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ORIGINAL ARTICLE

Outcome of single level disc prolapse treated with transforaminal steroid versus epidural steroid versus caudal steroids

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Abstract
Objective To determine the efficacy of fluoroscopic guided transforaminal steroid versus interlaminar epidural steroid versus caudal steroid.
Material and method A total of 90 patients were studied who had complains of low back pain with radiculopathy and MRI evidence of disc prolapse. Out of this group, patients were randomly assigned to three groups each having 30 patients. First group received transforaminal steroid injection, second group received caudal steroid injection, and third group received epidural steroid. All patients were followed up for 12 months, and the results were compared using change in Visual Analogue Scale score and Oswestry Disability Index (OSD).
Results The change in pain scores was statistically different at 1- and 6-month interval such that a higher change was observed by transforaminal route as compared to the other two. There was no difference in change of scores between interlaminar and caudal routes. For OSD, a greater change was seen in transforminal at all times as compared to the other two. There was no difference in change of scores between interlaminar and caudal routes at any time of assessment.
Conclusion In current study, transforaminal steroid injection group has better symptomatic improvement for both short and long term as compared to interlaminar and caudal steroid injection group.

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Keywords Low back pain · Transforaminal · Interlaminar · Caudal · Epidural injection · Epidural steroid · Single level disc prolapse · Radiculopathy

Introduction

Low back pain is one of the major causes of disability in people below 45 years of age. Traditional medical treatment for patient with low back pain includes oral medication, modification of life style, education, exercises, lumbar traction, and manual manipulation, application of heat, cryotherapy, and ultrasonography [1, 2]. Steroids are commonly used to reduce inflammation in epidural space [3–6]. Epidural injections are one of the common modalities of treatment for low back pain particularly originating from disc prolapse. Epidural steroid injection can be given in lumbar epidural space via transforaminal, interlaminar, and caudal route and each of which have different efficacy rate [7–9]. In earlier studies, it was given under non-fluoroscopic guidance and reports have shown that epidural injection may be misplaced in 30 % cases [10]. With the help of fluoroscopy, we can target the site of lesion, which results in improvement of outcome. In 1998, Lutz et al. [11] studied the efficacy of fluoroscopic guided transforaminal epidural steroid injection as a treatment for single level disc prolapse with radicular symptoms and confirmed it with magnetic resonance imaging, documenting herniated nucleus pulposus causing foraminal stenosis.

In a systematic review to evaluate the effect of therapeutic transforaminal lumbar epidural steroid injections by Laxmaiah Manchikanti in 2012, it was said that the evidence is good for radiculitis secondary to disc herniation with local anaesthetics and steroids and fair with local anaesthetics only [12]. Benny B in a comprehensive

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literature review concluded that there was strong evidence for transforaminal injections in the treatment of lumbosacral radicular pain both for short-term and long-term relief [13]. Riew KD article supported use of selective nerve root injections of corticosteroids in patients who have lumbar radicular pain at one or two levels prior to be considered for operative intervention [14].

We have used the grading system for disc prolapse on magnetic resonance imaging as suggested by Wildermuth et al. [15] in our study. The purpose of this study was to prospectively evaluate the efficacy of fluoroscopically guided epidural steroid injections.

Materials and methods

Patients were selected on OPD basis from 2011 to 2013 after taking a written informed consent.

Inclusion criteria

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

Exclusion criteria

1. Patients having clinical and radiological evidence of instability, e.g. spondylolysis or spondylolisthesis.
2. Patients with spinal fracture.

This was a prospective, single centre, randomized, and double blinded clinical trial. A total of 90 patients who fulfil the above-mentioned inclusion criteria were enrolled in the study and were randomly assigned one of the treatment modality. An independent resident doctor performed randomization using a computer genrated randomization schedule. All procedures were performed by single investigator and followed by other investigators. The investigators did not have access to the randomization sequence. The assessors and patients were blinded to the assigned treatment modality.

Out of 90, 51 were females; median age of the patients was 50 years (mean age 49.6445). All patients underwent MRI imaging before procedure. Our institutional ethical committee reviewed and approved the procedures. All patients after pre- and post-epidural steroid injection were analysed by VAS (Visual Analogue Scale) score and Oswestry Disability index.

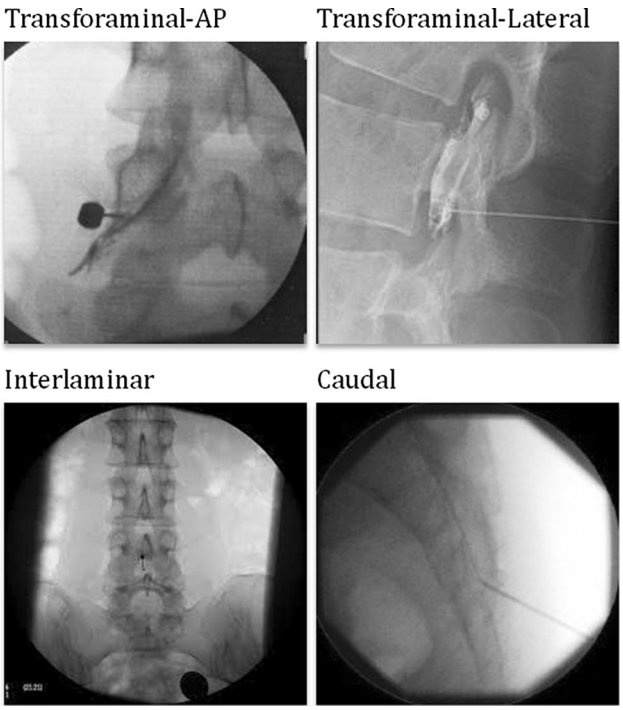

Fig. 1 Fluoroscopy images of needle position for transforaminal, interlaminer and caudal

Technique

30 patients received transforaminal, 30 patients received caudal, and 30 received interlaminar epidural steroid injection.

Patients were placed in prone position on radiolucent table under all aseptic precautions. 25-gauge 12 cm long spinal needle was advanced into the region of involved nerve root under fluoroscopic guidance. We used the technique described by Bogduk et al. [16]. Technique involved use of safe triangle, which was composed of roof formed by pedicle, tangential, base that corresponded to exiting nerve root and the lateral border of vertebral body. Needle positioning was confirmed by fluoroscopy in anterior, posterior, and lateral views (Fig. 1). To confirm epidural flow of injection, 1 ml of contrast material (omnipaque) was injected before drug injection [17]. A combination of triamcinolone acetate 40 mg with 1 ml of bupivacaine and 2 ml of lignocaine was used.

Interlaminar epidural steroid injection was given through traditional midline approach with 18-gauge 8 cm long spinal needle. Needle was advanced into midline epidural space using the loss of resistance technique. After negative aspiration of cerebrospinal fluid, 1 ml of non-

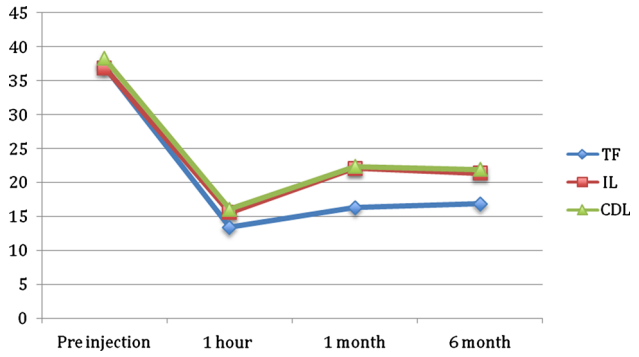

Fig. 2 Improvement of Oswesrty Disability Index (OSD) scores after either transforaminal (TF) or interlaminar (IL) or caudal (CDL) injection triamcinolone 40 mg to epidural space. Data are shown as mean ± SD. Results achieved in all three group are shown in *line diagram* with descending order of improvement (TF > IL > CDL)

ionic contrast material (omnipaque) was injected to document appropriate contrast spread into epidural space. A combination of triamcinolone acetate 40 mg with 1 ml of bupivacaine and 1 ml of lignocaine in dilution of 10 ml of normal saline was injected.

For caudal epidural steroid injection, we have given injection in sacral hiatus with patient in prone position with pillow under pelvis. Injection was given by 22-gauge spinal needle that was introduced through sacrococcygeal ligament into epidural space under fluoroscopic guidance. To confirm epidural flow of injection, 1 ml of contrast material (omnipaque) was injected before drug injection [17]. A combination of triamcinolone acetate 40 mg with 1 ml of bupivacaine and 2 ml of lignocaine in dilution of 10 ml of normal saline was injected. All these were taken to recovery area and they were asked to report their back pain and leg pain (radicular pain) compared on VAS (Visual Analogue Scale) score and Oswestry disability index score at 1 h post-injection period. Then these patients were asked to follow-up in our spine clinic at an interval of around 1 and 6 months consecutively. Patients who failed to respond to the treatment or patients whose response deteriorated received additional injection of same injection, dose, and approach. Maximum 3 injections were used per patient, with a minimum interval of 2 weeks between subsequent injections, if required. Patients who did not respond to three injection or developed cauda equine or progressive neurological deficit were considered for surgery.

Data

VAS (Visual analogue scale)

	Pre-injection VAS mean ± SD	Post-injection VAS at 1 h mean ± SD	Follow-up VAS at 1 month mean ± SD	Follow-up VAS at 6 month mean ± SD	Repeated injection	Surgery
Transforaminal (30)	7.1 ± 0.7	1.9 ± 0.7	2.4 ± 0.9	2.6 ± 0.7	4 (13.33 %)	2 (6.67 %)
Interlaminar (30)	7.0 ± 0.7	2.2 ± 0.4	3.5 ± 1.2	3.4 ± 1.4	3 (10.00 %)	3 (10.00 %)
Caudal (30)	7.2 ± 0.6	2.4 ± 0.5	3.6 ± 1.1	3.5 ± 1.0	5 (16.67 %)	3 (10.00 %)

Oswesrty Disability Index score (OSD) evaluation

	Pre-injection OSD mean ± SD	Post-injection OSD at 1 h mean ± SD	Follow-up OSD at 1 month mean ± SD	Follow-up OSD at 6 month mean ± SD	Repeated injection	Surgery
Transforaminal (30)	37.7 ± 2.83	13.4 ± 2.16	16.3 ± 3.74	16.8 ± 2.53	4 (13.33 %)	2 (6.67 %)
Interlaminar (30)	36.9 ± 2.82	15.6 ± 1.75	22.1 ± 5.18	21.4 ± 6.08	3 (10.00 %)	3 (10.00 %)
Caudal (30)	38.3 ± 2.78	16.1 ± 1.82	22.4 ± 4.55	21.9 ± 3.35	5 (16.67 %)	3 (10.00 %)

Methods

Change in pain scores and Oswesrty Disability Index (OSD) from baseline was calculated and compared across the routes using non-parametric tests (Mann–Whitney *U* test). To adjust for multiple comparisons, the *p* value was estimated using Bonferroni correction as $0.05/3 = 0.018$.

	Transforaminal	Interlaminar	Caudal
Pain scores			
Change in 1 h	5 [4, 6][a]	5 [4, 6][a]	5 [4, 6][a]
Change in 1 month	5 [3, 6][a]	4 [1, 5][b]	4 [1, 4][b]
Change in 6 months	4 [3, 6][a]	4 [−1, 4][b]	4 [0,5][b]
OSD scores			
Change in 1 h	24 [20, 29][a]	22 [16, 25][b]	22.5 [17, 28][b]
Change in 1 month	22 [13, 27][a]	16 [4, 20][b]	17 [5, 20][b]
Change in 6 months	21 [15, 26][a]	16 [1, 35][b]	16 [5, 23][b]

The numbers represent the median of the change in scores from baseline. The numbers in the brackets are the range of scores. Assignment of different alphabets in superscript (a, b, or c) signifies statistical significance at $p < 0.018$. Assignment of same alphabet signifies no statistical difference

Results

The change in pain scores was statistically different at 1- and 6-month interval such that a higher change was observed by transforaminal route as compared to other two. There was no difference in change of scores between interlaminar and caudal routes.

For Oswesrty Disability Index (OSD), a greater change was seen in transforaminal at all times as compared to other two. There was no difference in change of scores between interlaminar and caudal routes at any times of assessment (Fig. 2).

Limitations

Limitation of the study includes unavailability of a long-term follow-up and lack of documentation regarding additional therapy in each group like analgesic and physiotherapy which might had an effect on pain and disability scores.

Discussion

Analysis of our procedure indicates that all the three methods of treatment were effective in reducing pain score and OSD in patients with low back pain (discogenic) with radicular symptoms. While short-term effect in terms of change in pain and OSD was comparable across the groups, transforaminal group on average felt better as they showed no significant increase in pain score over 1- and 6-month follow-up and a greater decrease in OSD at all time compared to interlaminar and caudal routes. Interlaminar and caudal routes were comparable to each other in terms of pain and disability in all the follow-up. Improvement was not much different between all three groups immediately 1 h after injection, indicating that short-term treatment effect was mainly because of local anaesthetic agent. More targeted delivery of local steroid and local anaesthetic along the inflamed spinal nerve is most likely explanation for better outcome on long-term basis. Although there is a paucity of literature comparing fluoroscopic guided transforaminal steroid versus interlaminar epidural steroid versus caudal steroid, our results are indirectly supported by systemic review in 2014 which concluded that in the treatment of pain, transforaminal method demonstrated non-clinically significant superiority to interlaminar method at the 2-week follow-up [18] and by Ploumis who says that the effectiveness of transforaminal steroid injection for the stenosis patients with sciatica was superior to caudal at 6 months post-injection [19].

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Conflict of interest None of the authors have any potential conflict of interest.

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