



OPTIMIZING OUTCOMES IN NEUROPATHIC AND MYOFASCIAL PAIN ASSOCIATED WITH BRACHIAL PLEXUS INJURY AND PHANTOM LIMB PAIN: THE ROLE OF T2-T3 SYMPATHETIC RADIOFREQUENCY ABLATION

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ABSTRACT

Neuropathic pain resulting from brachial plexus injuries (BPI) and phantom limb pain (PLP) remains a clinical challenge due to its complex, multifactorial nature involving neuropathic, nociplastic, sympathetic, and myofascial pain mechanisms. This retrospective case series evaluates the efficacy of T2-T3 sympathetic radiofrequency ablation (RFA) as part of a comprehensive multimodal treatment strategy in five patients with chronic upper limb pain due to BPI, Pancoast tumors, and PLP. Clinical outcomes assessed by visual analog scale (VAS) demonstrated significant pain relief ranging from 50% to 90% over six months. Interventions targeting myofascial trigger points and sympathetic modulation via T2-T3 RFA provided sustained pain reduction and improved patient outcomes. Incorporating myofascial pain management alongside neuropathic and sympathetic interventions highlights the importance of an integrated treatment approach for complex pain syndromes.

KEYWORDS : Neuropathic pain, Brachial plexus injury, Phantom limb pain, Myofascial pain syndrome, Radiofrequency ablation, Multimodal pain management, T2-T3 sympathetic block.

INTRODUCTION

Pain arising from upper thoracic and cervical pathologies like brachial plexus injury (BPI) and phantom limb pain (PLP) remains challenging to manage due to its multifactorial nature, which encompasses neuropathic, nociplastic, sympathetic, and myofascial components. Brachial plexus injuries (BPI), common peripheral nerve injuries, can result in persistent neuropathic pain in up to 95% of cases involving nerve root avulsions (1). Sympathetically mediated pain, including conditions like complex regional pain syndrome (CRPS), further complicates management strategies (2). Additionally, myofascial pain syndrome (MPS) significantly contributes to chronic pain in patients with BPI and phantom limb pain (PLP), necessitating a comprehensive multimodal approach to treatment (7,8).

Radiofrequency ablation (RFA) of the T2-T3 sympathetic chain has emerged as a targeted intervention, providing durable pain relief by selectively disrupting the sympathetic fibers responsible for pain modulation. Unlike traditional interventions like stellate ganglion blocks, which may offer limited and transient relief (3), T2-T3 RFA consistently demonstrates more sustained outcomes with fewer complications (4). T2-T3 RFA when supplemented with myofascial trigger point injection, cervical epidural or peripheral nerve neurolysis in BPI or PLP depending on pain distribution and clinical examination can improve overall outcome of the patient.

METHODS

This retrospective case series evaluates five patients with chronic upper limb pain treated with T2-T3 sympathetic RFA. Clinical data, imaging findings, pain relief outcomes assessed by visual analog scale (VAS) at intervals of 1, 3, and 6 months, and multimodal treatments including interventions targeting myofascial pain were reviewed.

CASES

1. A 36-year-old male with right BPI presented with burning

pain in the C7-C8, T1 dermatomes. Imaging revealed pseudomeningoceles and neuroma in continuity. Treatment included stellate ganglion block, T2-T3 sympathetic RFA, myofascial trigger point injections, and ulnar nerve neurolysis, resulting in 70-80% pain relief.

2. A 59-year-old male with right Pancoast tumor exhibited electrical shooting pain. Imaging confirmed vertebral erosion and brachial plexus infiltration. Interventions included stellate ganglion block and T2-T3 sympathetic RFA, achieving 50-60% relief.
3. A 26-year-old male with phantom limb pain following an above-elbow amputation reported electrical shooting pain persisting since a 2016 road accident. Treatment comprised stellate ganglion block, T2-T3 sympathetic RFA, supraclavicular brachial plexus block, and stump local anesthetic plus steroid injection, with 70-80% pain relief.
4. A 55-year-old male with a right Pancoast tumor experienced electrical shooting pain in C6-C7 dermatomes, with imaging showing tumor involvement and lymph node infiltration. Stellate ganglion block and T2-T3 sympathetic RFA led to 60-70% pain relief.
5. A 52-year-old male with severe right BPI post-road accident (2001) described intermittent electrical shooting and constant dull aching pain. Due to implants, MRI was not performed, but nerve conduction studies revealed severe brachial plexus lesions. Treatment included stellate ganglion block, T2-T3 sympathetic RFA, trigger point injections for myofascial pain, and cervical epidural injections, achieving 70-90% relief.

DISCUSSION

This case series highlights the effectiveness of T2-T3 sympathetic RFA as part of a comprehensive multimodal pain management strategy addressing neuropathic, nociplastic, sympathetic, and myofascial pain. Sympathetic mechanisms contribute significantly to central sensitization and pain amplification in CRPS and BPI (1). RFA effectively disrupts these pathological processes, significantly reducing pain intensity.

Myofascial pain syndrome frequently complicates neuropathic pain conditions such as BPI and PLP by causing muscle tightness, trigger points, and referred pain patterns that mimic neuropathic symptoms (7). Treatment modalities including trigger point injections and physical therapy are essential to effectively manage these myofascial pain elements, thereby improving overall patient outcomes (8).

In phantom limb pain, myofascial trigger points within the residual limb significantly exacerbate chronic pain experiences, necessitating targeted treatment as part of comprehensive care (9). Thus, integrating interventions addressing myofascial pain into treatment protocols alongside T2-T3 sympathetic RFA offers superior outcomes.

While T2-T3 RFA is generally safe, potential complications include transient intercostal neuralgia and pneumothorax, which can be minimized by appropriate patient selection and image-guided techniques (5).

CONCLUSION

Effective management of chronic neuropathic pain in BPI and PLP demands a multimodal approach that targets neuropathic, nociplastic, sympathetic, and myofascial pain mechanisms. Incorporating interventions like trigger point injection, cervical epidural, peripheral nerve neurolysis with T2-T3 sympathetic RFA significantly enhances patient outcomes, providing sustained pain relief and improved quality of life. Further research with larger patient cohorts and longer follow-up is recommended to optimize patient selection and procedural techniques.

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