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Original Research Article

Outcome Assessment of the Transforaminal Steroid Injection in Patients with Prolapsed Intervertebral Disc

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Abstract

Aim: To evaluate the functional effect of transforaminal steroid injection in patients with prolapsed intervertebral disc.

Material and methods: This retrospective study was conducted in the Department of Orthopaedics, SKMCH, Muzaffarpur, Bihar, India for seven months. Patient with age between 18 to 65 years. Patient with low back pain and leg pain and/or with tingling. Patient with single intervertebral disc involvement (confirmed on MRI). Patient with unilateral symptoms. Patient with failed conservative management for more than 6 weeks. Patient and/or his/her legally acceptable representative willing to provide their voluntary written informed consent for participation in study. Routine blood investigations were done, the VAS and ODI score were assessed pre-injection.

Results: The mean VAS score for L3-L4 was 7.500 ± 0.548, for L4-L5 was 7.458 ± 0.743 and for L5-S1 was 7.500± 0.798. At 48 hours the mean VAS score for L3-L4 was 4.333 ± 0.516, for L4-L5 was 4.042 ± 1.220 and for L5-S1 was 3.583 ± 0.669. At 1 month the mean VAS score for L3- L4 was 2.833 ± 0.408, for L4-L5 was 2.600 ± 1.031 and for L5-S1 was 2.583 ± 0.793. At 3 months the mean VAS score for L3-L4 was 2.333 ± 0.516, for L4-L5 was 2.136 ± 0.668 and for L5-S1 was 2.250 ± 0.754. At 6 months the mean VAS score for L3-L4 was 2.167 ± 0.408, for L4-L5 was 2.068 ± 0.695 and for L5-S1 was 2.083 ± 0.900. The overall mean VAS at presentation was 7.470 ± 0.728, at 48 hours it was 3.985 ± 1.116, at 1 month it was 2.619 ±0.941, at 3 months it was 2.177 ± 0.666 and at 6 months it was 2.081 ± 0.708. the mean ODI score for L3-L4 was 65.000 ± 2.098, for L4-L5 was 61.500 ± 5.589 and for L5-S1 was 62.000 ± 3.908. At 48 hours the mean ODI score for L3-L4 was 54.667 ± 4.676, for L4-L5 was 50.250 ± 8.451 and for L5-S1 was 51.000 ± 4.221. At 1 month the mean ODI score for L3-L4 was 42.333 ± 4.633, for L4-L5 was 34.222 ± 9.883 and for L5-S1 was 34.833 ± 5.937. At 3 months the mean ODI score for L3-L4 was 38.667 ± 4.320, for L4-L5 was 29.500 ± 6.642 and for L5-S1 was 31.667±5.646. At 6 months the mean ODI score for L3-L4 was 36.667 ± 4.320, for L4-L5 was 27.000 ± 6.198 and for L5-S1 was 29.667 ± 6.706.

Conclusion: The results of our study indicate that transforaminal steroid injections are effective in reducing pain and improving functional outcomes in patients with prolapsed intervertebral discs. The significant decrease in VAS and ODI scores over six months post-injection demonstrates the procedure's efficacy. These findings are in line with other studies, which have consistently shown the benefits of this minimally invasive treatment option.

Keywords: Prolapsed intervertebral disc, transforaminal, steroid injection, methylprednisolone

Introduction

Prolapsed intervertebral disc (PID) is a prevalent and debilitating condition that affects a significant portion of the population, particularly adults in their mid-30s to 50s. The condition is characterized by the herniation of the nucleus pulposus through a tear in the annulus fibrosus, leading to compression of adjacent neural structures. This can result in severe back pain, radicular pain, and neurological deficits, severely impacting the patient's quality of life and functional capacity. The pathophysiology of PID involves both mechanical and biochemical mechanisms. [1,2] Mechanically, the herniated disc material can compress nerve roots, causing direct mechanical nerve irritation. Biochemically, the herniated disc material can release inflammatory cytokines such as interleukin-1 and tumor necrosis

factor-alpha, which contribute to nerve root inflammation and pain. These dual mechanisms underline the complexity of PID and the need for multifaceted therapeutic approaches. [3] The management of PID typically begins with conservative treatments including physical therapy, nonsteroidal anti-inflammatory drugs (NSAIDs), and oral steroids. Physical therapy aims to improve flexibility, strength, and endurance, while NSAIDs and oral steroids help to reduce inflammation and pain. However, these conservative measures may not be effective for all patients, particularly those with significant nerve root compression or persistent symptoms . Transforaminal steroid injections (TFESI) have emerged as a minimally invasive intervention for patients with PID who do not respond adequately to conservative treatments. [4,5] TFESI involves the delivery of corticosteroids and local aesthetics directly into the epidural space surrounding the affected nerve root. This targeted approach aims to reduce inflammation and pain at the site of nerve compression more effectively than systemic administration of steroids. The efficacy of TFESI is attributed to both the anti-inflammatory properties of corticosteroids and the anaesthetic effects of local aesthetics. Corticosteroids reduce inflammation by inhibiting phospholipase A2 and subsequent production of pro-inflammatory mediators such as prostaglandins and leukotrienes. This results in decreased nerve root oedema and pain. Local anaesthetics provide immediate pain relief by blocking sodium channels and interrupting nerve signal transmission. [6-8] While TFESI is generally considered safe, it is not without risks. Potential complications include dural puncture, infection, bleeding, and transient neurological symptoms. However, serious complications are rare. Proper patient selection, use of fluoroscopic guidance, and adherence to strict aseptic techniques can minimize these risks. Recent advances in imaging techniques and needle design have further enhanced the safety and efficacy of TFESI. [9,10] The use of real-time fluoroscopic or CT guidance allows for precise needle placement and reduces the risk of inadvertent injury to adjacent structures. Additionally, the development of multi-orifice needles has improved the distribution of injectates, potentially enhancing therapeutic outcomes. Research is ongoing to optimize the timing, dosage, and frequency of TFESI. The role of adjunctive therapies, such as the use of biological agents like platelet-rich plasma (PRP), is also being explored. These advancements hold promise for further improving the management of PID and reducing the need for surgical interventions.

Material and Methods

This retrospective study was conducted in the Department of Orthopaedics, SKMCH, Muzaffarpur, Bihar, India for seven months

Inclusion Criteria

- Patient with age between 18 to 65 years.
- Patient with low back pain and leg pain and/or with tingling.
- Patient with single intervertebral disc involvement (confirmed on MRI).
- Patient with unilateral symptoms.
- Patient with failed conservative management for more than 6 weeks.
- Patient and/or his/her legally acceptable representative willing to provide their voluntary written informed consent for participation in study.

Exclusion Criteria

- Patient with multiple intervertebral discs involvement.
- Patient with bilateral involvement.
- Patient with recurrent herniations.
- Patient with cauda equina syndrome, vertebral fractures, spondylolisthesis and arachnoiditis.
- Patient having repeated steroid injections or previous spinal surgeries.
- Patient with significant coagulopathies and use of anticoagulants.
- Patient diagnosed to have diabetes mellitus, active cancer, history of substance abuse, current psychiatric co- morbidity, pregnancy and congestive cardiac failure.
- Patient with history of allergy to contrast media, steroids and local anaesthetic agents.
- Patient with severe motor deficit.
- Patient and/or his/her legally acceptable representative not willing to provide their voluntary written informed consent for participation in study.

Methodology

Patients with inclusion criteria were then investigated further. Routine blood investigations were done, the VAS and ODI score were assessed pre-injection. Under sterile precautions 3 separate and labelled 2–5mL syringes were used. First non-ionic iohexol contrast medium, second 2% lignocaine for local anaesthesia and the last syringe was with 2 ml of methylprednisolone (40 mg/ml) along with 1 ml 2% lignocaine. The patient was positioned prone on a radiolucent procedure table, the desired level was identified using fluoroscopy guidance by C-arm. The X-ray projection was focused on the epiphyseal plate of the upper and lower vertebral body by controlling the cranial-caudal angle of the C-arm and the right and left angle of the C-arm was rotated by 20-35 degrees toward the region, so that the superior articular process could be seen at the middle of the intervertebral disc. After local anaesthesia with a 22G quincke spinal needle was inserted just above the superior

articulating process and directed toward the base of the pedicle, and advanced slowly until the bone was contacted just below the pedicle. The needle was then slightly withdrawn and redirected inferiorly into the targeted spinal nerve canal. Advancement was made under anteroposterior (AP) and lateral views to provide a 3-dimensional spatial representation. The AP view was taken to verify that the needle was not medial to the 6-o clock position of the pedicle; on the lateral view, the needle was positioned just below the pedicle in the ventral aspect of the intervertebral foramen. Non-ionic iohexol contrast dye 1-2 ml was injected and the dye pattern was assessed. If leg paraesthesia was noted as the needle approached the neural foramen, the needle was withdrawn slightly and the dye was injected. A positive image of the nerve root on fluoroscopy indicated that the needle had penetrated the periradicular membrane. Once the correct placement of the needle was confirmed, an infiltration of 2 ml of methylprednisolone (40 mg/ml) with 1 ml 2% lignocaine was injected. Following the procedure, the needle entry site was sealed with a sterile dressing or Band-Aid.

Results

Out of 66 patients, 3 patients opted for surgery within one month of transforaminal steroid injection and 1 patient opted for surgery between 1 and 3 month of transforaminal steroid injection. The mean age in our study patients was 39.79 ± 12.14 years. [Table 1]. Out of 66 people 38(58%) are male while 28(42%) are female. Male are higher 57.6% as compare to female who are little lower 42.4%. [Table 1]. At presentation the mean VAS score for L3-L4 was 7.500 ± 0.548, for L4-L5 was 7.458 ± 0.743 and for L5-S1 was 7.500± 0.798. At 48 hours the mean VAS score for L3-L4 was 4.333 ± 0.516, for L4-L5 was 4.042 ± 1.220 and for L5-S1 was 3.583 ± 0.669. At 1 month the mean VAS score for L3- L4 was 2.833 ± 0.408, for L4-L5 was 2.600 ± 1.031 and for L5-S1 was 2.583 ± 0.793. At 3 months the mean VAS score for L3-L4 was 2.333 ± 0.516, for L4-L5 was 2.136 ± 0.668 and for L5-S1 was 2.250 ± 0.754. At 6 months the mean VAS score for L3-L4 was 2.167 ± 0.408, for L4-L5 was 2.068 ± 0.695 and for L5-S1 was 2.083 ± 0.900. [Table 3]. The overall mean VAS at presentation was 7.470 ± 0.728, at 48 hours it was 3.985 ± 1.116, at 1 month it was 2.619 ±0.941, at 3 months it was 2.177 ± 0.666 and at 6 months it was 2.081 ± 0.708. There is a decreasing trend in the VAS score from presentation till 6 months. [Table 3]. At presentation the mean ODI score for L3-L4 was 65.000 ± 2.098, for L4-L5 was 61.500 ± 5.589 and for L5-S1 was 62.000 ± 3.908. At 48 hours the mean ODI score for L3-L4 was 54.667 ± 4.676, for L4-L5 was 50.250 ± 8.451 and for L5-S1 was 51.000 ± 4.221. At 1 month the mean ODI score for L3-L4 was 42.333 ± 4.633, for L4-L5 was 34.222 ± 9.883 and for L5-S1 was 34.833 ± 5.937. At 3 months the mean ODI score for L3-L4 was 38.667 ± 4.320, for L4-L5 was 29.500 ± 6.642 and for L5-S1 was 31.667 ± 5.646. At 6 months the mean ODI score for L3-L4 was 36.667 ± 4.320, for L4-L5 was 27.000 ± 6.198 and for L5-S1 was 29.667 ± 6.706. [Table 4]. The overall mean ODI at presentation was 61.909 ± 5.149, at 48 hours it was 50.788 ± 7.613, at 1 month it was 35.111 ± 9.107, at 3 months it was 30.806 ± 6.770 and at 6 months it was 28.452 ± 6.721. There is a decreasing trend in the ODI score from presentation till 6 months. [Table 4]

Table 1: Age and Sex Distribution

Age Group	**Frequency**	**Percent**
<=30	16	24.2
31-40	23	34.8
41-50	15	22.7
>=51	12	18.2
Total	66	100.0
Sex	**Frequency**	**Percent**
Female	28	42.4
Male	38	57.6
Total	66	100.0

Table 2: Distribution of patients according to level of PIVD

Level of PIVD	**Frequency**	**Percent**
L3-L4 PIVD	6	9.1
L4-L5 PIVD	48	72.7
L5-S1 PIVD	12	18.2
Total	66	100.0

Table 3: Comparison of mean VAS in relation to level of PIVD

Time Interval	Diagnosis	N	Mean VAS	Standard Deviation
Presentation	L3-L4	6	7.500	0.548
	L4-L5	48	7.458	0.743
	L5-S1	12	7.500	0.798
	Total	66	7.470	0.728
48 Hours	L3-L4	6	4.333	0.816
	L4-L5	48	4.042	1.220
	L5-S1	12	3.583	0.669
	Total	66	3.985	1.116
1 Month	L3-L4	6	2.833	0.408
	L4-L5	45	2.600	1.031
	L5-S1	12	2.583	0.793
	Total	63	2.619	0.941
3 Months	L3-L4	6	2.333	0.516
	L4-L5	44	2.136	0.668
	L5-S1	12	2.250	0.754
	Total	62	2.177	0.666
6 Months	L3-L4	6	2.167	0.408
	L4-L5	44	2.068	0.695
	L5-S1	12	2.083	0.900
	Total	62	2.081	0.708

Table 4: Comparison of mean ODI in relation to level of PIVD

Time Interval	Diagnosis	N	Mean ODI	Standard Deviation
Presentation	L3-L4	6	65.000	2.098
	L4-L5	48	61.500	5.589
	L5-S1	12	62.000	3.908
	Total	66	61.909	5.149
48 Hours	L3-L4	6	54.667	4.676
	L4-L5	48	50.250	8.451
	L5-S1	12	51.000	4.221
	Total	66	50.788	7.613
1 Month	L3-L4	6	42.333	4.633
	L4-L5	45	34.222	9.883
	L5-S1	12	34.833	5.937
	Total	63	35.111	9.107
3 Months	L3-L4	6	38.667	4.320
	L4-L5	44	29.500	6.642
	L5-S1	12	31.667	5.646
	Total	62	30.806	6.770
6 months	L3-L4	6	36.667	4.320
	L4-L5	44	27.000	6.198
	L5-S1	12	29.667	6.706
	Total	62	28.452	6.721

Table 5: Comparison of mean VAS between different time intervals

Time Interval	N	Mean VAS	Standard Deviation
Presentation	66	7.470	0.728
48 Hours	66	3.985	1.116
Presentation	63	7.444	0.713
1 Month	63	2.619	0.941
Presentation	62	7.419	0.691
3 Months	62	2.177	0.666
Presentation	62	7.419	0.691
6 Months	62	2.081	0.708
48 Hours	63	3.825	0.853

1 Month	63	2.619	0.941
1 Month	62	2.532	0.646
3 Months	62	2.177	0.666
3 Months	62	2.177	0.666
6 Months	62	2.081	0.708

Table 6: Comparison of mean ODI between different time intervals

Time Interval	N	Mean ODI	Standard Deviation
Presentation	66	61.909	5.149
48 Hours	66	50.788	7.613
Presentation	63	61.524	4.775
1 Month	63	35.111	9.107
Presentation	62	61.355	4.620
3 Month	62	30.806	6.770
Presentation	62	61.355	4.620
6 Month	62	28.452	6.721
48 Hours	63	50.000	6.749
1 Month	63	35.111	9.107
1 Month	62	34.419	7.325
3 Month	62	30.806	6.770
3 Month	62	30.806	6.770
6 Month	62	28.452	6.721

Discussion

The study aimed to evaluate the functional outcomes of transforaminal steroid injections in patients suffering from prolapsed intervertebral discs. The analysis included 66 patients with a mean age of 39.79 ± 12.14 years, comprising 38 males (58%) and 28 females (42%). A notable finding from the study was the significant reduction in pain and disability scores over six months following the injection. At presentation, the mean VAS score for L3-L4 was 7.500 ± 0.548, for L4-L5 was 7.458 ± 0.743, and for L5-S1 was 7.500 ± 0.798. Significant reductions were observed at 48 hours post-injection, with mean VAS scores of 4.333 ± 0.516 for L3-L4, 4.042 ± 1.220 for L4-L5, and 3.583 ± 0.669 for L5-S1. Continued improvement was noted at one month, three months, and six months post-injection, with mean VAS scores at six months being 2.167 ± 0.408 (L3-L4), 2.068 ± 0.695 (L4-L5), and 2.083 ± 0.900 (L5-S1). Overall, the mean VAS score decreased from 7.470 ± 0.728 at presentation to 2.081 ± 0.708 at six months.

These findings align with previous studies demonstrating the efficacy of transforaminal steroid injections in reducing pain associated with prolapsed intervertebral discs. Riew et al. (2021)[2] reported a significant decrease in VAS scores from 7.6 to 2.5 at six months post-injection, emphasizing the procedure's effectiveness in pain management . Similarly, a study by Chang et al. (2020) found a reduction in mean VAS scores from 8.0 to 3.0 over a six-month period .[3]

At presentation, the mean ODI score for L3-L4 was 65.000 ± 2.098, for L4-L5 was 61.500 ± 5.589, and for L5-S1 was 62.000 ± 3.908. At 48 hours post-injection, mean ODI scores dropped to 54.667 ± 4.676 (L3-L4), 50.250 ± 8.451 (L4-L5), and 51.000 ± 4.221 (L5-S1). Continued improvement was observed at one month, three months, and six months post-injection, with mean ODI scores at six months being 36.667 ± 4.320 (L3-L4), 27.000 ± 6.198 (L4-L5), and 29.667 ± 6.706 (L5-S1). Overall, the mean ODI score decreased from 61.909 ± 5.149 at presentation to 28.452 ± 6.721 at six months. These results are consistent with the findings of other studies. Kang et al. (2020) [9] observed a significant reduction in ODI scores from 63 to 29 at six months post-injection, indicating a substantial improvement in functional disability . In another study, Jasper et al. (2021) reported similar improvements with ODI scores decreasing from 60 to 30 within six months. [8]

Out of the 66 patients, three opted for surgery within one month of the transforaminal steroid injection, and one patient opted for surgery between one and three months post-injection. This relatively low rate of surgical intervention suggests that the majority of patients experienced sufficient relief from pain and disability to avoid surgery. Comparative studies have reported varying rates of surgical intervention post-transforaminal steroid injection. For instance, a study by El-Yahchouchi et al. (2020)[5] reported a 10% surgical intervention rate within six months, indicating a relatively higher reliance on surgical management in their cohort . Conversely, a study by Narouze et al. (2021) [6] found a surgical intervention rate of 5%, aligning closely with the findings of our study . In our study, males represented a slightly higher proportion (58%)

compared to females (42%). However, the gender distribution did not significantly impact the outcomes in terms of pain and disability reduction. This is consistent with the findings of other studies that have reported no significant gender differences in the effectiveness of transforaminal steroid injections .

Conclusion

The results of our study indicate that transforaminal steroid injections are effective in reducing pain and improving functional outcomes in patients with prolapsed intervertebral discs. The significant decrease in VAS and ODI scores over six months post-injection demonstrates the procedure's efficacy. These findings are in line with other studies, which have consistently shown the benefits of this minimally invasive treatment option.

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