EVALUATION OF PAIN RELIEF OUTCOMES USING SELECTIVE NERVE ROOT BLOCK IN LUMBAR RADICULOPATHY

Ho Huu Dung[1], Huynh Kim Hieu[2]

ABSTRACT

Background: Lumbar selective nerve root block (SNRB) is a routine diagnostic and therapeutic procedure at 1A Hospital for managing chronic low back pain and radiculopathy. The procedure aims to alleviate pain by injecting a local anesthetic and/or corticosteroid around the symptomatic nerve root. Despite its global application, clinical evidence regarding the efficacy of lumbar SNRB within the Vietnamese population remains limited. **Patients and Methods:** We conducted a retrospective study of 98 patients to evaluate the efficacy of lumbar SNRB. Treatment outcomes were assessed based on pain intensity (Visual Analog Scale - VAS), functional improvement (MacNab criteria), and the total duration of pain relief. **Results:** A significant improvement in mean VAS leg pain scores was observed, decreasing from 8.2 ± 1.73 at baseline to 2.08 ± 2.02 post-procedure in 88 cases. At the 6-month follow-up, the mean VAS score remained significantly lower than baseline at 3.56 ± 2.93 ($p < 0.01$). Recurrence of leg pain was reported within 1–2 weeks in 10.2% of cases (10/98); these patients subsequently underwent surgical intervention. The duration of effective pain relief ranged from one week to six months. **Conclusion:** These findings suggest that lumbar SNRB is an effective intervention for chronic low back pain and radiculopathy, providing significant pain reduction and functional recovery while potentially delaying the need for surgery in specific cases. However, further prospective studies with larger cohorts are warranted to confirm these results. Overall, lumbar SNRB represents a viable nonsurgical option for appropriately selected patients.

Keywords: *Selective nerve root block; Lumbar radiculopathy; Chronic low back pain; Pain relief; Lumbar disc herniation*

I. INTRODUCTION

Lumbar radiculopathy is a condition where the lumbar nerve roots are inflamed or compressed, causing radiating back pain along the sensory distribution of one or more roots, and may be accompanied by numbness, paresthesia, muscle weakness, or decreased deep tendon reflexes in the legs. There are many causes of lumbar radiculopathy, but the main ones are herniated discs causing nerve compression or lumbar spinal degeneration causing narrowing of the spinal canal, lateral recesses, and intervertebral foramina.

Most cases of lumbar radiculopathy are successfully treated conservatively with pain relievers, anti-inflammatory drugs, muscle relaxants, and physiotherapy. However, for some patients who do not respond to conservative treatment after 6 weeks, or in patients who are candidates for surgery but cannot undergo surgery immediately due to underlying medical conditions, non-surgical lumbar radiculopathy (NSRA) is a treatment method that should be considered.

In humans and animals, Grava showed that sciatic nerve pain only occurs when the herniated disc compresses an inflamed nerve root [3]. Furthermore, Franson et al. showed that the enzyme phospholipase A2 in the intervertebral disc is a key factor regulating the production of inflammatory mediators such as prostaglandins and leukotrienes [4]. In addition, Lee et al. showed that the activity of phospholipase A in compressed nerve roots is inhibited by corticosteroid injection [8].

At Hospital 1A, SNRB is a minimally invasive procedure for the diagnosis and treatment of chronic lower back pain and lumbar radiculopathy that is routinely performed. This procedure involves injecting local anesthetic along with corticosteroids around the nerve root at the point where the root exits the intervertebral foramen under fluoroscopy with the goal of reducing inflammation caused by nerve compression. Although widely applied in many parts of the world, there is still little research on the application of this procedure in Vietnam. Therefore, we conducted this study.

II. SUBJECTS AND METHODS

2.1. Subjects: All patients with lumbar disc herniation or lumbar spinal stenosis diagnosed with lumbar radiculopathy due to lumbar disc herniation who were examined and treated at Hospital 1A

[1] *Tam Anh General Hospital, Ho Chi Minh City*
[2] *Can Tho University of Medicine and Pharmacy*
Responsible person: Huynh Kim Hieu
Email: hkhieu@ctump.edu.vn
Date of receipt: 29.1.2026
Date of scientific judgment: 19.3.2026
Reviewed date: 7.5.2026

from November 2019 to November 2022.

2.1.1. Inclusion criteria: Patients presenting with lumbar radiculopathy secondary to disc herniation or spinal stenosis, with persistent symptoms despite 4–6 weeks of conservative management (e.g., physical therapy, NSAIDs, and activity modification); Follow-up time after procedure: Minimum 6 months; Location: Spine unit of Hospital 1A.

2.1.2. Exclusion criteria: Patients with previous lumbar disc herniation surgery or previous trauma; Patients with contraindications to SNRB: Infectious diseases of the vertebral body and intervertebral discs; Skin infections at the injection site; Severe systemic infections; History of allergy to local anesthetics or contrast agents; Coagulation disorders.

2.1.3. Sampling method: Sampling was based on research objectives.

2.2. *Research methods*

2.2.1. Study design: a retrospective descriptive cross-sectional study.

2.2.2. Pre-procedure examination and planning: All patients were scheduled for the procedure. Clinical examination to identify symptoms of lumbar nerve root compression. MRI to determine the level of herniation/stenosis. Detailed explanation of the procedure to the patient.

2.3.Operating room layout: C-arm on the opposite side of the intended nerve root block. The procedure team includes: 2 technicians: 1 lead physician + 1 assistant physician, 1 anesthesiologist + 1 anesthesia technician, 1 external support nurse

Figure 1. C-arm machine. Source: author

2.4. Surgical method

2.4.1.Patient preparation: The patient lies prone with two pillows along their length to reduce lumbar lordosis

2.4.2. Procedure steps:

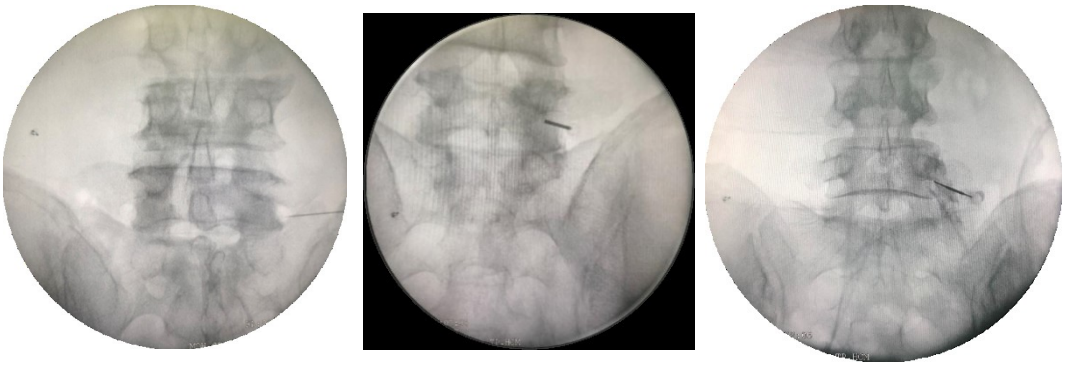

Figure 2. A. Identifying the injection site on the skin. B. Orienting the injection site with an 18G needle. C. Direction of the 22G needle in the 18G needle lumen

Disinfect the procedure area and drape the surgical field with sterile drapes. Tilt the fluoroscope towards the patient's head so that the X-ray beam is parallel to the superior endplate in the anterior-posterior plane (the superior endplate appears as a straight line on the film) Accurately identify the lumbar spine and intervertebral foramen using a C-arm (Figure 2). Use an 18G needle inserted in the same direction as the X-ray to create an entry point for the 22G needle. Insert a 22G needle through the existing 18G needle lumen to the 6 o'clock position of the pedicle until resistance or painful stimulation is felt in the patient. Verify the direction of the 22G needle using a C-arm in both anterior-posterior and oblique planes. In the anterior-posterior plane, the 22G needle should be correctly positioned at an angle between 9 o'clock and 6

o'clock (for the left pedicle) and 3 o'clock and 6 o'clock (for the right pedicle). At each injection step, check that the 22G needle is not in a blood vessel by withdrawing 2-3 ml of the syringe. Once the 22G needle is in the correct position, inject 1 ml of distilled water to stimulate the patient's radicular pain. If it resembles the patient's usual pain, inject 1 ml of 2% Lidocaine for pain relief. Inject 1 ml of Xenetix contrast agent and re-examine the contrast-enhancing nerve root image on the C-arm in both anterior-posterior and oblique views (Figure 3).

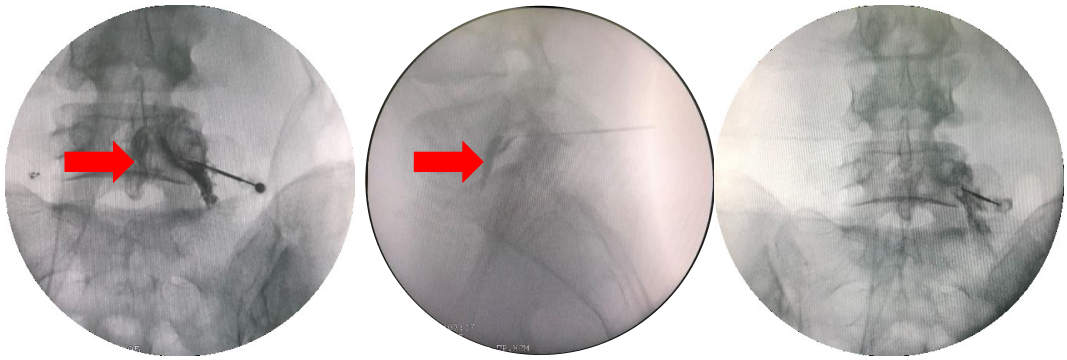

Figure 3. A, B. Nerve root shape (arrow) after contrast injection in both anterior-posterior and oblique views. C. Contrast-enhancing nerve root image.

If contrast enhancement of the nerve root and dura mater appears on the C-arm, inject 1 ml of Depo-Medrol + 1 ml of 0.5% Bupivacaine solution. Re-examine on the C-arm to see if the contrast enhancement of the nerve root and dura mater is blurred (Figure 2.4C) Withdraw both needles and bandage the wound.

2.5. Data collection: Patients are scheduled for follow-up appointments or called directly to assess symptoms of nerve root compression and their ability to perform daily activities. Information is collected from the patient's medical records during follow-up visits and completed in the data collection fields. X-ray and MRI images of the patient are taken using a digital camera. Treatment outcome evaluation criteria: Pain level according to the VAS scale. Satisfaction level according to the MacNab scale.

2.6. Data processing: Data was processed using SPSS 22 software.

III. RESULTS

Through a study of 98 cases diagnosed with lumbar radiculopathy due to lumbar disc herniation and spinal stenosis at the Spine Unit of Hospital 1A from November 2019 to March 2023, we obtained the following results:

The average age was 53.37 ± 16.56, the youngest age was 17 years old, and the oldest was 92 years old.

Males accounted for 60 cases (61.2%) and females accounted for 38 cases (38.8%).

100% of the cases recorded had disc herniation, of which disc herniation causing spinal stenosis accounted for 6.1% (6/98) and disc herniation with spinal instability accounted for 12.2% (12/98).

Table 1. Grouping by patient characteristics

Characteristics	Percentage (%)
Age	
20-29	7 (7.14%)
30-39	15 (15.30%)
40-49	18 (18.36%)
50-59	15 (15.30%)
60-69	26 (26.53%)
>=70	16 (16.32%)
Gender	
Male	60 (61.2%)
Female	38 (38.8%)
Lession grouping	
Disc herniation	98 (100%)
Disc herniation + Spinal stenosis	6 (6.1%)
Disc herniation + Spinal instability	12 (12.2%)
Number of herniation levels	
1 level	65 (66.33%)
2 levels	32 (32.65%)
3 levels	1 (1.02%)
Location of disc herniation	
TL3-4 only	1
TL4-5 only	44
TL5-S1 only	37
Multiple levels	16

Table 2. Distribution of patients by radicular pathology

Radicular pathology	Frenquency	Percentage (%)
L4	10	5.1
L5	121	61.7
S1	65	33.2
Total	196	100

Our study recorded that 5.1% (10/196) of L4 roots showed pathological manifestations, 61.7% (121/196) of L5 roots and 33.2% (65/196) of L4 roots showed pathological manifestations.

Table 3. Distribution of patients according to MacNab

MacNab	Frenquency	Percentage (%)
Poor	10	10.2
Medium	15	15.3
Good	40	40.8
Very good	33	33.7
Total	98	100

Our study recorded 10.2% (10/98) of cases with a "Poor" MacNab outcome, 15.3% (15/98) of cases with a "Moderate" outcome, 40.8% (40/98) with a "Good" outcome, and 33.7% (33/98) with a "Very Good" outcome.

- Clinical outcomes before and after block

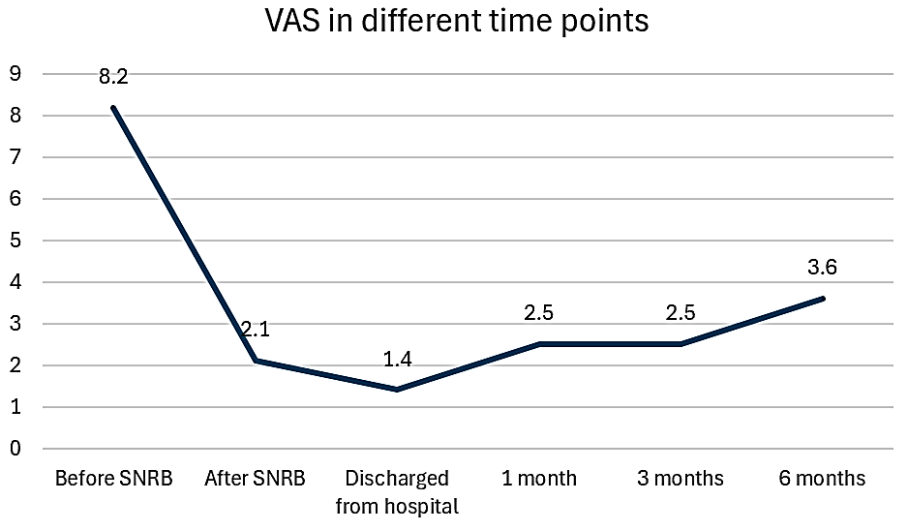

Figure 4. VAS at different time points

In 88 cases without recorded surgery, pre-blocker VAS was 8.2 ± 1.73, post-blocker VAS was 2.08 ± 2.02. Post-injection VAS at discharge was 1.4 ± 1.3. VAS after 1 month was 2.52 ± 2.43, after 3 months: 2.56 ± 2.29, and after 6 months: 3.56 ± 2.93. The shortest time to pain relief was recorded 1 week after injection. The pre-injection and post-blocker VAS showed statistically significant reductions (p <0.01).

Table 4. Distribution of patients by final outcomes

Surgery	Frequency	Percentage (%)
Yes	88	89.8
No	10	10.2
Total	98	100

A retrospective review of 98 patients recorded 10 cases that underwent surgery after nerve root block.t

IV. DISCUSSION

Our study results show that SNRB is an effective method for reducing radicular pain in the majority of patients. We found that the VAS pain score before and after injection decreased significantly in most patients, and this is consistent with many studies by other authors such as Giang (2020) [1]. Kumar et al. reported that 82.5% of radicular block patients experienced pain improvement within 2 weeks after injection. In 2016, Joswig et al. reported that 66.7% of radicular block patients experienced significant pain improvement within 1 month.

Regarding functional improvement after injection, we used the MacNab scale to evaluate and found that 74.5% of cases (73/98) rated their recovery level as "Good" to "Very Good" 6

months after the procedure. Of the 88 non-surgical cases, approximately 18 cases (20.4%) reported a recurrence of pain 6 months after the block (20%) but did not yet require surgery. However, as this was a retrospective study, it was difficult to accurately assess the duration of effective pain relief. Furthermore, based on Pearson correlation coefficients, we did not find a statistically significant correlation between the VAS score before, after, 1, 3, and 6 months and the patient's age.

In the 98 patients who underwent SNRB, we observed 10 cases requiring surgery because the pain symptoms in these 10 patients were similar to those before the procedure when they returned for follow-up 1 to 2 weeks after discharge. For these 10 cases requiring surgery, the post-procedure VAS decreased significantly in all 10 cases. These cases mainly involved patients with spondylolisthesis or multi-level disc herniation. In patients indicated for surgery, selective nerve root block was diagnostically significant and helped us identify the most symptomatic nerve root, thereby maximizing root decompression during surgery.

We performed fluoroscopy using a two-needle method. The advantage of this method when performed with fluoroscopy is that it allows for clear visualization of the anatomical structures of the vertebral bodies, the procedure is quick, and there is less radiation exposure for experienced surgeons. Based on our experience and that of Kingsbury, we could pre-explore anatomical landmarks by feeling the bone structures with an 18G needle [7]. The 18G needle facilitated easy navigation under fluoroscopy, and then a 22G needle was inserted to "guide" the needle tip to the correct location where the nerve root exits the intervertebral foramen in both anterior-posterior and oblique planes. Once the correct location was identified, we recreated clinical pain similar to the patient's pain and administered 1 ml of 2% Lidocaine for pain relief. To determine the direction of drug spread, we injected 1 ml of Xenetix contrast agent and evaluated it in two planes. If the nerve root sheath appeared on the fluoroscopy, we injected a solution containing Bupivacaine + Depomedrol 40 mg. However, currently, no studies have shown a correlation between the spread of the contrast agent and the effectiveness of pain relief after injection [5]. We also ensured that the volume of the block solution was only 2 ml so that the drug only acted on the nerve root we wanted to block and did not spread excessively into the dura mater or other nerve roots.

Regarding corticosteroids used in nerve block therapy, many authors have noted the use of different drugs with varying injection frequencies and dosages. Corticosteroids used in nerve block therapy are divided into two forms: granular and non-granular. Depo-Medrol (methylprednisolone acetate) and K-Cort (Triamcinolone acetonide) are two common corticosteroids available in the Vietnamese market. In 2005, author Anwar noted no difference in the efficacy of methylprednisolone and triamcinolone in a prospective, single-blind, randomized study [1]. In our study, the long-acting corticosteroid used was Depo-Medrol (methylprednisolone) at a dose of 40mg for a single injection. Other authors, such as Kang (2011), recommend that the smallest dose of triamcinolone, 10mg, has been effective in reducing pain [6]. On the other hand, many other studies worldwide compare the safety of granular and soluble corticosteroids. The authors suggest that granular corticosteroids may cause embolism of spinal cord blood vessels and spinal cord infarction. However, this risk is rare, and we did not observe any cases of embolism-related complications in this study.

V. CONCLUSION

Our study evaluated the effectiveness of SNRB in treating lumbar radiculopathy in patients with herniated discs and lumbar spinal stenosis. The results showed that this is a safe and effective treatment method that significantly reduced pain indicators and improved function in the majority of patients. However, this study has limitations due to its retrospective design with a small sample size and lack of a control group. Therefore, we need to conduct studies with larger sample sizes to increase clinical reliability.

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