

END-TO-SIDE NERVE TRANSFER IN NEUROPATHIC PAIN POST BRACHIAL PLEXUS INJURY

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Abstract

We report a case of a 59-year-old gentleman with complete left brachial plexus injury. He presented with chronic pain over the dorsum of his left hand since the injury eight years ago. Medical treatment had been optimised but the pain still persist. End-to-side nerve transfer was done involving superficial sensory radial nerve and median nerve to alleviate the pain. The surgery was considered successful as the patient claimed that the pain score had reduced a few weeks postoperatively. However, there was no sensory recovery and functionally no improvement was observed.

Keywords: Pain, Nerve Transfer, Brachial Plexus

Introduction

Chronic neuropathic pain post root avulsion brachial plexus injury occurs in up to 95% of patients (1). Their quality of life is affected as the pain is troublesome. Apart from that it also hinders rehabilitation following motor nerve transfer. Superficial sensory radial nerve transfer to median nerve has been advocated and proven to be effective in treating neuropathic pain over the dorsum of the hand (2, 3). The operative technique of this end-to-side neurotomy can be divided into epineurial window or no-window. The basis of creating a window is to promote axonal sprouting without compromising the donor nerve function. This procedure improves patient's pain and sensory evaluation thus increasing their quality of life.

Case presentation

A 59-year-old male with post traumatic closed complete postganglionic supraclavicular left brachial plexus injury in partial recovery complained of persistent pain over the left first webspace since a motor vehicle accident in 2012. The pain was described as burning sharp in nature and associated with numbness. It was severe as it disturbed his sleep and his daily activities. His visual analog score

was 8 out of 10. We have optimised his medical therapy and physiotherapy but the pain still disturbed him even though his pain score had reduced to 7 from 10. Clinically, sensation was diminished, 1 out of 2 over the superficial radial nerve distribution. Power of muscles supplied by median nerve were 4 out of 5 (flexor carpi radialis, pronator quadratus and flexor pollicis longus). Sensation over median nerve distribution was intact.

We decided for an end-to-side transfer of left superficial radial nerve to median nerve in view of persistent pain.

The patient was positioned in supine under general anesthesia and tourniquet was applied. Two incisions were made for the procedure. First, a 6 cm longitudinal incision was made, 4 cm proximal to the radial styloid to locate left superficial radial nerve. The nerve was divided and cut as proximally as possible. Another 6 cm longitudinal incision was made to approach the median nerve, 1 cm proximal to the wrist crease (Figure 1). After the nerve was identified, the ulnovolar part which corresponded to the fascicles of the third web space was cut and used as the donor site. The median nerve was explored and an epineurial window was created (Figure 2). Using subcutaneous tunneling, the distal part of the left superficial radial nerve then was attached

to the donor part of median nerve utilising an end to side transfer with epineurial window technique (Figure 3). The proximal part of superficial radial nerve was left in situ.



Figure 1: Two incisions were made in the left forearm for exploration of median nerve and superficial sensory branch of radial nerve.



Figure 2: Both the nerves were identified. The upper nerve is median nerve and the bottom nerve is the superficial sensory radial nerve.



Figure 3: The superficial sensory branch of radial nerve is transferred via subcutaneous tunneling to median nerve.

Post operatively, the left limb was placed in an armsling. The patient was discharged without specific postoperative rehabilitation advice. He was allowed full range of motion of his wrist and fingers and was advised to avoid heavy lifting. At three months post operation, the patient claimed that the pain had reduced. Pain score was 5 out of 10. His sleep was not disturbed but his daily activities such as riding motorcycle and writing were still slightly affected. Median nerve function was not compromised as muscle power remained 4 out of 5.

Discussion

Neuropathic pain over the superficial radial nerve distribution following brachial plexus injury can occur in one third of patients (3). Some studies reported a prevalence of up to 95% of patients (1). Most commonly affected are those with C5 and C6 root avulsions. The more number of roots are involved, the more severe the pain will persist (4). This pain is usually described as extreme, intractable pain such that the patient will bite his hand in order to relieve the pain which is coherent with our patient’s experience.

Disinhibition of neuron that causes spontaneous firing within substantia gelatinosa is described as the pathophysiology of this pain, consistent with the pain gate theory by Melzack and Wall (5). Immediate relief of pain following nerve transfer procedure in brachial plexus injury have been reported in a few cases. Sixteen out of 19 patients reported sensible relief of pain from day three up to 3 years post intercostal nerve transfer by Berman *et al* (6). Bertelli *et al* has reported significant reduction of pain in 36 patients who were operated on right from the first day postoperatively. At 2 years postoperatively, 80% of patients reported significant reduction or no pain at all. He also concluded that delayed nerve transfer for more than 2 years with no prospect of motor recovery has been proven effective for treatment of intractable pain in brachial plexus injury (7). In another study, comparisons between early and late nerve transfer, recovery in term of pain and sensory were significantly better in the group with shorter operative delay (4). In our patient, the recovery can be deemed significant as the pain affects less of his daily activities. One of the possible reason might be due to delayed surgery as the trauma happened more than 5 years ago.

Classically, recovery of motor function in brachial plexus injury is more crucial compared to sensory recovery. Once it is achieved, the surgeon will focus on sensory recovery. However, in the case of alleviation of pain, it depends on the severity and disturbance of daily activities. Few studies have done both nerve transfer for motor and sensory recovery or alleviation of pain in the same setting. Study has shown motor function is not compromised with additional improvement of pain and sensation if both nerve transfers are done simultaneously. Somsak *et al* reported improvement in hand grip and pinch of 8 patients at the end of follow up between 24-36 months

who have underwent simultaneous median nerve transfer for brachialis and superficial radial nerve transfer (3). As for our patient, who has partial recovery, motor function of median nerve is not compromised post operatively.

Sensory nerve transfer has been advocated in patients where primary repair or nerve grafting is impossible. End to side neurotomy has been used in the situation where donor nerve cannot be sacrificed. For example in our patient, the donor graft is from median nerve. A series of end to side neurotomy for digital nerve has been reported by Voche *et al*. There is a significant improvement of 2 point discrimination tests in a patient undergoing this technique (8). The technical detail of this technique is still being debated whether creating an epineurial window will allow faster healing rather than in the no-window group. In simple coaptation as demonstrated by Papalia *et al*, axons are able to regenerate even though fibers are smaller and less myelinated whether using suture or glue (9). However, in an animal study by Ernst *et al*, it was discovered that more axonal regeneration occurred in epineurial window technique resulting in better outcome (10). The basis of creating window is for realignment of Schwann cells. This opens window for ionic and cellular environment for axonal outgrowth. In the donor nerve, passing of the suture causes damage and will provide sprouting of axons. The size of window also matters. Larger size shows more ingrowth of larger axons (11). Few studies have compared end-to-side nerve repair with epineurial window between passing or without passing stitches. Most authors still prefer combining epineurial window technique and passing stitches to increase more axonal sprouting as what was utilised in our patient (10).

Conclusion

Chronic neuropathic pain in brachial plexus avulsion injury is debilitating to the patient. If medical therapy has been optimised but the pain still persist, surgical management in term of end-to-side sensory nerve transfer can be performed whether with or without window technique. This simple procedure is proven to be effective in treating neuropathic pain in brachial plexus injury especially if done early.

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