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Research Article

Selective Nerve Root Block versus Caudal Epidural Block in Single-Level Lumbar Intervertebral Disc Prolapse

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ABSTRACT

Background: Chronic lumbar radiculopathy due to intervertebral disc prolapse is prevalent and causes significant morbidity. Interventional pain management techniques like Selective Nerve Root Block (SNRB) and Caudal Epidural Block (CEB) are commonly used when conservative treatments fail. This study compares the efficacy of SNRB and CEB in managing pain and improving function in patients with single-level lumbar disc prolapse.

Methods: Sixty-six patients with single-level lumbar disc prolapse-induced radiculopathy were assigned according to surgeons choice to receive either SNRB or CEB. Pain intensity was measured using the Visual Analog Scale (VAS), and functional disability was assessed using the Oswestry Disability Index (ODI) and the Roland-Morris Disability Questionnaire (RMDQ) at baseline, 3 weeks, 6 weeks, 3 months, and 6 months post-intervention. Statistical analyses compared outcomes between the two groups.

Results: Both SNRB and CEB groups showed significant reductions in VAS, ODI, and RMDQ scores over time ($p < 0.001$). However, no statistically significant differences were observed between the groups at any follow-up point ($p > 0.05$). The mean age and sex distribution were comparable between groups ($p > 0.05$).

Conclusion: Both SNRB and CEB are effective in reducing pain and improving function in patients with single-level lumbar disc prolapse. No significant difference was observed between the two interventions over six months, suggesting that either technique can be utilized based on clinical judgment and patient preference.

Keywords: Lumbar radiculopathy; Selective Nerve Root Block; Caudal Epidural Block; Intervertebral Disc Prolapse; Pain Management.

INTRODUCTION

Chronic lumbar radiculopathy, characterized by persistent back and leg pain associated with nerve root pathology, is a prevalent condition affecting a significant portion of the adult population [1]. Lumbar intervertebral disc prolapse is a common cause, with a lifetime prevalence of 3.7% to 5.3% [2]. Despite natural resolution in nearly half of the cases, about 30% of patients experience persistent symptoms beyond one year, leading to substantial public health and economic burdens [3,4]. Up to 20% of affected individuals are unable to maintain employment, and 5–15% eventually require surgical intervention [5].

Lumbar disc herniations account for approximately 95% of spinal disc herniations, predominantly occurring at the L4–L5 and L5–S1 levels [6]. The pathology involves posterolateral protrusion of disc material, causing compression of adjacent nerve roots and leading to severe pain syndromes such as sciatica [7]. Precise diagnostic and therapeutic strategies are essential to manage symptoms effectively and prevent progression to surgery [8].

Conservative treatments, including pharmacological pain management, physical therapy, and lifestyle modifications, are the initial management strategies [9]. However, when these fail, interventional pain management techniques like Selective Nerve Root Block (SNRB) and Caudal Epidural Block (CEB) become pivotal [10,11]. SNRB targets the affected nerve root with corticosteroids and local anesthetics, providing both therapeutic relief and diagnostic confirmation [12].

Conversely, CEB administers steroids into the epidural space via the caudal canal, affecting multiple nerve roots and benefiting cases with multi-level involvement or unclear pain localization [13].

Comparing the efficacy of SNRB and CEB is crucial to optimize interventional strategies, potentially reducing the need for surgical interventions and improving patient outcomes [14]. This study aims to evaluate the effectiveness of SNRB versus CEB in pain reduction and functional improvement in patients with single-level lumbar disc prolapse-induced radiculopathy.

MATERIALS AND METHODS

Study Design and Participants

This prospective observational study included 66 patients diagnosed with single-level lumbar intervertebral disc prolapse-induced radiculopathy. Inclusion criteria were patients aged 18–60 years with confirmed single-level lumbar disc herniation on MRI and symptoms persisting despite conservative treatment for at least six weeks. Exclusion criteria included multi-level disc prolapse, previous spinal surgery, coagulopathy, infection at the injection site, or allergy to study medications.

Interventions

Patients were assigned into two groups of 33 each according to surgeons choice .Group A received Caudal Epidural Block (CEB), and Group B received Selective Nerve Root Block (SNRB). All procedures were performed under fluoroscopic guidance using standard sterile techniques. The CEB group received an injection of corticosteroid and local anesthetic via the caudal canal, while the SNRB group received the same medications targeted at the affected nerve root.

Outcome Measures

Pain intensity was assessed using the Visual Analog Scale (VAS). Functional disability was evaluated using the Oswestry Disability Index (ODI) and the Roland-Morris Disability Questionnaire (RMDQ). Assessments were conducted at baseline, 3 weeks, 6 weeks, 3 months, and 6 months post-intervention.

Statistical Analysis

Data were analyzed using appropriate statistical tests. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Comparisons between groups were made using independent t-tests for continuous variables and chi-square tests for categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Patient Demographics

A total of 66 patients participated, with 33 in each group. The mean age for the CEB group was 40.15 years (SD = 6.75), and for the SNRB group, it was 42.42 years (SD = 10.17), with no significant difference ($p = 0.104$). The sex distribution was comparable ($p = 0.301$), with males comprising 57.57% in the CEB group and 72.72% in the SNRB group (Table 1).

Table 1. Patient Demographics

	CEB Group	SNRB Group	p-value
Mean Age (years)	40.15 ± 6.75	42.42 ± 10.17	0.104
Sex Distribution			0.301
Female (%)	14 (42.42%)	9 (27.27%)	
Male (%)	19 (57.57%)	24 (72.72%)	

Pain Assessment

At baseline, mean VAS scores were similar between groups (CEB: 7.03 ± 0.98; SNRB: 7.00 ± 0.75; $p = 0.888$). Both groups showed significant reductions in VAS scores at all follow-up points ($p < 0.001$). At 6 months, VAS scores decreased to 2.82 ± 1.42 (CEB) and 2.48 ± 0.67 (SNRB), with no significant differences between groups ($p > 0.05$) (Table 2, Figure 1).

Table 2. Vas Scores over Time

Time Point	CEB Group (Mean ± SD)	SNRB Group (Mean ± SD)	p-value
Before Procedure	7.03 ± 0.98	7.00 ± 0.75	0.888
3 Weeks	3.91 ± 1.47	4.03 ± 0.88	0.685
6 Weeks	3.30 ± 1.40	3.06 ± 0.75	0.385
3 Months	2.94 ± 1.37	2.55 ± 0.67	0.143
6 Months	2.82 ± 1.42	2.48 ± 0.67	0.229

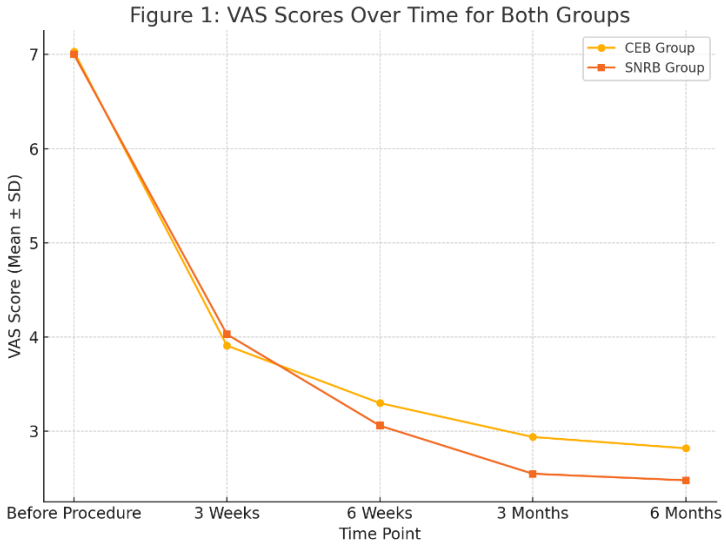

Figure 1. VAS Scores over Time for Both Groups

Functional Outcomes

ODI scores decreased significantly in both groups over time ($p < 0.001$). Baseline ODI scores were 41.52 ± 8.29 (CEB) and 41.21 ± 6.71 (SNRB). At 6 months, ODI scores were 14.82 ± 14.13 (CEB) and 13.09 ± 2.88 (SNRB), with no significant differences between groups ($p = 0.495$). Similarly, RMDQ scores showed significant reductions over time in both groups ($p < 0.001$), with no significant differences between groups ($p > 0.05$) (Table 3, Figure 2).

Table 3. Odi and Rmdq Scores over Time

Time Point	ODI CEB (Mean ± SD)	ODI SNRB (Mean ± SD)	p-value	RMDQ CEB (Mean ± SD)	RMDQ SNRB (Mean ± SD)	p-value
Before Procedure	41.52 ± 8.29	41.21 ± 6.71	0.870	14.64 ± 2.91	14.12 ± 2.18	0.419
3 Weeks	20.00 ± 6.30	19.27 ± 3.31	0.560	9.91 ± 3.49	10.18 ± 2.66	0.722
6 Weeks	15.94 ± 6.21	16.18 ± 2.76	0.838	7.91 ± 3.55	8.15 ± 2.48	0.748
3 Months	13.70 ± 6.50	14.36 ± 2.98	0.594	6.85 ± 3.56	7.03 ± 1.98	0.798
6 Months	14.82 ± 14.13	13.09 ± 2.88	0.495	6.24 ± 3.60	6.27 ± 1.82	0.965

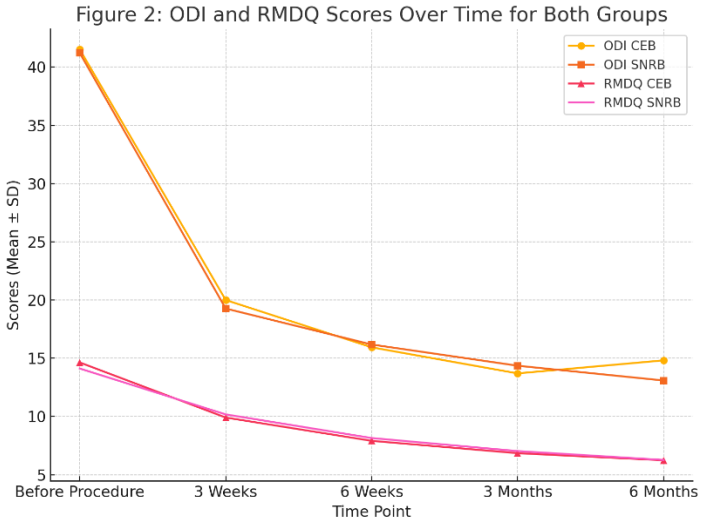

Figure 2. Odi and Rmdq Scores over Time for Both Groups

Complications and Adverse Events

No serious complications or adverse events were reported in either group during the study period. Minor side effects such as transient pain at the injection site were noted but resolved without intervention. One patient with a large herniated disc had developed transient urinary retention, which recovered spontaneously. She also had pain relief.

DISCUSSION

This study demonstrates that both SNRB and CEB are effective in reducing pain and improving functional outcomes in patients with single-level lumbar intervertebral disc prolapse-induced radiculopathy over six months. Significant reductions in VAS, ODI, and RMDQ scores within each group align with previous research indicating the efficacy of epidural steroid injections in managing lumbar radiculopathy [15,16].

Despite significant improvements, no significant differences were found between the SNRB and CEB groups at any follow-up point. This finding suggests that both techniques are equally effective, consistent with other comparative studies [17]. The lack of superiority may be attributed to the similar pharmacological effects of corticosteroids and local anesthetics used in both procedures [18].

SNRB offers targeted therapy, beneficial for diagnostic purposes and when precise localization of the affected nerve root is possible [19]. Conversely, CEB provides broader medication distribution, advantageous in cases with diffuse symptoms or multiple nerve root involvement [20].

The choice between SNRB and CEB may depend on individual patient factors, practitioner expertise, and resource availability. Considering the comparable efficacy, factors such as procedural complexity, duration, cost, and patient preference should guide intervention selection.

Limitations of this study include the relatively small sample size and short follow-up duration. Longer-term studies with larger populations are necessary to determine if effects persist and to assess any delayed complications or recurrences.

CONCLUSION

Both Selective Nerve Root Block and Caudal Epidural Block are effective interventions for managing pain and improving function in patients with single-level lumbar disc prolapse-induced radiculopathy. The absence of significant differences suggests that either technique can be selected based on individual patient needs and clinical judgment.

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