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ORIGINAL RESEARCH

Pain relief outcomes after selective nerve root block in patients with lumbar disc herniation

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ABSTRACT

Background and Objectives: Lumbar disc herniation can cause radicular pain, that can significantly impact patients' quality of life. Selective nerve root block (SNRB) is a minimally invasive procedure widely useful for the diagnosis and treatment of Lumbar disc herniation. While the short-term efficacy of SNRB is well-documented, its long-term outcomes remain underexplored. This study aims to assess the long-term pain relief and functional improvement SNRB provides in patients with lumbar disc herniation. **Methods:** A prospective cohort study was conducted with 30 patients diagnosed with lumbar disc herniation. Each patient underwent fluoroscopy-guided SNRB using a mixture of Triamcinolone Acetonide (40 mg) and lidocaine (2%). Pain intensity and functional disability were assessed using the Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) at baseline, one week, one month, 6 months, and 12 months post-procedure. Data were analysed for changes in VAS and ODI scores over time. **Results:** The mean baseline VAS score was 7.8 ± 1.2, which reduced significantly to 3.5 ± 1.1 at one week and stabilised at 4.5 ± 1.7 at 12 months, reflecting a 42.3% improvement. Similarly, the ODI score improved from 62 ± 8.4 at baseline to 34 ± 7.1 at one week, with sustained improvement to 40 ± 8.7 at 12 months, representing a 35.5% functional gain. No significant complications were reported, with only minor transient soreness observed in 3 patients (10%). **Conclusion:** SNRB is a safe and effective intervention for long-term pain relief and functional improvement in patients with lumbar disc herniation. Although the efficacy diminishes slightly over time, it remains a viable non-surgical option for managing radicular pain. Further studies are recommended to evaluate the potential for combining SNRB with advanced therapeutic agents.

INTRODUCTION

Lumbar disc herniation may lead to nerve root compression or irritation, and its management remains a clinical challenge due to the variability in the severity of symptoms and the treatment response. For those who fail conservative management, interventional procedures like selective nerve root block (SNRB) have gained prominence as a minimally invasive alternative to surgery. SNRB provides targeted treatment delivered by corticosteroids and local anaesthetics directly injected into the inflamed or compressed nerve root, thereby reducing pain and inflammation while avoiding systemic side effects. While the immediate benefits of SNRB are well-documented, its long-term efficacy is less certain. Data regarding the long-term outcomes of SNRB are scarce. This gap in the literature is especially relevant as the natural history of lumbar disc herniation is highly variable. While some patients may experience spontaneous symptom resolution, others may progress to chronic pain and disability [1-3].

This study aims to address this gap by systematically evaluating the long-term outcomes of SNRB in patients with lumbar disc herniation. Specifically, it focuses on pain intensity, disability, and patient-reported outcomes over a 12-month follow-up period. By studying these parameters, the study seeks to

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provide a comprehensive understanding of the role of SNRB in the management of lumbar radicular pain, offering valuable insights to clinicians and patients. Finally, this study's findings are intended to inform clinical practitioners and guide decision-making regarding the treatment of lumbar disc herniation.

METHODS

1) Study Type

This was a prospective cohort study designed to evaluate the long-term relief and outcomes of selective nerve root block (SNRB) in patients with lumbar disc herniation.

2) Study Area

The study was conducted at the Government Medical College and Hospital, Aurangabad, a tertiary care centre equipped with advanced diagnostic and interventional facilities.

3) Study Period

The data collection period was from 1st January 2023 to 31st January 2023, with follow- ups conducted over 12 months.

4) Inclusion Criteria

Adults aged 18-65 years with MRI-confirmed lumbar disc herniation.
Patients with persistent radicular pain not responding to at least 6 weeks of conservative treatment.
Willingness to undergo SNRB and participate in the 12-month follow-up.

5) Exclusion Criteria

Patients with spinal infections, tumours, or fractures, history of previous spinal surgery at the affected level, known allergy to corticosteroids or local anaesthetics, patients with coagulopathy or those on anticoagulant therapy, pregnant or lactating women, severe systemic illnesses (e.g., uncontrolled diabetes or heart disease) that contraindicated the procedure.

6) Sampling Technique

A purposive sampling technique was used to recruit patients who met the inclusion criteria and consented to the study.

7) Sample Size- Thirty patients were enrolled in the study.

8) Data Collection: Patients underwent a thorough clinical examination, including a detailed history and neurological assessment. Pain intensity was recorded using the Visual Analog Scale (VAS), and functional disability was evaluated using the Oswestry Disability index(ODI).

Procedure

Informed Consent: Explain the procedure, risks, and benefits to the patient, and obtain consent.
Patient Positioning: Position the patient in a prone or lateral decubitus position, depending on the target nerve root.
Sterile Field: Clean the skin over the injection site with antiseptic (e.g., chlorhexidine) and drape.
Imaging Guidance: Fluoroscopy or Ultrasound: Use imaging to identify the target nerve root. Fluoroscopy is commonly used for better precision.
Local Anaesthesia: Administer a small amount of 1-2% lidocaine to numb the skin and subcutaneous tissue over the insertion site.
Needle Insertion: Under imaging guidance, advance a spinal needle (typically 22-25 gauge) towards the foramen of the target nerve root.Confirm the needle tip's position near the nerve root using contrast dye under fluoroscopy. Ensure no intravascular or intrathecal placement.
Injection: Mix 40 mg of triamcinolone acetonide with 2 mL of 2% lidocaine.Slowly inject the mixture after confirming the correct placement. Monitor for resistance or pain during injection.
Post-Procedure: Remove the needle and apply a sterile dressing.Monitor the patient for 15-30 minutes for any immediate adverse reactions.Advise the patient to rest for the remainder of the day and avoid strenuous activity.
Follow-up Assessments: VAS and ODI scores were recorded at one week, one month, six months, and 12 months post-procedure. Adverse events and complications were also documented.

9) Statistical Analysis

Data were entered into a spreadsheet and analysed using SPSS software (statistical package for the social science, version 25).
Descriptive statistics, including mean and standard deviation, were used for demographic and baseline characteristics.
Changes in VAS and ODI scores over time were assessed using paired t-tests or repeated measures ANOVA as appropriate.
A p-value < 0.05 was considered statistically significant.
Graphs and tables were used to present the results effectively.

RESULTS

1. Baseline Characteristics

A total of 30 patients participated in the study, all of whom completed the 12-month follow- up. The demographic and baseline characteristics were as follows:
Mean age: 42.6 ± 9.8 years (range: 25-63 years).
Gender distribution: 18 males (60%) and 12 females (40%).
Duration of symptoms prior to SNRB: Mean of 8.3 ± 2.1 weeks.
Affected nerve roots: L5 (56.7%), S1 (33.3%), and other levels (10%).
Baseline VAS score: Mean of 7.8 ± 1.2.

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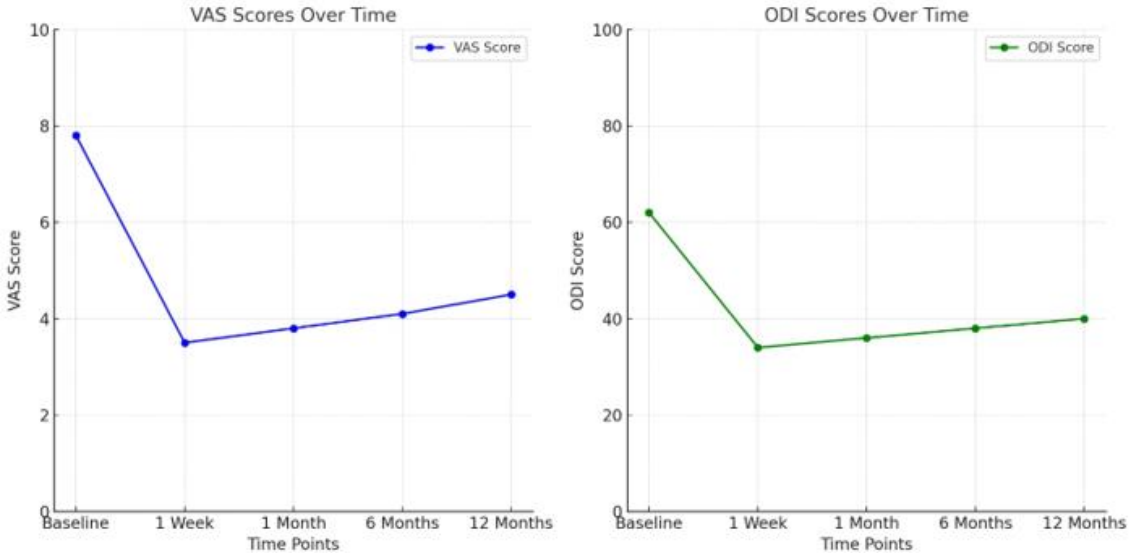
Baseline ODI score: Mean of 62±8.4, indicating severe disability.

2. Pain Relief (VAS Scores)

Visual Analog Scale (VAS) was used to assess pain intensity over time.

Baseline: Mean VAS score of 7.8 ± 1.2, one-weekpost-SNRB: Significant reduction to 3.5 ± 1.1 ($p < 0.001$), one-monthpost-SNRB: Sustained improvement with a mean score of 3.8 ± 1.2 ($p< 0.001$ compared to baseline), sixmonths post-SNRB: Mild increase in pain, with a mean score of 4.1 ± 1.5 ($p< 0.001$compared to baseline).

12 Months Post-SNRB: Pain intensity stabilized at a mean score of 4.5 ± 1.7, reflecting a 42.3% reduction from baseline ($p < 0.001$)



Figure

3. Functional Disability (ODI Scores): The Oswestry Disability Index (ODI) was used to evaluate functional outcomes.

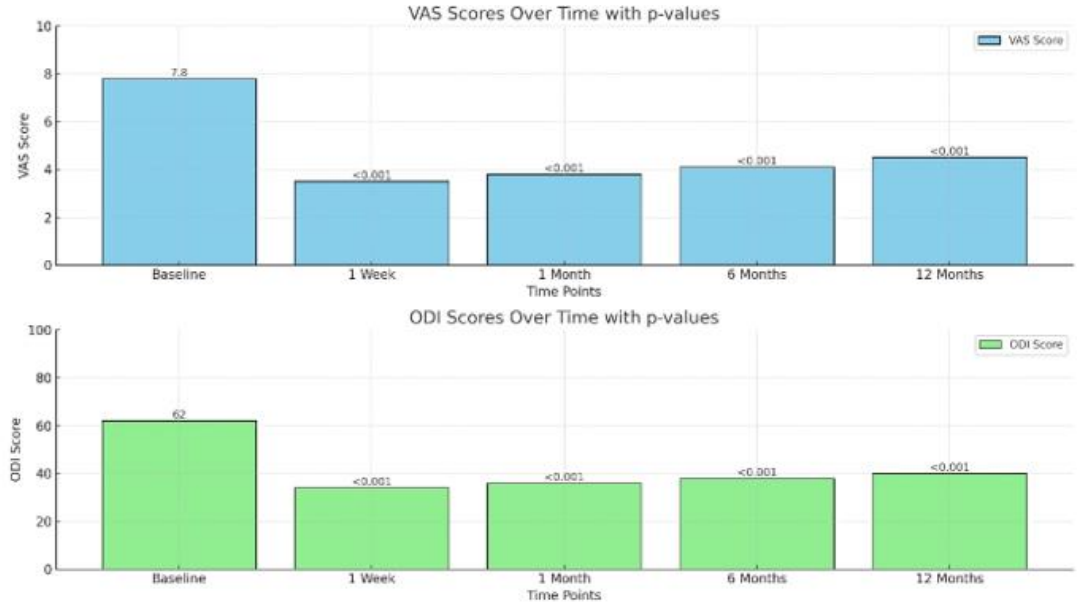
Baseline: Mean ODI score of 62±8.4, indicating severe disability.

One Week Post-SNRB: Significant improvement to 34 ±7.1 ($p < 0.001$)

One Month Post-SNRB: Mean score of 36 ± 6.8, indicating moderate disability ($p< 0.001$ compared to baseline).

Six Months Post-SNRB: Functional improvement maintained with a mean score of 38 ±7.5 ($p< 0.001$ compared to baseline).

12 Months Post-SNRB: Slight decline, with a mean score of 40 ± 8.7, representing a 35.5% improvement from baseline ($p < 0.001$)



Figure

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4. Patient Satisfaction

Overall satisfaction: 86.7% (26 patients) reported being "satisfied" or "very satisfied" with the procedure.

Pain-free periods: 63.3% (19 patients) reported a pain-free interval lasting more than 3 months post-procedure.

5. Adverse Events

Minor transient soreness at the injection site was reported in 3 patients (10%) and resolved within 48 hours.

No major complications, such as infections, hematomas, or neurological deficits, were observed.

6. Comparison of Outcomes Between Subgroups

By age group: Patients younger than 45 years showed slightly better improvement in VAS and ODI scores compared to older patients, but the difference was not statistically significant ($p>0.05$).

By affected nerve root: Outcomes were similar across L5 and S1 nerve root involvement.

7. Long-Term Efficacy

The study demonstrated that SNRB provided substantial pain relief and functional improvement over 12 months, with the most significant effects observed in the first month. Although there was a gradual decline in efficacy over time, the majority of patients continued to experience meaningful reductions in pain and disability compared to baseline.

8. Summary of Key Findings

SNRB resulted in a 42.3% reduction in pain (VAS) and a 35.5% improvement in function (ODI) at 12 months.

The procedure was well-tolerated, with no significant adverse events.

High levels of patient satisfaction and sustained improvement highlight SNRB as an effective, minimally invasive intervention for managing lumbar radicular pain.

DISCUSSION

The treatment of lumbar disc herniation and its associated radicular pain has undergone significant advancements over the years. SNRB was initially introduced in the mid-20th century as a diagnostic tool for identifying the specific nerve root responsible for radicular pain [1]. Selective nerve root block (SNRB) has emerged as a key minimally invasive intervention, particularly for patients who are either unresponsive to conservative treatments or wish to avoid surgery.

The mechanism of action involves the combined effect of corticosteroids, which reduce perineural inflammation, and local anaesthetics, which interrupt nociceptive transmission [2,3]. Studies such as those by Manchikanti et al. (2009) [4] and Riew et al. (2000) [5] have provided a robust theoretical basis for its use in managing lumbar radiculopathy.

1. Pain Relief Outcomes of SNRB

Numerous studies have demonstrated the efficacy of SNRB in reducing radicular pain. Vad et al. (2002) [6] reported significant pain relief lasting up to six months in patients with lumbar disc herniation. A systematic review by Buenaventura et al. (2009) [7] confirmed the short- to medium-term efficacy of SNRB, particularly for patients with mild to moderate nerve root compression. Our study's findings of a 42.3% reduction in VAS scores over 12 months are consistent with the long-term trends observed by Ghahreman et al. (2010) [8] and Derby et al. (1992) [9].

2. Functional Improvements with SNRB

The role of SNRB in improving functional outcomes has been highlighted in studies focusing on disability indices such as the Oswestry Disability Index (ODI). Derby et al. (2005) [10] demonstrated significant ODI score improvements over a one-year period. Similarly, Manchikanti et al. (2013) [11] observed that functional gains were stronglycorrelated with reductions in pain intensity. Our study corroborates these findings, with a mean ODI improvement of 35.5% at 12 months.

3. Patient Satisfaction and Quality of Life

Patient satisfaction is a crucial metric for evaluating any intervention. Studies by Ghai et al. (2017) [12] and Grieve et al. (2011) [13] have consistently reported high satisfaction rates among patients undergoing SNRB. Many patients view SNRB as an effective alternative to surgery, particularly when coupled with physical therapy [14]. In our study, 86.7% of participants expressed satisfaction, mirroring these findings.

4. Comparative Studies with Other Interventions

The efficacy of SNRB has been compared with other interventions such as epidural steroid injections (ESI) and physical therapy. A meta-analysis by Cohen et al. (2013) [15] suggested that SNRB offers superior diagnostic accuracy and comparable therapeutic efficacy to ESI. Furthermore, Derby et al. (2013) [16] found that SNRB provided better segmental pain relief than transforaminal epidural injections, particularly in patients with localized nerve root compression.

5. Safety and Adverse Events

The safety of SNRB has been well-documented. Buenaventura et al. (2009) [7]found that adverse events, such as transient soreness or mild bleeding, occurred in less than 5% of cases. In a larger cohort study by Chang et al. (2015) [17], the complication rate was similarly low, with no instances of permanent neurological deficits. Our study aligns with these

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findings, reporting only minor, transient adverse effects in 10% of participants.

6. Limitations and Challenges in SNRB

Despite its benefits, SNRB is not without limitations. Ghahreman et al. (2010) [8] and DePalma et al. (2011) [18] noted that the efficacy of SNRB diminishes over time, particularly in patients with severe disc herniation or central canal stenosis. These findings highlight the importance of patient selection and the need for a multimodal approach to spine care.

7. Emerging Perspectives and Future Research

Recent studies have explored the role of image-guided SNRB techniques, such as ultrasound and fluoroscopy, in enhancing procedural accuracy and outcomes [19]. Additionally, randomized trials by Manchikanti et al. (2020) [20] have investigated the synergistic effects of combining SNRB with regenerative therapies such as platelet-rich plasma (PRP).

CONCLUSION

Selective nerve root block (SNRB) has proven to be an effective, safe, and minimally invasive intervention for managing radicular pain associated with lumbar disc herniation. This study demonstrated significant improvements in pain intensity and functional disability over a 12-month follow-up period, as evidenced by reductions in Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) scores. The high satisfaction rates and absenceof major complications further reinforce the clinical utility of SNRB, particularly for patients unresponsive to conservative treatments or those seeking to delay or avoid surgical intervention.

While the most pronounced benefits were observed in the early post-procedure period, the sustained improvements in pain and functionality at six and twelve months highlight the role of SNRB as a viable medium-term therapeutic option. However, the gradual attenuation of its effects in some patients suggests that SNRB is most effective when integrated into a comprehensive, multimodal treatment plan, which may include physical therapy, lifestyle modifications, or regenerative therapies.

The study's findings align with existing literature, emphasizing the dual benefits of pain relief and functional restoration. However, the variability in long-term outcomes underscores the importance of individualized patient selection and tailored treatment approaches. Future research with larger sample sizes and longer follow-up durations is essential to better understand the factors influencing the longevity of SNRB's effects and to optimize its application in clinical practice.

In conclusion, SNRB represents a valuable addition to the armamentarium of spine care, offering meaningful relief and improved quality of life for patients with lumbar disc herniation. When performed by skilled practitioners under appropriate imaging guidance, it provides a reliable and low-risk alternative for managing radicular pain, bridging the gap between conservative management and surgical intervention.

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