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THERPEUTIC EFFECT OF PERIPHERAL NERVE BLOCK AND TRANSFORAMINAL SELECTIVE NERVE BLOCK FOR MANAGEMENT OF LUMBOSACRAL RADICULAR PAIN: A COMPARATIVE STUDY

Orthopaedics

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ABSTRACT

Introduction: Lumbosacral radicular pain is characterized by a radiating pain in lumbar or sacral dermatomes ,which may or may not be accompanied by other radicular irritation symptoms and/or symptoms of decreased function.Radiculopathy can cause radicular pain, weakness, impaired sensation and trouble controlling particular muscle groups. Intervertebral disc prolapses, degenerative spondylolisthesis, and spinal canal stenosis can also cause it. **Aim:** To compare the therapeutic efficacy of peripheral nerve block (sodium channel block) with Transforaminal selective nerve block for management of lumbosacral radicular pain. **Methodology:** A comparative analytical, cross-sectional study where all 80 patients between the 18 – 75 age group who were suspected of lumbosacral pain with radiculopathy on the clinical and radiological grounds presenting as per the inclusion and exclusion criteria during the study period were included and divided into two equal groups, i.e., Group P (peripheral nerve block) and Group T (Transforaminal selective nerve block). Results: The study compared Group P (n=40) and Group T (n=40) for managing lumbosacral radicular pain, it was found that, there were no significant differences in chief complaints (72.50% vs. 60.00% lumbosacral pain with radiculopathy), pain distribution (p=0.4223), VAS scores over follow-up (p>0.05 for all), SLRT measurements (p>0.05), ODI scores (p>0.05), with complications. **Conclusion:** Both treatments are safe, cost- effective, and reliable. Both procedures provide significant relief from radicular pain in lower limbs for upto 6 months of duration.But peripheral nerve block can be performed in OPD, while transforaminol block needs c-arm and operation theater as a day care OPD or indoor procedure..

KEYWORDS

Lumbar radicular pain, paraesthesia, sodium channel blocker, transforaminal selective nerve block, VAS score.

INTRODUCTION

Lumbosacral Radicular Syndrome (LRS), known as sciatica, manifests with lower back pain radiating into the lower extremities along specific dermatomes, often originating from lumbar levels L4-L5 and L5-S1. [1] In the Indian population, lumbosacral radiculopathy affects 1% to 4.3%, while low back pain prevalence, with or without radiculopathy, is reported at 23.09% with a lifetime prevalence of 60-80%. [2,3] This condition typically results from nerve root compression due to lumbar disc prolapse (LDP) or foraminal stenosis. [4,5] Radicular pain, characterized by symptoms like numbness, tingling, and muscle weakness, is primarily caused by herniated discs in 90% of cases, with other rare causes including foraminal stenosis, inflammation, cysts, tumors, and nerve root injury [6,7]. Low back pain is classified based on duration,acute (<6 weeks), subacute (6–12 weeks), and chronic (>12 weeks), with up to 40% of patients experiencing symptoms beyond six weeks [8,9]. Sciatica, often managed conservatively, involves treatments like nonsteroidal anti-inflammatory drugs (NSAIDs), lumbar transforaminal epidural steroid injections (TFESI), and other modalities such as physiotherapy and rest. Surgery is considered urgent for acute cases with severe symptoms like paraplegia or bladder dysfunction. [10] Epidural injections, while popular, carry risks like neurological damage and abscess formation.[11] However a new modality in which we can administer peripheral nerve block for radicular pain or radiculopathy which blocks sodium channel with low dose of lignocaine at very low cost and without need of sterile condition like operation theater ,c-arm and flouroscopy[12] .

This study aims to compare the functional outcomes of peripheral nerve block (sodium channel block) with transforaminal selective nerve block in patients with lumbosacral radicular pain.

MATERIAL AND METHODS

This comparative, analytical cross-sectional study was conducted at the Tertiary Care Centre, Hind Institute of Medical Sciences & Hospital, Barabanki, Uttar Pradesh. The study spanned 18 months, with 12 months dedicated to data collection and 6 months to analysis. Ethical clearance was obtained from the Institutional Ethics Committee (HIMS), and written informed consent was secured from all patients prior to their participation. A total of 80 patients, suspected of having lumbosacral pain with radiculopathy based on clinical and radiological grounds, were included in the study. These patients were divided into two groups of 40 each, labelled Group P (peripheral nerve block) and Group T (Transforaminal selective nerve block).

Inclusion Criteria

Inclusion criteria encompassed patients with radicular pain that correlated with clinical and radiological findings, those aged 18-75 years, and patients experiencing persistent pain not relieved by medication for at least three weeks. Additional criteria included the presence of a prolapsed intervertebral disc with traversing and exiting nerve root evidenced by MRI, an average pain score of greater than 5 on a 10-point Visual Analogue Scale (VAS), and a positive Straight Leg Raise Test (SLRT) confirmed by the Lasegue test.

Exclusion Criteria

Exclusion criteria ruled out patients with sacroiliitis or similar pathologies that could produce false-positive SLRT results, those with renal failure, uncontrollable diabetes that could lead to adverse steroid effects, and those with cutaneous disorders around the injection site. Patients with neurological deficits, spinal instability, traumatic spine conditions, previous adverse reactions to lidocaine or contrast agents, poor general health that impeded regular hospital visits, bleeding or

coagulative disorders, previous spinal surgery, and pregnant patients were also excluded.

For data collection, detailed medical histories and significant clinical findings were documented for all patients. Each patient underwent a comprehensive examination, including clinical, neurological, and orthopaedic assessments. Diagnostic investigations involved blood tests, including viral markers, PT, APTT, and INR, alongside imaging studies such as X-ray and MRI. Before procedure patients were thoroughly informed about the study and the importance of the procedure for disease management, and written consent was obtained.

Transforaminal Seelctive Nerve Block

During the procedure, patients were positioned prone, and the entry site was localized under C-Arm guidance. Identify the nerve root with the help of kambin's right angled triangle. Kambin's triangle is a right angled triangle located dorsolaterally above the disc, where the height represents the dura or traversing nerve root, the hypotenuse signifies the exiting nerve root, and the base denotes the superior border of the caudal vertebra. [9,13] .

After scrubbing, cleaning, and draping the area, a local anaesthetic comprising 5 ml of 2% lidocaine diluted with 5 ml distilled water and 80 mg of triamcinolone was injected locally at particular nerve root.Conventionally, TFESI is administered around the involved nerve root, I.e. for a L4-5 paracentral disc herniation with L5 radiculopathy, the drug is administered around the exiting L5 root After procedure, patients were monitored for observation periods ranging from one hour to overnight, depending on their condition.

Peripheral Nerve Block(sodium Channel Block)

Nociceptors, which are pseudo-unipolar, allow local anesthetics to inhibit up-regulated channels at the nerve periphery, reducing pain by affecting both ends of the neuron equally. [14] Mechano-sensitization of the dorsal root ganglion or nerve root involves sodium channels, crucial in transmitting neuropathic and nociceptive pain signals. The mechanism of action of local anaesthetics (LAs) uses of the treatment of peripheral pain, through the blocking of the sodium channels useful in the axon conduction of sensory nerves. Even in the non-blocking concentration, LAs suppress oscillations of the resting membrane potential without significant sensory and motor blockage. Blocking these channels via peripheral nerve root block offers a novel treatment approach for lumbosacral radicular pain, targeting altered channel expressions responsible for generating inappropriate pain signals.

For L5 radiculopathy

1.5inch 22G needle was used to block Posterior tibial nerve. It was inserted just posterior to the pulse of posterior tibial artery or if not palpable midway between Achilles tendon and the posterior aspect of medial malleolus. 5 ml of 2% lidocaine diluted with 5 ml distilled water and 80 mg of triamcinolone was injected.

Block for S1 radiculopathy

Sural nerve block was given with 5 ml of 2% lidocaine diluted with 5 ml distilled water and 80 mg of triamcinolone was injected .Needle is inserted lateral to the tendon and is directed toward the lateral malleolus , local anesthetic is injected.

Statistical Analysis:

The information was input into Microsoft Excel and analysed utilizing version 26 of the statistical software SPSS (SPSS Inc., Chicago, IL, USA). When necessary, the continuous variables were assessed using the range value or the mean (standard deviation). Utilizing chi-square, the dichotomous variables were analysed in number/frequency format. In order to compare the means of two or more groups, the student t-test was utilized for analysis. By utilizing an analysis by variance (ANOVA) test, the means of two or more groups were compared.

Observation And Outcomes

Tables And Figures

Table-1: Clinico-demographic Parameters Of Enrolled Patients Among Group PAnd Group T

Clinico-demographics		GROUP- P [n=40]		GROUP- T [n=40]		P-VALUE
		N	%	N	%	
AGE	21-30	4	10.00%	5	12.50%	X=3.633
	31-40	17	42.50%	10	25.00%	p=0.4579
	41-50	8	20.00%	11	27.50%	
	51-60	5	12.50%	9	22.50%	
	61-71	6	15.00%	5	12.50%	
GENDER	Female	23	57.50%	28	70.00%	X=1.352
	Male	17	42.50%	12	30.00%	p=0.2449
CHIEF COMPLAINTS	Lumbosacral pain with radiculopathy	29	72.50%	24	60.00%	X=1.398 p=0.2371
	Lower back pain	11	27.50%	16	40.00%	
SITE OF RADIATING PAIN	B/L	11	27.50%	11	27.50%	X=1.724
	LEFT	17	42.50%	12	30.00%	p=0.4223
	RIGHT	12	30.00%	17	42.50%	

Table-2: Comparison Of Pain And Functional Outcomes Over Time Between Group P And Group T.

PAIN AND FUNCTIONAL OUTCOMES		GROUP- P [n=40]		GROUP- T [n=40]		P-VALUE
		MEAN	SD	MEAN	SD	
VAS	BEFORE PROCEDURE	8.15	1.05	8.20	1.09	t=0.2089 p=0.8350
	48TH HOUR	5.00	1.01	5.15	1.35	t=0.5627 p=0.5753
	2 WEEKS	4.15	0.83	4.20	1.18	t=0.2192 p=0.8271
	6 WEEKS	3.22	0.97	3.35	1.05	t=0.5752 p=0.5668
	3 MONTHS	2.25	0.67	2.30	0.72	t=0.3215 p=0.7487
STRAIGHT LEG TEST	BEFORE PROCEDURE	34.37	4.96	34.00	4.96	t=0.3336 p=0.7396
	48TH HOUR	51.00	7.78	52.25	7.33	t=0.7396 p=0.4618
	2 WEEKS	59.50	7.83	61.50	7.70	t=1.152 p=0.2529
	6 WEEKS	68.50	8.02	71.25	6.48	t=1.687 p=0.0956
	3 MONTHS	76.00	6.32	76.75	4.74	t=0.6004 p=0.5499
OSWESTRY DISABILITY INDEX	BEFORE PROCEDURE	30.65	8.50	32.00	7.96	t=0.7332 p=0.4656
	3 MONTHS	75.25	11.45	78.40	9.65	t=1.330 p=0.1872

Table-3: Distribution Of Patients As Per Invovled Nerve Roots Within Group-p And Group-t With Lumbosacral Radicular Pain.

DIAGNOSIS	GROUP-P [n=40]		GROUP-T [n=40]		P-VALUE
	N	%	N	%	X=2.15
L3L4	3	7.50%	4	10.00%	p=0.7065
L3L4, L4L5	5	12.50%	3	7.50%	
L4L5	4	10.00%	8	20.00%	
L4L5, L5S1	15	37.50%	13	32.50%	
L5S1	13	32.50%	12	30.00%	

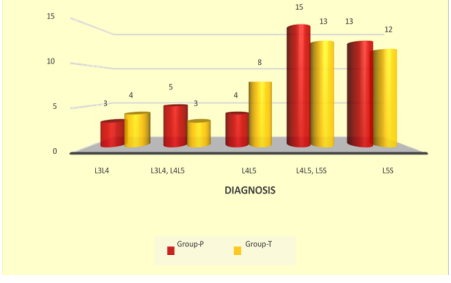

Figure1: Distribution of patients as per invovled nerve roots within Group-P and Group-T with lumbosacral radicular pain.

RESULTS

The age distribution between Group P and Group T was similar, with mean ages of 44.40±11.92 years and 46.10±11.73 years, respectively, showing no significant difference (p=0.5222). Gender distribution also showed no significant difference, with 57.50% of Group P and 70.00% of Group T being female (p=0.2449). Chief complaints were comparable, with 72.50% of Group P and 60.00% of Group T reporting

lumbosacral pain with radiculopathy (p=0.2371). [Table-1] Diagnoses across lumbar spine levels showed Group T had higher rates at L3L4 (10.00%) compared to Group P (7.50%). At L3L4-L4L5, Group P had 12.50% compared to Group T's 7.50%. For L4L5 combined with L5S1, Group P had 37.50%, slightly higher than Group T's 32.50%. At L5S1, Group T had 30.00% compared to Group P's 32.50%. The statistical analysis showed no significant difference between the groups (p=0.7065). [Figure-1] Pain distribution showed no significant differences between groups (p=0.4223); 27.50% in both groups had bilateral pain, with 42.50% left-side and 30.00% right-side in Group P, and 30.00% left-side and 42.50% right-side in Group T. Pre-procedure, the mean VAS score was 8.15 (SD=1.05) for Group P and 8.20 (SD=1.09) for Group T. Follow-up intervals showed no significant differences in VAS scores between the groups, suggesting comparable pain relief outcomes (p>0.05 for all comparisons). The mean SLRT measurements before the procedure were 34.37 (SD=4.96) for Group P and 34.00 (SD=4.96) for Group T (p>0.05). The mean ODI scores before the procedure were 30.65 (SD=8.50) for Group P and 32.00 (SD=7.96) for Group T. At the 3-month follow-up, scores improved to 75.25 (SD=11.45) for Group P and 78.40 (SD=9.65) for Group T, showing improvement without significant differences (p>0.05). [Table-2] The complications between Group T and Group P showed no significant differences. Group T had 5.00% with headaches (p=0.7401), 7.50% with transient lower limb weakness (p=0.1709), and 5.00% with hematoma formation (p=0.7094), compared to Group P with 7.50% headaches, 0.00% transient lower limb weakness, and 2.50% hematoma formation. [Figure-2]

DISCUSSION

In the present study, lumbosacral pain with radiculopathy was the chief complaint in both group P (72.50%) and T (60.00%), followed by lower back pain. Notably, these findings suggest a general similarity in lumbar spine diagnoses between Group-P and Group-T, implying potential shared factors influencing spinal health within both groups. Statistically, no significant difference was noted in the complaints (p=0.2371) and diagnosis (p=0.7065). The most common site of radiating pain in group P was left (42.50%), subsequent to the right (30.00%). On the contrary, in group T, right site was the prominent (42.50%), subsequent to the left (30.00%). Additionally, 27.50% of patients in each group had bilateral radiating pain and no substantial difference was noted in the site of pain among groups (p=0.4223). Comparatively, Adabala V et al. [13] included patients with radiculopathy-associated lower back discomfort, focusing solely on L5S1, similar to Adilay U et al. [14]. Kumar S et al. [16] included only patients with low back pain, unlike our study which considered radiculopathy with backache. Kumar M et al. [16] reported outcomes with lower limb radiculopathy and back pain, predominantly on the left side (51%). Kanaan T et al. [17] found low back pain and radiculopathy were common complaints (55.26%), with lumbar disc herniation most frequently at L4-L5 (42.11%). In the present study, the mean VAS score before procedure was 8.15±1.05 in group P and 8.20±1.09 in group T. The patients were followed up at 48th hour, 2 weeks, 6 weeks and 3 months. A gradual decrease was recorded among both groups and the VAS score was comparable in both groups. The VAS scores measured before the procedure and at various follow-up intervals (48 hours, 2 weeks, 6 weeks, and 3 months) showed no statistically significant differences between the two treatment groups at any of the time points (p>0.05 for all comparisons). Adabala V et al. [13] used the Numeric Rating Scale (NRS) to show a substantial decrease in pain from pre-block (8.8±0.99) to post-block (3.67±1.4) at week four. Kumar S et al. [15] observed pain reduction from 8.65±1.12 initially to 1.94±1.94 at three months, with the most significant change at two months. These studies consistently demonstrate significant pain relief across various interventions for lumbosacral radicular pain. In the present study, the mean SLRT measurements before procedure was 34.37±4.96 in group P and 34.00±4.96 in group T. A gradual increase was recorded among both groups and the measurements were comparable in both groups. At 3rd month, the SLRT measurement was 76.00±6.32 in group P and 76.75±4.74 in group T and no statistically significant differences between the two treatment groups at any of the time points (p>0.05) was noted. This finding is consistent with Kumar S et al. [15], who observed a progressive increase in SLR measurements over time, from re-injection to one-month follow-up, showing significant differences between the drug mixture and placebo groups at various intervals except at re-injection. In the present study, the mean ODI before procedure was 30.65±8.50 in group P and 32.00±7.96 in group T. At the 3-month follow-up, the mean ODI scores increased to 75.25±11.45 in Group P and 78.40±9.65 in Group T, reflecting an improvement in disability scores in both groups but without a significant difference between them. The results indicated no statistically significant differences between the two treatment groups at both baseline and the 3-month follow-up assessment (p>0.05). This finding aligns with Adilay U et al. [14], who reported significant reductions in ODI scores at various follow-up intervals. Khan J et al. [19] also documented decreased ODI scores from baseline to final follow-up. In our study Group P, most of the patients had transient lower limb weakness [3(7.50%)], while in Group T most of the patients had headache [2(5.00%)]. Hematoma formation at the injection site was observed in 2 patients of group T and 1 patient in group P. There was no serious complication such as epidural hematoma, infection, or arterial injection because sterility was maintained, and aspiration was performed consistently before administering the medicine. At the conclusion of one year of follow up, 62 patients benefited from steroid injection while 3 patients benefitted from surgery intervention after effect of block failed. Overall, both groups experienced comparable complication rates. Peripheral nerve block injections offer a straightforward outpatient option for acute low back pain management without fluoroscopy. However, direct comparison with selective nerve block techniques is lacking, highlighting the need for further research to establish superiority in managing lumbosacral radiculopathy. While peripheral nerve blocks show promise in pain reduction with minimal side effects, larger randomized trials with extended follow-ups are essential for comparison with existing therapies. Trans-foraminal injections done for radiculopathy have got well known side-effects,like allergic reactions, neurological deterioration, CSF leaks, , headache, hematomas, To prevent these side-effects sterile conditions with controlled environment like operation theater was needed, which indirectly increases the cost and duration of blocks .While peripheral nerve block can be administered in OPD and patient can sent home on the same day. Our study indicates favourable outcomes for both peripheral and selective nerve blocks in alleviating lumbosacral radiculopathy and improving disability scores.

CONCLUSION

The study provides valuable insights into the therapeutic effectiveness of peripheral nerve block (sodium channel block) versus transforaminal selective nerve block for managing lumbosacral radicular pain. The findings indicate that both interventions yield comparable outcomes in terms of pain relief, functional improvement, and diagnostic distribution. This underscores the importance of offering multiple treatment options to patients suffering from lumbosacral radicular pain, allowing healthcare providers to tailor interventions based on individual patient characteristics and preferences. However, the study has limitations, including a small sample size, being single-centric, and having a short follow-up period. Future research should involve larger, multicentre studies with longer follow-up periods to validate these findings and provide more comprehensive recommendations. Additionally, exploring patient-reported outcomes and long-term effectiveness can further enhance the understanding of these treatment modalities. Future studies should also focus on long-term efficacy, cost-effectiveness, and patient-reported outcomes, as well as explore novel techniques and optimize treatment protocols. These efforts aim to enhance patient care, improve quality of life, and reduce the burden of lumbosacral radicular pain on healthcare systems.

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