A Novel Approach in Treating Phantom Limb Pain Using Erector Spinae Plane Block

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ABSTRACT

Phantom limb pain (PLP) is difficult to control, and patients frequently exhibit inadequate relief from medications or encounter unbearable side effects. We present here a novel application of erector spinae plane (ESP) block to manage PLP.

Our patient is a 23-year-old, college student, diagnosed with high-grade osteosarcoma of the right humerus who underwent a right shoulder disarticulation. He reported PLP despite multimodal analgesia postoperatively. An ESP block using a high-frequency linear probe ultrasound was performed. A G23 spinal needle was advanced in-plane toward the right T3 transverse process. After negative aspiration, 20 mL of therapeutic solution containing bupivacaine 0.25%, lidocaine 1%, epinephrine 5 mcg/ml, and 40 mg methylprednisolone was injected. After the procedure, the patient reported that his PLP went down to NRS 1/10. He consistently reported to have an NRS score of 0-1/10 on succeeding consultations despite discontinuation of opioid and pregabalin.

In literature, ESP block has been used as a regional technique for shoulder disarticulation surgery and other neuropathic pain conditions, but no account has shown its use for PLP treatment. The procedure was successfully done to alleviate the upper extremity phantom limb pain, significantly reduce analgesic requirements, and improve tolerance of physical therapy and overall quality of life.

Keywords: phantom limb pain, erector spinae plane block, steroid injection, cancer pain

INTRODUCTION

Prevalence of PLP in cancer amputees is found to be increased at 41% to 76%.[1-3] While various causes of PLP have been identified, it is likely that the persistence of this condition is influenced by a range of factors, including somatic, psychological, and social factors.[4]

Establishing effective pain control in cancer amputees can significantly improve their quality of life. The novel application of a steroid injection for PLP opens doors to managing pain even in the region of the body that have already been amputated. As nerve injury is the universal cause of PLP, with corresponding changes in both the peripheral and central nervous systems[5], the potential in blocking the transmission of pain signals from the amputated limb to the brain can overall decrease the burden of treatment and also, opioid requirement. There is paucity of literature in using blocks in managing PLP and those are mainly preventive (as regional anesthesia technique)[6] rather than therapeutic once PLP has set in.

Our case report is the first documented ultrasound-guided erector spinae plane (ESP) steroid injection that was safely done to alleviate PLP in Philippine General Hospital

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(PGH). To our knowledge, as of writing this manuscript, there is no other official account of this procedure done for PLP treatment even in other institutions. We present here the administration of local anesthetic and steroids to treat upper extremity phantom limb pain.

CASE PRESENTATION

We present a case of a 23-year-old college student with high-grade osteosarcoma of the right humerus, diagnosed after a bicycle accident which resulted in a fracture of the proximal third of the humerus (Karnofsky score of 50). He had cancer treatments and developed chemotherapy-induced peripheral neuropathy, which was managed with high dose tramadol (400 mg/day) and pregabalin (300 mg/day). He eventually underwent a right shoulder disarticulation under general anesthesia in our institution.

On the first postoperative day, the patient reported phantom limb pain characterized by a numb sensation and itching on the missing limb. PLP persisted despite multimodal analgesia using tramadol drip at 300 mg/day, celecoxib at 200 mg twice a day, paracetamol 500 mg tablet every 6 hours (2000 mg per day), pregabalin 50 mg tablet thrice a day (150 mg/day), morphine 2 mg IV as needed dose, and ketamine 200 mg + lidocaine 2000 mg infusion ordered to run for 48 hours. The patient reported a least numerical rating scale (NRS) score of 4/10 and a worst pain score of NRS 8/10.

On the 3rd postoperative day, the patient was referred to Pain Management service. Tramadol was replaced with fentanyl at 10 mcg/hour, and the pregabalin was increased to 150 mg twice a day (300 mg/day). After these changes, the patient reported improvement and pain score reduced to least NRS of 2/10 and worst pain score of NRS 4-6/10. Eventually, the patient was discharged on the 6th postoperative day with home pain medications, including a fentanyl citrate transdermal patch at 12.5 mcg/hour, codeine 30 mg tablet every eight hours as needed for moderate to severe pain, and pregabalin 450 mg/day. Patient preferred to use his own pre-surgery stocks of codeine and claimed that the 30 mg dosing worked fine for him.

Upon follow-up consult, the patient reported worsening of phantom limb pain, together with right upper back and stump pain, despite increasing pregabalin to 600 mg/day and codeine intake (at least 2 rescues per day). The patient reported being afraid to go out in public places due to fear of experiencing pain attacks with an average NRS of 6/10. He expressed desire to try other pain modalities. After a thorough discussion of the risks and benefits of a novel approach to treat his pain, he consented to undergo an ultrasound-guided ESP block using local anesthetic and steroids.

The pre-procedure pain score was recorded as NRS 5 out of 10 on the phantom limb and stump. The patient was positioned upright in a seated position. The injection site was prepared and draped in usual sterile manner and a high-frequency (12-15 MHz) linear ultrasound probe was covered for sterility. The transverse process of T3 on the right side was identified using ultrasound guidance. Skin infiltration with 2% lidocaine using G27 needle was done. Then, a 3.5-inch G23 spinal needle was advanced in-plane toward the right T3 transverse process under real-time ultrasound guidance. The needle tip was confirmed to be located between the bone and the fascia with hydro-dissection with sterile water. After negative aspiration, a therapeutic solution containing bupivacaine 0.25%, lidocaine 1%, epinephrine 5 mcg/ml, and 40 mg methylprednisolone was injected. Adequate cephalo-caudad spread was observed as the erector spinae muscle was lifted up (Figure 1).

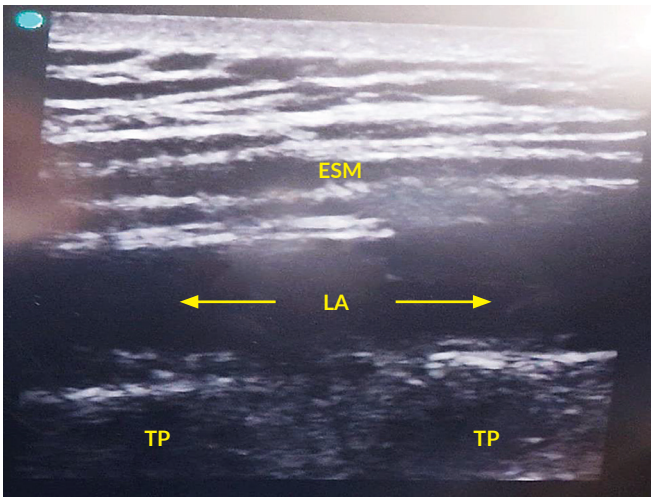

Figure 1. Ultrasound image demonstrating local anesthetic + steroid (LA) spread in the ESP.

ESM – erector spinae muscle; TP – transverse process

OUTCOME AND FOLLOW-UP

Immediately after the procedure, the patient reported that his PLP and stump pain went down to NRS 1/10. No complication was observed. Immediately after being discharged, the patient reported feeling "normal" and was able to enjoy a movie inside a theater for the first time without the use of a large support pillow and without being bothered by pain. Three days post block, the fentanyl patch was removed. No codeine rescue was required. Within twenty-four hours after patch removal, the patient reported a daily average of NRS 0-1/10 on the phantom limb (Karnofsky score of 80-90). Pregabalin was also titrated down gradually and physical therapy remained well tolerated. Three months after the ESP block, patient was completely off pain medication for PLP.

DISCUSSION

Management of PLP is challenging because clinically, the treatments being offered or used for this condition have either had limited satisfaction or had side effects.[5] For our

patient, opioid therapy using fentanyl was initially effective. The opioid facilitated the improvement when other oral and intravenous medications failed, and caused the eventual hospital discharge. However, noting the neuropathic mechanism of PLP, an ESP block eventually controlled the pain more effectively in line with the comprehensive algorithm for management of neuropathic pain. Interventional therapies are recommended as third line, whereas strong opioids were fifth in the guideline.[7]

To the authors' knowledge, the only treatments used for PLP in our institution are: 1) Oral and IV analgesics and 2) Physical therapy. This is not surprising as the evidence for other modalities for PLP, such as interventional pain procedures, are still lacking. In literature, sympathetic nerve block has been documented in a case report presenting a patient with complex regional pain syndrome (CRPS) of the right upper limb due to polytrauma and complete brachial plexus injury who underwent multiple therapies before ultimately undergoing amputation. Patient later developed a difficult-to-manage PLP, which was treated with a stellate ganglion block (SGB), resulting in significant pain reduction.[8] On the other hand, the use of invasive neuromodulation techniques for pain management, such as peripheral nerve, spinal cord, or dorsal root ganglion stimulation, has not been widely adopted in clinical practice due to a lack of substantial evidence.[5] While small cohort studies have shown mixed results[9], large-scale studies are needed to provide more conclusive evidence on the effectiveness of these techniques.

The ESP block was first described in 2016 and greatly attracted interest[10] with its simple technique. It is an interfacial plane block that is performed by injecting a local anesthetic between the erector spinae muscle and transverse process. This innovative technique has been shown to provide effective analgesia for a wide range of surgical procedures, including breast surgery, thoracic surgery, and abdominal surgery.[11-13]

In addition to its use in regional anesthesia during surgeries, including shoulder disarticulation[6], the ESP technique has also been used to treat acute and chronic neuropathic pain. Forero et al. has successfully used ultrasound-guided ESP block in the management of a 3-year history of thoracic neuropathic pain from fractures of the second to ninth ribs from previous motor-vehicular collision. The investigators used 20 mL of 0.5% ropivacaine which was placed into the plane of the interfascial layer of the erector spinae muscle. After one month, the patient has stopped taking pregabalin and reports that the allodynia has been resolved with analgesia now being less severe, at under 25% of its previous intensity. The patient's neuropathic pain and the cutaneous block of the chest wall were resolved, indicating that both the dorsal and ventral rami of the thoracic spinal nerves were impacted by the local anesthetic.[14]

Evidences suggest the local anesthetic diffuses into the musculofascial plane over craniocaudal multiple vertebrae levels in ESP. A cadaveric study done by Dautzenberg et al.[15] showed ESP injectate spread ranging from the fourth cervical to the tenth thoracic vertebra when injected at the second thoracic vertebrae. With this, the ESP has widened its application beyond the torso.[16] High thoracic ESP blockade can relieve acute and chronic shoulder pain through local anesthetic diffusion to cervical nerve roots.[17] A case report by Bang et al.[18], wherein the use of continuous, high thoracic (T1-2) level ESP block at 4 mL per hour resulted to a sympatholytic effect in upper extremity complex regional pain syndrome. Furthermore, a review by Campbell et al.[17] showed that the use of lumbar erector spinae plane (ESP) blocks in hip arthroplasty and arthroscopy is comparable to lumbar plexus, quadratus lumborum, and fascia iliaca blocks, but is motor-sparing.

A mixture of local anesthetic and steroid was used as therapeutic solution for our case. A review by Viderman et al.[19] showed that out of 43 patients with various chronic pain syndromes treated with ESP, 11 had also received steroid medication in addition to a local anesthetic. The steroid medications used were dexamethasone at doses of 2 to 8 mg and methylprednisolone at a dose of 40 mg. The duration of analgesic effect in those who received steroid medication ranged from two weeks to 12 weeks, with methylprednisolone having the longest duration.

Utilizing an interdisciplinary approach can help ensure better management of PLP[20] in line with biopsychosocial approach to pain management. While the mechanisms behind PLP are complex, it is important to understand the impact it can have on the life of amputees who may experience significant suffering. Limb amputation may be necessary to remove a tumor, but the resulting PLP can have a profound impact on a patient's quality of life. Our patient is fortunate to have good family support which he claimed to be very helpful in his battle with pain and disease. His sense of feeling "normal" despite having lost an arm, caused the patient to enjoy activities that give quality to his days. Finally, coming off his maintenance pain medications also significantly reduced financial disease burden.

Exploring the use of this block may reveal more benefits for our patients especially those with chronic cancer pain. While the ESP block has shown promising result for treating upper extremity PLP, more studies will be needed to see if this will hold true for both cancer and noncancer amputees. We believe that the potential of this interventional pain technique goes far beyond this condition.

CONCLUSION

We have found that the erector spinae plane block at T3 level is a safe and effective option for treating upper extremity phantom limb pain in a cancer amputee. To our knowledge, this is the first to demonstrate the use of ESP block for PLP. This technique serves as a safe and cost-effective interventional option to decrease analgesic requirement and improve the quality of life of amputees.

Informed Consent

The patient provided verbal and written consent for writing this case report and its publication.

Statement of Authorship

Both authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

Both authors declared no conflicts of interest.

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