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Original Research Article

A Clinical Study to Assess the Efficacy of Peripheral Nerve Block and Intraarticular Steroid Injection in Treating Complex Regional Pain Syndrome of the Shoulder Joint

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Abstract

Aim: To investigate the efficacy of peripheral nerve block and intraarticular steroid injection in treating complex regional pain syndrome of the shoulder joint.

Material and methods: This hospital-based study was conducted in the Department of physical medicine and rehabilitation, ESIC Medical College Bihta, Patna, Bihar , India. All consecutive adult patients, both male and female, in the age group of 18–70 years, attending out-patient or in-patient services of the department, who had features of CRPS in upper limb (and satisfied Budapest clinical diagnostic criteria), due to any etiology, within one year of illness were included in the study. The primary outcome measure was the reduction in pain in the affected upper limb. The pain was assessed using a visual analog scale (VAS) with scores ranging from 0 to 10.

Results: The median duration of illness was 58 days, IQR (166, 48). The majority (78.8%) were cases of cerebrovascular accident (22 ischemic and 4 hemorrhagic) with clinical presentation as hemiplegia. Four (12.1%) patients had cervical spinal cord injury, out of which two had bilateral involvement. Three (9.1%) patients had traumatic brachial plexus injury in the involved limb. All the patients had pain in the shoulder joint on passive movement and restricted ROM except one patient where ROM was full in all four planes but painful. All the cases had swelling in the affected hand with restricted and painful ROM of the joints. Fourteen (42.4%) patients had associated hypertension and seven (21.2%) had diabetes mellitus, however, controlled with medication. Subluxation of the shoulder joint was present in 18.2% and mild to moderate spasticity around the shoulder joint in 63.6% patients. The improvement in ROM of all joints, reduction of pain in affected upper limb and decrease in hand swelling were all seen as statistically significant.

Conclusion: In conclusion, the study shows that PNB (ulnar, median, and radial nerves) at the level of the wrist along with intra-articular steroid injection of the shoulder joint is an effective form of management of CRPS of the upper limb. The addition of steroids to the local anesthetic for block helps in the reduction of the swelling and stiffness of the joints by reducing local inflammation. The pain-free period facilitates the exercise program. The method does not need in-patient care or necessity to undergo general anesthesia.

Keywords: Peripheral nerve block, Intraarticular steroid injection, Regional pain, Shoulder joint

Introduction

Complex Regional Pain Syndrome (CRPS) is a chronic pain condition characterized by severe pain, swelling, and changes in the skin. The condition typically affects one limb, often following an injury, and its pathophysiology is not entirely understood. Treatment strategies for CRPS are varied, focusing on pain relief and functional recovery. [1-5] Two notable interventions include peripheral nerve blocks and intra-articular steroid injections, particularly for CRPS affecting the shoulder joint. Peripheral nerve blocks involve the injection of anesthetic agents near specific nerves to block pain signals from reaching the brain. This technique is often used in the management of CRPS to provide immediate pain relief and reduce inflammation. Various studies have demonstrated the efficacy of

peripheral nerve blocks in CRPS management. [6-12] The primary mechanism through which nerve blocks exert their effect is by inhibiting the transmission of pain signals through the affected nerves. Local anesthetics such as lidocaine or bupivacaine are commonly used. By blocking sodium channels, these agents prevent the depolarization of nerve fibers, thereby halting the conduction of pain signals. The anti-inflammatory properties of these anesthetics further aid in reducing the inflammatory response associated with CRPS. Intra-articular steroid injections involve injecting corticosteroids directly into the joint space. This intervention aims to reduce inflammation and provide pain relief. In the context of CRPS affecting the shoulder joint, intra-articular steroid injections can be particularly beneficial. Corticosteroids such as methylprednisolone and triamcinolone are commonly used due to their potent anti-inflammatory effects. Corticosteroids exert their effect by modulating the immune response and reducing the production of pro-inflammatory cytokines. This leads to a decrease in inflammation and subsequent pain relief. The local administration of steroids directly into the joint space ensures a high concentration of the drug at the site of inflammation, thereby enhancing its therapeutic efficacy. [13-18]

Material and Methods

This single-center, prospective, hospital-based study was conducted in the Department of physical medicine and rehabilitation, ESIC Medical College Bihta, Patna, Bihar, India for one year. All consecutive adult patients, both male and female, in the age group of 18–70 years, attending out-patient or in-patient services of the department, who had features of CRPS in upper limb (and satisfied Budapest clinical diagnostic criteria), due to any etiology, within one year of illness were included in the study. All the participants were explained about the procedure in detail and written informed consent was obtained. Patients who had received treatment for CRPS of the upper limb in any form were not included in the study. Patients with altered consciousness, aphasia, uncontrolled blood sugar levels, presence of coagulation disorder and known allergy to the injection components were not included. The primary outcome measure was the reduction in pain in the affected upper limb. The pain was assessed using a visual analog scale (VAS) with scores ranging from 0 to 10. The secondary outcome measures were an improvement in passive ROM of the joints (shoulder, wrist, metacarpophalangeal, and interphalangeal joints) of the involved upper limb and reduction in the swelling of the hand. The shoulder joint ROM was assessed in four different planes (flexion, abduction, internal and external rotations). In the case of other joints (wrist, metacarpophalangeal, and interphalangeal joints), ROM was noted in a single plane, that is, flexion and extension. The measurement of ROM was done with a goniometer. The size of the swollen hand was measured by a flexible measuring tape at the level of the mid palm, just distal to the thumb. All the assessments were noted before the procedure and after 1 week of the injection procedure. All the assessments were done by the same investigator. Any complications during or after injection and associated features like subluxation of the shoulder joint and spasticity of muscles around the joint were noted down. The technique of injection: All aseptic and antiseptic procedure was followed for the procedure. The anterior approach for injecting the shoulder joint was used with the patient in the supine position. The coracoid process of the scapula was identified and the site of needle insertion was identified by going 1 cm lateral and 1 cm inferior to the coracoid process and was injected with 40 mg (1 mL) methylprednisolone (MP) mixed with 5 mL of 2% lignocaine and 5ml of sterile water. For PNB, the median nerve was blocked at the carpal tunnel; ulnar nerve was blocked at two sites, one at the level of Guyon's canal and the other cutaneous branch at the dorsomedial aspect of the hand one fingerbreadth distal to the ulnar styloid process. The superficial branch of the radial nerve was blocked on the dorsolateral aspect of forearm two fingerbreadths (approximately 3 cm) proximal to the radial styloid process. For PNB, each site was injected with 10 mg (0.25 mL) MP mixed with 1.5 mL of 2% lignocaine and 1.5 mL of sterile water. After injection, gentle passive ROM exercises for all joints were started. The patients' caregivers were taught exercise programs to be done three times daily with 10 repetitions each.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 24 (SPSS Inc., Chicago, Illinois, USA). The confidence interval and p-value were set at 95% and $\leq$ 0.05 respectively.

Results

A total of 35 patients gave consent and were enrolled for the study with initial assessment and intervention. Two patients did not come for review after 1 week and thus considered drop-out. Hence parameters of a total of 33 patients were analyzed. Two of the patients had bilateral upper limb involvement leading to a total of 35 upper limbs with CRPS. There were 25 (75.7%) men and 8 (24.3%) women in the study, with a median age of 57 years, interquartile range (IQR) (62, 48). The median duration of illness was 58 days, IQR (166, 48). The majority (78.8%) were cases of cerebrovascular accident (22 ischemic and 4 hemorrhagic) with clinical presentation as hemiplegia. Four (12.1%)

patients had cervical spinal cord injury, out of which two had bilateral involvement. Three (9.1%) patients had traumatic brachial plexus injury in the involved limb. All the patients had pain in the shoulder joint on passive movement and restricted ROM except one patient where ROM was full in all four planes but painful. All the cases had swelling in the affected hand with restricted and painful ROM of the joints. Fourteen (42.4%) patients had associated hypertension and seven (21.2%) had diabetes mellitus, however, controlled with medication. Subluxation of the shoulder joint was present in 18.2% and mild to moderate spasticity around the shoulder joint in 63.6% patients. The improvement in ROM of all joints, reduction of pain in affected upper limb and decrease in hand swelling were all seen as statistically significant [Table 1]. the decrease in hand swelling in one of the study participants. The VAS scores improved from a mean of 7.8 to 2.7 on a scale of 10. Only one patient had minor complications as dizziness post-injection which lasted for 10 min and subsided without intervention. The same patient had increased pain in the injected shoulder joint that resolved with ice fomentation within 12 h.

Table 1: Comparison of readings before (pre) and after (post) injection procedure

Variable	Mean (SD) pre	Mean (SD) post	Mean difference (post-pre), 95% CI	P
VAS score	7.8 (1.5)	2.7 (1.8)	-5.1 (-5.7, -4.5)	<0.0001
Hand size (in cm)	21.1 (1.3)	20.2 (1.1)	-0.9 (-1.1, -0.7)	<0.0001
ROM of joints (in degrees)				
Shoulder flexion	125.3 (21.9)	163.6 (19.7)	38.3 (32.1, 44.5)	<0.0001
Shoulder abduction	102.9 (32.9)	158.9 (28.1)	55.9 (45.7, 66.1)	<0.0001
Shoulder IR	56.3 (15.9)	67.6 (9.3)	11.3 (6.7, 15.9)	<0.0001
Shoulder ER	49.6 (24.7)	81.0 (15.1)	31.4 (24.8, 38.1)	<0.0001
Wrist DF	55.7 (15.9)	64.7 (10.1)	9.1 (4.7, 13.2)	<0.0001
Wrist PF	61.0 (18.2)	68.7 (14.1)	7.7 (3.6, 11.8)	0.0003
Thumb MCP	52.9 (10.2)	57.4 (9.4)	4.6 (2.3, 6.8)	0.0001
Thumb IP	54.5 (19.4)	63.4 (16.7)	8.9 (5.7, 12.1)	<0.0001
Index finger MCP	72.2 (13.1)	82.6 (9.8)	10.4 (6.9, 13.9)	<0.0001
Middle finger MCP	73.1 (13.9)	83.8 (10.9)	10.7 (7.5, 13.9)	<0.0001
Ring finger MCP	71.7 (14.3)	83.5 (11.2)	11.7 (7.9, 15.4)	<0.0001
Little finger MCP	70.4 (15.5)	82.6 (13.1)	12.2 (8.6, 15.8)	<0.0001
Index finger PIP	87.1 (12.9)	97.1 (11.5)	10.0 (7.1, 12.9)	<0.0001
Middle finger PIP	86.0 (13.1)	98.1 (11.1)	12.1 (8.9, 15.3)	<0.0001
Ring finger PIP	85.9 (13.1)	98.8 (10.3)	12.9 (8.8, 16.9)	<0.0001
Little finger PIP	88.8 (10.3)	99.1 (9.4)	10.2 (6.8, 13.5)	<0.0001
Index finger DIP	54.4 (10.9)	62.6 (7.4)	8.2 (4.9, 11.5)	<0.0001
Middle finger DIP	55.4 (11.5)	62.5 (7.3)	7.1 (4.1, 10.2)	<0.0001
Ring finger DIP	53.6 (10.9)	62.2 (6.9)	8.7 (5.6, 11.8)	<0.0001
Little finger DIP	56.9 (16.5)	65.8 (14.9)	8.9 (4.9, 12.9)	<0.0001

IR: Internal rotation; ER: External rotation; DF: Dorsiflexion; PF: Palmar flexion; MCP: Metacarpophalangeal joint; IP: Interphalangeal joint; PIP: Proximal interphalangeal joint; DIP: Distal interphalangeal joint; VAS: Visual analog scale

Discussion

We studied the effect of peripheral nerve blocks along with intra-articular injection in the shoulder joint in the management of CRPS of the upper limb. We report a significant improvement in pain, swelling and ROM of joints of the affected upper limb. The literature review showed that no such study has been reported which has used a similar technique in the management of CRPS. Hence, the findings of our study provide an alternate option with evidence in the overall realm of management of CRPS of the upper limb. CRPS with an estimated incidence rate of 26.2 per 100,000 person-years has multiple causes. [19] In CRPS developed in a paralytic upper limb, apart from the pain in the shoulder joint, restriction of ROM is frequently seen. That was the basis of intra-articular shoulder joint injection. The anterior approach of injecting the shoulder joint has a high success rate even without image guidance. Porat et al. recorded 99% accuracy while injecting 100 patients. [20] An immediate reduction of pain during passive ROM after injection confirmed the accuracy of the injection in our case.

The rationale of using corticosteroid (methylprednisolone) along with local anesthetic (LA) solution for PNB in our study is to use the

anti-inflammatory action of the steroid, locally. Though the exact mechanism is not known, the combined solution seems to prolong the action of LA [21] In related studies, only plain LA was used for single-dose or continuous infusion with catheter in-situ. [15-18,22,23] After a thorough search, we could not find any study that has used a similar method in the management of CRPS. In one study, the author has reported a case series of nine patients with CRPS (nine upper limbs and two lower limbs), where the nerves around the knee joint for the lower limb and proximal to the site of pain in case of upper limb were blocked with 3 mL of Marcain. He showed an improvement in pain and swelling in the affected limb, though specific nerves were not indicated. [22] Another study has shown the effect of the popliteal block for lower limb and axillary blocks for upper limb along with initial Bier block under general anesthesia in the treatment of 13 children with CRPS 1 who had failed to respond to the conventional treatment. They kept the catheter in-situ for 4 days. [15] A case report of lower limb CRPS treatment with continuous sciatic nerve block with parenteral ketamine infusion for 3 days had shown positive results.[17] In our study, we tried to find out a simpler way of treatment that does not require in-patient care or need to undergo general anesthesia to put any catheter. The method adopted in the present study is an outpatient procedure that requires observation for only 30 min after the procedure. The patient can go back home and continue the exercise program. In one case report of treatment of upper limb CRPS with a single dose of interscalene brachial plexus block, the patient was treated on an out-patient basis. [18] All our patients with CRPS of the upper limb had paralytic affected limb for which they required a caregiver for the exercises of the shoulder joint. So the compliance of the exercise program is not known. Hence, significant improvement in ROM of joints and reduction in pain and swelling could be attributed to the injection procedure.

Conclusion

In conclusion, the study shows that PNB (ulnar, median, and radial nerves) at the level of the wrist along with intra-articular steroid injection of the shoulder joint is an effective form of management of CRPS of the upper limb. The addition of steroids to the local anesthetic for block helps in the reduction of the swelling and stiffness of the joints by reducing local inflammation. The pain-free period facilitates the exercise program. The method does not need in-patient care or necessity to undergo general anesthesia. It is a safe procedure with minimal complications and can be performed as an outpatient procedure. However, further randomized controlled studies with larger sample size and longer follow-up may help to validate the procedure.

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