Effectiveness of Distal Sodium Channel Blocks in Managing Cervical Radiculopathy

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ABSTRACT

Objective: To find the effectiveness of distal sodium channel blocks (DSCB) in managing cervical radiculopathy.

Study Design: Open-labelled single-group pilot study.

Place and Duration of the Study: Pain Clinic of the Armed Forces Institute of Rehabilitation Medicine, Rawalpindi, Pakistan, from January to June 2022.

Methodology: Patients with cervical radiculopathy with non-inflammatory pain, presenting within six months of disease onset, aged between 18-50 years, were included. Numerical rating scale (NRS) scores for pain were noted down at baseline and at 30 minutes, 24 hours, and 1 week post (DSCB). DSCB was performed at Alpha 1, Alpha 2, Alpha 3, and Alpha 4 using 2 ml of 2% plain lignocaine + 1 ml Kenacort + 7 ml distilled water = 10 ml solution of 0.4% lignocaine; 2.5 ml indicated at each of the four sites.

Results: Out of 30 patients, 13 (43.3%) were females and 17 (56.6%) were males. The mean age of patients was 43 ± 7.0 years. No serious procedural complications were noted except a few. Post-DSCB, follow-up was done for one week. A significant fall in NRS was observed at every visit. Results were statistically significant ($p < 0.001$) when pre-NRS was compared with post-DSCB NRS at 30 minutes, 24 hours, and 1 week.

Conclusion: DSCBs have become yet another reliable choice for pain management without the requirement for any particular environment. Even after one week of follow-up, the patients' NRS pain scores were significantly decreased.

Key Words: *Cervical radiculopathy, Epidural spinal injection, Pain management, Upper limb pain*.

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INTRODUCTION

Currently, upper limb radiculopathy and neck pain are two fairly common complaints. Due to the nerve inflammation, cervical radiculopathy causes pain to radiate to the upper limb. Upper limb pain can occur as a modest discomfort with limited upper limb movement to severe pain.[1] Shoulder pathology may also be present in some cases. Shoulder diseases are often ruled out by a clinical examination of the shoulder joint. However, to rule out cervical radiculopathy, the symptoms emanating from or affecting the shoulder joint create a diagnostic challenge.[2] The clinical signs of tingling, numbness, and weakness are characteristics of radiculopathy, however, they rarely manifest or typically present later.[3]

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Cervical radiculopathy affects 107.3 out of every 100,000 people in the general population.[4] Cervical radiculopathy is caused by mechanical compression and results from nerve root dysfunction. Radicular symptoms, however, might also be brought on by inflammatory cytokines generated from injured intervertebral discs.[5] Significant pain and functional limitations may result from nerve root inflammation. Patients frequently experience panic as a result, which causes needless hospital admissions and examinations.

Worldwide, cervical radiculopathy is a significant socioeconomic burden, particularly in low- and middle-income nations such as Pakistan.[6] There has always been a need for more cheap, non-invasive, and cost-effective pain management techniques for most people. Distal sodium channel blockers (DSCBs), such as lignocaine, have been used by some writers in recent years to treat radicular pain in the upper and lower extremities.[7-9] It is based on the hypothesis that dorsal root ganglia (DRG) and nerve root voltage-gated sodium channel hyperexcitability / hypersensitisation causes radicular pain.[7-11] Sodium channel blockers can be injected into the nerve's periphery to block hypersensitive sodium channels proximally because DRG neurons are pseudo-unipolar type with connecting peripheral and central processes.[8-10]

For a developing country such as Pakistan, DSCBs seem to be a very cost-effective alternative to expensive invasive procedures

such as epidural injections. However, no local data are available to show the efficacy of DSCBs to date. This study aimed to find the effectiveness of DSCBs in managing patients with cervical radiculopathy.

METHODOLOGY

This open-labelled single-group study with a non-randomised unblended prospective design was conducted at the Pain Clinic of the Armed Forces Institute of Rehabilitation Medicine, Rawalpindi, Pakistan, for a duration of six months from January to June 2022. Ethical approval was obtained from the Institutional Review Board (IRB) vide reference number 04/2021. The calculated sample was 2 by using a WHO calculator (5% margin of error and 95% confidence level) and a prevalence of 0.107%.[4] To increase the significance of the study, 30 patients were included after getting informed consent. Sampling was done using the non-probability consecutive sampling technique.

Patients of either gender of cervical radiculopathy with non-inflammatory pain, presenting within six months of disease onset, aged between 18-50 years, were included. Patients with history of vertebral / bone fracture, inflammatory pain, fibromyalgia / polymyal-gia rheumatica, psychological disorders / taking psychiatric treatment, history of cardiac arrhythmias / myocardial infarction / ischaemic heart disease and history of previous spinal surgery, or using steroids were excluded.

Detailed history and complete physical examination were done. Distal target sites for injection were selected. These sites were Alpha 1 (1st web space), Alpha 2 (into the carpal tunnel), Alpha 3 (above the medial epicondyle), and Alpha 4 (above the lateral epicondyle).[9] Numerical rating scale (NRS) was used to score the severity of pain in a range from 0-10.[12] NRS score was documented at baseline (pre-DSCB), 30 minutes, 24 hours, and 1 week post-DSCB.

Patients were made comfortable on the couch in the supine position and aseptic conditions were ensured. The injection mixture included 2 ml of 2 % plain lignocaine + 1 ml Kenacort + 7 ml distilled water = 10 ml solution of 0.4 % lignocaine. Two and a half ml was injected at each point for Alpha 1 (1st web space), Alpha 2 (into the carpal tunnel), Alpha 3 (above the medial epicondyle), and Alpha 4. Patients were re-evaluated at 30 minutes, 24 hours, and 1 week, and fresh scores for NRS and complications were noted down.

Effective pain relief was defined as 50% or more improvement in NRS score after injection at 24 hours and at 1 week. If a patient reported less than 50% relief at 24 hours, DSCB was repeated at 4 pain portals (repeated twice at maximum i.e, at 24 hours and/or 1 week, as indicated). On repeat-DSCBs, only 0.4% plain lignocaine (2 ml of 2 % plain ligno + 8 ml distilled water = 10 ml solution of 0.4 % ligno) was injected without steroid. Patients were assessed at 30 minutes, 24 hours, and 1 week by the researchers.

Data were analysed using Statistical Package for Social Sciences (SPSS) version 21.0 (IBM - Illinois). For quantitative variables, mean ± standard deviation (SD) was computed and qualitative variables were expressed as frequency and percentages. A paired sample t-test was applied and calculated through the OpenEpi calculator for a comparison of pre- and post-DSCB NRS, and a p-value of ≤0.05 was considered statistically significant.

RESULTS

Out of the 30 patients, 13 (43.3%) were females and 17 (56.6%) were males. A statistically significant difference was observed in NRS score which was compared at 30 minutes (5.05 ± 1.761), 24 hours (4.75 ± 2.359), and 1st week (4.05 ± 2.837) with pre-DSCBs (8.60 ± 0.821) NRS score, as shown in Table I.

Table I: Comparison of means – pre and post-DSCB NRS scores using paired samples t-test.

Parameters	Pre-DSCB Mean ± SD	Follow-up	Post-DSCB Mean ± SD	Mean difference (pre-post)	p-value
NRS	8.60 ± 0.821	At 30 minutes	5.05 ± 1.761	3.55	<0.001
	8.60 ± 0.821	At 24 hours	4.75 ± 2.359	3.85	<0.001
	8.60 ± 0.821	At 1 week	4.05 ± 2.837	4.55	<0.001

Table II: Comparison of means – total number of injections and NRS scores using paired sample t-test.

Total no. of injections	Pre-DSCB Mean ± SD	Follow-up	Post-DSCB Mean ± SD	p-value
1 Injection	8.2 ± 0.83	At 30 minutes	3.6 ± 1.14	<0.001
(n = 6)		At 24 hours	3.00 ±1.00	<0.001
		At 1 week	2.8 ± 2.28	< 0.001
2 Injections	8.7 ± 0.79	At 30 minutes	5.53 ± 1.68	<0.001
(n = 24)		At 24 hours	5.3 ± 2.4	< 0.001
		At 1 week	4.46 ± 2.94	< 0.001

Table III: Frequency of complications observed during the treatment.

Complications	After 30 minutes	After 24 hours	After 1 week
Pain	1 (3.3%)	4 (13.3%)	1 (3.3%)
Swelling	1(3.3%)	1 (3.3%)	0 (0%)
Infection	0 (0%)	1 (3.3%)	0 (0%)
Bruising	0 (0%)	8 (26.6%)	4 (13.3%)
Local erythema	0 (0%)	1 (3.3%)	0 (0%)

Regarding the number of sessions of DSCBs, 6 (20%) patients underwent only one session and the remaining 24 (80%) patients underwent two sessions. On comparing pre-NRS score with post-DSCB at every follow-up with respect to the number of injections, results remained statistically significant, as shown in Table II.

Post-DSCB, follow-up was done for 1 week. No serious procedural complications were noted except a few which are listed in Table III.

DISCUSSION

A malfunction of the cervical spinal nerve, the nerve root, or both characterises the neurologic disorder known as cervical radiculopathy. Pain in the neck and/or one or both upper limbs is how it typically manifests. Such pain may or may not be connected to reflex changes in the afflicted nerve root distribution, as well as sensory or motor deficits.[11] The two most frequent causes of cervical radiculopathy are intervertebral disc collapse with subsequent nerve root impingement and degenerative alterations in the cervical uncovertebral joints that result in cervical spondylosis.[12]

It has been discussed how DSCB helps individuals with cervical radiculopathy who are experiencing pain to feel better. Up until one week, a significant decrease in NRS pain score was observed. DSCB provides instant pain relief and is simple to do outside without the need for any specialised equipment. It can be employed as a time-saving, cost-effective alternative treatment that allows the analgesic effect of medication to take effect.

Previous studies have also shown the analgesic efficacy of peripherally delivered local anaesthetic in reducing radicular pain.[7,8] In addition, Pote *et al*. observed that lignocaine significantly reduced pain alleviation for L5 and S1 radiculopathy.[1] In contrast to the present investigation, which found a few problems that were also resolved later, a comparable trial by Shaffat *et al*. found that DSCB considerably reduced pain in patients even at four weeks of follow-up.[13]

In trials on the animals, local anaesthetics that were injected peri-neurally near the dorsal root ganglion caused a reduction in tissue necrosis factor-α expression, which in turn reduced mechanical allodynia.[14] In a study, it was observed that local anaesthetic applied peripherally can have the same effect as central anaesthetic since DRGs are pseudo-unipolar neurons with connecting peripheral and central processes. However, there is not enough evidence to support this claim.[7,10] To precisely remark on the mechanism of pain alleviation by peripherally delivered local anaesthetics, more research is required.

There is little evidence to support non-surgical therapy of cervical radiculopathy.[15] Non-steroidal analgesics and opiates have limited short-term effectiveness, according to available evidence.[15] Because the benefits of regular mobility outweigh the drawbacks of rest, it is frequently advised to patients with acute radicular pain to continue their regular physical activity.[16] Extra foraminal glucocorticoid injections significantly reduce radicular pain in an acute setting.[16] However, there are few guidelines for the use of additional foraminal glucocorticoid injection in acute settings, and this pain alleviation is not clinically meaningful. DSCB can therefore be utilised in acute circumstances as a time-buying treatment to help the patient regain regular movement. However, this requires additional testing through randomised controlled trials with a significant sample size.

Radicular discomfort is frequently treated with epidural steroid injection (ESI).[17] When compared to conservative care at three months, ESI has no cost-effective advantages.[17-19] Additionally, the improvement in quality of life (QoL) in patients treated with ESI at three months was comparable to that of conservative management.[17,20] DSCB is a financially advantageous alternative for treating radicular pain, and additional research can be planned to see how it affects patients' QoL.

This research had a few limitations. The small sample size and study methodology thwart the generalisability of the findings. Additionally, as part of routine therapy, the patients were using oral analgesics and medicines for neuropathic pain, which could be confounding factors. Future research with randomised controlled trials and higher sample sizes and by taking confounder variables into account can provide more concrete results. Nevertheless, this study has shed light on the potential significance of DSCB in the acute care context, which can inspire the researchers to create additional studies to address the shortcomings of the present study.

CONCLUSION

DSCBs have become yet another reliable choice for pain management without the requirement for any particular environment. Even after one week of follow-up, the present study's patients' NRS pain scores were significantly decreased. It can be employed as a time-buying alternative procedure to wait for the medication's analgesic effects to take effect.

ETHICAL APPROVAL:

This study was conducted after obtaining approval from Institutional Ethical Review Board of the Armed Forces Institute of Rehabilitation, Rawalpindi, Pakistan (Ref No: 04/2021).

PATIENTS' CONSENT:

Written informed consent was obtained from the patients.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

SJ, MR, HKS, SSN, TM, SAAM: Conception, acquisition, data analysis, interpretation, drafting of the work, critical revision, and final approval.

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