MANAGEMENT OF PAINFUL NEUROMA AND SENSORY RECONSTRUCTION OF SUPERFICIAL BRANCH OF RADIAL NERVE: A CASE REPORT

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ABSTRACT

Background: *Injury to the superficial branch of the radial nerve (SBRN) is a challenging clinical condition due to its superficial anatomical course and high susceptibility to traumatic and iatrogenic injury. SBRN injury may result in painful neuroma formation and chronic neuropathic pain, often described as an "unforgiving nerve", and optimal surgical management remains controversial.* ***Case Presentation:*** *A 40-year-old male presented with persistent forearm pain and sensory disturbance three months after radial plate fixation. Clinical evaluation suggested a painful neuroma of the SBRN. Surgical management consisted of neuroma excision with proximal stump burial into the brachioradialis muscle and end-to-side epineural window transfer of the distal SBRN to the median nerve. At six months postoperatively, the patient experienced marked pain reduction and improvement in sensory symptoms without cross-misperception or new sensory deficit in the median nerve distribution.* ***Discussion:*** *Painful SBRN neuromas are associated with high rates of persistent neuropathic pain and variable outcomes following conventional surgical treatments. Proximal nerve burial is intended to reduce ectopic neural discharge, while end-to-side sensory nerve transfer provides a biological target for axonal ingrowth and potential sensory reinnervation. The combination of these techniques may address both pain control and functional recovery while avoiding complete sensory denervation.* ***Conclusion:*** *Brachioradialis muscle burial combined with end-to-side epineural window transfer to the median nerve represents an effective surgical option for the management of painful SBRN neuroma.*

Keywords: *Superficial branch of radial nerve; Painful neuroma; End-to-side nerve transfer; Sensory nerve reconstruction*

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BACKGROUND

Injuries to the superficial branch of the radial nerve (SBRN) represent a challenging clinical entity due to the nerve's superficial anatomical course and its critical role in sensory innervation of the dorsoradial aspect of the hand. The SBRN is a purely sensory nerve originating from the radial nerve (C6–C7) and becomes subcutaneous in the distal forearm, making it particularly vulnerable to traumatic, iatrogenic, and postoperative injuries, especially during orthopedic and hand surgical procedures.[1–3] Even minor insults to this nerve may result in significant sensory disturbance, neuropathic pain, or painful neuroma formation.

Clinical series suggest that traumatic and iatrogenic mechanisms account for the majority of cases, with common causes including forearm fractures, surgical exposure of the radius, plate fixation or removal, venipuncture, wrist arthroscopy, and percutaneous pinning.[2–4] Iatrogenic injury has been identified as a particularly significant contributor, especially following orthopedic and hand surgical procedures involving the distal forearm.[2,5] Although not all SBRN injuries progress to chronic symptoms, epidemiological studies have demonstrated a high prevalence of persistent neuropathic pain following traumatic SBRN injury, highlighting the substantial morbidity associated with this condition despite its limited sensory territory.[6]

Neuroma of the SBRN is a well-recognized cause of persistent pain, paresthesia, and hypersensitivity that can be disproportionate to the initial injury. Owing to its limited capacity for spontaneous recovery and high propensity for neuropathic pain, the SBRN has been described in the literature as an "unforgiving nerve".[6–8] Patients with SBRN neuromas often experience severe functional impairment, and conservative management frequently fails to provide durable symptom relief. Consequently, surgical intervention is commonly required, yet optimal treatment remains controversial.

Multiple surgical strategies have been proposed for the management of painful SBRN neuromas, including neurolysis, neuroma excision with nerve reconstruction, muscle or nerve denervation techniques, neurectomy, and nerve transposition.[6,8] Despite these options, outcomes are variable, and recurrence of pain is not uncommon. In recent years, sensory nerve transfer technique, particularly end-to-side nerve coaptation have gained attention as a potential strategy to both relieve neuropathic pain and promote meaningful sensory reinnervation.[7]

This case report describes a patient with a painful SBRN neuroma following forearm surgery who was treated with a sensory end-to-side epineural window reconstruction to the median nerve. The case highlights the potential role of nerve transfer techniques in managing complex SBRN injuries.

CASE PRESENTATION

A 40-year-old male patient came to the Orthopedic clinic complaining of pain in the forearm area, which he had been experiencing for about 3 months. Pain accompanied by thumb and index finger numbness on dorsal side numbness. The patient cannot perceive heat and does not feel anything sensation when the affected areas are touched or pinched. The patient previously had a plate inserted in the radius, which was

placed on the radial side of the bone by the previous surgeon (Fig.1). Afterward, the patient experienced tenderness around the surgical scar, as well as numbness of the thumb and index finger on the dorsal side. The patient has never experienced pain and numbness like this before, and there is no family history of anyone with a similar condition. A history of radiating pain from the neck down to the fingers was denied. Because of resource limitations, a nerve study and MRI were not performed. Based only on history taking and physical examination, the patient was diagnosed with neuroma of the SBRN. After a long discussion, the patient expressed the need not only for pain reduction but also for a sensory recovery. However, he did not want a sural nerve autograft donor as an interposition material, so we decided to perform a sensory end-to-side (ETS) epineural window to the median nerve, with the acknowledge risk of sensory disturbance in the ring finger and little finger.

Before starting the incision, we marked the hand (Fig.2). After that, an incision of approximately 5 cm was made over the old scar (Fig.3), SBRN exploration and decompression were performed (Fig.4), and it was separated from the surrounding soft tissue and plate exposure (Fig. 5). After successful separation and plate removal, the coaptation process of the SBRN nerve (Fig.6) to the median nerve began. Firstly, we transported and buried the proximal stump in brachioradialis muscle belly and mobilized the distal stump of SBRN (Fig.7). After that, a zigzag incision about 3 cm long was made on the distal volar aspect of the forearm, and the distal stump of the SBRN was inserted into the incision from below (Fig.8). After that, median nerve decompression was performed (Fig.9) and coaptation with the median nerve was done using the end-to-side (ETS) technique with an epineural window at the ulnar side of the median nerve under a microscope (Fig.10). The operation is complete and the surgical wound is closed (Fig.11).

The patient is followed up regularly to observe neuroma pain and sensory function. After six months of follow-up, the patient's VAS score, which was initially 8/10, decreased to 1/10, and the patient was able to feel touch and pain in the interphalangeal (IP) joint of the thumb and the distal interphalangeal (DIP) joint of the index finger without any cross-misperception. During the follow-up, there was no numbness in the third and fourth fingers.



Figure 1: Previous operation



Figure 2: Markings on the hand before incision



Figure 3: The old scar that was the site of the incision for this surgery.



Figure 4: Decompression of superficial branch of radial nerve



Figure 5: Separation of SBRN from soft tissue and plate exposure



Figure 6: Superficial branch of Radial Nerve Neuroma



Figure 7: After transposition and burial of the proximal stump and mobilization of the distal stump of SBRN



Figure 8: Distal stump of SBRN was inserted to median nerve teritories



Figure 9: Decompression of median nerve

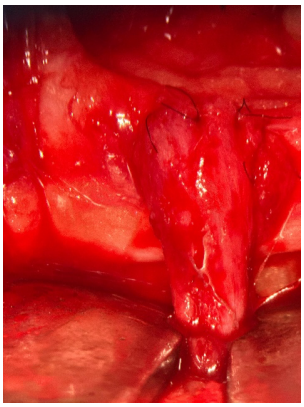


Figure 10: Coaptation of SBRN to median nerve



Figure 11: Operation wound

DISCUSSION

The SBRN is one of two branches of the radial nerve and is derived from C6 and C7. The radial nerve divides into two at the elbow; the first branch is the posterior interosseous nerve (PIN), which carries motor nerves, and the SBRN, which carries sensory nerves from the radial nerve. The SBRN is located on the radial side of the forearm and runs under the brachioradialis muscle. The SBRN is lateral to the radial artery. The SBRN pierces the deep fascia of the forearm, approximately 7 cm proximal to the radiocarpal joint and 9 cm proximal to the radial styloid. The SBRN will enter the anatomical snuffbox of the hand and innervate 2/3 of the dorsum of the hand.[1–3] The SBRN is a superficial nerve, making it susceptible to injury, especially during surgery.[3] Our patient also had a history of injury because previous surgery.

Neuroma pain in SBRN injury is very difficult to eliminate; it is not uncommon for patients to undergo repeated surgeries, and the results of the operations are often unsatisfactory. Some literature even refers it as an "unforgiving nerve".[6,8,9] There are several techniques used to achieve satisfactory results from SBRN injury surgery, namely neurolysis, nerve reconstruction, denervation (BR muscle), denervation (Other), pin neurectomy, and lateral antebrachial cutaneous nerve (LABCN) neurectomy.[8] Our patient underwent sensory end-to-side surgery with an epineural window to the median nerve for the sensory reconstruction and burial of the proximal stump to the brachioradialis muscle belly for preventing the proximal stump neuroma. Supported by a paper written by Leechavengvongs, et al., which states that end-to-side SBRN to the median nerve is a good technique for inducing nerve regeneration.[7] A retrospective study by Stokvis, et, al. reported different findings. In this study, it is mentioned that the surgical method with the most satisfactory results is denervation of the brachioradialis muscle, due to the large muscle belly and little excursion of the brachioradialis muscle.[8] For proximal stump burial, this is supported by a paper written by Brakkee et al., which states that the most effective technique for preventing neuroma pain in the proximal stump is to bury the proximal stump under the brachioradialis muscle due to its large muscle belly.[6]

For the surgical technique used, we employed end-to-side with an epineural window. The use of the technique with an epineural window aims to accelerate axon regeneration. This aligns with experimental research conducted by Stefano, et, al., whose findings indeed confirmed that ETS accelerates axon regeneration because it activates neuronal molecular pathways.[10]

In our patients, we did not find any cross-misperception between the nerves that were coapted. This is consistent with papers written by Voche, et, al., and Leechavengvongs, et, al., which concluded that the coaptation of damaged sensory nerves to other nerves will not interfere with the function of the nerve receiving the damaged nerve.[7,11] Experimental research by Stefano et al. states that nerve healing in patients does not depend on fiber specificity between the donor injured nerve and the healthy recipient nerve.[10]

CONCLUSION

SBRN injury is common because the nerve is anatomically located superficially, and when damaged, it often requires repeated surgery due to its poor prognosis. Some authors even refer to the SBRN as an ‘unforgiving nerve.’ In this patient, neuroma excision with proximal stump burial into the brachioradialis muscle belly provided good pain relief and helped prevent neuroma recurrence. In addition, end-to-side (ETS) reconstruction with a epineural window proved effective, yielding good results while preserving the function of the SBRN.

CLINICAL IMPORTANCE

SBRN injury has been described as an “unforgiving nerve”, which is why the ETS technique with an epineural window

provides the surgeon with an opportunity to restore sensory function of the SBRN, while proximal stump burial relieves the patient from recurrent neuroma pain.

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