Original Article

J Nepal Health Res Counc 2019 Apr-Jun;17(43): 242-6

DOI https://doi.org/10.33314/jnhrc.v0i0.1976

Clinical Efficacy of Selective Nerve Root Block in Lumbar Radiculopathy due to Disc Prolapse

Gaurav Raj Dhakal,[1] Pawan Kumar Hamal,[2] Siddhartha Dhungana,[3] Yoshiharu Kawaguchi[4]

[1]Spine Unit, National Trauma Center, Kathmandu, Nepal, [2]Department of Anesthesia, National Trauma Center, Kathmandu, Nepal, [3]National Trauma Center, Kathmandu, Nepal, [4]University of Toyama, Toyama, Japan.

ABSTRACT

Background: Selective Nerve Root Block using steroid is a proven technique for management of lumbar radiculopathy. The aim of the study was to determine the effectiveness of selective nerve root block in lumbar radiculopathy.

Methods: A prospective observational study was conducted for duration of one year in patients diagnosed with lumbar radiculopathy. Patients with leg pain, positive straight leg raising test and single level disc prolapse were included in the study. The procedure was performed under fluoroscopic guidance and Visual Analogue Pain rating scale and Oswestry Disability Index score was used for assessment pre-injection, 1 week, 1 month, 6 months and 1-year post injection.

Results: Total 35 patient with mean age of 37.7± 9.31 years were included in the study. The pre-injection Visual Analogue Pain Score(Mean ± S.D:7.8±0.7) was significantly reduced at one week (4.2±1.47, p <0.00001), one month (2.74±1.06, p <0.00001), six months (2.31±0.75, p <0.00001) and one year (2.62±0.84, p <0.00001). Similarly, pre-injection Oswestry Disability Index score (Mean ± S.D: 32.09±5.95) was significantly reduced at one week (19.51±7.26, p <0.00001), one month (12.71±4.56, p <0.00001), six months (9.8±2.87, p <0.00001) and one year (10.09±2.97, p <0.00001) but not significantly improved when compared at 6 months and 1 year (p < 0.44).

Conclusions: Selective Nerve Root Block in lumbar radiculopathy significantly reduces Visual Analogue Pain Score up to a year, however, the reduction in pain plateaus around six months.Disability index score only reduces for first 6 months but doesn't significantly reduce from six months to one year.

Keywords: Lumbar; radiculopathy; selective nerve root block; steroid.

INTRODUCTION

Lumbar intervertebral disc prolapse is a common cause of radiculopathy with low back pain. Majority of the patients can be treated conservatively and only a few require surgery.[1-3] Diagnostic and therapeutic block procedures can be useful in determining the source of the pain and its treatment.[4] Clinical studies show an increased chemical sensitivity of the nerve to disc tissue and suggest reversible inflammatory cause.[5,6] Selective Nerve Root Block (SNRB) provides an alternative approach and demonstrates superior efficacy over epidural injections in management of radiculopathy secondary to disc pathology, degenerative and foraminal stenosis.[7-10] SNRB provides both diagnostic and therapeutic modality and provides alternative to surgery and improves compliance to physical therapies.[7]

The purpose of this study was to examine the efficacy of a single selective nerve root injection in patients with lumbar radiculopathy due to disc herniation with the validated Nepali version of the Oswestry Disability Index (ODI) Questionnaire in the Nepalese population and Visual Analogue Score (VAS).

METHODS

This was a prospective observational study approved by the Hospital Review Board and Ethics Committee and performed at a tertiary level hospital in Nepal. Patients were sampled purposively as they fit the inclusion criteria. During the duration of one year using convenient sampling altogether 35 patients were selected in the study. Patients with history of low back pain and radiculopathy were included in the

Correspondence: **Gaurav Raj Dhakal, Spine Unit, National Trauma Center, Kathmandu, Nepal. Email: spinegaurav@gmail.com, Phone: +9779851234584.**

study after an informed consent. These patients had a positive straight leg raising test and a lateralized lumbar disc herniation in the magnetic resonance imaging (MRI). Patients with instability, degenerative stenosis, multilevel herniations, nerve sheath and spinal tumors, cauda equine syndrome, progressive weakness, previous root blocks and spine surgeries, uncontrolled diabetes and bleeding diathesis, infection and inflammatory conditions were excluded.

The pre-injection pain using Visual analogue scale (VAS) and disability status was scored on the Nepali version of the ODI. The ODI was filled by the patient in the physiotherapy department and handed over to the physiotherapist. The physiotherapist kept the record of subsequent ODI of all the included patients and the spine surgeon and pain specialist were blinded to the outcome.The Nepali version of ODI has been proved to have good comprehensibility, internal consistency (Cronbach alpha 0.723) and validity.[11] The procedure was performed by spine surgeon and pain specialist in the operating room with image intensifier under aseptic precautions. After injecting local anesthesia to the skin and subcutaneous tissue, 25-gauge spinal needle was placed transforaminally under image guidance. When the patient reported the reproduction of the pain and its distribution as the needle tip hit the epiradicular sheath, the image intensifier was then rotated to a lateral position to confirm the position of the needle tip. 2ml 0.5% bupivacaine was injected and the patient was asked whether there was relief of the pain. A positive SNRB was taken as defined by Derby and Kine[4] as the degree of reduction of leg pain occurring within 20 minutes of the injection lasting minimum of 30 minutes. Pain reduction of 50% was considered positive. Then 2ml (8mg) of the steroid Dexamethasone Sodium Phosphate (Dexona) was injected seperately. After an hour of observation in the recovery room, the patient was then discharged and advised for ODI follow up. Post injection VAS and ODI scores were recorded during follow up separately by a physiotherapist blinded to the study outcome. Complications were noted during the time of procedure and during follow up periods.

The data was recorded in the Microsoft Excel Sheet and analysis was performed using the SPSS version 2.0 with the appropriate statistical tool according to the type of variables identified and their distribution characteristics.

RESULTS

Total 35 patients with lumbar and sacral radiculopathy with mean age 37.7± 9.31 years were included in the study (Table 1). Male (18) and Female (17) presented with the pathology. The most common root was lumbar (L5) followed by sacral (S1) (Table 1.)

Table 1. Age, gender characteristics and disc pathology at different spine level.

Age in years (Mean ± S. D)	37.7± 9.31
Sex (N=35)	Male= 18, Female= 17
Lumbar disc 4 (L 4)	3
Lumbar disc 5 (L 5)	21
Sacral disc 1 (S 1)	11

The pre-injection VAS Score (Mean ± S.D: 7.8±0.7) was significantly reduced at one week (4.2±1.47, p <0.00001), one month (2.74±1.06, p <0.00001), six months (2.31±0.75, p <0.00001) and one year (2.62±0.84, p <0.00001) (Table 2, Figure 1). The VAS score was also significantly reduced when compared at six month and one-year duration (p-value <0.003) (Table 2). Similarly, pre-injection Oswestry Disability Index score (Mean ± S.D: 32.09±5.95) was significantly reduced at one week (19.51±7.26, p <0.00001), one month (12.71±4.56, p <0.00001), six months (9.8±2.87, p <0.00001) and one year (10.09±2.97, p <0.00001) (Table 3, Figure 2). ODI score did not reduce significantly when compared at 6 months and 1-year (p < 0.44) duration (Table 3, Figure 2).

Table 2. Visual Analogue Pain Score (VAS) at different time interval and comparisons.

Time	Mean ± S. D	P-value
Pre-injection	7.8±0.7	
One Week	4.2±1.47	Pre vs week <0.00001
One Month	2.74±1.06	Pre vs month <0.00001
Six months	2.31±0.75	Pre vs six month <0.00001
One year	2.62±0.84	Pre vs one year<0.00001
Six-months vs One year		0.003

Table 3. Oswestry Disability Index (ODI) at different time interval and comparisons.

Time	Mean ± S. D	P-value
Pre-injection	32.09±5.95	
Week	19.51±7.26	Pre vs week <0.00001
Month	12.71±4.56	Pre vs month <0.00001
Six months	9.8±2.87	Pre vs six month <0.00001

One year	10.09±2.97	Pre vs one year<0.00001
Six-months vs One year		0.4484

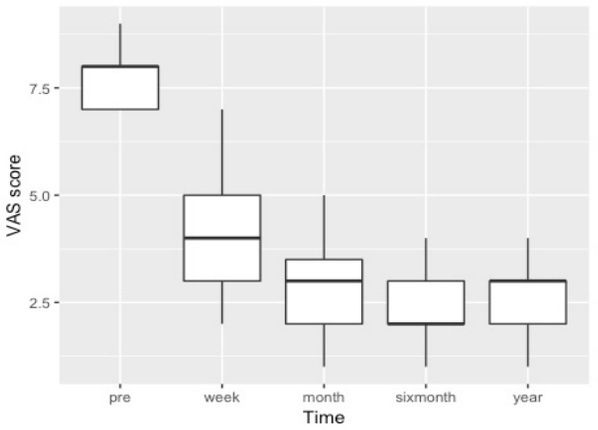

Figure 1. Boxplot showing Visual Analogue Pain Score (VAS) at different time interval (pre-injection, 1 week, 1 month, 6 months and 1 year).

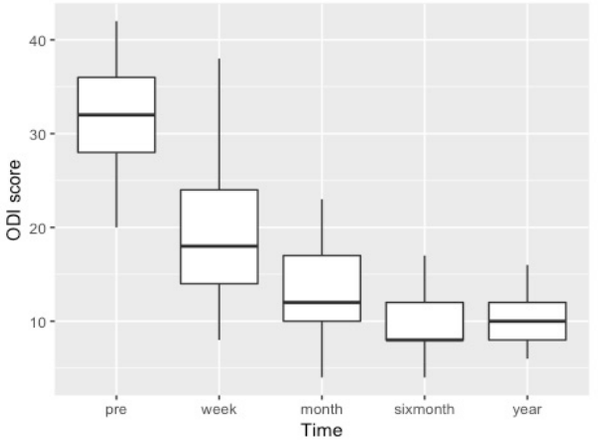

Figure 2. Boxplot showing Oswestry Disability Index (ODI) at different time interval (pre-injection, 1 week, 1 month, 6 months and 1 year).

There was no complication during the time of procedure and follow up periods.

DISCUSSION

Nerve roots subjected to chronic irritation cause radicular pain [12,13] and the ability to reproduce the pain and then diminish it forms the basis of SNRB. These days MRI scans have surpassed all diagnostic modalities in spine surgery. However, they do not demonstrate all the causes of radiculopathy nor do they always corelate symptoms with the findings.[14] SNRB is a simple and cheaper method of identifying the pathological root pain as well as administering the therapeutic medicine. Pain relief is the main goal of a SNRB.

Visual analogue score which is one of the parameters in the study was significantly reduced compared to pre-injection values particularly in first 1 month (Table 2.) compared to other studies where the score was analyzed in 6 weeks, 3 months and 1 year.[15,16] These studies show VAS reduction by approximately 30-40% in first 6 weeks. Kappinen has also analysed VAS reduction in first 3 months which reduced by almost 50%[VAS preinjection: 71±18, 3months: 34.3] .[15] However the reduction is better in our study with statistical significance. The slight difference in result can be attributed to various factors. VAS score is a subjective modality, there are chances of variation in interpretation with different population, pain beliefs among races, and pain perceptions.[17] VAS values also plateau with no significant reduction after 6 months with Kappinen study comparable to our study.[15] Tafazzel also confirms these findings with no benefits in their assessment of VAS in 12 months.[16] VAS score although shows significant reduction even when compared between 6 months and one year duration (Table 2.) but the reduction in score is not clinically useful when compared to earlier duration (Figure 1). These studies have used methylprednisolone as a study drug which is long acting steroid compared to dexamethasone used in our study which has shorter duration of action, however findings are comparable.

ODI score in our study has comparable pattern as VAS score in our study, however the magnitude of reduction is in lesser extent (Table2, Table 3). In the first 3 months Kapinen showed reduction in ODI score by almost 40-50% although not significant [ODI: pre-injection: 42.9±16,], however, the reduction is not significant in 6 months [18.9], and 12 months [15.9].[15] The scores are even lesser for Tafazzel even at first 6 weeks [ODI: pre-injection: 43.4 (32-54) Vs 6 weeks: 34.6 ± 2.1. p=0.93].[16] Systemic review shows that the reduction in ODI score are not significant with SNRB compared to VAS score reduction.[18] ODI score plateaus after 6 months and the reduction when compared with one-year duration is not significant (Figure 2). These reduction parameters show similar pattern as our study highlighting the need of physical therapies for disability reduction for longer duration.

Nerve infiltration is a dynamic and subjective test. Patients undergoing the procedures may find it painful and have difficulty cooperating mostly during early part of the study.[19] However, we have excluded cases which have failed to comply with pain reduction during the first week of injection. Studies recommend the usage of contrast medium to confirm the accuracy of needle placement and improve safety characteristics.

Because of the shape and size of the back, needle placement becomes difficult in some patients. Also, it has been reported that the furcal nerve[20] and the sinu-vertebral[21]nerve may become stimulated due to inaccurate needle placement. However, we did not face any difficulty in needle placement and we used the image intensifier for needle tip confirmation.

Several authors have suggested a primary role of inflammation and studies have shown increased neural sensitivity to minor mechanical stimulation of irritated nerves.[5,6] Phospholipase A2 is the chief inflammatory product responsible for the radicular pain and is also the rate limiting step in the arachidonic pathway.[21,22] Triamcinolone,[23] Dexamethasone, Methyprednisolone were the commonly used steroids in various clinical studies. Studies support similarity in pain scores with use of triamcinolone and dexamethasone in transforaminal epidural injection.[24] There is no change in long term outcomes based upon the type of steroid use.[25,26] Triamcinolone tends to aggregate into larger particles and causes occlusion of the vessel resulting in ischemia or infarction[27] hence, we used the non-particulate steroid Dexamethasone Sodium Phosphate.

Except for radicular spasm and cord infarct other serious side effects of the SNRB are rare. Insomnia, facial flushing, nausea, rash, fever are the frequently reported side effects.[28-30] Complications such as elevated blood glucose and blood pressure, fluid retention, menstrual flow abnormalities and hypothalamic pituitary axis suppression have also been reported.[31] In our study, none of the patients reported any adverse effects and this can be attributed to the usage of the non-particulate steroid Dexamethasone.

This study highlights the efficacy of SNRB in Nepali population presenting to a tertiary center but the outcome will be more validated and accurate with larger sample size and geographical distribution with diverse populations and racial characteristics.

CONCLUSIONS

Selective nerve root block in lumbar radiculopathy significantly reduces the pain acutely from weeks up to a year, however, the reduction in pain plateaus around six months duration. Disability scores reduces in first six month but to lesser extent from six month to one year. The study also recommends use of VAS and Nepali version of ODI score in assessing and guiding patient management, undergoing selective nerve root block in different medical setup of the country.

REFERENCES

1. Hakelius A. Prognosis in Sciatica: A Clinical Follow-Up of Surgical and Non Surgical Treatment. ActaOrthopaedicaScandinavica [Internet]. Informa UK Limited; 1970 Feb;41(sup129):1–76. [DOI]
2. Hasue M, Fujiwara M. Epidemiologic and clinical studies of long-term prognosis of low-back pain and sciatica. Spine. 1979;4(2):150-5.PMID: 162551
3. WEBER H. Lumbar Disc Herniation. Spine [Internet]. Ovid Technologies (Wolters Kluwer Health); 1983 Mar;8(2):131–40. [DOI]
4. Derby R, Kine G, Saal JA, Reynolds J, Goldthwaite N, White AH, et al. Response to Steroid and Duration of Radicular Pain as Predictors of Surgical Outcome. Spine [Internet]. Ovid Technologies (Wolters Kluwer Health); 1992 Jun;17(Supplement):S176–S183. [DOI]
5. Haueisen Dc, Smith Bs, Myers Sr, Pryce Ml. The Diagnostic Accuracy of Spinal Nerve Injection Studies Their Role in the Evaluation of Recurrent Sciatica. Clinical Orthopaedics and Related Research [Internet]. Ovid Technologies (Wolters Kluwer Health); 1985 Sep;&NA;(198):179-183. [DOI]
6. Howe JF, Loeser JD, Calvin WH. Mechanosensitivity of dorsal root ganglia and chronically injured axons: A physiological basis for the radicular pain of nerve root compression. Pain [Internet]. Ovid Technologies (Wolters Kluwer Health); 1977 Feb;3(1):25–41 [DOI]
7. Datta S, Manchikanti L, Falco FJ, Calodney AK, Atluri S, Benyamin RM, Buenaventura RM, Cohen SP. Diagnostic utility of selective nerve root blocks in the diagnosis of lumbosacral radicular pain: systematic review and update of current evidence. Pain Physician. 2013 Apr;16(2 Suppl):SE97-124.[Google scholar]
8. Thomas E, Cyteval C, Abiad L, Picot MC, Taourel P, Blotman F. Efficacy of transforaminal versus interspinous corticosteroid injectionindiscalradiculalgia ? a prospective, randomised, double-blind study. Clinical Rheumatology [Internet]. Springer Nature; 2003 Oct 1;22(4-5):299–304. [DOI]
9. Wetzel FT. The Use of Selective Nerve Root Blocks: Diagnostic, Therapeutic, or Placebo? Spine [Internet]. Ovid Technologies (Wolters Kluwer Health); 1998 Oct;23(20):2254–6. [DOI]
10. Riew Kd, Yin Y, Gilula L, Bridwell Kh, LenkeLg, Lauryssen C, et al. The Effect of Nerve-Root Injections on the Need for Operative Treatment of Lumbar Radicular Pain. The Journal of Bone and Joint Surgery-American Volume [Internet]. Ovid Technologies (Wolters Kluwer Health); 2000 Nov;82(11):1589–93. [DOI]
11. Acharya RS, Al-Oraibi S, Adhikari SP, Parajuli N, Limbu H,

Enezi FA. Validation in the Cross-Cultural Adaptation of the Nepali Version of the Oswestry Disability Index. Indian Journal of Physiotherapy and Occupational Therapy - An International Journal [Internet]. Diva Enterprises Private Limited; 2014;8(2):158. [DOI]

12. Shantha TR, Evans JA, HERSHEY SG. The Relationship of Epidural Anesthesia to Neural Membranes and Arachnoid Villi. Anesthesiology [Internet]. Ovid Technologies (Wolters Kluwer Health); 1972 Nov;37(5):543–57. [DOI]
13. Sunderland S, Bradley Kc. Stress-Strain Phenomena In Human Spinal Nerve Roots. Brain [Internet]. Oxford University Press (OUP); 1961;84(1):120–4. [DOI]
14. Svanbergsson G, Ingvarsson T, Arnardóttir RH. MRI for diagnosis of low back pain: Usability, association with symptoms and influence on treatment. Laeknabladid. 2017;103(1):17-22.[DOI]
15. Karppinen J, Malmivaara A, Kurunlahti M, Kyllonen E, Pienimaki T, Nieminen P, et al. Periradicular infiltration for sciatica: a randomized controlled trial. (University Hospital of Oulu, Helsinki, Finland). Spine. 2001;26:1059-1067. Pain Practice [Internet]. Wiley; 2001 Dec;1(4):384–5. [DOI]
16. Corticosteroids in peri-radicular infiltration for radicular pain: a randomised double blind controlled trial. One year results and subgroup analysis. Tafazal S, Ng L, Chaudhary N, Sell P. Eur Spine J 2009;18(8):1220–5. The Spine Journal [Internet]. Elsevier BV; 2010 Feb;10(2):185–185. [DOI]
17. Jensen MP, Tomé-Pires C, de la Vega R, Galán S, Solé E, Miró J. What Determines Whether a Pain is Rated as Mild, Moderate, or Severe? The Importance of Pain Beliefs and Pain Interference. The Clinical Journal of Pain [Internet]. Ovid Technologies (Wolters Kluwer Health); 2017 May;33(5):414–21. [DOI]
18. Quraishi NA. Transforaminal injection of corticosteroids for lumbar radiculopathy: systematic review and meta-analysis. European Spine Journal [Internet]. Springer Nature; 2011 Sep 4;21(2):214–9. [DOI]
19. STANLEY D, McLAREN MI, EUINTON HA, GETTY CJM. A Prospective Study of Nerve Root Infiltration in the Diagnosis of Sciatica A Comparison with Radiculography, Computed Tomography, and Operative Findings. Spine [Internet]. Ovid Technologies (Wolters Kluwer Health); 1990 Jun;15(6):540–3. [DOI]
20. KIKUCHI S, HASUE M, NISHIYAMA K, ITO T. Anatomic and Clinical Studies of Radicular Symptoms. Spine [Internet]. Ovid Technologies (Wolters Kluwer Health); 1984 Jan;9(1):23–30. [DOI]
21. Kirk EJ. Impulses in dorsal spinal nerve rootlets in cats and rabbits arising from dorsal root ganglia isolated from the periphery. The Journal of Comparative Neurology [Internet]. Wiley; 1974 May 15;155(2):165–75. [DOI]
22. DOOLEY JF, McBROOM RJ, TAGUCHI T, MACNAB I. Nerve Root Infiltration in the Diagnosis of Radicular Pain. Spine [Internet]. Ovid Technologies (Wolters Kluwer Health); 1988 Jan;13(1):79–83. [DOI]
23. Kang SS, Hwang BM, Son HJ, Cheong IY, Lee SJ, Lee SH, Chung TY. The dosages of corticosteroid in transforaminal epidural steroid injections for lumbar radicular pain due to a herniated disc. Pain Physician. 2011 Jul 1;14(4):361-70. [Google scholar] Shakir A, Ma V, Mehta B. Comparison of Pain Score Reduction Using Triamcinolone vs. Dexamethasone in Cervical Transforaminal Epidural Steroid Injections. American Journal of Physical Medicine & Rehabilitation [Internet]. Ovid Technologies (Wolters Kluwer Health); 2013 Sep;92(9):768–75. [DOI]
24. Manchikanti L, Singh V, Falco FJ, Cash KA, Pampati V. Evaluation of the effectiveness of lumbar interlaminar epidural injections in managing chronic pain of lumbar disc herniation or radiculitis: A randomized, double-blind, controlled trial. Pain Physician. 2010 Jul 1;13(4):343-55. [PubMed]
25. LaxmaiahManchikanti MD, Boswell MV, MA SA. Comprehensive review of therapeutic interventions in managing chronic spinal pain. Pain Physician. 2009 Jul;12:E123-98.[Google scholar]
26. Gharibo C, Koo C, Chung J, Moroz A. Epidural steroid injections: An update on mechanisms of injury and safety. Techniques in Regional Anesthesia and Pain Management [Internet]. Elsevier BV; 2009 Oct;13(4):266–71. [DOI]
27. Manchikanti L, Singh V, Cash KA, Pampati V, Damron KS, Boswell MV. A Randomized, Controlled, Double-Blind Trial of Fluoroscopic Caudal Epidural Injections in the Treatment of Lumbar Disc Herniation and Radiculitis. Spine [Internet]. Ovid Technologies (Wolters Kluwer Health); 2011 Nov;36(23):1897–905. [DOI]
28. Carette S, Leclaire R, Marcoux S, Morin F, Blaise GA, St.-Pierre A, et al. Epidural Corticosteroid Injections for Sciatica Due to Herniated Nucleus Pulposus. New England Journal of Medicine [Internet]. Massachusetts Medical Society; 1997 Jun 5;336(23):1634–40. [DOI]
29. McLain RF, Kapural L, Mekhail NA. Epidural steroid therapy for back and leg pain: mechanisms of action and efficacy. The Spine Journal [Internet]. Elsevier BV; 2005 Mar;5(2):191–201. [DOI]
30. Manchikanti L, Boswell MV, Singh V, Benyamin RM, Fellows B et al: Comprehensive evidence-based guidelines for interventional techniques in the management of chronic spinal pain. Pain Physician 2009;12:699-802. PMID: 19644537