Section: Orthopaedics

Original Research Article

EFFECTIVENESS OF THERAPEUTIC LUMBAR TRANSFORAMINAL EPIDURAL STEROID INJECTIONS IN MANAGING DISCOGENIC PAIN

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ABSTRACT

Background: A degenerate disc is one with structural failure combined with accelerated or advanced signs of aging. Early degenerative changes should refer to accelerated age-related changes in a structurally intact disc. Degenerative disc disease should be applied to a degenerate disc that is also painful. Most patients achieve good response with a single ESI injection and the repeat injection is not recommended in the complete responders. **Aim & Objectives:** This study to evaluate the effect of therapeutic transformational lumbar steroid injections for discogenic pain.

Materials and Methods: A hospital based observational study was conducted among a total of 20 patients who underwent percutaneous transforaminal steroid injection using Kambin's triangle approach. Patients were identified during a period of 1 year from November 2022 to October 2023.Data collection was performed after obtaining approval from IEC of KMC and MGM Hospital Warangal.

Results: In this study, 20 patients with discogenic pain epidural PRP injection therapy was shown to cause significant pain reduction and functional improvement, which were measured using the numerical rating scale (NRS) and the Oswestry disability index (ODI). In this study, data on 20 subjects from Epidural Steroid Injections study showed positive results transforaminal steroid injections provide modest analgesic benefit at 3 months in patients with lumbar discogenic pain.

Conclusion: The advantage of Kambin's triangle approach is needle placement anterior to epidural space in cases with reduced disc space, which is safe and does not injure any neurovascular structures.

Keywords: Numerical Rating Scale (NRS), Oswestry Disability Index (ODI), Discogenic pain, Epidural steroidal injection.

INTRODUCTION

Adams and Roughley proposed definitions for disc degeneration and degenerative disc disease as follows: "The process of disc degeneration is an aberrant, cell mediated response to progressive structural failure. A degenerate disc is one with structural failure combined with accelerated or advanced signs of aging. Early degenerative changes should refer to accelerated age-related changes in a structurally intact disc. Degenerative disc disease should be applied to a degenerate disc that is also painful." As with many other complex disease states, degenerative disc disease is helpful as an organizing principle for multiple complex pathologies, but is also confusing in its lack of specificity. Further clarification and definition of the terms "early degenerative changes" and "age related changes" will help in our understanding of the broader term "degenerative disc disease."[1]

Figure 1: Discogenic Pain

Early degenerative changes usually occur and progress without symptoms; there are usually subtle changes to the matrix of the nucleus pulposus (NP) and inner annulus fibrosus (AF). As a result of these nonpainful conditions, it is hard or impossible to separate such early degenerative changes from aging in the human. However, basic science studies can discernearly degenerative changes to involve a shift in the balance of anabolic and catabolic activities that can predispose to accelerated degeneration, as well as increased proinflammatory cytokine production from IVD cells that are considered to be nociceptive and noxious triggers that can progress to painful conditions.[2-3] For example, nitric oxide, leukotrienes, prostaglandinE, and lactic acid are known to increase in early IVD degeneration; all are considered to be powerful direct nociceptive stimuli. Disc degeneration is perhaps most easily distinguished by a loss of tissue and by structural derangement. Although disc degeneration is age-associated, disc degenerationis not equal to disc aging, but rather involves pathological structural defects, which are distinct from age-associated changes.[4] Such localized defects can result in strain concentrations, apoptosis, and increase proinflammatory conditions and deformities, which can result in painful conditions.[5]

Epidural injections are administered by accessing the lumbar epidural space by multiple routes including transforaminal, caudal, and interlaminar. Substantial differences have been described among these 3 approaches, with the transforaminal approach having the advantage of being target-specific and using the smallest volume, fulfilling the aim of reaching the primary site of pathology, namely the ventral lateral epidural space.[6] However, transforaminalepidural injections a e also associated with substantial risk compared to either caudal or interlaminar epidural injections.[7] Further, multiple prognostic indicators,[8] the depth of the epidural space,[9] the relationship of the radicular medullaryartery,[10] injectate volumes required,[11] filling patterns, and multiple modifications to improve safety and effectiveness,[12] are important in treating multiple types of painful conditions.[13] Transforaminal epidural injections have been utilized for multiple indications including lumbar radiculitis with or without disc herniation, discogenic pain, spinal stenosis, and in post lumbar surgery syndrome.[14] The comparative effectiveness of multiple types of steroids have also been studied.[15] In addition, utilization of lumbar transforaminal epidural injections has increased 152% for the primary procedure and 218% for subsequent procedures as illustrated from 2002 to 2006.[16] From 2000 to 2010, they increased 699% for the primary procedure and922% for subsequent procedures, an annual increase of 70% and 92%, respectively.[17] Despite increasing utilization of lumbar transforaminalepidural injections, significant debate continues regarding their effectiveness.

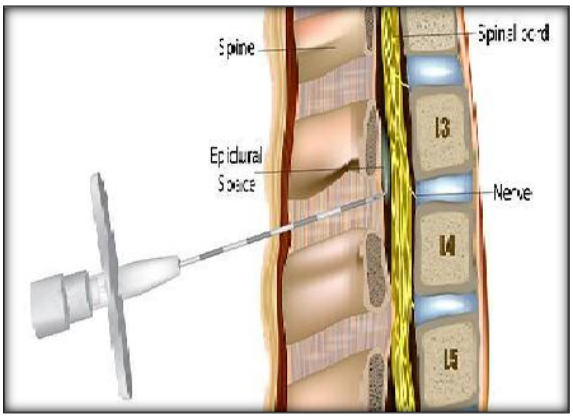


Figure 2: Epidural injection

Among the multiple interventions used in managing chronic spinal pain, lumbar epidural steroid injections have been used extensively to treat lumbar radicular and discogenic pain. Among caudal, inter laminar transforaminal routes, the transforaminal steroid injections have gained rapid and widespread acceptance for treatment of lumbar discogenic pain. The potential advantages are targeted delivery of a steroid to the site of pathology, presumably an inflamed nerve root.

Since the introduction of Fluoroscopy guided ESI, most patients achieve good response with a single ESI injection and the repeat injection is not recommended in the complete responders. Repeat ESIs are recommended only when first injection fails to maintain a favourable outcome and the patient's pain aggravated after the initial injection. This study to evaluate the effect of therapeutic transforaminal lumbar steroid injections for discogenic pain.

MATERIAL AND METHODS

Study Design

A systematic review of therapeutic transforaminal steroid injection therapy for low back and lower extremity pain.

Inclusion Criteria

Patients with age between 20 to 80 years presenting with unilateral L5 and S1 radiculopathy for more than 45 days.

No symptoms improvement or continuation of pain for more than 1 month after physical therapy and medications.

Failed conservative treatment

Patient Reluctant for surgery

Exclusion Criteria

- Patients with age <20 or >80 years
- Bilateral radiculopathy with claudication
- Cauda equine syndrome
- History of previous surgery, infections, cancer
- severe neurological deficits
- uncontrolled medical or psychiatric illness
- Allergy to contrast medium and steroids

Methods of Injection

KAMBIN'S TRIANGLE APPROACH

- Patients were positioned prone, cushioned with pillows underneath the abdomen to compensate Lumber Lordosis.
- Squaring of both the endplates was done under Image intensification with tilt in cephalocaudal direction.
- A 3.5 inch 22-gauge spinal needle was then inserted into the skin, paraspinally, aiming at the anterior epidural space in to the kambins triangle.

The needle was advanced 2-3mm and end on view of needle placement, hitting the facet and sliding in to the epidural space was confirmed with contralateral oblique and lateral views.

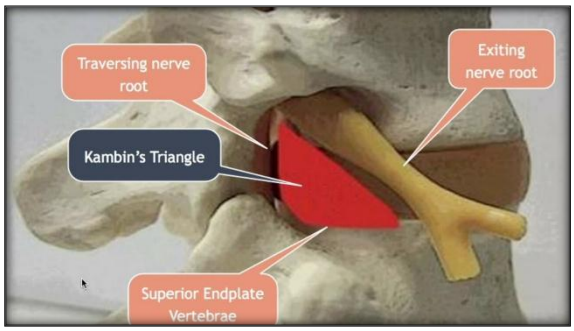


Figure 3: Kambin's Triangle Approach

- Once the needle is secured into the site, a single injection of 1 cc of non-ion contrast agent was administered to measure the position and degree of contrast agent diffusion.
- A second injection of 2cc of pre-filled Lidocaine controlled syringe (1.5ml+20mg Triamcinolone) with 0.5% Lidocaine was administered.

Complications

- Intradural perforation, intradiscal injections, inadvertent spinal nerve pricking, intravascular injection, discal injection, infections, etc.

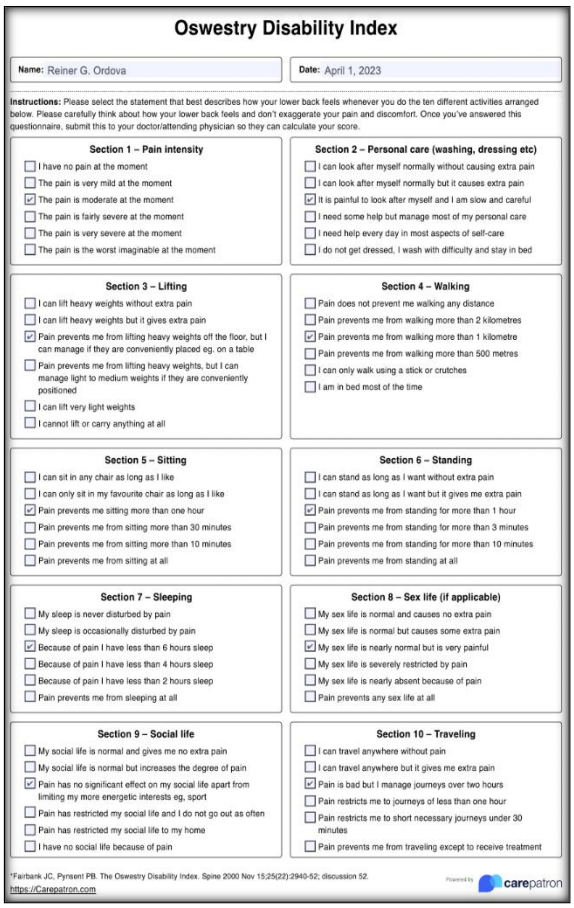
Outcome Measures

- Pain relief (short term - upto 6 months, long term >6 months)
- Secondary outcome measures were improvement in functional status, physiological status, return to work and reduce opioid intake.
- A hospital based observational study was conducted among a total of 20 patients who underwent percutaneous transforaminal steroid injection using Kambin's triangle approach.
- Patients were identified during a period of 1 year from November 2022 to October 2023.

Data collection was performed after obtaining approval from IEC of KMC and MGM Hospital Warangal

- The ODI and NRS scores were calculated at pre injection, one month and three months post op respectively.

The data were put into an Excel sheet in Microsoft Office and analysed using IBM SPSS statistics for Windows version 24.0.



Oswestry Disability Index

Name: Reiner G. Ordova — Date: April 1, 2023

Instructions: Please select the statement that best describes how your lower back feels whenever you do the ten different activities arranged below. Please carefully think about how your lower back feels and don't exaggerate your pain and discomfort. Once you've answered this questionnaire, submit this to your doctor/attending physician so they can calculate your score.

Section 1 – Pain intensity
- ☐ I have no pain at the moment
- ☐ The pain is very mild at the moment
- ☑ The pain is moderate at the moment
- ☐ The pain is fairly severe at the moment
- ☐ The pain is very severe at the moment
- ☐ The pain is the worst imaginable at the moment

Section 2 – Personal care (washing, dressing etc)
- ☐ I can look after myself normally without causing extra pain
- ☐ I can look after myself normally but it causes extra pain
- ☑ It is painful to look after myself and I am slow and careful
- ☐ I need some help but manage most of my personal care
- ☐ I need help every day in most aspects of self-care
- ☐ I do not get dressed, I wash with difficulty and stay in bed

Section 3 – Lifting
- ☐ I can lift heavy weights without extra pain
- ☐ I can lift heavy weights but it gives extra pain
- ☑ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently placed eg. on a table
- ☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned
- ☐ I can lift very light weights
- ☐ I cannot lift or carry anything at all

Section 4 – Walking
- ☐ Pain does not prevent me walking any distance
- ☐ Pain prevents me from walking more than 2 kilometres
- ☑ Pain prevents me from walking more than 1 kilometre
- ☐ Pain prevents me from walking more than 500 metres
- ☐ I can only walk using a stick or crutches
- ☐ I am in bed most of the time

Section 5 – Sitting
- ☐ I can sit in any chair as long as I like
- ☐ I can only sit in my favourite chair as long as I like
- ☑ Pain prevents me sitting more than one hour
- ☐ Pain prevents me from sitting more than 30 minutes
- ☐ Pain prevents me from sitting more than 10 minutes
- ☐ Pain prevents me from sitting at all

Section 6 – Standing
- ☐ I can stand as long as I want without extra pain
- ☐ I can stand as long as I want but it gives me extra pain
- ☑ Pain prevents me from standing for more than 1 hour
- ☐ Pain prevents me from standing for more than 3 minutes
- ☐ Pain prevents me from standing for more than 10 minutes
- ☐ Pain prevents me from standing at all

Section 7 – Sleeping
- ☐ My sleep is never disturbed by pain
- ☐ My sleep is occasionally disturbed by pain
- ☑ Because of pain I have less than 6 hours sleep
- ☐ Because of pain I have less than 4 hours sleep
- ☐ Because of pain I have less than 2 hours sleep
- ☐ Pain prevents me from sleeping at all

Section 8 – Sex life (if applicable)
- ☐ My sex life is normal and causes no extra pain
- ☐ My sex life is normal but causes some extra pain
- ☑ My sex life is nearly normal but is very painful
- ☐ My sex life is severely restricted by pain
- ☐ My sex life is nearly absent because of pain
- ☐ Pain prevents any sex life at all

Section 9 – Social life
- ☐ My social life is normal and gives me no extra pain
- ☐ My social life is normal but increases the degree of pain
- ☑ Pain has no significant effect on my social life apart from limiting my more energetic interests eg, sport
- ☐ Pain has restricted my social life and I do not go out as often
- ☐ Pain has restricted my social life to my home
- ☐ I have no social life because of pain

Section 10 – Traveling
- ☐ I can travel anywhere without pain
- ☐ I can travel anywhere but it gives me extra pain
- ☑ Pain is bad but I manage journeys over two hours
- ☐ Pain restricts me to journeys of less than one hour
- ☐ Pain restricts me to short necessary journeys under 30 minutes
- ☐ Pain prevents me from traveling except to receive treatment

*Fairbank JC, Pynsent PB. The Oswestry Disability Index. Spine 2000 Nov 15;25(22):2940-52; discussion 52.
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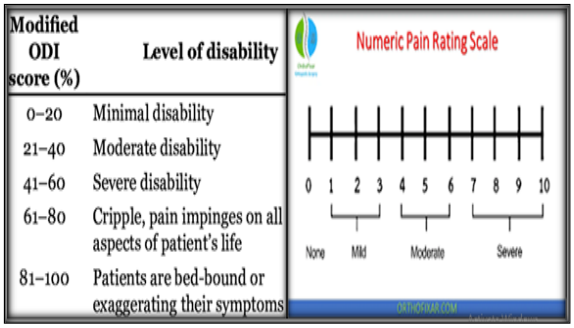

Modified ODI score (%)	Level of disability
0–20	Minimal disability
21–40	Moderate disability
41–60	Severe disability
61–80	Cripple, pain impinges on all aspects of patient's life
81–100	Patients are bed-bound or exaggerating their symptoms

Limitations

- Primary limitation – since the sample size is small, not possible to draw a definitive conclusion
- Patients with additional pathology like spondylolisthesis, facetal cyst, lumbar canal stenosis, were not assessed on dynamic imaging.
- Several confounders- duration of pain, functional safety of patient.
- Monitoring only 6 months.

RESULTS

In this study, 20 patients with discogenic pain epidural Steroidal injection therapy was shown to cause significant pain reduction and functional improvement, which were measured using the numerical rating scale (NRS) and the Oswestry disability index (ODI). The patient is asked to make three pain ratings, corresponding to current, best and worst pain experienced over the past 24 hours. The average of the 3 ratings was used to represent the patient's level of pain over the previous 24 hours. Pain intensity is frequently measured on an 11-point pain intensity numerical rating scale (PI-NRS), where 0=no pain and 10=worst possible pain. However, it is difficult to interpret the clinical importance of changes from baseline on this scale (such as a 1- or 2-point change). To date, there are no data driven estimates for clinically important differences in pain intensity scales used for chronic pain studies. There were 10 items in the Oswestry disability index (ODI), including pain, individual function, and personal comprehensive function. The minimum score for each item is 0 (good state), whereas the highest score is 5 (poor state).The Oswestry disability index referred to the percentage of the sum of score from all 10 items out of 50.In this study, data on 20 subjects from Epidural Steroid Injections study showed positive results transforaminal steroid injections provide modest analgesic benefit at 3 months in patients with lumbar discogenic pain Where as other 13 studies randomized trials meeting inclusion criteria for evaluating lumbar transforaminal epiduralsteroid injections, 5 trials,[18] evaluated. short-term results and 8 trials evaluated long-term results.[19] There were 4 nonrandomized studies,[20] meeting inclusion criteria evaluating the effectiveness of transforaminal epidural injections of which 2 were short-term and 2 were long-term.

Our results showed that the 7 items of the ODI had weak IIO property. The IIO property is a useful feature for measurement of disability. For example, if a patient with LBP reports impaired personal hygiene, the patient would also suffer from disability of the other 6 items of the ODI. Also, when a patient reports improved disability of pain intensity, the patient would have improved disability of the other 6 items of the ODI. Besides, our results concurred with recent studies that the disability of personal hygiene is the most difficult item of the ODI.[20]

Our results have two implications for research of the ODI. First, the raw score of the ODI might not be the ideal aggregate score of the ODI. Alternative scoring methods of the ODI include dividing the raw score into 5 categories, and using the individual items of the ODI.[21] Second, further research should consider multidimensional scaling of the ODI, for example, multidimensional scaling and item-response theory models.[22,23]

Short- and long-term relief was evaluated in 13 randomized trials, of which 10 trials,[24] with 498 patients receiving steroids and 60 patients receiving local anesthetic only 2 showed positive results. One randomized trial showed negative results utilizing 44 patients in the steroid group. Negative results for local anesthetics were seen in 2 trials with 54 patients. Further,2 randomized trials showed results which could not be determined: these included 15 patients receiving local anesthetic and steroids,[25] 80 patients receiving sodium chloride solution and steroids, and 80 patients receiving normal saline.

Overall, long-term relief was illustrated in 6 of the 8 randomized trials evaluating long-term follow-up whereas one trial showed results which were undetermined and one trial showed negative results.[26] A total of 538 patients were included in the positive studies and a total of 90 patients were included in the study with negative results. Among the non-randomized studies, there were only 2 studies evaluating long-term follow-up of these, one study showed positive long-term results with 54 patients receiving transforaminal injections.

Rosenberg et al, Berger et al and Manchikanti et al,[27-28] studied the role of transforaminal epidural injections in managing discogenic pain without radiculitis or disc herniation. However, these studies included a small number of patients. Thus, there were no data for assessment of the evidence.

Of the 4 randomized active-controlled trials only 3 trials which included 46 patients,[29] 17 patients, and 57 patients receiving local anesthetic with steroids, showed positive results both short-term and long-term One randomized trial with 23 patients receiving bupivacaine with steroids, had negative results for steroids. Among the non-randomized studies, one study which included 49 patients, showed positive results for short-term improvement and a second study with 62 patients showed negative results for short-term improvement.

Table 1: The ODI and NRS scores at pre injection, one month and three months post op respectively

	Pre injection (n=20)	After 1 month (n=20)	After 3 months (n=20)
NRS SCALE	6	5	4
ODI SCALE	18	10	4

DISCUSSION

High levels of phospholipase A2, an enzyme involved in the production of prostaglandin and leukotrienes during inflammation, have been found in herniated discs, and may be involved in the generation of radiculopathic pain. Also, mechanical irritation of the dorsal root ganglia has been shown to decrease the thermal nociceptive threshold, and to correlate with c-fos expression, as well as the appearance of pain related behaviors. It also has been shown that mechanical compression alone may not be directly associated with the onset of pain, and resolution of symptoms may not correlate with the resolution of the compression.[30] Moreover, several studies have shown abnormal MRI findings in those without back pain. In addition other factors such as substance P, calcitonin gene-related peptide, nitrous oxide, and phospholipase A2 may be released from the disc.

This systematic review evaluating the effectiveness of lumbar transforaminal epidural injections in managing chronic low back and lower extremity pain caused by disc herniation with radiculitis showed good evidence for them. However, the evidence is fair for spinal stenosis. There was no evidence available for axial pain in the literature. For lumbar radiculitis in post-surgery syndrome, evidence is limited. In this evaluation, a total of 13 randomized trials and 5 non-randomized studies were included.[31] Only the studies meeting at least moderate quality criteria were included in analysis. A quality assessment for all the manuscripts was performed. This rigorous review yielded similar results to Buenaventura et al published in 2009, a critical review of APS guidelines and a reassessment of the American College of Occupational and Environmental Medicine (ACOEM) guidelines. Further, results provided by other reviewers are also in line with the evidence from this review.

Systematic review of the efficacy of lumbosacral transforaminal epidural steroid injections, extensively discussed not only the effectiveness, but also their role in avoiding surgical interventions. They concluded that there was fair evidence supporting transforaminal epidural steroid injections as superior to placebo for treating radicular symptoms, and there was good evidence that transforaminal epidural steroid injection should be used as a surgery-sparing intervention.[32-33] They also concluded that transforaminal epidural injections were superior to interlaminarepidural injections and caudal epidural injections for radicular pain. However, they raised multiple issues related to challenges facing the determination of global recommendations based on the available evidence. They noted that the body of evidence contained very heterogenous studies with significant differences in the study populations, controls used, duration of follow- up, outcome measures, the type of intervention, number of injections, the technical approaches, types of medications, and volume of injection. In the present systematic review, we also echo the findings with the same issues. However, the present evaluation showed only limited evidence for superiority of transforaminal epidural injections over caudal or interlaminar epidural injections performed under fluoroscopy. In contrast, the evidence in this manuscript correlates with their conclusions that transforaminalepidural steroid injections are effective in avoiding surgical interventions.

CONCLUSION

The advantage of Kambin's triangle approach is needle placement anterior to epidural space in cases with reduced disc space, which is safe and does not injure any neurovascular structures. Transforaminal steroid injections provide modest analgesic benefit at 3 months in patients with lumbar discogenic pain, but they have no impact in physical disability or incidence of surgery. Fluoroscopically guided transforaminal steroid injections serve as an important tool in the non-surgical management of lumbosacral radiculopathy secondary to herniated discs.

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