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A Dual-Treatment Approach for Degenerative Shoulder Pain: Coracohumeral Ligament Release and Peripheral Nerve Stimulation Case Report

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Background: Chronic degenerative shoulder pain, often due to adhesive capsulitis or osteoarthritis, is challenging to treat. Total shoulder arthroplasty is an option when conservative treatment fails to alleviate symptoms, but many patients are unsuitable surgical candidates and require alternative treatment plans.

Case Report: This case report presents a successful treatment approach combining coracohumeral ligament release and peripheral nerve stimulation (PNS). A 77-year-old patient with myelomalacia and progressive shoulder pain was found to have limited range of motion (ROM) and severe shoulder arthritis. He underwent multiple treatments over 4 years, including percutaneous tenotomy, corticosteroid injections, and stellate ganglion blocks. While his shoulder mobility improved, pain persisted. A PNS trial reduced pain by 80%, leading to permanent neurostimulator implantation.

Conclusions: This case highlights the potential of a sequential approach: first restoring ROM via ligament release, then managing pain with PNS as an effective alternative for patients ineligible for shoulder arthroplasty.

Key words: Osteoarthritis, shoulder, peripheral nerve stimulator, frozen shoulder, adhesive capsulitis, coracohumeral ligament, chronic pain, function

BACKGROUND

Chronic degenerative shoulder pain secondary to adhesive capsulitis or osteoarthritis can be difficult to treat (1,2). Total shoulder arthroplasty is often an option when treatment with physical therapy or corticosteroid injections fails to alleviate symptoms, but many patients are unsuitable surgical candidates and require alternative treatment plans (3). This case report details the successful treatment of chronic degenerative shoulder pain using a sequential approach with coracohumeral ligament (CHL) release first to restore range of motion (ROM), followed by peripheral nerve stimulation (PNS) to manage pain symptoms.

METHODS

Patient-informed consent was obtained for presenting this case report. The report does not include any identifiable patient information and is, therefore, exempt from Institutional Review Board review.

RESULTS

A 77-year-old man with a medical history significant for hypertension, hyperlipidemia, diabetes mellitus, chronic kidney disease (CKD) stage 3, and myelomalacia status post cervical decompression surgery, initially presented with 6 months of progressively worsening shoulder pain. On physical examination, the patient exhibited a limited ROM in the left shoulder. A mag-

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netic resonance imaging revealed full-thickness tears in both the supraspinatus and infraspinatus tendons, as well as severe glenohumeral arthritis. However, due to his extensive medical comorbidities, he was deemed unsuitable for surgical intervention.

The initial differential diagnosis included adhesive capsulitis and complex regional pain syndrome (CRPS), as he had notable exam findings, including a positive skin drag test. Myelomalacia was also considered as a pathogenesis for the patient's pain through impaired neurosensory-afferent signaling and development of neuropathic arthropathy, which can be seen radiographically as widespread joint destruction and bone resorption (4,5). Nevertheless, the patient's imaging was significant for decreased glenohumeral joint space and osteophytes consistent with osteoarthritis, making a stronger case for mechanical degeneration as his primary generator of pain. Given the patient met Budapest criteria, he was initially treated for presumed CRPS with tizanidine and prednisone (6). Due to the inclusion of systemic corticosteroids in the treatment plan, corticosteroid glenohumeral joint injections were postponed in favor of a stellate ganglion block, which provided significant relief for one month. Multiple stellate ganglion blocks were subsequently performed, providing temporary relief with an estimated 50% to 80% reduction in pain, in conjunction with numerous physical therapy sessions.

Ultimately, the patient underwent percutaneous CHL release using the Tenex® system (Tenex Health, Lake Forest, CA). Using ultrasound guidance, the CHL was identified in the sagittal plane. A local anesthetic track was created, and an incision was made at the entry site. A Tenex® needle (Tenex Health, Lake Forest, CA) was introduced to selectively disrupt the CHL. Retracting and protracting strokes were performed while walking along the CHL's lateral border until the CHL was interrupted. Further description of the technique has been described by Yerra et al (7). Following CHL release, the patient had improved external rotation from 21° to 45°, but the pain persisted. Subsequently, the patient underwent 3 glenohumeral corticosteroid injections alongside ongoing physical therapy. External rotation further increased to 60° and abduction to 80°. However, the patient's daily function remained impacted by ongoing persistent pain.

Pharmacologic management following procedural intervention included trials of gabapentin at doses up to 300 mg 3 times daily and duloxetine 30 mg daily, though these offered limited relief. Nonsteroidal anti-inflammatory drugs were avoided in this patient due to his history of CKD. Opioid prescriptions were avoided after shared decision-making with the patient. Consideration was given to spinal cord stimulation, but this was ultimately ruled out due to his history of C3-C4 laminectomy, which rendered his postsurgical anatomy unsuitable for cervical neurostimulation.

Next, left suprascapular and axillary nerve blocks were performed, followed by radiofrequency ablation (RFA) using Stryker Venom® needles (Stryker Instruments, Kalamazoo, MI), which yielded excellent pain relief and a marked improvement in the patient's ability to perform activities of daily living as well as his engagement in home exercise programs and physical therapy. Unfortunately, this relief was temporary, lasting approximately 2-3 weeks before pain recurred.

Given his positive response to RFA, the decision was made to trial a PNS targeting the same 2 nerves. A 60-day Sprint® PNS system (SPR Therapeutics, Inc, Cleveland, OH) was used in this case. The patient reported significant pain reduction of 80% to 90% with the PNS leads in place, greatly improving his quality of life. Following the successful trial, a permanent PNS implantation was performed. One lead was placed at a time, with 2 weeks in between placement of the suprascapular and axillary leads. After 2 weeks, the patient followed up in the clinic. The patient continues to experience sustained pain relief and improved functional capacity.

DISCUSSION

CHL release is a promising treatment option for adhesive capsulitis, particularly in cases that have not responded to conservative therapies (8). This procedure involves the release of CHL, which is often hypertrophied in adhesive capsulitis and limits external rotation of the shoulder. The CHL also provides support for the rotator cuff muscles and tendons, and prevents inferior translation of the humeral head within the glenoid fossa.

Ultrasound-guided CHL release has demonstrated significant improvements in both ROM and pain reduction. Yukata et al (9) reported an increase in the ROM during passive external rotation from an average of 18° preoperatively to 47° immediately following the procedure, with continued improvements in pain and function observed at the 6-month follow-up. Notably, none of the patients in this study had any complications from the procedure. This can be attributed to the use of ultrasound guidance to precisely target the CHL, thereby significantly reducing the risk of damage to surrounding tissues and enhancing procedural accuracy.

A prospective, randomized, controlled crossover trial by Wahezi et al (8) further confirms the effectiveness of percutaneous CHL release. Patients who underwent this procedure showed marked improvements in external rotation, abduction, and shoulder function. They also reported significant reductions in pain compared to those who received only local anesthetic injections. These benefits were sustained with improvements persisting at the 2-year follow-up.

While current literature supports CHL release to improve shoulder function in patients with adhesive capsulitis, this case demonstrates that restoration of shoulder ROM may not adequately alleviate pain from concurrent underlying degenerative shoulder pathologies, thus requiring adjunctive treatment to optimize outcomes. The patient's increase in shoulder ROM during daily activity coupled with underlying severe glenohumeral arthritis likely led to increased pain from intraarticular inflammation for which he found only short-term relief from 3 corticosteroid injections and stellate ganglion blocks. Despite improvement in function following CHL release, durable pain relief was only achieved after trial of PNS, which has emerged as a promising treatment alternative in refractory shoulder pain (10).

PNS placement involves the percutaneous implantation of a small electrode near the target nerve, which dispatches electrical impulses to modulate pain signals. Ultrasound or fluoroscopic guidance ensures accurate placement of the electrode. Anatomically, PNS of the axillary and suprascapular nerves is most supported at this point to effectively treat chronic intractable shoulder pain (4,11,12).

There are a few theories as to how PNSs provide analgesic effects. Centrally acting analgesia is based on the gate control theory of pain modulation (10). They stimulate Aβ fibers, which activate inhibitory interneurons in the dorsal horn of the spinal cord and therefore attenuate nociceptive signals from Aδ and C fibers to the central nervous system. In addition to addressing central sensitization, PNSs have been shown to reduce nociceptive signals as well as other inflammatory cytokines and neurotransmitters (13).

Clinical evidence supports the efficacy of PNS in reducing chronic shoulder pain. For instance, a retrospective case series demonstrated that axillary PNS led to significant pain reduction, with 88% of patients achieving at least a 50% reduction in pain. Additionally, these patients reported decreased opioid use and higher satisfaction rates. Another study (4,12) showed that suprascapular nerve stimulation provided significant pain relief and improved shoulder function in patients with chronic intractable shoulder pain.

While there are individual case reports suggesting that PNS offers improvement in ROM for patients with adhesive capsulitis, this evidence is largely anecdotal and not backed by randomized control trial data as is the case with CHL release (14-17). There is currently a body of evidence correlating CHL thickness with decreased ROM in patients with adhesive capsulitis suggesting a biomechanical component limiting ROM that would not be addressed with neuromodulation alone (18). This distinction underscores the importance of tailoring treatment approaches based on the underlying pathology, with CHL release targeting structural restrictions and PNS addressing persistent pain that remains despite improved mobility.

The American Society of Pain and Neuroscience (ASPN) has provided guidelines supporting the use of implantable PNS for chronic pain, including shoulder pain, emphasizing its safety and efficacy (10). The ASPN specifically highlights Level I evidence supporting PNS as another addition to the therapeutic options available for chronic shoulder pain. This recommendation is particularly strong for patients who have not responded to other treatments, making PNS a viable option in the multimodal treatment algorithm for managing refractory pain.

In this case, the successful use of CHL release followed by PNS illustrates a novel, stepwise approach to managing chronic degenerative shoulder pain, particularly after failure of multiple treatment modalities to provide pain relief and improve functionality. By focusing first on enhancing external shoulder rotation via CHL release to restore function and then addressing pain through neuromodulation, this approach offers a structured path to recovery.

Future research is necessary to examine the relationship between improvement in ROM and pain response for patients with chronic degenerative shoulder conditions. Additional research is also warranted to determine whether the stepwise approach identified in this case starting with CHL release to restore shoulder ROM, followed by PNS for pain modulation can lead to optimized outcomes in patients with adhesive capsulitis and concurrent glenohumeral arthritis who are managed nonoperatively.

CONCLUSIONS

PNS has shown promising results for refractory shoulder pain as compared to other neuromodulatory modalities, including spinal cord stimulators (19). However, there is limited literature on whether PNS outcomes are optimized by ligamentous release to biomechanically restore shoulder ROM prior to PNS placement. The success of pain relief in this case suggests that using a stepwise, dual approach targeted first at restoring shoulder ROM via CHL release, followed by PNS for pain management may offer a promising treatment alternative for patients who are unsuitable for surgery.

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