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RESEARCH ARTICLE
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"HEALING PATHWAYS IN LUMBAR DISC PROLAPSE: A PROSPECTIVE FUNCTIONAL COMPARISON BETWEEN EPIDURAL PRP AND STEROID INFILTRATION"

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ABSTRACT

Background: Lumbar disc prolapse is a prevalent cause of low back pain, particularly in adults under 45, often leading to disability and reduced quality of life. Among the many treatment options, epidural steroid injections (ESIs) have long been a standard non-surgical approach. Recently, platelet-rich plasma (PRP) therapy has emerged as a regenerative alternative with promising outcomes.

Objective: This prospective observational study aimed to compare the clinical effectiveness of epidural PRP versus steroid injections in patients diagnosed with lumbar disc prolapse, focusing on pain reduction and functional improvement.

Methods: Sixty patients with MRI-confirmed intervertebral disc prolapse were divided into two equal groups (n=30 each). Group S received interlaminar epidural steroid injections, while Group P received PRP prepared by double centrifugation. Pain and function were assessed using VAS, MODQ, NRS, and SLRT at baseline, 1, 3, and 6 months post-procedure.

Results: Both groups demonstrated significant improvements in pain scores and functional outcomes over time. While the PRP group showed slightly better gains in SLRT and ODI at six months, the differences between groups were not statistically significant. No complications were reported in the PRP group, whereas one patient in the steroid group experienced transient giddiness.

Conclusion: Both epidural PRP and steroid injections are effective in managing pain and improving function in lumbar disc prolapse. PRP offers a comparable, safe, and biologically regenerative alternative to steroids, especially in patients with comorbidities where steroids are contraindicated.

INTRODUCTION : Low back pain has become a major public health issue for people under 45 years. It is one of the main reasons for limit physical activities and is spreading in epidemic proportions various risk factors for developing spine pain may be physical, socio- economical, poor medical health, psychological state, occupational and environmental. These all factors contribute to

the risk of experiencing back pain. The origin of low back pain may be from spinal ligaments, spinal nerve roots, vertebral periosteum, facet joints, the paravertebral musculature and annulus fibrosus.1 The most common process is age-related degenerative processes in the vertebral discs and facet joints. In patients with Prolapsed Intervertebral Disc (PIVD), there is acute disc herniation causing mechanical compression of the nerve within the intervertebral foramina and an inflammatory response which causes swelling and direct neuronal activity.1

Epidural steroid injection has been widely accepted as a treatment for lumbar disc herniation, with its effectiveness proven by multiple researchers. The mechanism includes anti-inflammation, pain relief, and functional improvement. there are three different routes for steroid injection: interlaminar, transforaminal, and caudal route transforaminal fared better than the other two because it could reach targeted sites, namely spinal nerve, anterior epidural space and dorsal route ganglion, as well as the inflammation secondary to compression2

Rich Plasma (PRP) is a novel therapeutic tool of autologous nature which has strongly emerged in recent years due to successful therapeutic use in elite athletes. Many famous professional football players, Rafael Nadal and Tiger woods attribute, in part, their "miraculous" recoveries to the employment of this enigmatic treatment dubbed the "PRP phenomenon." The use of PRP treatment is quite common in rheumatology, orthopedics, and sports medicine congresses. Despite the controversy surrounding it, the treatment is effective and there is an apparent lack of side effects. Mostly PRP has been used for chronic enthesopaty and tendinopathy, including knee osteoarthritis. It has become one of the important tool for use of pain physician because of low cost, ease of use, and its apparent safety. In the spine, PRP has been applied to the intervertebral discs, the facet joints, ligaments, and for radiculopathies. Hence this study is done to compare the results between PRP and epidural steroid in PIVDP.

AIMS AND OBJECTIVES

- ❖ Pain relief
- ❖ To compare the functional outcome in patients with disc prolapse treated with epidural steroid injection or epidural PRP injection.

MATERIALS AND METHODS

STUDY DESIGN: A prospective observational Clinical Study

STUDY SETTING: PES institute of medical science and research , Kuppam. STUDY PERIOD: 18 months (September 2022 –February 2024)

STUDY POPULATION: Patients diagnosed and confirmed through mri with disc prolapse SAMPLING METHOD: prospective sampling

SAMPLE SIZE: 60 patients with two equal groups (Minimum of 30 in each group)

INCLUSION CRITERA:

- Age more than 18 years
- Back pain with or without radiculopathy due to intervertebral disc prolapse persisting for more than 3 months.
- Patients not treated conservatively or by physiotherapy
- Pain level on VAS more than 5

EXCLUSION CRITERIA:

- Any spinal deformity or fracture,
- Raised intracranial pressure,
- Bowel bladder involvement,
- Coagulation disorders,
- Fever,
- Local and systemic infection,

- All the contraindication for neuraxial blockade,

Patients meeting the above inclusion criteria presenting to PESIMSR OPD were selected for the study, patient were explained regarding both infiltration and were allotted in one group by chit method, Patients was informed about the planned procedure and its complications. Written consent was obtained for the same. patient details, investigations (cbc, rft, serum electrolytes), mri findings will be noted in both the groups that is epidural steroid injection group(group s) and epidural prp injection group (group P), nsaids are stopped 2 weeks prior to having prp injections in prp group and steroids are avoided in patients with uncontrolled dm2. Pain measured in the patient by using VAS score, Modified Oswestry disability questionaire, Numerical rating scale, SLRT will be assessed before the procedure.vitals before ,during and after procedure will be noted down, complications if any will be noted down. Immediate post-procedure patients will be assessed in the form of VAS Score, Modified Oswestry disability questionnaire (MODQ),Numerical rating scale(NRS),SLRT and will be clinically followed in opd at 1st,3rd, and 6th month by using the same in both the groups

PROCEDURE FOR STEROID INFILTRATION:

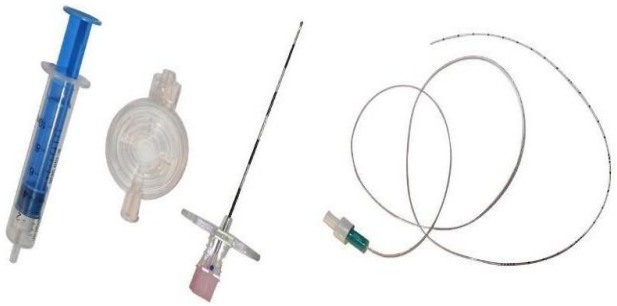
- Patient kept on npo and with proper iv fluids.
- Patient shifted to operating room monitors connected (pulse oximeter, nibp, ecg leads)
- Baseline hemodynamic variable noted and patient positioned
- Under aseptic precaution parts has been painted and draped,
- Local anesthesia was given.
- Epidural needle passed at the required level.
- Epidural space confirmed by loss of resistance method and hanging drop method
- For Steroid 1ml(40mg) kenacort given

PROCEDURE FOR PRP INFILTRATION

- Parts painted and draped under sterile conditions.
- Local anesthesia given
- Epidural needle passed at the required level
- Epidural space confirmed by negative suction and loss of resistance method and hanging drop method and 5 Ml PRP given

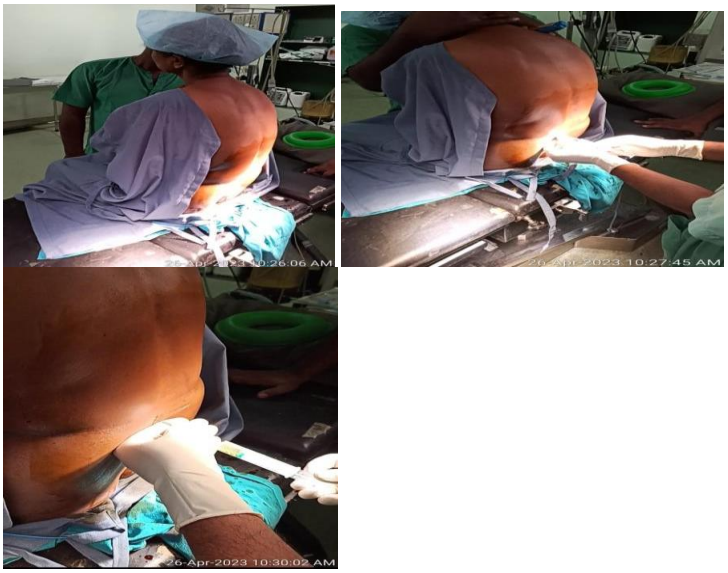
PRP PREPARATION

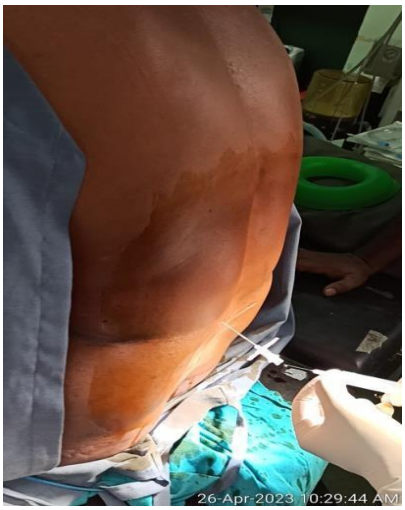
By double centrifugation method 2000 rpm for 15 minutes and then 3500 rpm for 8 minutes.
CENTRIFUGATION MACHINE



EPIDURAL SET

STEPS OF INJECTION





FigA Paint and drape,
Fig B local anesthesia
Fig C Epidural needle passed at required level,
Fig D PRP is given into epidural space

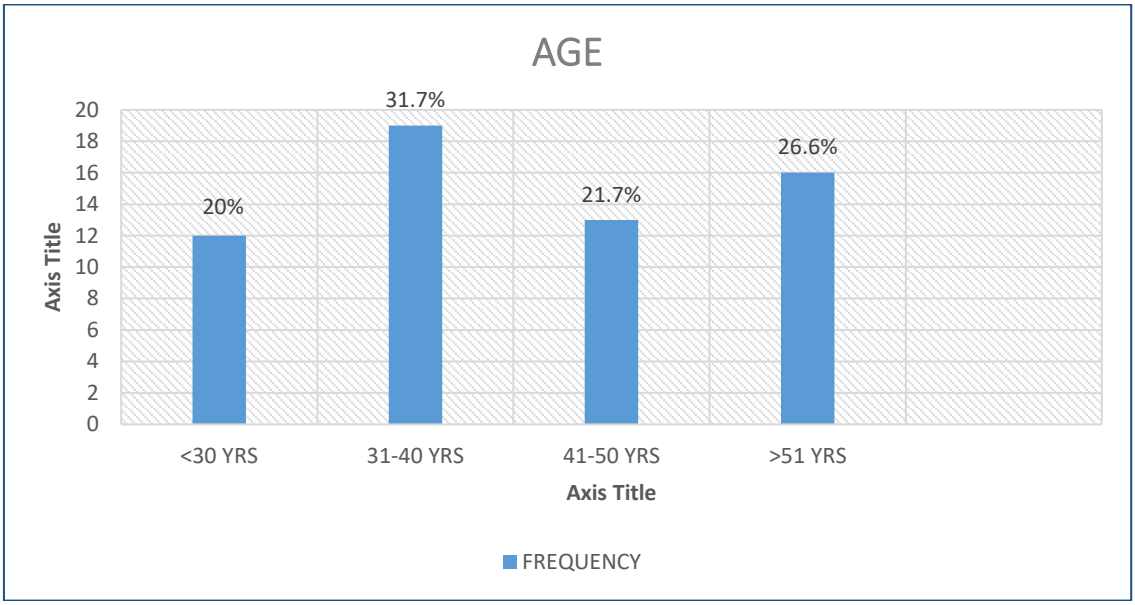
RESULTS

DATA ANALYSIS AND INTERPRETATION

The data was be entered into MS Excel 2019 version and further analyzed using SPSS (version 26.0; SPSS Inc. Chicago IL,USA) For descriptive analysis, the categorical variables will be analyzed by using frequency and percentages and the continuous variables will be analysed by calculating mean ± Standard Deviation. For inferential analysis, The numerical data were analyzed using the Paired and "t"-test. The categorical data were analyzed using Chi square test.'m will be applied and "p" <0.05 will be considered as statistically significant

TABLE 1: Distribution of study subjects according to Age

Age	Frequency	Percentage(%)
<30years	12	20.0%
31-40years	19	31.7%
41-50years	13	21.7%
>51years	16	26.6%
Total	**60**	**100%**



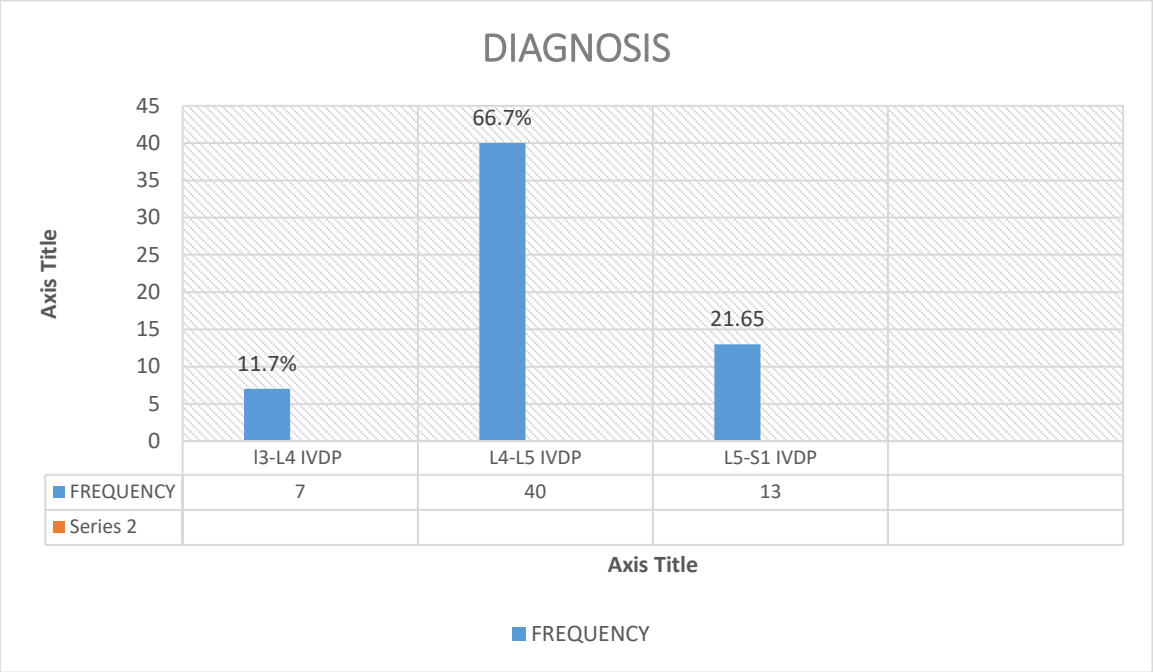
GRAPH 1 : Distribution of study subjects according to Age

In our study we found that most of the patients were above the age of 50 years.

Table 2: Distribution of study subjects according to Diagnosis

Diagnosis	Frequency	Percentage(%)
l3-l4 IVDP	7	11.7%
l4-l5 IVDP	40	66.7%
l5-s1 IVDP	13	21.6%
Total	**60**	**100%**

In our study we found that most of the cases were found to inter vertebral disc prolapse L4-L5.



GRAPH 2: Distribution of study subjects according to Diagnosis

Diagnosis	Group		X^2-value	'p' value
	PRP	STEROID		
l3-l4 ivdp	4 (13.3%)	3 (10.0%)	0.3198	0.852
l4-l5 ivdp	19 (63.3%)	21 (70.0%)		
l5-s1 ivdp	7 (23.3%)	6 (20.0%)		
Total	**30 (100%)**	**30 (100%)**		

TABLE 3: Association between the Diagnosis and Group of the Subjects

TABLE 4: Association between the Co morbidities and Group of the Subjects

Co morbidities (under control)	Group	
	PRP	STEROID
DIABETES MELLITUS 2	5 (16.6%)	1 (3.33%)
HYPERTENSION	2 (6.7%)	2 (6.8%)
DM2 & HTN	1 (3.3%)	0 (0%)
No	22 (73.3%)	27 (90.0%)
Total	**30 (100%)**	**30 (100%)**

TABLE 5: Association between the Complications and Procedure of the Subjects:

Complications	Group		X^2-value	'p' value
	PRP	STEROID		
Yes	0 (0%)	1 (3.3%)	1.0169	0.313
No	30 (100%)	29 (96.7%)		
Total	**30 (100%)**	**30 (100%)**		

Table 6: Comparison between the vasscore with group of the subjects.

VAS	Group		t-value	'p' value
	PRP Mean±SD	STEROID Mean±SD		
Pre_vas	6.3±0.7	6.3±1	0.000	1.000
Post_vas1month	4.5±1.1	4.2±1.0	0.9214	0.3606
Post_vas3months	2.8±0.9	2.5±0.9	1.3776	0.1736
Post_vas6months	1.5±0.5	1.5±0.8	0.1827	0.8557

GRAPH: Comparison between the vasscore with group of the subjects

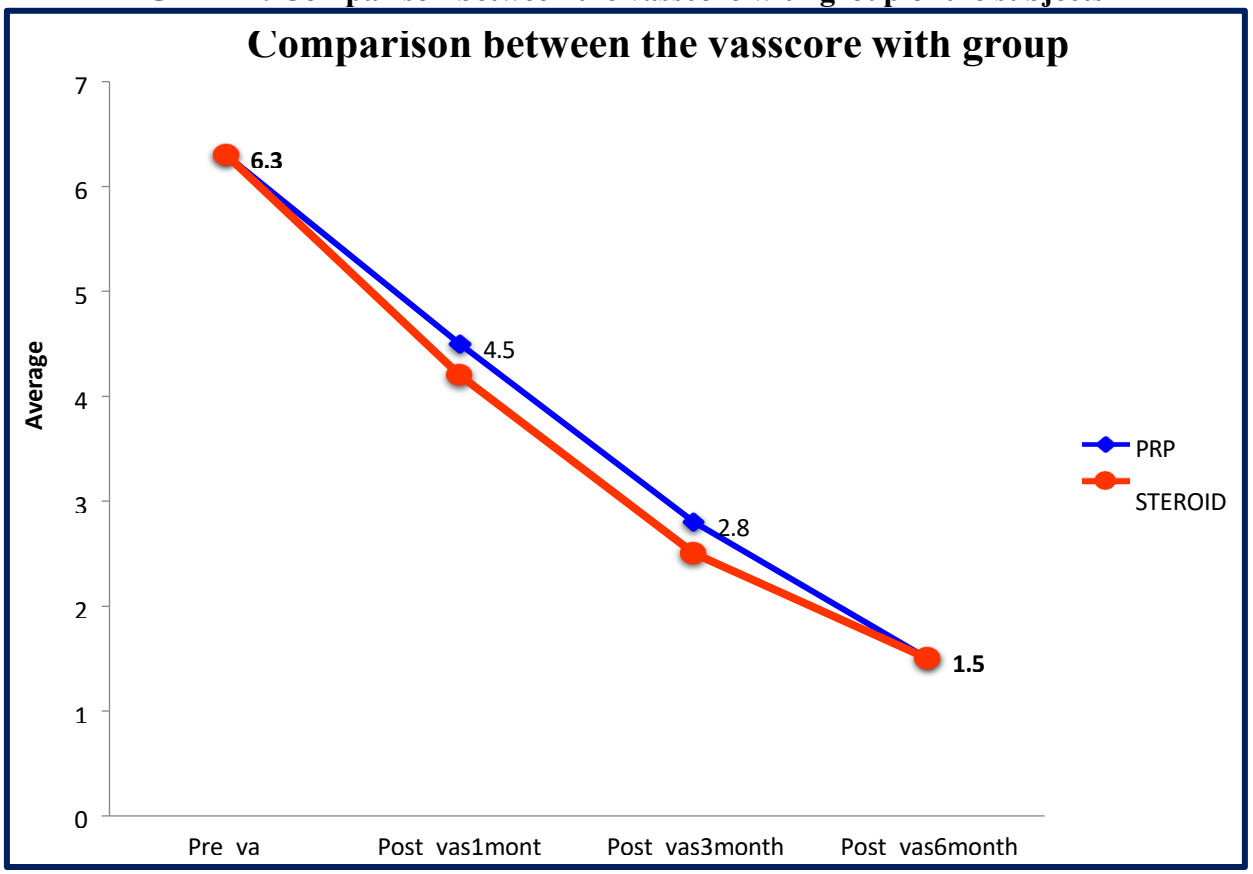


TABLE 7: Comparison between the modq with group of the subjects

MODQ	Group		t-value	'p' value
	PRP Mean±SD	STEROID Mean±SD		
Pre_modq	37.6±3.4	39.3±4.2	1.7102	0.0926
Post_modq1month	28.3±6.0	28.1±5.9	0.1511	0.8804
Post_modq3months	21.2±4.3	19.6±5.0	1.3117	0.1948
Post_modq6months	12±3.7	13.6±4.4	1.5844	0.1185

GRAPH: Comparison between the modq with group of the subjects:

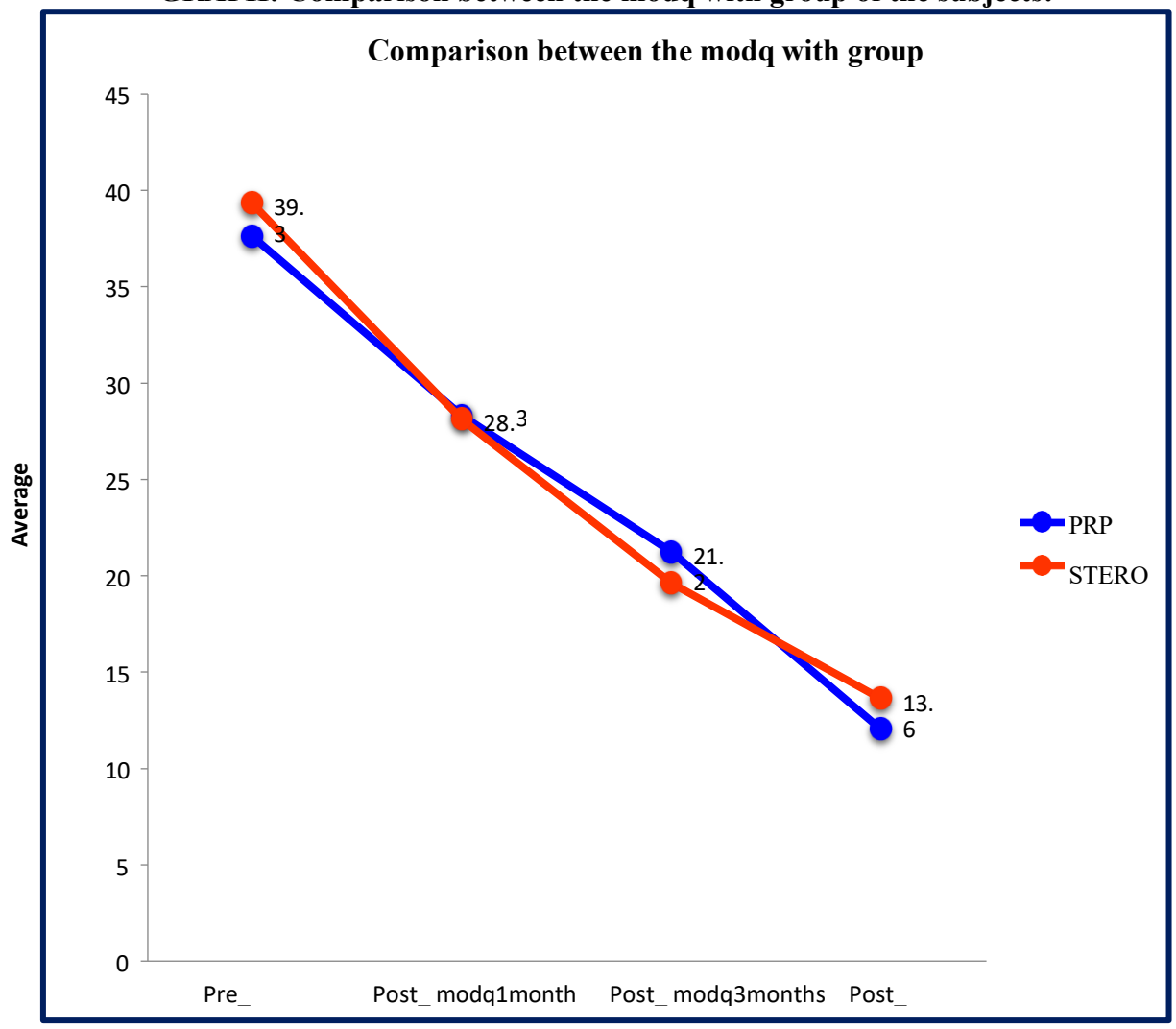


TABLE 8: Comparison between the slrt with group of the subjects:

slrt	Group		t-value	'p' value
	PRP Mean±SD	STEROID Mean±SD		
Pre_ slrt	60±9.8	58.3±12.3	0.5787	0.5650
Post_ slrt1month	69.3±10.8	71.6±13.1	0.7508	0.4558
Post_ slrt3months	80.0±8.7	79.3±11.7	0.2500	0.8035
Post_ slrt6months	84.6±7.7	80.6±9.8	1.7523	0.0850

GRAPH: Comparison between the slrt with group of the subjects:

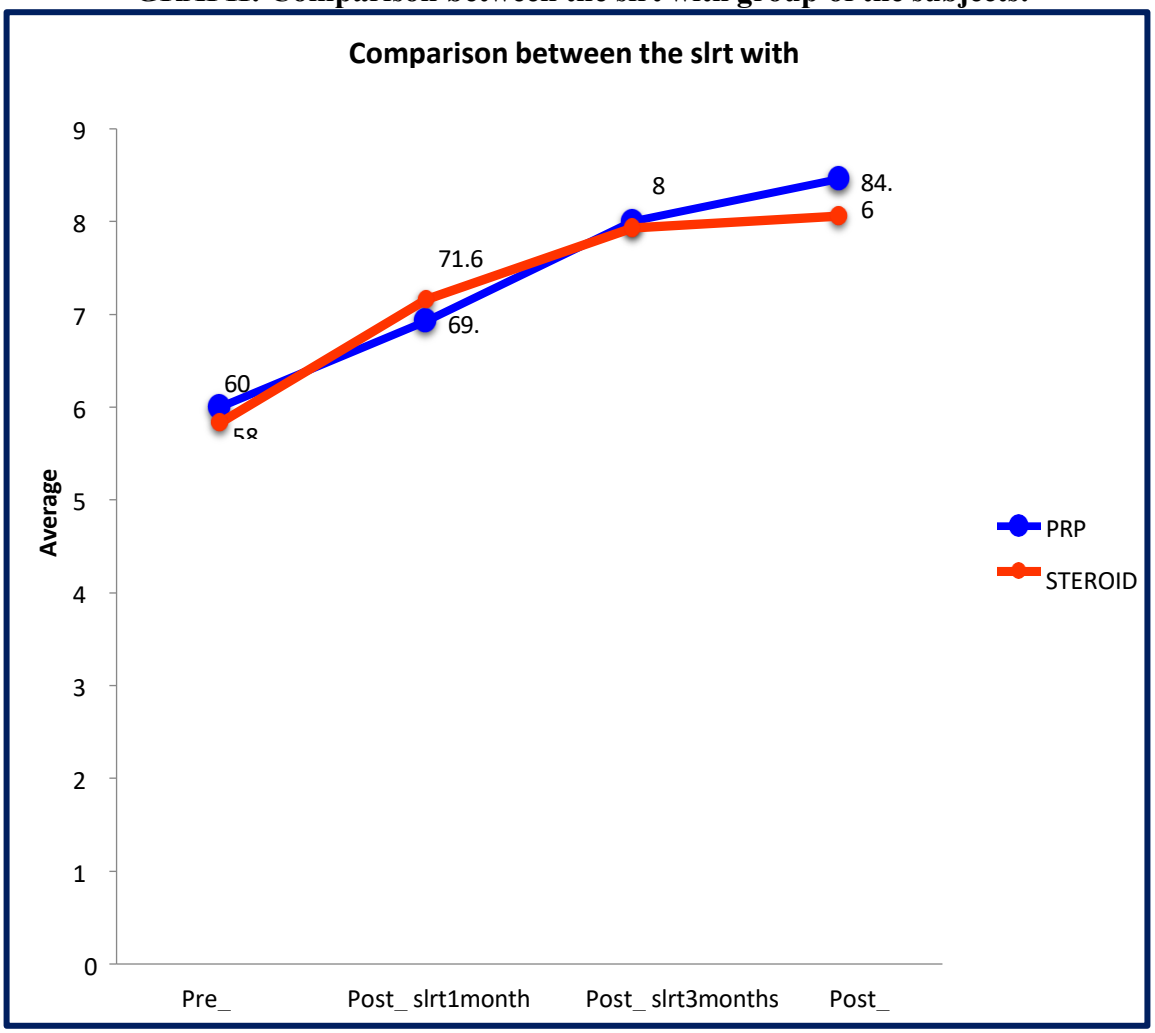
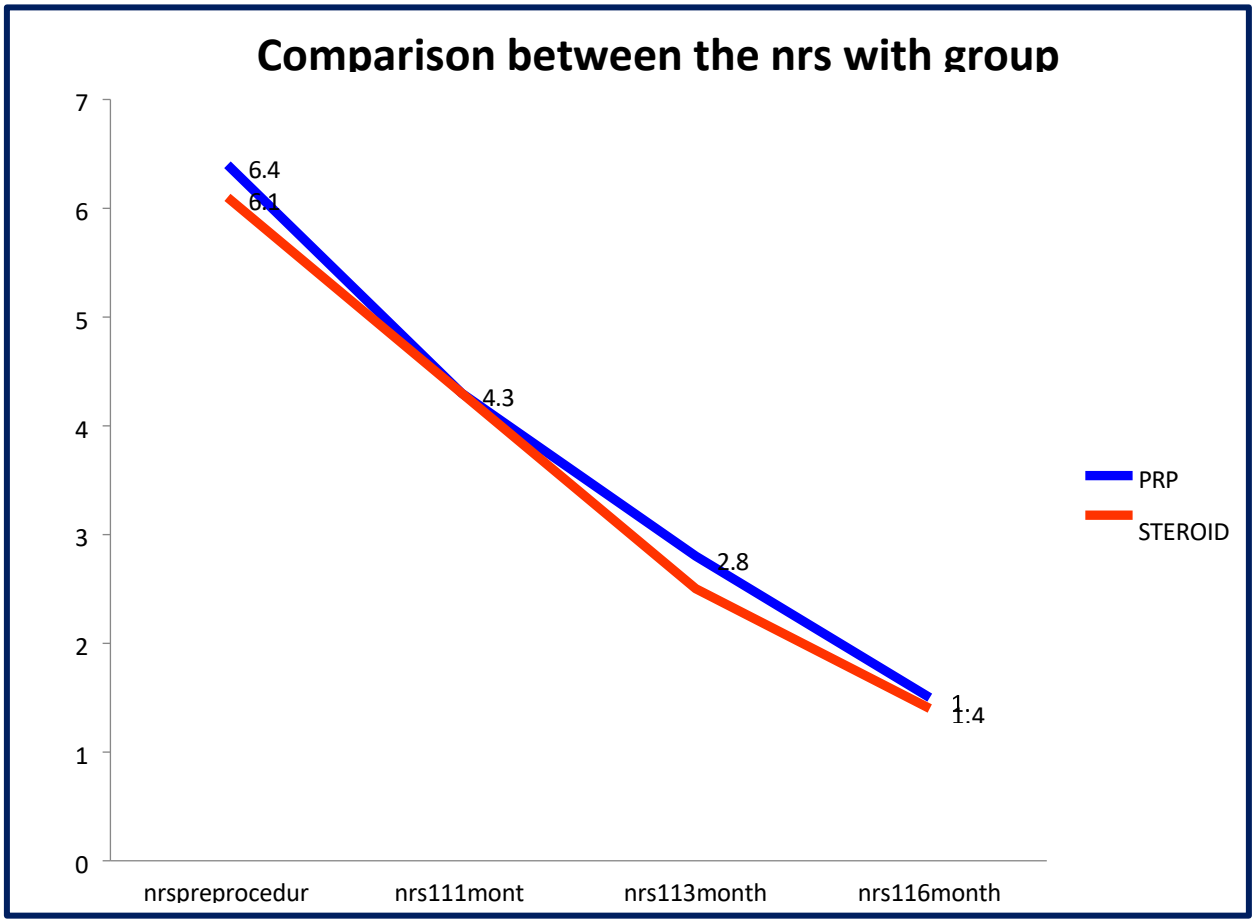


TABLE 9: Comparison between the nrs with group of the subjects

nrs	Group		t-value	'p' value
	PRP Mean±SD	STEROID Mean±SD		
nrspreprocedure	6.4±0.9	6.1±0.9	1.0957	0.2777
nrs111month	4.3±1.1	4.3±1.1	0.2267	0.8215
nrs113months	2.8±1.03	2.5±0.8	0.9529	0.3446
nrs116months	1.5±0.8	1.4±0.5	0.7337	0.4661



GRAPH: Comparison between the nrs with group of the subjects

Table 10: Association between the Diagnosis and Gender of the Subjects:

Diagnosis	Gender		X^2-value	'p' value
	Male	Female		
l3-l4 ivdp	2 (9.1%)	5 (13.2%)	11.6142	0.003*
l4-l5 ivdp	10 (45.4%)	30 (78.9%)		
l5-s1 ivdp	10 (45.5%)	3 (7.9%)		
Total	**30 (100%)**	**30 (100%)**		

TABLE 11: Association between the Diagnosis and Side of the Subjects.

Diagnosis	Side				X^2-value	'p' value
	B/L	LEFT	RIGHT	back		
l3-l4 ivdp	2 (18.2%)	3 (12.0%)	1(5.6%)	1 (16.7%)	3.7683	0.708
l4-l5 ivdp	8 (72.7%)	15 (60.0%)	14 (77.8%)	3 (50.0%)		
l5-s1 ivdp	1 (9.1%)	7 (28.0%)	3 (16.7%)	2 (33.3%)		
Total	**11 (100%)**	**25 (100%)**	**18 (100%)**	**6 (100%)**		

DISCUSSION

Mechanism of Action

Steroid Injections

Epidural steroid injections (ESIs) are widely used for managing radicular pain due to intervertebral disc herniation. Their mechanism primarily revolves around controlling the inflammatory cascade triggered by disc material or mechanical irritation of nerve roots.

Firstly, steroids inhibit the release of chemical mediators such as phospholipase A2, which are commonly secreted by degenerated or herniated discs. These mediators can activate nociceptive nerve endings, contributing to pain generation. By limiting their release, steroids help dampen the initial pain signaling pathway.

Secondly, steroids suppress the synthesis of inflammatory mediators like prostaglandins and leukotrienes. These substances play a crucial role in promoting inflammation, vasodilation, and sensitization of peripheral nerves. Their suppression leads to reduced neuroinflammation and subsequently, decreased pain perception.

Thirdly, steroids inhibit ectopic neuronal discharges and spontaneous firing from sensitized or compressed nerve roots. This reduction in aberrant nerve signaling plays a vital role in controlling chronic neuropathic pain associated with radiculopathy.

Platelet-Rich Plasma (PRP)

Platelet-rich plasma (PRP) is an autologous concentrate of platelets suspended in a small volume of plasma. It has gained attention as a regenerative treatment for discogenic pain and degenerative spine conditions. The exact mechanism remains under investigation, but multiple biological effects have been proposed:

PRP promotes healing by releasing a multitude of growth factors, including vascular endothelial growth factor (VEGF), transforming growth factor-beta (TGF-β1), platelet-derived growth factor (PDGF), epidermal growth factor (EGF), basic fibroblast growth factor (bFGF), insulin-like growth factor (IGF), hepatocyte growth factor (HGF), and connective tissue growth factor (CTGF). These bioactive molecules stimulate cell proliferation, angiogenesis, matrix synthesis, and tissue regeneration.

Additionally, cytokines and chemokines released by platelets play a critical role in modulating inflammation. While they help in recruiting reparative cells, they also inhibit excessive leukocyte infiltration through anti-inflammatory cytokines, helping maintain a balanced healing environment.

PRP may also contribute to mechanical repair. Like in skin wound healing, where platelets pull wound edges together, it has been postulated that PRP can help approximate torn annular fibers in intervertebral discs. However, the avascular nature of the disc limits PRP's healing capacity compared to vascularized tissues like skin.

A variety of in vitro, in vivo, and clinical studies have demonstrated PRP's efficacy in improving disc height, hydration, and extracellular matrix integrity, paving the way for human trials and clinical use.

Clinical Profile and Observations

In our study, intervertebral disc prolapse was most commonly seen in individuals aged 31–40 years (31%), followed by >51 years (26.6%). A female predominance (63.3%) was noted. These findings are in line with other studies such as those by Viet Thyang Le et al., where female patients outnumbered males, and gender was found to be a significant risk factor.

The L4–L5 level was the most frequently involved segment, consistent with the high mobility and biomechanical stress at this junction. Among 60 patients, 14 presented with sensory deficits and 4 with motor deficits. Post-treatment, improvements were seen in sensory symptoms, and one of four patients showed motor improvement.

A study by Zhen Xu et al. also demonstrated significant improvements in pain, nerve repair, and spinal function using ultrasound-guided transforaminal PRP and steroid injections, further validating our observations.

Safety and Complications

All patients underwent pre-procedural investigations including CBC, renal function tests, and serum electrolytes. Comorbid conditions such as diabetes and hypertension were screened, and steroids were avoided in these patients, with PRP preferred due to its better safety profile.

In our cohort, no adverse effects were noted in PRP-treated patients. In contrast, one steroid-treated patient experienced giddiness approximately 6 hours post-procedure, which resolved without intervention.

A meta-analysis by Standiford Helm et al. (2021) reviewing 66 studies on transforaminal ESI reported that the majority of RCTs found the procedure to be safe. The most common complication was transient increased post-injection pain, which resolved spontaneously. Other complications reported across literature include dural puncture, epidural abscess, headache, and in rare cases, cord infarcts, particularly with particulate steroids.

Our use of the Tuohy needle minimized such risks. Literature suggests that blunt-tip needles, unlike pencil-tip needles, do not enter arteries, reducing the risk of neural injury during transforaminal injections.

Outcome Comparison: PRP vs Steroids

Using VAS (Visual Analog Scale), ODI (Oswestry Disability Index), NRS-11 (Numeric Rating Scale), and SLRT (Straight Leg Raise Test), we evaluated clinical outcomes over six months.

Steroid Group:

VAS reduced from 6.3 to 1.5
NRS-11 reduced from 6.3 to 1.5
ODI improved from 39.3 to 13.6
SLRT increased from 58.3° to 80.6°

PRP Group:

VAS reduced from 6.3 to 1.5
NRS-11 reduced from 6.3 to 1.5
ODI improved from 37.6 to 12
SLRT increased from 60° to 84.6°

Both groups showed statistically significant improvements, but no significant intergroup difference was observed. These findings align with those by Zhen Xu et al., where both PRP and steroid groups showed similar clinical improvements over 1 year with no major differences in VAS, ODI, or SF-36 scores.

Route of Administration and Needle Type

In our study, PRP and steroid injections were administered via the interlaminar approach, which offers broad epidural spread and is technically simpler than transforaminal injections. A review by Makkar et al. and Ghai et al. reported no significant difference between parasagittal interlaminar and transforaminal approaches in terms of efficacy.

Given the potential risks of transforaminal ESI—especially with particulate steroids—Glaser and Shah advocate for the infraneural approach, which avoids radiculomedullary arteries.

CONCLUSION

In both the group that is steroid and prp there was decrease in the pain after the procedure, with decrease in vas,nrs and odi score when compared to the values before the procedure
On comparision between the two group there was no significant difference in between the two groups in vas, nrs, odi scores

There was no complications seen in the prp group, however in steroid group one patient complains of giddiness after the procedure which eventually reduced after taking fluids and analgesics.

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