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Comparison of treatment outcome of transforaminal and caudal epidural steroid injections for radiating low back pain

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ABSTRACT

Background: Low back pain is a common disorder. Nearly everyone is affected by it at some time during one's life time. Corticosteroid injections showed early and moderate but unsustained improvements versus placebo in certain outcomes for lumbar radiculitis. Hence; the present study was undertaken for assessing and comparing the efficacy of transforaminal and caudal epidural steroid injections outcome for the treatment of lumbar radiculitis.
Methods: The study was conducted prospectively on 60 patients (30 each) from 20-75 years of age. All the patients were divided into two groups; Group A included patients in which Transforaminal route was used while Group B included patients in which caudal route was used. Pain relief was assessed after the epidural steroid injection using visual analogue scale (VAS) and Oswestry disability index (ODI).
Results: Mean VAS and mean ODI score for the patients of Group A was significantly lower in comparison to the patients of group B at post-last injection, 15 days post-last injection, 1-month post-last injection and 3 months post-last injection time interval.
Conclusions: Transforaminal approach exhibited superior efficacy and should be performed with increasing frequency. Transforaminal epidural steroid injection also gave better quality of life.

Keywords: Transformainal, Caudal, Low back pain, Radiculitis

INTRODUCTION

One of the most common orthopedic problems that one encounters during their lifetime is back pain. The cause of back and leg pain is often attributed to prolapsed intervertebral disc which at which happens by mechanically compression of the nerve root. The pain produced by inflammatory reaction is attributed to the escape of the contents of the nucleus pulposus. It causes inflammatory reaction in the disc itself, in the region of the facet joint. A chemical neuroradiculitis is produced due to various inflammatory mediators.[1] The most common clinical appearance of lumbar radiculitis is radicular leg pain below the knee level with or without neurological deficits in the distribution of lumbosacral nerves. The nerve root impingement is due to radiculopathy of prolapsed disc in the majority of cases.[2]

Among the treatment of lumbar radiculitis which includes pain reduction uses of analgesics or non-steroidal drug anti-inflammatory drugs (NSAIDs), or other more specific drugs alongside neuropathic pain. Epidural steroid injection (ESI) is one of the possible treatment options.[3] The treatment of lumbar radiculitis or discogenic back pain with ESIs is being done since long time.[4,5] Epidural injections are the most commonly used in intervention in the treatment of pain of disc herniation.[5] Radcliff et al recommended the analysis of

SPORT trial that epidural steroid injections related with prevention of surgery by the rate of 41%.[6] There are three approaches in which epidural injections are given in lumbar spine: transforaminal, caudal or interlaminar. These three approaches have their own advantages and disadvantages and these are based on the level of structural abnormalities having potentially different outcomes.[7,8]

Among the various methods of medication delivery, the interlaminar approach is considered the most proficient for the assumed site of pathology. But the most targeted specific modality requiring the smallest volume to reach the primary site of pathology is the transforaminal approach. In contrast, the caudal epidural injections require comparatively large volumes and are related with an alleged lack of specificity of assumed site of pathology. Even though having shortcomings, caudal epidural injections are considered as the safest and easiest approach, with minimal risk of inadvertent dural puncture, and are preferred modality in the post-surgery syndrome.[7,9-11] The most recent approaches the transforaminal, which is used to target a predetermined nerve root with medications for diagnostics as well as therapeutic purposes.[12,13] In transforaminal injections there is a ventrolateral contrast spread along the segmental nerve. The target is the segmental nerve (and dorsal root ganglion) within the radicular canal.[14-16] Hence, keeping in mind the observations of aforementioned studies, the purpose of the present trial was to assess the clinical outcome of transforaminal and caudal epidural route for the lumbar radiculitis and to compare their results which will facilitate the formulation of better effective route of drug administration in alteration of pain and to establish treatment protocol for definitive or intermediary use.

METHODS

Written informed consent was obtained from the patients for publication of this case report and accompanying images. The present study was conducted in Government medical college and hospital, Faridkot institute from February 2018 to November 2019 and it included prospective study of assessment and comparison of efficacy of transforaminal and caudal epidural steroid injection in 60 patients 20-75 years of age with radiating low back pain.

Inclusion criteria

Inclusion criteria for current study were; age between 20 to 75 years. Radiating back pain with no relief after twelve weeks of conservative therapy. Magnetic resonance imaging (MRI) evidence of herniated nucleus pulposus at level corresponding with symptoms and clinical findings. A score of greater than 20 score on the Oswestry low back pain disability questionnaire.

Exclusion criteria

Exclusion criteria for current study were; patient refusal for the procedure. Patients with significant coagulopathies and use of anticoagulants. Patient with history of allergy to contrast media, steroids and local anaesthetic agents. Previous lumbar spine surgeries or epidural steroid injections. Multi-level degenerative spine disease, unstable spine, vertebral compression fractures.

The patients were randomly allocated to one of the two groups of 50 patients each. Group A- for transforaminal approach and group B- for Caudal approach. With all aseptic precautions, in group A (Transforaminal), Patients were placed in the prone position and the X-ray projection was focused on the epiphyseal plate of the upper and lower vertebral body. At that location, 22 Gauge spinal needle was inserted into the skin toward the lateral lower part of the superior articular process and parallel to the Flouroscopy image, and the process was touched, directed laterally and advanced by 2-3 mm. Then, the needle was located medially in the 5 o'clock direction of the upper pedicle at the anteroposterior view, without further advancement and in the posteroinferior of the intervertebral foramen at lateral view. Using this subpedicular approach, the agents are injected at the exit zone as the distal site of the nerve root canal. After the final location of the needle was secured, 1 cc of non-ionic contrast agent was administered to observe diffusion location and scope of the contrast agent, and then 3 cc of the prepared agent (Bupivacaine 1 ml (0.5% Preservative Free) along with Methylprednisolone 2 ml (80 mg)) was administered (Figure 1).

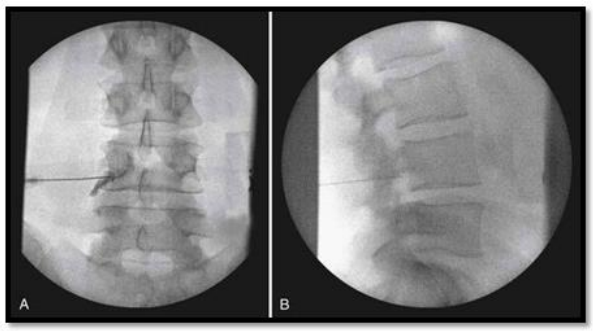

Figure 1: Flouroscopic image showing flow of the dye in the "nerve root canal".

With all aseptic precautions, in group B (Caudal), the patient was placed in prone position for fluoroscopy-guided caudal epidural injection. In lateral view of fluoroscopy, the sacral hiatus was identified as an abrupt drop off at the end of S4 lamina. The needle trajectory was visualized and navigated accordingly into the sacral canal. By injecting contrast medium under fluoroscopy, the placement of needle tip within the sacral epidural space was verified. Needle was placed in epidural space and bupivacaine 4 ml (0.5% preservative free) along with methylprednisolone 2 ml (80 mg) and 4 ml normal saline

is injected into the sacral hiatus (Figure 2). Patient was monitored in post procedure room for at least 1hour for vitals, any muscle weakness, fresh bleeding, and sedation etc and the discharged.

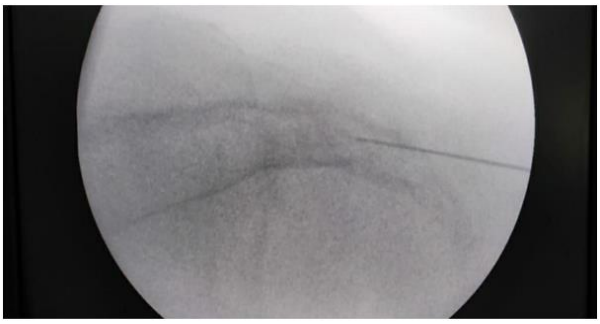

Figure 2: Fluoroscopy-guided caudal epidural injection; proper needle tip placement was verified by observing under fluoroscopic guidance.

Patients were evaluated on the basis of Visual analogue scale (VAS) and Oswestry disability index (ODI) at immediate post injection, 2 weeks, 1 month, 3 month, 6 months and 1 year follow up. All the results were summarized in Microsoft excel sheet and were analyzed by SPSS software. Chi-square test and student t test was used for assessment of level of significance with $p<0.05$.

RESULTS

All the results were subjected to statistical analysis. It was observed that for both the groups patients mainly belonged to the age group of 41 to 60 years. Mean age of the patients of both the groups was 44.5. Both the Groups mainly consisted of major proportion the patients of Group B were females while the remaining were males as shown in (Figure 3).

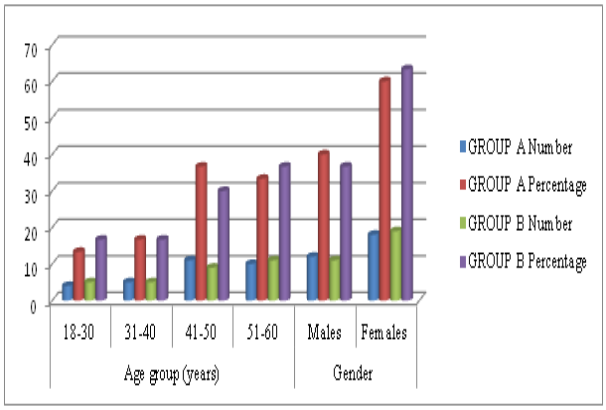

Figure 3: Demographic data.

Mean VAS among the patients of Group A (transforaminal) and among the patients of Group B (Caudal) were obtained as shown in (Table 1). Mean VAS for the patients of Group A was significantly lower in comparison to the patients of group B at post-last injection, 15 days post-last injection, 1-month post-last injection and 3 months post-last injection time interval. Mean ODI among the patients of Group A (Transforaminal) and among the patients of Group B (Caudal) were obtained as shown in (Table 1).

Table 1: Mean VAS score and ODI score.

Time interval	Group A		Group B		P value
	Mean	SD	Mean	SD	
VAS Score					
Pre-injection	6.8	2.4	7.1	2.8	0.85
Post- last injection	4.1	1.9	4.7	2.1	0.00 (S)
Post- last injection 15 days	3.9	1.7	4.6	1.9	0.00 (S)
Post- last injection 1 month	3.7	1.8	4.3	1.7	0.00 (S)
Post-last injection 3 months	3.6	1.4	4.1	1.6	0.00 (S)
Post-last injection 6 months	4.1	1.8	4.3	1.9	0.49
Post- last injection 1 year	5.9	2.2	5.8	2.1	0.19
ODI score					
Pre-injection	58.9	9.4	60.3	8.7	0.77
Post- last injection	26.3	4.8	30.1	4.3	0.02 (S)
Post- last injection 15 days	23.1	4.3	29.7	4.1	0.01 (S)
Post- last injection 1 month	22.8	3.7	27.1	2.6	0.01 (S)
Post-last injection 3 months	20.1	3.7	25.8	2.6	0.01 (S)
Post-last injection 6 months	27.7	4.7	29.1	4.3	0.37
Post- last injection 1 year	39.4	4.7	42.1	5.1	0.74

Mean ODI for the patients of Group A was significantly lower in comparison to the patients of group B at post-last injection, 15 days post-last injection, 1-month post-last injection and 3 months post-last injection time interval. On comparison of mean VAS score within Group A at pre-injection and 3 months post last injection showed significant results whereas insignificant result on similar comparison with 1 year post last injection as

shown in. Similar results were obtained on comparison in Group B (Table 2,3). Whereas on comparison of mean ODI score within Group A at pre-injection and 3 months post last injection showed significant results also on comparison with 1 year post last injection. Similar significant results were obtained on comparison in Group B (Table 4-5). In the current study, two patients from caudal group complained of local site pain, sweating and transient drowsiness during the time of injection. These complaints were relieved by slowing down the speed of drug injection. Three patients from transforaminal group headache. None of the patients had an infection or a reaction to contrast material and medication used.

Table 2: Comparison of mean VAS score within group A and B after three months.

Parameter	Group	Pre-injection		Post-last injection 3 months		P value
		Mean	SD	Mean	SD	
VAS Score	Group A	6.8	2.4	3.6	1.4	0.000
	Group B	7.1	2.8	4.1	1.6	0.000

Table 3: Comparison of mean VAS score within group A and B after one year.

Parameter	Group	Pre-injection		Post-last injection 1 year		P value
		Mean	SD	Mean	SD	
VAS Score	Group A	6.8	2.4	5.9	2.2	0.135
	Group B	7.1	2.8	5.8	2.1	0.059

Table 4: Comparison of mean ODI score within group A and B after three months.

Parameter	Group	Pre-injection		Post-last injection 3 months		P value
		Mean	SD	Mean	SD	
ODI Score	Group A	58.9	9.4	20.1	3.7	0.000
	Group B	60.3	8.7	25.8	2.6	0.001

Table 5: Comparison of mean ODI score within group A and B after one year.

Parameter	Group	Pre-injection		Post-last injection 1 year		P value
		Mean	SD	Mean	SD	
ODI Score	Group A	58.9	9.4	39.4	4.7	0.001
	Group B	60.3	8.7	42.1	5.1	0.000

DISCUSSION

Pharmacologically, epidural steroids are thought to act as inhibitors of production of inflammatory substances, therefore decreasing the interneural oedema and venous congestion. In cases of lumbar radiculitis which cannot be treated by traditional methods, epidural steroid injections are employed. It has been seen that co-administration of corticosteroid and local anesthetics helps in providing the stabilization of cellular membrane, inhibition in immune response, suppression of prostaglandin synthesis and increase in neuronal blood flow.[17] A systematic review conducted by Abdi et al found strong evidence for short term pain relief and moderate evidence for long term pain relief by use of epidural steroids.[18] Boswell et al found strong evidence for efficiency of transforaminal epidural steroids while reasonable evidence for caudal epidural steroids in reducing pain due to lumbar prolapsed disc.[19] Similar results were supported in other relevant studies.[20,21] However, some latest studies including some systematic reviews propose contradictory results about effectiveness leading to dividing opinion among the treating physicians.[22-25] There is also controversy regarding the most efficient route for epidural injections and these have also been reported in various extensive studies in past.[26,27] For example, Ackerman and Ahmed reported the advantages of transforaminal routes over caudal and interlaminar routes.[26] Similar studies in past have also concluded that transforaminal route is better than caudal approach in concordance with results of the present study.[28-31] However, conflicting to this there is yet another study which states that there is no disparity between efficiency of these three routes.[27] Hence, the present study was undertaken to evaluate the outcome of Transforaminal and caudal epidural steroid injections and compare them in view of clinical outcome. The present study suggests transforaminal approach offers better pain relief and quality of life as compared to caudal approach. Caudal routes were found to be slightly less effective with no major difference in their clinical outcomes at 1 year of follow up. The reason for higher effectiveness of transforaminal route can be attributed to the precise delivery of medication at the exact site of pathology. With caudal route, due to availability of wider epidural

space leads to very less quantity of steroid reaching the site of inflammation.

In the present study, transforaminal group showed better results in comparison of caudal group in terms of short terms, mid-term as well as follow up after one year. Various studies for e.g., by Boswell et al and Abdi et al Concluded in their systematic reviews about the discal pathology was strong for short term and moderate for long term pain relief and also their trends was compared in recent systematic reviews by Conn et al.[18,19,32] The VAS and ODI score improved in both the groups but the better results were with transforaminal group as compared to Caudal group for the same period of comparison. Also, significant results were achieved at 6 months post-last injection as shown in (Table 1).

The method of administration of lumbar epidural steroid injections has different efficacy. These have their own adversities so maintaining a rigid protocol during these dealings is mandatory. Apart from minor adverse reactions, major complications due to needle position, steroid itself and other drugs in formulation such as dural puncture can cause nausea and headache after the procedure.[20] Neurotoxicity can also occur due to subdural release of chemicals.[33] Infections may also occur, although rare. So form sepsis should be maintained during the event. The IV line should be maintained at all times prior to the process as the sudden release of histamines due to foreign material can induce sudden hypotension. Similarly, for caudal route there is increased risk of placement of needle tip anterior to sacrum or into rectum. However, the risk involving the puncture of dura matter is minimal in this method. However, the placement of needle to the nerve root involves risk of its disturbance transforaminal technique. This method also includes the risk of paraplegia if inadvertent intra-arterial injection of particulate steroid occurs into a radicular artery that reinforces the blood supply of the lower end of spinal cord.[34] Benoist et al mentioned that epidural steroids are well accepted and rather the complications are due to a technical inaccuracy.[35] Steroids can cause unfavorable events such as fluid retention, osteoporosis, steroid myopathy, weight gain, necrosis of bone, etc. Therefore, there should be extra precautions while administrating these methods like ESIs by clinicians.[36] In the present study, two patients from caudal group complained of local site pain sweating transient drowning drowsiness during the time of administration of injection. However, by slowing down the speed of drug injections these complaints were relieved. Three patients from transforaminal group headache. None of the patients had an infection or a reaction to contrast material and medication used.

Limitations

Limitations of this study were its small sample size, which made assessing the effectiveness of the interventions on different patient outcomes difficult. Another limitation of this study was that the patients taken into consideration were only with lumbar radiculitis with one side radiating pain. Patients with different diagnosis were not taken into consideration likely Lumbar canal stenosis, central PIVD.

CONCLUSION

Transforaminal approach exhibited superior efficacy and should be performed with increasing frequency. Before selecting a steroid injection route for the management of radicular pain, the benefits and risks of the approaches discussed herein must be taken into consideration. Superiority of transforamnal caudal injections makes it of much more use in morbid, non-compliant, and inappropriate for surgery due to severe co-morbid conditions patients to improve life quality. The short-term and mid-term effects after both transforaminal and caudal epidural steroid injections improved VAS and ODI Score also clinical outcome and quality of life, but transforaminal showed better results and quality of life for similar duration of comparison. The long–term outcome after both transforaminal and caudal epidural steroid injections though improved VAS and ODI score along with clinical outcome and quality of life but one year comparison of both transforaminal and caudal epidural injection showed similar results.

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Ethical approval: The study was approved by the institutional ethics committee

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