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BREAKING THE CHAINS OF PAIN : ADVANCED SYMPATHECTOMY AND NEUROLYSIS FOR RELENTLESS UPPER LIMB NEUROPATHY

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ABSTRACT Chronic upper limb pain following brachial plexus injuries is a complex condition, often involving neuropathic and sympathetically mediated pain. This case report presents a 36-year-old male with severe upper limb pain post-brachial plexus injury, unresponsive to pharmacological therapy and multiple stellate ganglion blocks. T2-T3 radiofrequency sympathectomy was performed, resulting in significant pain relief. Residual pain in the ulnar nerve distribution was managed with neurolysis using 6% phenol, achieving sustained relief and improved quality of life at a 6-month follow-up. The case highlights the utility of thoracic sympathectomy and targeted nerve neurolysis in managing refractory upper limb neuropathic pain.

KEYWORDS : brachial plexus injury, neuropathic pain, T2-T3 radiofrequency sympathectomy, ulnar nerve neurolysis, CRPS, chronic upper limb pain, stellate ganglion block

INTRODUCTION

Chronic upper limb pain following brachial plexus injuries is a challenging condition to manage, often requiring a multimodal and tailored approach. Neuropathic pain is common in peripheral nerve and brachial plexus injuries, affecting up to 95% of cases, especially with root avulsions. It results from mechanisms like peripheral sensitization, ectopic discharges, central sensitization, and cortical reorganization.1 Symptoms range from sensory deficits (e.g., hypesthesia) to heightened responses like allodynia and hyperesthesia. Brachial plexus injuries, commonly caused by trauma, can lead to debilitating pain and functional impairment. Persistent pain is often neuropathic in origin and may involve the sympathetic and peripheral nervous systems.[1,2]

Sympathectomy can be a valuable component of multimodal therapy, particularly when sympathetically mediated pain is a significant factor as in CRPS. While stellate ganglion blockade is typically the first-line treatment for upper limb CRPS after conservative measures fail, numerous studies have highlighted its limited effectiveness in managing this condition.[3,4]

Percutaneous radiofrequency (RF) sympathectomy at the T2 and T3 levels is an established method for managing pain in upper limb CRPS. This technique offers precise nerve (ganglion) lesioning with minimal unintended harm to adjacent structures. Despite its effectiveness, reports on its use for upper limb neuropathic pain remain limited.[2]

Case Study

A 36-year-old male presented with a history of a right brachial plexus injury sustained after a road traffic accident in June 2022. MRI showed injury to C6, C7, C8 and T1 nerve roots. The patient underwent exploration and suprascapular nerve transfer in July 2022. Postoperatively, he reported severe pain in the right upper limb, including the shoulder, arm, and forearm, and hand which was non dermatomal and corresponding of C6, C7, C8 and T1 distributions. The pain was continuous, burning and with recurrent attacks of severe pain in between. It significantly impaired his daily activities and disrupted his sleep. Despite visiting multiple hospitals, his pain remained uncontrolled.

After 1 year he presented to pain OPD at AIIMS Rishikesh. Following a detailed history and examination, and failure to respond to pharmacological therapy, a stellate ganglion block was performed under ultrasonography guidance using 1% lignocaine and 8 mg dexamethasone. This resulted in a 50% reduction in pain, which was subsequently managed with pharmacotherapy. However, the patient's pain recurred six weeks later, necessitating repeated stellate ganglion blocks, which provided only short-term and inadequate relief.

Given the refractory nature of his pain, T2-T3 sympathetic radiofrequency ablation (RFA) was considered after a thorough review of the literature. T2-T3 sympathetic RFA had been reported as effective in upper limb CRPS following brachial plexus injury in a case series by Chee et. al.[2] After a diagnostic T2-T3 sympathetic ganglion blockade, RFA was performed.

During both procedures, the patient was positioned prone. The diagnostic block was administered at the T2 level, with an appropriate volume of local anesthetic and contrast dye injected to ensure sufficient spread to the T3 level. Using fluoroscopic guidance, the T2 vertebral body was identified in an anteroposterior view. To align the T2 vertebral body, the fluoroscope was angled approximately 15 degrees towards the ipsilateral side and rotated about 15 degrees cephalad. The skin entry point was at the lateral edge of the T2 vertebral body, slightly above the third rib. To minimize the risk of pneumothorax, the entry point was kept within 4 cm of the spinous process. A 22-gauge, 10 cm spinal needle was advanced toward the lateral border of the T2 vertebral body above the third rib using a tunnel view. Lateral, anteroposterior, and oblique fluoroscopic views guided the needle, which was positioned at the posterior third of the vertebral body and aligned with the midline in a cephalocaudal direction.

Once the needle was correctly placed, 1 to 1.5 ml of Iohexol 200 mg/ml dye was injected. The dye's spread was monitored in anteroposterior and lateral fluoroscopic views, confirming upward and downward distribution along the thoracic vertebral column. Subsequently, 5 ml of 1 % preservative free lignocaine combined with 40 mg of triamcinolone acetate was injected. The block was deemed successful if the visual analogue scale (VAS) score for upper limb pain was reduced by more than 50% for at least 2 hours.

For the RFA procedure, a 22-gauge, 10 cm curved, sharp RF-insulated needle with a 10 mm active tip and a Halyard RF generator were employed. The needle was positioned as described above. After confirming the placement, a 10 cm electrode was introduced through the RF needle. Sensory (50 Hz, up to 0.6 V) and motor (2 Hz, up to 1.2 V) test stimulations were conducted to verify the needle's location. If the patient reported no sensory response in the corresponding dermatomes and exhibited no intercostal muscle contractions, the needle placement was considered accurate.

Before lesioning, 3 ml of 1% preservative free lignocaine was injected. Two lesions were created with the needle angled medially in cephalad and caudad directions to maximize the lesion area. Two cycles of RF lesioning were performed for 75 seconds each at 70°C and 80°C. This procedure was conducted at both the T2 and T3 levels. After the lesioning 8 mg of dexamethasone, 4 mg at each level was injected.

T2-T3 RFA resulted in 70% pain relief. However, residual pain on the medial side of the forearm, corresponding to the ulnar nerve distribution, persisted but was manageable with minimal medications. Six months later, the pain in the medial forearm worsened significantly. An ulnar nerve diagnostic block at the posterior elbow under ultrasound guidance provided complete but transient relief for two weeks. Based on this response, ulnar nerve neurolysis with 6% phenol was performed. At a 6-month follow-up, the patient reported sustained pain relief and improved quality of life.

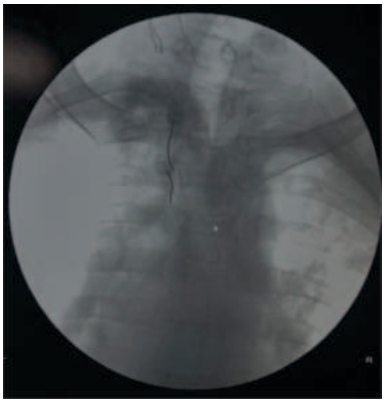

Figure 1: Needle Position In Anterio-posterior View

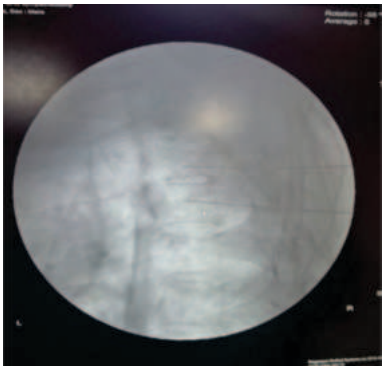

Figure 2: Needle Position In Lateral View For T2-t3 Sympathetic Block

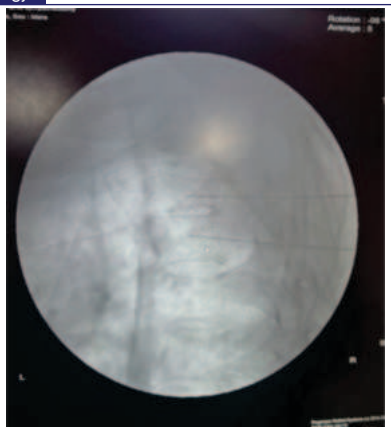

Figure 3: Dye Spread Covering T2 And T3 Level

DISCUSSION

Neuropathic pain is a frequent consequence of brachial plexus injuries, arising from abnormal nerve regeneration, painful neuroma formation, or fibrous tissue compression in postganglionic lesions. In preganglionic injuries, the presence and severity of pain depend on the extent of axonal damage. Pain may develop immediately or months after the injury, often intensifying over time due to sympathetic nervous system plasticity. Pain location varies with the affected roots, ranging from the hand for most roots to the shoulder for C5 lesions, the thumb and index finger for C6, and from the elbow to the hand for C7, C8, and T1 lesions.[1]

Stellate ganglion block is a relatively simple and commonly done procedure for upper limb neuropathic and sympathetic pain. However, its effects are often short-lived.[3,5] Approximately 20% of patients have Kuntz fibers, sympathetic pathways that bypass the stellate ganglion, potentially reducing the block's efficacy. Neurolytic procedures targeting the stellate ganglion carry risks such as prolonged or permanent Horner syndrome and injury to the phrenic or recurrent laryngeal nerves. Thoracic sympathetic blocks offer a safer alternative, addressing the same conditions without these complications.[5,6]

While thoracic sympathectomy has limitations, including the risk of pneumothorax and the need for precise needle placement, these risks can be mitigated with proper techniques, such as keeping the needle entry within 4 cm of the spinous process and using the "hugging the vertebral body" approach. Anatomical variations in the sympathetic supply to the upper limb may contribute to recurrence of pain post-thoracic sympathectomy. Nonetheless, sympathectomy significantly reduces sympathetically mediated pain, though it may not address all pain types, such as myofascial or radicular pain, which require additional interventions.[2]

CONCLUSION

This case highlights the complexity of managing chronic upper limb pain following brachial plexus injuries. While stellate ganglion blocks provide initial relief, their efficacy may be limited in refractory cases. T2-T3 RFA is a viable and effective alternative, offering significant pain reduction with minimal complications. For residual pain, targeted interventions like ulnar nerve neurolysis can achieve sustained relief and improved quality of life. A multimodal, tailored approach is essential for optimizing pain management in such challenging cases.

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