Assessment of the implication of epidural steroid injection versus other conservative measures in the management of lumbar disc herniation

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Introduction
The aim of this work was to compare the potential efficacy of epidural steroid injection versus other conservative measures for relieving pain and improving function in patients with lumbar disc herniation (LDH).

Methods
This study included 45 patients who presented with low back pain and sciatica due to LDH (at levels of L4–L5 or L5–S1) diagnosed clinically and confirmed by means of MRI. Patients were classified into two groups: group I (15 patients) was treated with drugs and physiotherapy, and group II (30 patients) was subclassified into two subgroups of 15 patients each (group IIL received lumbar epidural injection, whereas group IIC received caudal epidural injection). All patients were assessed at presentation and after starting the treatment at the first week and first, second, and third month using the visual analogue scale (VAS) for pain and the Oswestry Disability Index (ODI) for function status.

Results
Groups I, IIL, and IIC showed improvement in pain and function, confirmed by a decrease in the mean VAS and ODI scores. Both groups of injection showed a significant difference ($P < 0.05$) when compared with group I with regard to VAS and ODI. There was an insignificant difference ($P > 0.05$) between the lumbar and caudal groups in the VAS, except at the second month ($P < 0.05$), and in the ODI, except at first week and first month ($P < 0.05$).

Conclusion
Epidural injection could be a preferable choice in managing low back and radicular pain due to LDH. It was a clinically useful mode of treatment that is cost-effective and could offset the need for surgery.

Keywords:
conservative treatment, epidural steroid injection, lumber disc herniation

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Introduction

Low back pain (LBP) is the most common problem that causes morbidity and socioeconomic loss in the society. Although LBP is self-limiting, it leads to functional limitation when it is persistent and associated with radicular pain. This is among the most common reasons for use of medical services [1].

The treatment of LBP must follow a logical consequence of diagnosis and management. The vast majority of patients with LBP suffer from some mechanical disorder of the disc, ligaments, facet, or nerve root complex. The majority of these problems resolve with conservative treatment [2]. Radicular pain has been attributed to both mechanical deformation as well as to the effect of inflammatory cytokines on the dorsal root ganglion. For this reason, the local delivery of steroids through epidural injection seems to be a rational option [3,4].

Several studies that have been conducted within the last decade showed that a definite trend toward nonsurgical management of lumbosacral disc herniation with radicular symptoms has occurred. Nonsurgical treatment of lumbar radicular pain includes NSAIDs, analgesics, oral or parenteral steroids, therapeutic exercises, and the epidural injections [1]. Epidural injections are performed through lumbar and caudal approaches. The treatment options are considerable and yet the outcomes associated with many treatments are either questionable or not well investigated [5]. Thus, when choosing a therapeutic technique, we must not only consider efficacy but also safety and reproducibility.

Aim

The aim of this study was to compare the potential efficacy of epidural steroid injection (caudal or lumbar) versus other conservative measures for relieving pain and improving function in patients with lumbar disc herniation (LDH).

Patients and methods

This study was carried out on 45 patients with LDH (at levels of L4–L5 or L5–S1 with single level of disc herniation and first degree of disc herniation) who presented with LBP and sciatica for more than 6 weeks, diagnosed clinically and confirmed by means of recent MRI. These patients were selected from the Rheumatology, Rehabilitation and Physical Medicine Outpatient Clinic of Benha University Hospitals as they were referred by a neurosurgery doctor for relieving pain and improving function. Patients were excluded from the study if they had any of the following: spondyloarthropathy, spondylolisthesis or congenital vertebral anomaly, history of a vertebral operation, rapidly progressive neurological motor deficit, systemic infectious disease or local skin infection, cardiopulmonary disease or diabetes or hypertension with blood pressure greater than 140/90 at the time of injection, and chronic disease or a known case of a bleeding disorder.

All patients were subjected to the following: full history taking and thorough clinical examination with stress on neurological examination of the back and lower limbs; plain radiographs and MRI for all lumbar vertebrae to confirm diagnosis; evaluation of pain using the visual analogue scale (VAS) [6]; evaluation using the Oswestry Disability Index (ODI), to measure patients' function capacity by evaluating pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and travelling [7].

The patients included in the study were aware of the side effects and probable complications. Written informed consent was obtained from each participant. The study was approved by the Benha Medical Ethical Committee.

The patients were classified into two groups: group I included 15 patients who refused epidural injections and preferred medication (celocoxib 100–200 mg plus chlorzoxazone 250 mg+paracetamol 300 mg in one preparation three times per day as muscle relaxant for 14 days continuously; at 15th day patients were allowed to use paracetamol only), physical therapy, and rehabilitation measures in the form of lumbar supports, superficial heat, and lumbar spine stabilization exercises (LSSE). The LSSE consisted of progressive isometric contractions of the lumbar multifidus and transversus abdominis muscles to maintain a neutral spinal position. Thereafter, static lumbar stability exercises were started with curl-up, pelvic bridge, side bridge, and quadruped positions. These gradually progressed to dynamic stabilization exercise. Finally, these exercises were integrated into the performance of daily living activities and work. The exercises were started from elementary level and gradually progressed until the patients were able to control their spine in different positions. The intensity of exercises for each participant was controlled based on the exercise tolerance and pain thresholds. Patients were supervised by physiotherapists. LSSE were conducted for 6 weeks, three times per week. Each session lasted 30–45 min [8].

Group II included 30 patients who accepted the injection. This group was subdivided randomly into two subgroups with regard to route of injection. This procedure was carried out in the operating theater under complete aseptic precautions by the same physician (doctor of anesthesia) for all patients in these group. The injection comprised 1 ml of long-acting methyl prednisolone acetate (Depo-Medrole) 40 mg/ml, 1 ml of dexamethasone phosphate 8 mg/2 ml, 2 ml of 2% lidocaine, and 6 ml of normal saline, totaling 10 ml. Group IIL included 15 patients. Lumbar epidural injections were performed using the loss of resistance technique with a stainless steel 18 G epidural needle at a level of the interspinous space (one space proximal to the level of disc herniation) to the epidural space [9]. Group IIC included 15 patients. Caudal epidural injection was given to this group. A 20 G needle was introduced through the sacral hiatus to the epidural space [1]. All of the patients in group II were instructed to change his or her position every 10 min after injection for better access of drug to diseased area. Patients were observed for 3–4 h, and then if there were no complications they were allowed to go home.

All patients were assessed at presentation and after treatment at first week, and first, second, and third month with the VAS scale and ODI score.

Statistical analysis

The statistical package for social sciences, version 9.01 (SPSS Inc., Chicago, Illinois, USA) was used. The χ^2-test (Fisher's exact test when necessary) and a t-test were used for categorical and continuous data comparison, respectively. One-way analysis of variance was used to compare more than two groups. A P value of less than 0.05 was considered significant.

Results

This study was carried out on 45 patients with LDH (at levels of L4–L5 or L5–LS1) who presented with LBP and sciatica. There were 18 female (40%) and 27 male patients (60%), and their ages ranged between 20 and 40 years (mean ± SD 32 ± 5.12 years). All of our 45 patients completed the treatment plan and assessments. Group I included 15 patients, five female (33.3%) and 10 male (66.7%) patients between 25 and 37 years of age (mean ± SD 31 ± 4.34 years), with LBP duration ranging between 6 and 67 weeks, with a mean ± SD of 24.26 ± 0.80. Group II included 30 patients between 20 and 40 years, with a mean ± SD of 32.80 ± 5.48. Group II was subclassified into two subgroups: a lumbar injection group (subgroup IIL), including patients between 30 and 40 years of age (mean ± SD 35 ± 3.10) with LBP duration ranging between 6 and 72 weeks (mean ± SD 30 ± 13), and a caudal injection group (subgroup IIC), including patients between 20 and 37 years (mean ± SD 30 ± 2.10) with LBP duration ranging between 6 and 72 weeks (mean±SD 25 ± 13) (Table 1).

(1) Group II showed a significant difference ($P < 0.05$) in VAS and ODI ($P < 0.05$) score when compared with group I in all stages of follow-up (Table 2).
(2) On comparing the two subgroups (IIL and IIC) with regard to age and disease duration, there was no statistically significant difference with regard to age ($P > 0.05$), but there was a significant difference with regard to disease duration ($P < 0.05$).
(3) There were no significant differences ($P > 0.05$) between the lumbar and caudal groups as regards VAS (except at second month, $P < 0.05$) and ODI (except at first week and first month $P < 0.05$) (Table 3).
(4) Groups I, IIL, and IIC showed improvement in pain and function at the end of the evaluation, confirmed by a decrease in the mean VAS (from 7.20 to 5.67, 8.1 to 2.8, and 7.4 to 3.5, respectively) and in the mean ODI (from 56.13 to 49.33, 61.0 to 24.7, 59.0 to 36.0, respectively).
(5) There was a significant difference ($P < 0.05$) between the three groups in the VAS and the ODI score during follow-up stages except at third month, when the differences did not reach statistical significance (Table 4).

Table 1 Clinical characteristics of groups I, IIL, and IIC

Characteristics	Group I	Group IIL	Group IIC
Age (years)	25.37 (31±4.34)	30.40 (35±3.10)	20.37 (30±2.10)
Sex (F : M)	5:10	6:9	7:8
Disease duration (weeks)	6.67 (24.26±0.80)	6.72 (30±13)	6.72 (25±13)
Weight (kg)	65.105 (84±5.3)	60.100 (81±7.3)	62.102 (82±4.7)
BMI	22.35 (28±7.0)	22.30 (26±8.0)	18.33 (26±2.0)
Level of herniation (*n* (%))			
L4-L5	6 (40)	5 (33.3)	6 (40)
L5-S1	9 (60)	10 (66.7)	9 (60)

chi-squar test=0.189, *p* is=0.909, NS. F : M, female : male.

Table 2 Comparison between the mean visual analogue scale and the mean Oswestry Disability Index of groups I and II

Period	Clinical parameter	Mean±SD		*P* value
		Group I	Group II	
At presentation	VAS	7.2±1.082	7.73±1.082	>0.05
	ODI	56.133±15.6747	60.000±13.1961	>0.05
First week	VAS	6.40±1.183	3.13±1.191	<0.05*
	ODI	50.33±15.751	30.67±11.798	<0.05*
First month	VAS	5.73±0.961	3.40±1.380	<0.05*
	ODI	49.33±16.132	31.33±10.822	<0.05*
Second month	VAS	5.67±0.976	3.83±1.315	<0.05*
	ODI	50.33±16.417	32.93±10.113	<0.05*
Third month	VAS	5.80±0.862	4.27±1.143	<0.05*
	ODI	51.33±15.407	35.33±10.981	<0.05*

ODI, Oswestry Disability Index; VAS, visual analogue scale. **P*<0.05, significant.

Table 3 Comparison between the mean visual analogue scale and the mean Oswestry Disability Index of groups IIL and IIC

Period	Clinical parameter	Mean+SD		*P* value
		Group IIL	Group IIC	
At presentation	VAS	8.07±1.100	7.40±1.298	>0.05
	ODI	61.00±13.1203	59.000±13.6539	>0.05
First week	VAS	2.80±1.207	3.47±1.125	>0.05
	ODI	24.67±6.67	36.67±12.910	<0.05*
First month	VAS	2.93±1.486	3.87±1.125	>0.05
	ODI	26.67±6.455	36.00±12.421	<0.05*
Second month	VAS	3.20±1.320	4.47±0.990	<0.05*
	ODI	29.87±6.116	36.00±12.421	>0.05
Third month	VAS	3.93±1.280	4.60±0.910	>0.05
	ODI	34.67±9.722	36.00±12.421	>0.05

ODI, Oswestry Disability Index; VAS, visual analogue scale. **P*<0.05, significant.

Discussion

The physical, psychological, and socioeconomic impact of LBP is enormous. Studies have determined that sciatica or radicular pain due to herniated disc range between 17 and 55% [5]. Several trials have been conducted to evaluate exercise and drug treatment versus epidural steroid injections in people with LBP, with review articles in general reporting moderate effects. Nevertheless, for clinicians, the most important question is not whether treatment is better than other, but which treatment is most effective [10].

In the current study, over a period of 3 months, there was an improvement in the assessment parameters of group I that reached peak at the second month, and then began to change again without reaching their values before treatment. There was a decrease in pain,

Table 4 Comparison between the mean visual analogue scale and the mean Oswestry of groups I, IIL, and IIC

Period	Clinical parameter	Mean+SD			*P* value
		Group I	Group IIL	Group IIC	
At presentation	VAS	7.2±1.082	8.07±1.100	7.40±1.298	>0.05
	ODI	56.133±15.6747	61.00±13.1203	59.000±13.6539	>0.05
First week	VAS	6.40±1.183	2.80±1.207	3.47±1.125	<0.05*
	ODI	50.33±15.751	24.67±6.67	36.67±12.910	<0.05*
First month	VAS	5.73±0.961	2.93±1.486	3.87±1.125	<0.05*
	ODI	49.33±16.132	26.67±6.455	36.00±12.421	<0.05*
Second month	VAS	5.67±0.976	3.20±1.320	4.47±0.990	<0.05*
	ODI	50.33±16.417	29.87±6.116	36.00+12.421	<0.05*
Third month	VAS	5.80±0.862	3.93±1.280	4.60±0.910	>0.05
	ODI	51.33±15.407	34.67±9.722	36.00±12.421	>0.05

ODI, Oswestry Disability Index; VAS, visual analogue scale. *P<0.05, significant.

confirmed by a decrease in the mean VAS value as well as a decrease in the mean ODI score. These results are in agreement with the findings of other two studies [1,11], in which patients on NSAIDs plus exercise showed improvement in VAS value and ODI score.

In our study, we used heat therapy, back supports, and LSSE in addition to other treatment measures. All these measures played an important role in the improvement of our patients and can be attributed to the fact that heat therapy reduces pain and improves function [12]. Several studies [13–16] reported that LSSE can effectively reduce pain intensity in the lower back and legs and improve functional capacity in LDH. This improvement might be attributed to the fact that LSSE are designed to improve spinal stability, flexibility, strength deficits of the superficial and deep muscles of the spine, and retain precise neural control of these muscles [17–19].

In contrast, a meta-analysis [20] in chronic LBP patients demonstrated that core stability exercise (LSSE) is effective in the improvement of pain and physical function in the short term, rather than the long term.

We found that there was a significant difference (P< 0.05) between groups I and II in the mean VAS and the mean ODI score. The epidural injected group showed a significant improvement, especially within the first weeks after injection (P < 0.05).

This is in agreement with the findings of two other studies [1,21], which suggested that the improvement in the epidural steroid injection group was faster and better than that in the NSAIDs group, and there were statistically significant differences between the assessment scores of the groups. Improvement in pain within the first weeks can offset the need for surgery. Most clinicians know that one of the most common indications for surgical interventions is intractable pain within first months after onset of symptoms [22]. This improvement might be attributed to the high volumes that are administered in the epidura, different mixtures of steroids, local anesthetics, and saline. The injection acts like a hose of water being squirted into a blocked pipe in an effort to shift the blockage, so-called 'volume effect'. Theoretically, local installation of steroid preparation yields higher local concentrations compared with oral dosing. Furthermore, epidural injection of corticosteroids is not dependent on local blood flow, which is frequently impaired with compressive lesions [23].

Epidural steroids can be given either through lumbar or caudal routes. Some studies suggested that patients should receive three injections for more efficacy, whereas others mentioned that only one injection could be enough and effective to avoid more side effects [2].

In the current study we injected through either lumbar or caudal route. We found that there were insignificant differences (P > 0.05) between the lumbar and the caudal group as regards VAS (except at second month) and ODI (except at first week and first month).

Our study is in agreement with the study by Manchikanti *et al.* [24], who showed equal efficacy for caudal and lumber approaches in managing pain and functional disability from disc herniation. Sergio *et al.* [25] reported that lumbar and caudal injections were equivalent, and allowed to decrease surgery in ~60% of the cases. Regardless of the technique, 24–28% of the patients required one or two repeated injections within 12 months for the management of their primary complaint. In our study, patients were managed with only one injection intended for 3 months.

In contrast, Singh *et al.* [2] suggested that there was a significant improvement in the subjective and objective criteria in lumbar epidural route injection as compared with caudal route. This difference may be due to differences in the number of patients, selection of patients for each route, and injected solution.

Our results did not coincide with the long-term results of Carette *et al.* [26], who found a significant improvement in leg pain in a lumbar epidural injection group after 6 weeks, with no difference after 3 and 12 months. Wilson-MacDonald *et al.* [27] reported pain relief only in the first 5 weeks after lumbar epidural injection, whereas no difference in results was seen after that. Bush and Hillier [28] also confirmed that improvement was significantly greater in the steroid group at the fourth week, but no significant difference in pain was recorded at 1 year thereafter. The difference may be caused by the short-term assessment in our study, selection of patients for the caudal route, or contents of the injected solution.

In our study, after 3 months, all groups showed improvement, but the injection groups were statistically better, with significant differences in all clinical parameters ($P < 0.05$) during the follow-up stages except at the third month, when the differences did not reach statistical significance.

The major limitation of our study was lack of fluoroscopy guidance during epidural steroid injections. Moreover, we did not repeat steroid epidural injections. Many studies mentioned that some patients might benefit from repeated injection [10,29].

Further studies are recommended with larger number of patients and long period of assessment to detect patients' need for further injections and to assess whether the injection would offset the need for surgery during this period or patients would need surgical intervention.

Conclusion

Epidural steroid injection could be a preferable choice in managing low back and radicular pain due to disc herniation. It was a clinically useful mode of treatment that is cost effective and could offset the need for surgery in short-term events. The caudal epidural route was safe and simple to be used.

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Conflicts of interest

There are no conflicts of interest.

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