use is not advisable, a recently described technique for painful neuromas is STM nerve transfer.[5–7,9,10] The proximal sensory nerve is coapted to a distal expendable motor nerve branch, giving the growing axons a distal nerve segment toward the motor end plates of the muscle cells. The midterm results have been encouraging.[10–14] Sensory-to-motor nerve transfer is an extension of targeted muscle reinnervation.[5–7,11]

The technique described here represents an STM nerve transfer of the DBUN to a nearby expendable motor nerve, the distal AIN, which contains mainly motor fibers to the PQ and some articular sensory fibers to the wrist. The anatomy is consistent, the technique is straightforward, it is based on already described pathophysiology, and the results in the patient reported here were positive. The functional deficit of denervating the PQ muscle is unnoticeable to most patients, provided the other pronator muscles are functional. The theoretical possibility of recurrent pain caused by some axons from the DBUN entering the articular branch of the AIN proved groundless in this case. This is a single case report, and although the result was favorable, more experience is needed before this technique can be recommended.

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