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# A COMPARATIVE STUDY OF FLUOROSCOPIC GUIDED TRANSFORAMINAL INJECTIONS OF STEROID VERSUS PLATELET-RICH PLASMA IN SINGLE LEVEL LUMBAR DISC HERNIATION.

Orthopaedics

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## ABSTRACT

**Objective:** To compare the efficacy of fluoroscopic guided transforaminal steroid vs autologous Platelet-rich plasma (PRP) injection in lumbar disc herniation. **Materials And Methods:** A total of 80 patients were studied who had complaints of low back pain with radiculopathy and MRI evidence of single level disc prolapse. Out of this group, patients were randomly assigned to two groups each having 40 patients. The first group received a transforaminal steroid injection and the second group transforaminal PRP injection. All patients were followed up for 12 months, and the results were compared using a change in Visual Analogue Scale (VAS) score and Oswestry Disability Index (ODI). **Results**: Both groups were comparable in terms of demographics, pre-procedure VAS scores, and ODI scores. At the 1-week follow-up, the steroid group had significantly better improvement than the PRP group. At 3 weeks, 6 weeks, and 6 months no difference in outcomes was observed. **Conclusion:** PRP is a safer alternative to steroids for transforaminal lumbar injections in lumbar radiculopathy. Although improvement was delayed, 6 weeks and 6 months outcomes were comparable. Multiple PRP injections may be beneficial because of its autologous nature.

## KEYWORDS

Low back pain - Radiculopathy - single level disc prolapse - Transforaminal – Steroid vs PRP.

## INTRODUCTION

Chronic low back pain with or without radiculopathy in the lower extremities is a common condition encountered by Orthopaedic surgeons [1]. Epidural injections are commonly used to manage chronic radicular leg pain and can be administered through different routes such as transforaminal, caudal, or interlaminar. Among these routes, the transforaminal route is considered the best as it allows for drug delivery close to the affected area, potentially onto the inflamed nerve root. This means that only a small amount of drugs is required [2]. Additionally, some authors have suggested that drug delivery directly at the anterior extradural space of the nerve root where the actual compression occurs is possible [3,4].

Laxmaiah Manchikanti's 2012 Systemic review found strong evidence supporting the effectiveness of transforaminal lumbar epidural injections with steroids and local anesthetics for radiculitis from disc herniation. However, using local anesthetics alone had moderate evidence [5]. A study by Prashant Chandrakant Kamble and Ayush Sharma found that, in the short term, pain reduction and ODI improvement were similar across the groups, the transforaminal group experienced better outcomes, with no significant increase in pain scores over 1 and 6 months of follow-up and a greater decrease in ODI at all time points compared to the interlaminar and caudal routes [6].

According to a study by Praneeth Reddy, K., Mahesh Kumar, D., Harsha, M., & Santhosh Kumar Raju K. (2024) transforaminal steroid injections provided better short- and long-term improvement in pain and ODI compared to caudal steroid injections for single-level disc prolapse, with greater reductions in pain scores and ODI at all follow-up intervals [7].

Gupta, A., Chhabra, H. S., Singh, V., & Nagarjuna, D. (2024) conducted a double-blind randomized controlled pilot study comparing lumbar transforaminal injection of steroids with platelet-rich plasma (PRP) for treating lumbar radiculopathy. The study found that while steroids provided quicker initial relief, PRP showed better outcomes at 6 weeks and 6 months. After 1 year, both treatments had comparable outcomes [8].

The drugs used in transforaminal injections have been widely discussed, particularly in their effectiveness in managing conditions like radiculopathy and sciatica [9]. Steroids are the most commonly used, in this study Methylprednisolone is used. Other steroids such as Triamcinolone, betamethasone, and etanercept [10], also show promising results. Local anesthetics like lidocaine and bupivacaine are used for immediate pain relief, and sodium hyaluronate or carboxymethyl cellulose solutions can enhance medication delivery [11]. According to the literature, several complications have been associated with epidural steroid injections, including neurotoxicity, steroid-related pharmacologic effects (such as hypercorticism, adrenal suppression, and hyperglycaemia), and neurologic injury [12,13]. Furthermore, contraindications to steroid use such as allergies, diabetes, severe osteoporosis, pregnancy, severe hypertension, and infections restrict the use of steroid injections. Moreover, evidence has shown positive results from using platelet-rich plasma (PRP) in treating discogenic back pain [14,15]. Platelet-rich plasma (PRP), a biological product derived from the centrifugation of autologous blood resulting in a high concentration of platelets in a small volume of plasma, has shown positive effects on pain relief in various musculoskeletal diseases, especially osteoarthritis, tendinosis, and ligament tears [16]. PRP contains a high concentration of growth factors (GFs) and cytokines, which play significant roles in anti-inflammatory, antiapoptotic, and proliferative effects on neurons and fibroblasts [17]. Although the role of PRP in pain relief appears promising, the effect of transforaminal PRP injection in lumbar disc herniation with radicular pain remains unclear. Therefore, this study aims to investigate the efficacy and safety of fluoroscopic platelet-rich plasma injections compared with steroid injections in treating lumbar disc herniation.

## MATERIALS AND METHODS

Patients were selected on an OPD basis from August 2023 - July 2024 after taking a written informed consent.

**Inclusion Criteria:**

1. Age between 20-60 years.
2. Patients who did not respond to a conservative line of management (Physiotherapy, NSAIDS).
3. Patients with low back pain (discogenic) with radicular symptoms.
4. Clinical and radiological correlation of nerve root compression.
5. No H/O prior lumbar surgery.
6. No H/O prior epidural injection.

**Exclusion Criteria:**

1. Cauda equina syndrome

2. Patients with Motor deficit
3. History of spinal surgery at the affected segment
4. Spinal infection/spondylodiscitis
5. Multilevel disc herniations
6. Spinal/foraminal stenosis
7. Myelopathy
8. Spinal fracture
9. Coagulation disorders

This was a prospective, single-center, randomized, double-blinded clinical trial. A total of 80 patients who met the inclusion criteria were enrolled and randomly assigned to one of two treatment groups. An independent resident doctor conducted the randomization using a computer-generated schedule. The study comprised two groups: one group received steroid injections (methylprednisolone, referred to as the steroid group), while the other group received platelet-rich plasma (PRP) injections, prepared from the patient's own blood (referred to as the PRP group). Both treatments were administered via the transforaminal route under fluoroscopic guidance. In this double-blinded procedure, 18 mL of blood was drawn from all participants, regardless of group assignment; the blood from the steroid group was discarded. To maintain blinding, the preloaded syringes used for injections were covered with sterile autoclave tape. Neither the participants nor the surgeon administering the injections and collecting follow-up data were aware of the treatment assignments. Data collection and follow-ups were conducted with both participants and the surgeon remaining blind to their treatment group until after the statistical analysis.

**Technique:**
From 80 patients enrolled in the study, 40 patients received steroid injections, another 40 patients received PRP injections, and no patients were lost to follow-up. Patients were positioned prone on a radiolucent table, ensuring all aseptic protocols were followed. A 22-gauge, 12 cm spinal needle was carefully advanced to the affected nerve root area using fluoroscopic guidance. This procedure employed the technique detailed by Bogduk et al., which involves using a "safe triangle" [18]. This triangle is defined by the pedicle forming the roof, the exiting nerve root as the base, and the vertebral body as the lateral border. The correct positioning of the needle was verified through fluoroscopy in both anteroposterior and lateral views. Before administering the medication, 1 ml of contrast material (Iohexol) was injected to confirm epidural flow [19]. The drug combination used for the steroid group is injection including 80 mg of methylprednisolone mixed with 2 ml of lignocaine. In the PRP group 2 ml of autologous PRP and 2 ml of lignocaine.

The PRP preparation process involved drawing an 18 ml blood sample from the anterior elbow vein and combining it with 2 ml of 3.8% (w/v) sodium citrate. This mixture was then centrifuged at 1500 rpm for 15 minutes at room temperature (23°C) under sterile conditions, resulting in the formation of three distinct layers. The lower layer, consisting of red blood cells, was discarded. The remaining portion of the sample was transferred to a new centrifuge tube and subjected to a second centrifugation at 3500 rpm for 7 minutes at room temperature. From the lower part of this centrifuged sample, 4 ml containing PRP was extracted. Subsequently, 1 ml of this PRP was sent for quantitative platelet analysis

**Fig 1:** Clinical images of PRP preparation

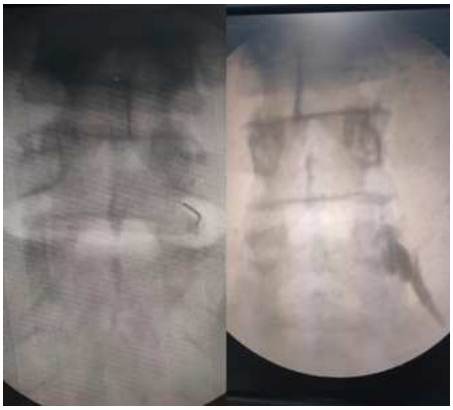

**Fig 2:** Fluoroscopic images of Lumbar transforaminal injections

**RESULT:**
In this study, each group was composed of 40 patients. The demographic details are presented in Table 1. Both groups were comparable in terms of age, sex, and affected level.

**Table 1: Demographic details between two study groups.**

| Group | Steroid injection | PRP injection |
|---|---|---|
| Number of Participants | 40 | 40 |
| Mean Age (years) | 44.63 | 44.55 |
| Sex Distribution | | |
| -Male | 26 | 25 |
| -Female | 14 | 15 |

In this study, two outcome measures were used: the Visual Analog Scale (VAS) for leg pain and the Oswestry Disability Index (ODI). The mean ODI and VAS scale scores were comparable among the groups at baseline(pre-procedure) and 1 week, 3 weeks, 3 months, and 6 months follow-up, with a p-value greater than 0.05, indicating no significant difference between the groups.

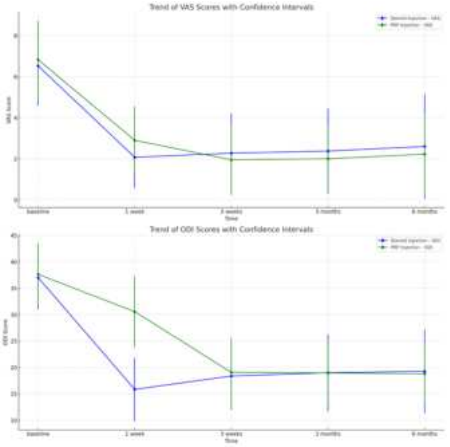

**Figure 3:** Progress of mean Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) scores of Steroid and PRP group from 1 week to 6 months.

**Table 2: Progress of mean Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) scores of Steroid and PRP group from 1 week to 6 months.**

| Time Point | Steroid group VAS (Mean ± SD) | PRP group VAS (Mean ± SD) | Steroid group ODI (Mean ± SD) | PRP group ODI (Mean ± SD) |
|---|---|---|---|---|
| Pre-procedure (Baseline) | 6.53 ± 0.99 | 6.78 ± 1.00 | 37.03 ± 3.07 | 37.63 ± 2.99 |
| 1 Week | 2.10 ± 0.74 | 2.90 ± 0.84 | 15.83 ± 3.05 | 30.55 ± 3.44 |
| 3 Weeks | 2.30 ± 0.97 | 2.00 ± 0.85 | 18.35 ± 3.26 | 19.05 ± 3.37 |
| 3 Months | 2.43 ± 1.03 | 2.05 ± 0.81 | 18.98 ± 3.70 | 18.93 ± 3.17 |
| 6 Months | 2.68 ± 1.27 | 2.23 ± 1.00 | 19.25 ± 4.03 | 18.80 ± 2.98 |

In this study after 6 months follow-up of patients, in the steroid group, 6 patients received repeat transforaminal steroid injection and 2 patients underwent surgery at end of 6 months follow-up. In the PRP

group, 5 patients received repeat transforaminal PRP injection and 2 patients underwent surgery at end of 6 months follow-up.

## DISCUSSION:

This study shows that Fluoroscopic-guided transforaminal injection of both PRP and steroid leads to significant improvement in the aspects of pain relief, nerve repair, spinal function, and life quality. Furthermore, the outcome after 6 months of follow-up has proven that these improvements stay effective for the long term. Besides, no complications or side effects were found during any of the follow-ups.

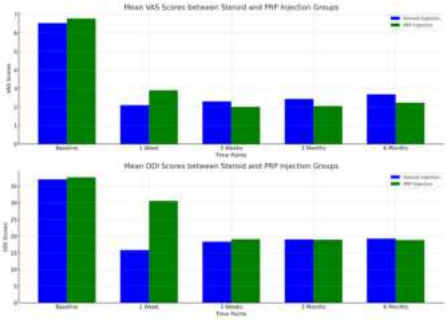


**Fig 4:** comparison of mean VAS and ODI scores between two groups

**Table 3: Mann Whitney U- Test between steroid and PRP group**

| Time Point | VAS U-statistic | VAS p-value | ODI U-statistic | ODI p-value |
|---|---|---|---|---|
| Baseline | 687 | 0.259501 | 700 | 0.335853 |
| 1 Week | 388 | 0.000022 | 0 | 1.26E-14 |
| 3 Weeks | 938.5 | 0.149579 | 713 | 0.401743 |
| 3 Months | 952 | 0.117274 | 798 | 0.988416 |
| 6 Months | 956.5 | 0.116612 | 845 | 0.666803 |

At the 1-week follow-up, the steroid group showed better improvement in mean VAS and ODI scores, and the results were statistically significant ($p<0.0001$). The PRP group showed better improvement in the mean VAS and ODI scores at the 3-week follow-up than at the 1-week follow-up, and the steroid group maintained improvement. The two groups showed no significant statistical difference in the mean VAS and scores at the 3-month and 6-month follow-up.

Platelet-rich plasma (PRP) is increasingly used to treat musculoskeletal diseases due to its anti-inflammatory properties and its ability to promote healing. PRP delivers a high concentration of growth factors and cytokines, including VEGF, TGFβ-1, PDGF, and IGF-1, from the α-granules of platelets [20]. After injection, platelets quickly aggregate and release most of their growth factors within an hour [21]. These factors enhance cell proliferation, new blood vessel formation, and extracellular matrix protein synthesis, aiding tissue repair and regeneration [22]. The primary rationale for using PRP is to increase the concentration of platelets at targeted sites, facilitating the release of cytokines and growth factors. This release helps regulate inflammation and immune responses essential for tissue healing [23].

## CONCLUSION:

The study indicates that fluoroscopic-guided transforaminal PRP injections are as effective as transforaminal steroid injections in treating lumbar disc herniation with radicular pain and may be a safer option. Although the improvement with transforaminal PRP is delayed, long-term follow-up showed similar results to transforaminal steroid injections.

### Limitations:

The limitations of this study include the absence of long-term follow-up and the lack of documentation on additional therapies, such as analgesics and physiotherapy, which may have influenced pain and disability scores.

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