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Short term results of single shot epidural steroid administration in patients with lumbar canal stenosis

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Abstract
Background: Lumbar spinal canal stenosis (LSCS) is one of the many reasons of persistent back pain. Spinal canal narrowing due to disc degeneration, osteophytes, and arthritic facet joints is what's known as LSCS. The purpose of this research is to examine the efficacy of epidural steroid administration (ESI) in reducing pain experienced by people with LSCS.
Methods: This is a prospective clinical trial conducted on 25 cases from 20 to 70 years old suffering from LSCS with pain and radiculopathy symptoms. They have persistent symptoms for at least 6 months despite medication use & physiotherapy and refused surgery. All the administrations were performed by a single spine surgeon at the same center. A solution containing triamcinolone acetate 40 mg (1 ml), xylocaine 2% (1 ml)) and saline 10 ml as flushing agent.
Results: VAS score was significantly decreased at day one, after one and three months of follow up compared to pre-treatment. VAS was also significantly decreased after the first and the third month compared to day one. VAS score was significantly lower in mild and moderate LSCS cases compared to severe LSCS cases after one day, one and three months of epidural steroid administration. The percentage of decrease in VAS score after one day, one and three months of epidural steroid administration from pretreatment VAS were significantly higher in mild and moderate LSCS cases than severe LSCS cases.
Conclusions: In situations of spinal canal stenosis, ESI might be regarded as an effective technique for the relief of pain and alleviation of disability.

Keywords: Epidural steroid administration, lumbar canal stenosis, VAS score

Introduction
There is a growing economic and healthcare burden associated with chronic back pain. Many people will have back discomfort at some point in their lives; some estimates put that number as high as 90%. [1].
Lumbar spinal canal stenosis (LSCS) is one of the many reasons of persistent back pain. Spinal canal narrowing due to degenerative disc disease, osteophytes, and facet joint arthritic alterations [2, 3].
Many theories are hypothesized to explain symptoms of LSCS, nearly all of them go to neurovascular mechanism ”that is caused by mechanical block” as a main cause of these symptoms, this mechanism includes arterial flow in cauda equina, venous congestion, high epidural pressure, nerve root stimulation by local inflammation, or direct compression in the central canal along with hypertrophic ligamentum flavum [2-5].
Symptoms of LSCS include pain radiating from the lower spine to the hips or down the legs, numbness or weakness in legs and sever symptoms as sexual dysfunction or loss of bladder& bowl control.
There are several modalities of treatment of LSCS including surgical and non- surgical options. Non-surgical methods as medication, physical therapy and local administration. Medication and physical therapy are for cases of LSCS with mild symptoms.
Surgery is the most common method for treatment of LSCS specially for cases with moderate and sever symptoms. Local administration is a common non-surgical method of treatment of LSCS specially for cases who are unfit for surgery or even refuse surgery or those with no

response to medical treatments after 6 months [6-10].
While epidural steroid administrations (ESI) attempt to reduce pain response and enhance function, they cannot treat spinal stenosis itself. Surgical decompression of the thecal sac is the only known solution for this condition. These administrations' effects may be broken down into several categories, the most prominent of which is anti-inflammatory [7, 8].
ESIs position the drug at or near the site of pain production. It can "flush out" inflammatory proteins and chemicals that may contribute to or increase pain in the rapid region, relieving local inflammation and perhaps alleviating pain [10].
ESI is a combination of a corticosteroid with a local anesthetic pain alleviation medicine. The local anesthetic medicine is important as it gives rapid pain alleviation. Corticosteroid medicines take longer to have an effect. Sometimes the administration alone is sufficient to provide pain alleviation, but commonly an ESI is used in combination with a comprehensive rehabilitation program to provide additional benefit [10, 12].
The use of epidural administrations to treat LSCS has proven controversial. The benefits of ESI have been compared to those of surgical procedures by several researchers. Several meta-analyses and randomised studies have shown that epidural administrations are both clinically and economically successful in treating spinal stenosis pain [12-15].
The work's goal is to investigate whether or not epidural steroid administration can alleviate pain in those who have lumbar spinal canal stenosis (LSCS).

Patients and Methods
This is a prospective clinical trial conducted in orthopedic surgery department of Tanta University Hospitals from June 2021 to June 2022 on 25 cases from 20 to 70 years old suffering from LSCS with pain and radiculopathy symptoms. They have persistent symptoms for at least 6 months despite medication use & physiotherapy and refused surgery.
Cases or their family members provided signed consent after receiving necessary information. The Ethical Committee gave its authorization to conduct the research.
Exclusion criteria include positive medical history for diabetes mellitus, rheumatoid arthritis or other immunological disease, presence of any concomitant medical problems, local or systemic infection, primary spinal cord pathology or pott's spine and previous spine surgery.
All cases were subjected to the following: full history taking, clinical examination, laboratory and radiological examination.

Procedure
All the administrations were performed by a single spine surgeon at the same center. A solution containing triamcinolone acetate 40 mg (1 ml), xylocaine 2% (1 ml)) and saline 10 ml as flushing agent. ESI were given in operation theatre. The case is put on lateral position with their thighs and neck flexed to make the back curve. Then skin in low back area was cleaned and then after identifying the proper space, skin was anesthetized using local anesthetic.
Needle was inserted and directed towards epidural space under fluoroscopic guidance. Once the needle is in proper space, confirmation was done by pushing air or normal saline and by doing negative suction test. The epidural steroid solution was then administered. After administration, the case was monitored for 15 to 20 minutes before transportation.
All cases received oral gabapentin 100 mg after the administration and also given prophylactic antibiotic for five days. They were asked to rest & avoid any strenuous activities on the day of the administration. In case of severe pain diclofenac sodium 100mg was administrated as the rescue medication. Pain alleviation was recorded at 1st day, 1st month & 3rd month by using visual analog scale (VAS) pain score and compared this score with pre-administration score.

Interlaminar technique
Although this surgery is most typically done at the L4-5 interlaminar level, it can be done at any interlaminar level in the lumbar spine. Depending on the volume administered, the anaesthetic may spread one or two spinal levels caudally or dorsally from the posterior epidural area. If an MRI reveals significant central stenosis at the L3-L4 level, then an L3-L4 interlaminar ESI may be an option for a case who presents with non-specific, bilateral neurogenic claudication (figure.1) [16].

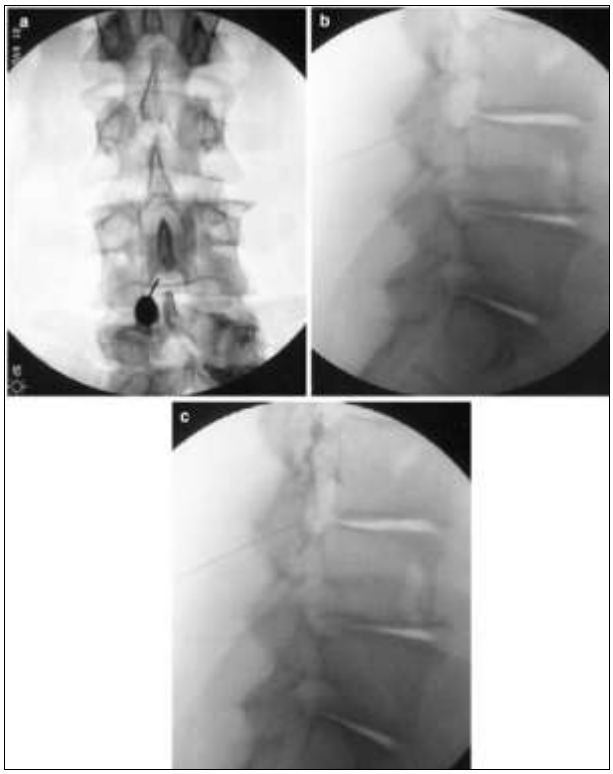

Fig 1: Fluoroscopic images of an L3-4 interlaminar technique. (a) AP view, pre-contrast, (b) Lateral view, pre-contrast, and (c) Lateral view, post-contrast [16]

Caudal technique
When symptoms are more generalised (as opposed to being monoradicular, in which case a transforaminal technique would be preferable), or if there is post-operative worry for epidural scarring (when performing an interlaminar technique would risk dural puncture), this method is most applicable for L4-5 and L5-S1 pathology (Fig.2) [17].

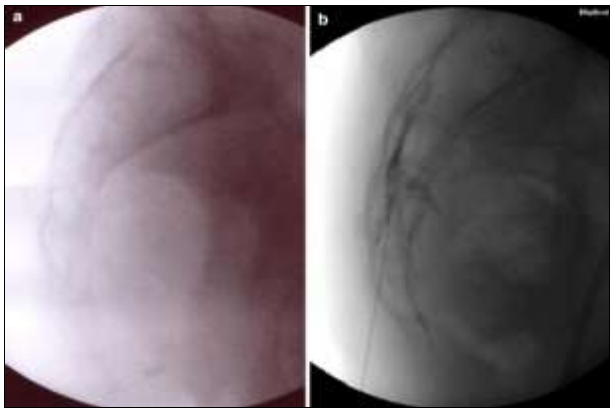

Fig 2: Fluoroscopic images of a caudal technique. (a) Lateral view, pre-contrast and (b) lateral view, post-contrast (17)

Transforaminal technique

This technique requires fluoroscopic guidance and is the most selective of the three. A case with right L5 radicular symptoms and MRI confirmed L4-5 central or lateral recess stenosis, may most benefit from a right L5-S1 transforaminal ESI (Fig.3) [18].

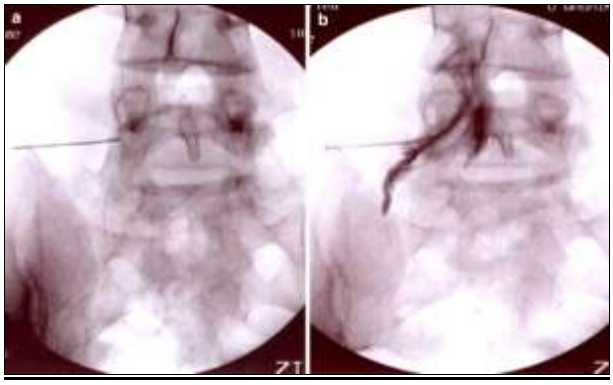

Fig 3: Fluoroscopic images of a right L5-S1 transforaminal technique targeting the right L5 nerve root. (a) AP view, pre-contrast and (b) AP view, post-contrast

Statistical analysis

The data was statistically analysed using SPSS version 20 for Windows (Chicago, Illinois, USA). Mean and standard deviation or number and percentages were used to show the demographic data. A paired t-test or its nonparametric analogue was used to compare baseline and post-intervention values for each outcome measure (Wilcoxon signed-rank). Independent t tests and its nonparametric alternatives were used to compare the groups' mean gains on outcome measures (Mann-Whitney U test). Potential associations were analysed using either Pearson's or Spearman's correlation. The cut off for significance was at $p< 0.05$.

Results

Demographic characteristics are illustrated in table.1

Table 1: Baseline characteristics in the research participants

		Research participants (n =25)
Age (years)	Mean±SD	51.6±11.52
Sex	Male	11 (44%)
	Female	14 (56%)
Smoking	Smoker	6 (24%)
	Non-smoker	19 (76%)
Drug abuse	Abuser	2 (8%)
	Non-abuser	23 (92%)

SD: Standard deviation

Results of the laboratory investigations of the studied cases are shown in table.2

Table 2: Laboratory data of the research participants

		Research participants (n =25)
Hb (g/dl)	Mean±SD	13.86±1.95
PLT count (x10^3 cells/µl)	Mean±SD	329.92±38.75
TLC (x10^3 cells/µl)	Mean±SD	7.16±1.42
RBG (mg/dl)	Mean±SD	139.52±30.08

Clinical characteristics (pain duration, LSCSS, pretreatment VAS) are shown in table.3

Table 3: Clinical data of the research participants

		Research participants (n =25)
Pain duration (months)	Mean±SD	21.44±8.86
LSCSS	Grade 1	5 (20%)
	Grade 2	11 (44%)
	Grade 3	9 (36%)
Pretreatment VAS	Mean±SD	6.84±0.94

LSCSS: lumbar canal stenosis severity

VAS score was significantly decreased at day one, after one and three months of follow up compared to pre-treatment (P <0.001). VAS was also significantly decreased after the first and the third month compared to day one (<0.001). There was no statistically significant difference between VAS score after 1 month and 3 months. (table.4)

Table 4: VAS score of the research participants

Vas score	Research participants (n =25)			
	Pretreatment	1 day	1 month	3 months
Mean±SD	6.84±0.94	5.56±1.0	4±1	3.84±1.11
P1, P2 and P3		<0.001*	<0.001*	<0.001*
P4 and P5			<0.001*	<0.001*
P6				0.949

P1, P2, and P3: Significance between pretreatment and 1 day, 1 months, and 3 months respectively. P4 and P5: Significance between 1 day and 1 months and 3 months respectively. P6: Significance between 1 month and 3 months. *: statistically significant P value.

There was no significant difference in VAS score before treatment with epidural steroid administration in the research participants. VAS score was significantly lower in mild and moderate LSCS cases compared to severe LSCS cases after one day, one and three months of epidural steroid administration (p<0.001) (Table.5)

Table 5: Comparison of VAS score between cases with mild and moderate LSCS and cases with severe LSCS

		Mild and moderate LSCS cases (n =16)	Severe LSCS cases (n =9)	P value
Pretreatment	Mean±SD	6.62±0.96	7.22±0.83	0.131
1 day	Mean±SD	5±0.63	6.56±0.73	<0.001*
1 months	Mean±SD	3.5±0.61	4.89±0.93	<0.001*
3 months	Mean±SD	3.31±0.95	4.78±0.67	<0.001*

LSCS: lumbar canal stenosis, *statistically significant P value

The percentage of decrease in VAS score after one day, one and three months of epidural steroid administration from pretreatment VAS were significantly higher in mild and moderate LSCS cases than severe LSCS cases (p<0.001, =0.014, and =0.029 respectively) (table.6).

Table 6: Percentage of decrease in VAS score after treatment compared to pretreatment score between mild and moderate, and severe LSCS cases

		Mild and moderate LSCS cases (n =16)	Severe LSCS cases (n =9)	P value
1 day (%)	Mean±SD	24±10	9±7	<0.001*
1 months (%)	Mean±SD	46±13	32±12	0.014*
3 months (%)	Mean±SD	48±17	33±10	0.029*

LSCS: lumbar canal stenosis, *statistically significant P value

Discussion

From the results in current research, it was observed that cases with LSCS had normal hematological parameters including normal hemoglobin level (Hb %) with a mean value of 13.86±1.95 g/dl and normal platelet count with a mean value of 329.92±38.75 $x10^3$ cell /µl as well as normal total leucocytic count with a mean value of 7.16±1.42 $x10^3$ cells/µl. In addition, the cases had random blood glucose with a mean value of 139.52±30.08 mg/dl.

These findings are comparable to Kumar *et al*., 2016 [19] who conducted a case report to evaluate the effect of ayurvedic intervention in the management of a lumbar stenosis case and found that the case had normal level of Hb% (13.6 g/dl) and normal level of the platelet count (161,000 cell /µl) in addition to normal level of random plasma glucose (118 mg/dl)

In the current research, it was found that cases suffering from LSCS had pain duration ranged from 6-45 months with a mean value of 21.44±8.86 months.

These results are in agreement with Do *et al*., 2020 [20] who reported that the majority of cases had pain duration lasted for 19.0±16.7 months.

These data are conflicted with the results of Bajpai and Yelavarthi, 2020 [21] who found that the mean value of pain duration in cases suffering from LSCS was 8.4±3.4 which considered shorter than our result. Relatively small sample size, different research design and population could explain this contradiction.

Also, our results noticed that regarding LSCS severity 5 (20%) participants with grade 1 LSCS severity, 11 (44%) with grade 2 and 9 (36%) with grade 3.

This results are in agreement with Do *et al*., 2020 [20] who reported that 51.73% of cases with grade 2 and 48.27% of cases with grade 3.

Moreover, the current finings revealed that the pre-treatment visual analog scales (VAS) of the research participants ranged from 5-8 with a mean value of 6.84±0.94.

Our results are harmonious with Sevgili and Sari, 2020 [22] who performed a prospective research proposing This single intradiscal autologous platelet-rich plasma (PRP) transfusion may give significant pain alleviation and facilitate a return to pre-illness activity levels in the low back pain cases. They found that cases suffered from low back pain for about 12 month with 5.6±1.0 average pre-treatment VAS score.

Further, Sabbaghan *et al*., 2020 [23] recruited a retrospective research including 111 cases with MRI-confirmed spinal canal stenosis (SCS) who underwent epidural administration to evaluate the effectiveness of translaminar administration of triamcinolone in LSCS. The results demonstrated that the mean pre-treatment VAS for lower limb pain was 7.4±1.5.

Our results demonstrated that there was a statistically significant difference between the different follow ups of VAS score in the research participants (p<0.001). VAS score was statistically significantly lower at day one, after the first month and after three months of follow up compared to pre-treatment (P = 0.005, <0.001 and <0.001, respectively). VAS was also statistically significantly lower after the first month and the third month compared to day 1 (<0.001 and <0.001. respectively).

These results are in accordance with Do *et al*., 2020 [20] who explained that the degree of pain alleviation after treatment was significantly lower in cases with severe LSCS compared to pre-treatment. In addition, about 25% of the cases exhibited effective pain alleviation (pain alleviation of ≥50%) at 3 months after treatment. Only 18% of cases with severe LSCS demonstrated effective response to interlaminar ESI, whereas 30% of cases with moderate LSCS demonstrated effective pain alleviation.

In addition, similar results were reported by Sabbaghan *et al*., 2020 [23] who demonstrated that the epidural steroid administration was significantly able to reduce the severity of LSCS pain through evaluation of VAS score which demonstrated that the mean pre-treatment VAS for lower limb pain was 7.4±1.5, which improved to 4.2±1.6 after the intervention (p< 0.001).

Our results are supported by Kim *et al*., 2012 [24] who enrolled 20 cases with chronic low back pain to evaluate the efficacy of steroid administration in cases with chronic low back pain. The results observed that the follow-up mean VAS significantly decreased after administration at one and three months (p<0.05). VAS data demonstrated intradiscal steroids administration was effective for up to 6 months, the reduced pain (55%) at three months after treatment means repeated intradiscal steroids administration at regular intervals could be helpful for reducing chronic low back pain.

Conclusion

The mean VAS significantly decreased after administration between the time of one day and three months. VAS score decreased after 1 month after treatment and the effect was maintained for 3 months hence, In situations of SCS, ESI might be regarded as an effective technique for the relief of pain and alleviation of disability.

Conflict of Interest

Not available

Financial Support

Not available

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