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Effect of Epidural Steroid Injection and Selective Nerve Root Block in Low Back Pain: A Comparative Study

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Abstract

Background: *Low back pain with radiculopathy due to lumbar disc herniation is a common cause of disability. Epidural steroid injection (ESI) and selective nerve root block (SNRB) are two commonly used interventional pain management techniques. This study aimed to compare the efficacy of ESI and SNRB in relieving pain and improving functional outcomes in patients with lumbar radiculopathy.*

Methods: *This randomized comparative study was conducted at the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from November 2018 to September 2019. A total of 66 patients with prolapsed lumbar intervertebral discs and radiculopathy were randomly assigned to receive either ESI or SNRB using a combination of long-acting steroid and local anesthetic. Pain intensity and functional disability were assessed using the Visual Analogue Scale (VAS) and the Roland Morris Disability Questionnaire (RMDQ) at baseline, one week, three weeks, one month, three months, and six months post-intervention. Muscle power was assessed using the Medical Research Council (MRC) grading system.*

Results: *Both groups showed significant improvement in pain and function; however, the SNRB group demonstrated greater and sustained improvement at all follow-up points. The mean VAS and RMDQ scores were significantly lower in the SNRB group compared to the ESI group ($p<0.05$). Improvement in muscle power was also superior in the SNRB group.*

Conclusion: *Selective nerve root block provides better short-term and midterm pain relief and functional recovery than epidural steroid injection in patients with lumbar disc herniation with radiculopathy.*

Keywords: *Low back pain, Roland Morris Disability Questionnaire (RMDQ), Epidural steroid injection (ESI), Selective nerve root block (SNRB).*

1. Introduction

Low back pain (LBP) is a common issue that most people encounter at some point in their lives. The majority of cases progress from an acute state to a chronic episode, significantly impacting individuals, families, communities, governments, and businesses globally.[1]

Despite its substantial burden, LBP is often underestimated. LBP is the leading cause of activity limitation and work absence worldwide.[2] Thirty years ago, LBP was primarily considered a problem of Western nations, but research now shows that low and middle-income countries also face significant challenges due to LBP.[3] According to Qaseem et al. (2017), LBP is classified as acute, sub-acute, and chronic when it lasts less than four weeks, four to twelve weeks, and more than twelve weeks, respectively.[4] Asians, particularly those in rural areas, are more prone to suffer from LBP, which plays a crucial role in restricting daily activities. In Bangladesh, the prevalence of LBP is notably high, with a significant association with activities involving bending and twisting movements.[5] LBP affects people of all ages, from young children to the elderly, and is a frequent reason for medical consultations.

The 2010 Global Burden of Disease Study ranked LBP among the top 10 diseases and injuries causing the most Disability Adjusted Life Years (DALYs) globally.[2] Conservative treatments such as physical therapy and medication are often the first line of management. However, when these fail, minimally invasive procedures like epidural steroid injections (ESI) and selective nerve root blocks (SNRB) are employed.[6] Both ESI and SNRB are popular interventional treatments for back pain. They are essential practices in image-guided spine pain management, beneficial for conditions such as radiculopathy, spinal stenosis with neurogenic claudication, and axial pain.[7] The success rate of lumbar disc surgeries, which can sometimes follow these interventions, varies significantly from 49% to 95%.[8] However, complications can arise, such as Cushing's syndrome and adrenal suppression following ESI.[9] Comparative studies, such as those by Ghosh et al. (2020), have demonstrated that transforaminal epidural injections (TFEI) offer superior pain relief and functional outcomes compared to SNRB.[10] Similarly, Singh et al. (2017) found that caudal epidural block provided better long-term pain relief and functional improvement than SNRB.[11] These findings underscore the need for further research, particularly in populations like Bangladesh, to optimize treatment protocols and improve patient outcomes.

Epidural steroid injections work by reducing inflammation around the spinal nerves, thereby alleviating pain. This procedure typically involves the injection of corticosteroids into the epidural space, providing both diagnostic and therapeutic benefits.[12] On the other hand, selective nerve root blocks involve targeted delivery of anesthetics and steroids to specific nerve roots, which can be particularly beneficial for localized nerve irritation.[13] This method, although technically more demanding, can offer precise pain relief and diagnostic clarity.[14] In conclusion, understanding the comparative effectiveness of ESI and SNRB is crucial for enhancing LBP management, particularly in diverse populations such as those in Bangladesh. This study aims to fill existing research gaps and provide evidence-based guidance for clinical practice.

2. Materials and Methods

This randomized comparative study was conducted at the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from November 2018 to September 2019. This study involved sixty-six patients with prolapsed lumbar intervertebral discs and radiculopathy, who were randomly assigned to receive either selective nerve root blocks or epidural steroid injections. Patients, or their next of kin, were informed about the disease, intervention, outcome, and prognosis, and all provided written informed consent. Before the intervention, patients were instructed on how to assess their functional status using the Roland Morris Disability Questionnaire (RMDQ) and the Visual Analogue Scale (VAS), which ranges from 0 (no pain) to 10 (worst pain). Post-intervention, clinical and neurological evaluations were conducted. Higher RMDQ scores indicated greater disability and significant changes in VAS scores were defined as those differing by more than 50% from baseline. Rescue medications, including tramadol and paracetamol, were administered as needed. Follow-ups occurred weekly, every three weeks, monthly, and every six months, either via phone or in-person visits. Patients were also guided in performing Activities of Daily Living (ADLs) and closely supervised by their guardians to

avoid confounding errors. Statistical analyses were performed using SPSS version 23.0, with descriptive analysis conducted for all datasets. Mean values were determined for continuous variables, and frequencies and percentages were used for quantitative observations. The unpaired Student's t-test was used for continuous variables, while the chi-square and Fisher's exact tests were applied to categorical data. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

The demographic characteristics of the patients in the two studied groups, the ESI group and the SNRB group, were compared. The average age of patients in the ESI group was 47.9±7.2 years, while in the SNRB group, it was 50.6±5.6 years, with no significant difference between the groups (p=0.093). The mean height was 156.9±4.1 cm for the ESI group and 158.1±3.2 cm for the SNRB group, again showing no significant difference (p=0.189). Similarly, the mean weight of the ESI group was 58.9±4.9 kg compared to 61.1±4.5 kg in the SNRB group, with no significant difference (p=0.062). Regarding sex distribution, the ESI group consisted of 22 males (66.7%) and 11 females (33.3%), whereas the SNRB group had 27 males (81.8%) and 6 females (18.2%), with no significant difference (p=0.159). Occupational status was also comparable between the two groups.

In the ESI group, 16 patients (48.5%) were in service, 2 (6.1%) were in business, 8 (24.2%) were manual workers, and 7 (21.2%) were categorized as others. In the SNRB group, 19 patients (57.6%) were in service, 3 (9.1%) were in business, 7 (21.2%) were manual workers, and 4 (12.1%) were in the other category. There was no significant difference in occupational status between the two groups (p=0.758).

Table 1. *Demography of patients in two studied groups (n=66)*

Variable / Groups	ESI Group n=33	SNRB group n=33	P value
Age (years)	47.9±7.2	50.6±5.6	[a]0.093[ns]
Height (cm)	156.9± 4.1	158.1±3.2	[a]0.189[ns]
Weight (kg)	58.9±4.9	61.1±4.5	[a]0.062[ns]
Sex			
Male	22 (66.7)	27 (81.8)	[b]0.159[ns]
Female	11 (33.3)	6 (18.2)	
Occupational status			
Service	16 (48.5)	19 (57.6)	[b]0.758[ns]
Business	2 (6.1)	3 (9.1)	
Manual workers	8 (24.2)	7 (21.2)	
Others	7 (21.2)	4 (12.1)	

ns= non-significant

The distribution of muscle power after the intervention, measured using the Medical Research Council (MRC) grade, differed significantly between the ESI and SNRB groups. In the ESI group, 20 patients (60.6%) had muscle power graded as III, and 13 patients (39.4%) had muscle power graded as IV. There were no patients in the ESI group with muscle power graded as 0, I, II, or V.

Conversely, in the SNRB group, all 33 patients (100.0%) had muscle power graded as V. There were no patients in the SNRB group with muscle power graded as 0, I, II, III, or IV.

Table 2. *Distribution of the study patients by muscle Power after intervention using MRC grade (n=66)*

Muscle Power	ESI Group n=33	SNRB Group n=33
Grade 0	0(0.0)	0(0.0)
Grade I	0(0.0)	0(0.0)
Grade II	0(0.0)	0(0.0)
Grade III	20 (60.6)	0(0.0)
Grade IV	13(39.4)	0(0.0)
Grade V	0(0.0)	33 (100.0)

Values are expressed as parenthesis in percentage over raw total

The Visual Analogue Scale (VAS) scores for pain were measured at various time points pre- and post-intervention in both the ESI and SNRB groups. Initially, the pre-treatment VAS scores were comparable between the ESI group (8.65±0.8) and the SNRB group (8.01±0.6), with no significant difference (p=0.146). After one week, the VAS scores showed a significant

reduction in both groups, with the ESI group at 7.65±0.6 and the SNRB group at 6.85±0.6, indicating a significant difference in favor of the SNRB group (p=0.001). This trend continued at the three-week mark, where the ESI group had a VAS score of 5.45±0.6 compared to 4.83±0.7 in the SNRB group (p=0.001). At one month post-intervention, the VAS scores were 5.25±0.6 for the ESI group and 4.55±0.9 for the SNRB group, showing continued significant improvement in the SNRB group (p=0.001). This significant difference persisted at three months, with the ESI group scoring 4.96±0.7 and the SNRB group scoring 4.25±0.9 (p=0.001). At the six-month follow-up, the VAS scores further decreased to 4.65±0.6 in the ESI group and 3.98±0.7 in the SNRB group, maintaining a significant difference (p=0.001) favoring the SNRB group.

Table 3. *Distribution of the study patients by VAS score (n=66)*

VAS score	ESI Group n=33	SNRB Group n=33	P value
Pre-treatment	8.65±0.8	8.01±0.6	0.146^{ns}
After 1 week	7.65±0.6	6.85±0.6	0.001^{s}
After 3 weeks	5.45±0.6	4.83±0.7	0.001^{s}
After 1 month	5.25±0.6	4.55±0.9	0.001^{s}
After 3 months	4.96±0.7	4.25±0.9	0.001^{s}
After 6 months	4.65±0.6	3.98±0.7	0.001^{s}

Values are expressed as parenthesis in percentage over raw total

Initially, the pre-treatment VAS scores were high and similar in both groups, with the ESI group averaging 8.65 and the SNRB group 8.01. After one week of treatment, the VAS scores decreased in both groups, but the reduction was more pronounced in the SNRB group (6.85) compared to the ESI group (7.65).

This trend of greater pain reduction in the SNRB group continued at subsequent follow-ups. After three weeks, the VAS scores further decreased to 5.45 in the ESI group and 4.83 in the SNRB group. After one month, the scores were 5.25 for the ESI group and 4.55 for the SNRB group.

At the three-month follow-up, the VAS scores were 4.96 for the ESI group and 4.25 for the SNRB group. Finally, after six months, the scores further decreased to 4.65 in the ESI group and 3.98 in the SNRB group.

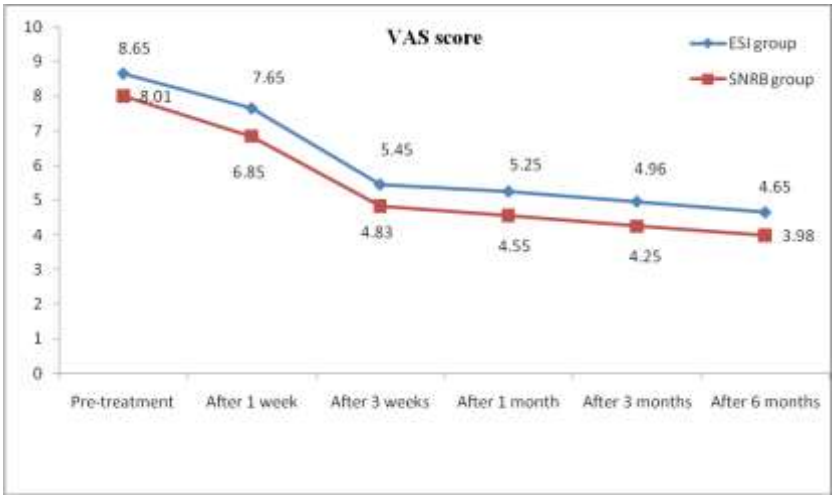

Figure 1. *Mean VAS score of the study patients by different follow up in two group (n=66)*

4. DISCUSSION

Appropriately managing low back pain can be difficult, especially since the idea of an intervertebral disc prolapse only simplifies the issue.

The demographics of the ESI group and the SNRB group in this study were statistically similar in terms of age, sex, and weight (p>0.05); the chi-square test was used to assess sex and occupation, and the unpaired student's t-test was used to assess age, height, and weight. Over half of the patients in both groups were service holders, and the majority of the patients were male. Because the male-to-female ratio and sedentary work habits, this may affect the disease process. However, because of the etiology of the disease, it did not materially change the study's outcome. The Medical Research Council (MRC) muscle power scale was used to measure muscle power in this study. Before the intervention, every patient who was enrolled possessed grade

V muscle power. Thirteen patients were grade IV and twenty patients were grade III following intervention in the ESI group. This occurred as a result of the bupivacaine dose-related blockage of motor function. However, all patients had grade V muscle power. This resulted from the tiny dosage of bupivacaine that was administered. Both the ESI group and the SNRB group saw an increase in the mean Straight Leg Raising Test (SLRT) value following the intervention; however, the difference between the two groups was not statistically significant ($p>0.05$).On the other hand, SLRT increased after the intervention in each group which was statistically significant ($p<0.05$) because of the effectivity (reduce pain) of the interventions. This study showed that the mean Visual Analogue Scale (VAS) score after intervention in both groups gradually decreased in subsequent follow-ups of 1 week, 3 weeks, 1 month, 3 months, and 6 months, which was statistically significant ($p <0.05$).

However, improvement was more significant in the SNRB group than in the ESI group. In the SNRB group, drugs were put adjacent to the nerve root & dorsal root ganglia and action was more prompt and accurate. But in the case of the ESI group drugs were deposited at the epidural space and it acted by diffusion to the nerve root at the dural ink cuff zone. So pain relief was more significant in the SNRB group than ESI group. In a similar study Schaufele et al. (2006) found that, at six months after the procedure, the VAS score improvement in the selective nerve root group was statistically significant ($p<0.01$) compared to the epidural steroid injection group.[15] The current study found that, in the following follow-up periods of one week, three weeks, one month, three months, and six months, the mean RMDQ score in both the ESI and SNRB groups gradually decreased.

This difference was statistically significant ($p <0.05$) between the two groups. However, because of the increased functional status following the SNRB technique's treatment of the affected nerve root, the SNRB group's improvement was greater than that of the ESI group. There is a constriction in the line diagram at the follow-up of 3 weeks, because RMDQ is comprised of 24 questionnaires and some questions are related to disability. So any answer to the questions that are not related to pain also influences in RMDQ score which was reflected in the results of the present study. In a study conducted by Arun-Kumar et al. (2015), patients in the selective nerve root block group showed a significant improvement in their functional status and disability after three months using the RMDQ score.[16] They also used the RMDQ score to monitor the functional outcome in patients in the selective nerve root block group for up to six months. They found a significant improvement in the functional activity. According to Riew et al.'s 2006 study, corticosteroid injections were effective for up to thirteen to twenty-eight months when used in conjunction with selective nerve root block (SNRB) for the treatment of lumbar radicular pain and followed up for five years, and refrained from having surgery for a minimum of a year following a selective nerve root block.[17] Every other study was combined with a three- to six-month follow-up period.

5. Limitations of the Study

This study was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. The follow-up period was limited to six months, so long-term outcomes could not be evaluated. Additionally, blinding of participants and clinicians was not possible due to the nature of the procedures, which may introduce bias. Variations in injection technique or drug spread could also have influenced the results.

6. Conclusion

Under the conditions of the present study, it has been concluded that selective nerve root block is an interventional method of pain management with better short-term and midterm pain relief and improvement of functional disability than epidural steroid injection in the case of lumbar intervertebral disc herniation with radiculopathy.

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