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Stellate ganglion pulsed radiofrequency ablation for stretch induced complex regional pain syndrome type II

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Abstract

Complex regional pain syndrome (CRPS) following injury or nerve damage, as its name signifies, is a challenging entity, and its successful management requires a multidisciplinary approach. It not only manifests as severe pain, but also gives rise to functional disability, lack of sleep, lack of enjoyment of life and poor quality of life. Various pain interventional techniques have been described in the literature for the management of CRPS ranging from sympathetic blocks to spinal cord stimulator. A 34-year-old liver transplant donor, who developed position-induced right upper limb neuropathic pain suggestive of CRPS type II was managed initially with medications and later with stellate ganglion block under fluoroscopic guidance at cervical C7 position. Following an initial significant improvement in pain and allodynia, which was transient, a pulsed radiofrequency ablation of stellate ganglion was performed successfully to provide prolonged and sustained pain relief, which persisted up to 14 months of follow-up.

Keywords: *Complex regional pain syndrome*, *pulsed radiofrequency ablation*, *stellate ganglion block*, *stretch-induced neuropathic pain*

INTRODUCTION

Neuropathic pain following complex regional pain syndrome (CRPS) is very distressing and impairs quality of life significantly. Neuropathic pain can result due to insult of neurons or ganglia and this can also cause CRPS. Position related complication such as stretch-induced neuropathy is one of the complications following long duration surgery like liver transplant.[1] Radiofrequency ablation (RFA) has been used for prolonged pain relief in many neuropathic pain conditions and there are reports in literature of the use of pulsed RFA (PRFA) of neural tissue for the alleviation of chronic pain.[2,3,4] Pulsed radiofrequency (RF) for stretch induced neuropathic pain leading to CRPS, however, has not been reported in the literature. We report a case of liver transplant donor patient with florid features of CRPS of upper limb, caused by position-induced brachial plexopathy, which responded very well to PRFA of stellate ganglion.

CASE REPORT

A 34-year-old Ethiopian male liver transplant donor, weighing 103 kg, presented to our pain clinic, 1 week following surgery (liver transplant donation) with severe pain and swelling in right arm, associated with

weakness in right upper limb. The intensity of pain was 10 on a 10 point visual analogue scale with the least pain being 8/10. The pain was constant, and nature varied from shooting, burning to electric shock like sensation, which was associated with numbness in forearm and fingers. He also experienced hyperalgesia, mechano-allodynia and increased sensitivity to various sensations in the upper limb. The limb was supported with a splint and covered with a cloth. There was a color change in the right upper limb with the temperature difference between the two hands mainly thumb. Even slight movement of the limb was very painful and resulted in severe distress, agitation, diaphoresis and insomnia. Neurological examination revealed allodynia, dysesthesia, and motor power of 2/5 in cervical C5 to thoracic T1 distribution of the right upper limb. Nerve conduction study revealed features suggestive of brachial plexopathy with axonal injury. He was on the fentanyl patch 25 μg/h, tramadol 100 mg 4 times a day, gabapentin 300 mg 3 times a day and etoricoxib 120 mg once daily orally. Despite this, his pain score (numerical rating scale) improved from 8/10 to 7/10 with only 10-15% pain relief. Probable diagnosis of stretch-induced CRPS type II was made, and a diagnostic stellate ganglion block at cervical C7 under C-arm guidance was performed using 10 ml of 0.25% bupivacaine without any complication. There was 100% pain relief following the procedure, and he was started on pregabalin 75 mg orally twice a day along with physical therapy. The pain relief persisted for almost a week after which he again presented to our pain clinic with severe pain in right upper limb. This time although allodynia was less, there was hyperalgesia in his hand and any movement of the hand was painful. A right stellate ganglion block was repeated with 10 ml of solution containing 40 mg triamcinolone and 0.125% bupivacaine, which once again resulted in excellent pain relief. The dose of pregabalin was escalated to 150 mg twice a day with the addition of amitriptyline 10 mg at night for 1-week, followed by 25 mg at night subsequently. He was also prescribed tramadol 100 mg as and when required for the breakthrough pain up to a total of 300 mg/day. Two weeks later, he returned with allodynia, sharp shooting and burning pain associated with numbness in forearm and hand. At this stage, a decision was made to perform PRFA of stellate ganglion for sustained pain relief as the previous therapeutic procedures were found to produce good pain relief, albeit, temporarily. A detailed informed consent explaining the risks/benefits of the procedure was taken, and he was scheduled for a PRFA of right stellate ganglion.

The patient was placed in the supine position with slight neck extension. The area was cleaned and painted with povidone iodine. Using C-arm guidance, a 22 gauge, 5 cm, short beveled RF needle was guided to identify right stellate ganglion at cervical C7 level. Position of the needle was confirmed using 0.5 ml of iohexol dye [Figure 1]. Correct needle position was confirmed using sensory and motor stimulation at 50 and 2 Hz frequency respectively. After excluding motor stimulation of cervical nerve roots in the form of paresthesia of the arm or hand and ensuring preservation of vocal cord function, an anesthetic block of the ganglion was performed using 0.5 ml of 0.25% bupivacaine followed by PRFA. PRFA current consisted of 20 msond bursts with a frequency of 2 Hz and 45 V at 42°C temperature. Two cycles of 120 s each at three different locations (one each at the junction of the transverse process and the vertebral body, one at most medial aspect of the transverse process and last at the upper portion of the junction of the transverse process and the body of C7) was performed. This resulted in sustained improvement in neuropathic pain which persisted till 14 months of follow-up. No side effect of RFA was observed immediately and later. Fentanyl patch was weaned off immediately, and other neuropathic drugs like pregabalin and amitriptyline were tapered gradually over 3 weeks period. The patient returned to his job after 2 months and resumed his work with good quality of life.

DISCUSSION

Chronic pain not only causes physical suffering but also has a negative impact on psycho-social, mental, emotional and spiritual aspects of a patient. The involvement of nerve, ganglion or plexus results in neuropathic pain, which is very distressing to most patients. CRPS can occur following injury to the peripheral nerves, after surgery, trauma, fractures or in some cases it may be idiopathic in nature.[5] Various neurological complications including brachial plexopathy have been reported in 8.4 to as high as

47% of liver transplant recipient patients.[1] In this patient acute onset, CRPS was probably secondary to position-induced neuropathy due to excessive stretching of the arm during prolonged liver transplantation surgery. Exact etiology of CRPS is not known, but it is believed to involve a neuronal inflammatory reaction in combination with cortical reorganization and sympathetically mediated pain.[6] Budapest criteria have been proposed to diagnose CRPS.[7] Our patient demonstrated all the classical signs and symptoms of CRPS such as continuous pain with sensory, motor, vasomotor and sudomotor changes. Management of this type of neuropathic pain requires a multidisciplinary approach, which includes physical therapy, pharmacotherapy, psychotherapy and interventional pain management techniques wherever applicable.

Various neuro-interventional techniques such as chemical neurolysis, thermal ablation, and neurodestruction have been described for resistant neuropathic pain.[1,7,8] There is growing interest in the use of RFA for management of various painful conditions including malignant pain.[8] Two types of RFA are done for management of chronic pain conditions. Conventional RF uses continuous output of high frequency current with temperature of 70-80°C. PRFA is a newer alternative to conventional RFA with the proposed advantage of avoiding the complication of deafferentation pain and neuritis that sometimes can be seen after the conventional neural ablation.[9,10] The exact mechanism of action of pulsed RF is unknown. However, it is assumed and also demonstrated from studies that it acts by neuromodulation and also affects gene expression in the dorsal horn.[11] Another postulated mechanism is a reduction in the release of substance *P* in response to noxious stimuli; thereby leading to both decreased nociceptive behavior and reduced hyperalgesia.[12] Pulsed RF is done with brief pulses of high voltage electric current of temperature at 42°C. In conventional RF, the electrode needle is directed parallel to the nerve while in pulsed RF, the electrode is placed perpendicular to the target structure to perform successful lesioning.[13] We preferred to perform PRFA for this patient to avoid the potential complications of conventional RFA. The anatomical location of stellate ganglion varies, and therefore three lesions were done with two cycles of current at each location. This resulted in significant and sustained improvement in symptoms such as pain, hypersensitivity, and allodynia.

Initial reports of stellate ganglion RFA have been encouraging, for chronic head and neck pain.[14] Kastler *et al*. reported >50% improvement in pain relief for 2 years duration with RF neurolysis of stellate ganglion under computed tomography guidance.[15] Successful pain relief for 3 years has been reported, where stellate ganglion RFA was done 5 times.[16] In a retrospective series of RFA of stellate ganglia for chronic pain syndromes, Forouzanfar *et al*. reported that 40% of patients had >50% relief of pain.[17] Linson *et al*. found that 19 out of 26 patients (73%) improved after stellate ganglion block for patients with CRPS in the upper arm.[18] Prolonged continuous stellate ganglion blockade has been found useful in the treatment of posttraumatic reflex sympathetic dystrophy in one study.[19] Thoracic sympathetic RFA has also been described in the literature for pain induced by CRPS.[20] While the long-term efficacy and safety of PRFA has not been completely established, a recent case series reported encouraging results using PRFA in patients with neuropathic pain syndromes.[21] Our patient also had good pain relief following PRFA of the stellate ganglion till 14 months of follow-up.

Although complications such as cardiac arrhythmia, pneumothorax, and nerve injury have been described following stellate ganglion block, but till now there are no reported complication after PRFA.[22] Wulf and Maier also reported no major complications in a long series of 45,000 cases.[23] In our patient also PRFA of stellate ganglion was performed uneventfully.

CONCLUSION

The technique of PRFA of stellate ganglion is minimally invasive, effective and associated with minimal complications. It is highly effective for pain relief in patients with neuropathic pain due to CRPS. Pulsed RF lesioning can be done as an adjunct to pharmacological treatment for relief of neuropathic pain. In this

patient, PRFA for stretch-induced brachial plexopathy resulted in dramatic and sustained pain relief and can be considered as an option for management of severe neuropathic pain.

Footnotes

Source of Support: Nil

Conflict of Interest: None declared.

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Figures and Tables

Figure 1

Stellate ganglion pulse radiofrequency ablation at C7 level