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A Comparison of the Interlaminar v. the Transforaminal Approach To Steroid Injections under Fluoroscopic Control in Treating Lumbar Radicular Pain

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Abstract

***Background and Purpose**: Lateral lumbar spinal compression is a common source of lower back and leg pain. Steroids injected around the dura-sac markedly decrease inflammation commonly associated with conditions such as, disc-herniation or s. This study's goal was to prove how epidural injections of steroids, transforaminal or interlaminar, lead to improved pain reduction.*

***Materials and Methods**: 50 patients were included in the study by random choice. They were stratified with magnetic resonance imaging and mlectromyography, according to their confirmed diagnosis of lumbar lateral spinal compression. The selected patients were divided into two groups according to reception-path of epidural steroids. In both groups 25 patients were selected by random choice to receive interlaminar or transforaminal epidural steroid injections, in both cases under fluoroscopic guidance. The patients were monitored and their pain assessed by using the visual analogue scale (0–10) during each visit, and during the visits three and six months following the first injection (using VAS scores).*

***Results and conclusions**: After the first and second injection of steroids an efficient decrease of pain was evident, although a tendency towards further decrease was not continued after the third injection of steroids and local anaesthesia. The tendency towards decreasing and maintaining the level of pain was recorded as the same both with the interlaminar and the transforaminal approach to steroid injections. The difference in assessed pain between the group with the transforaminal approach and the group with the interlaminar approach did not appear significant in our study. The results of our research have demonstrated that there is no difference in the efficacy of the epidural steroid injection regarding its approach; that is the efficacy is at the same level both with the interlaminar approach as with the transforaminal approach.*

INTRODUCTION

Lateral lumbar spinal compression is a common source of lower back- and leg-pain. The pathophysiology of lateral lumbar spinal compression includes narrowing or stricture of the central spinal canal,

its compression recesses of the nerve roots in the central spinal canal, the lateral recesses, or in the neural foramina *(1)*. Up until recently, the treatment of choice for patients with enduring back-pain was narrowed down to conservative treatment consisting of analgesics, physical therapy, psychological therapies, interlaminar epidural steroid injections or surgery. During the last few decades a number of non-surgical or minimally invasive interventions have been introduced, with the aim of treatment where conservative treatments have failed, but without major surgical interventions. Injecting steroids around the dura-sac area markedly decreases inflammation associated with common conditions such as, disc--herniation or s. It is also thought that a flushing effect from the injection helps to remove or »flush out« inflammatory proteins that may cause pain, from the area around the structures. Inflammation is a common component of many lower back conditions and in reducing inflammation the pain decreases. However, questions regarding the efficacy of epidural steroids abound as studies on epidural steroid injections have traditionally suffered from inadequate design and inconsistent outcomes *(2, 3, 4)*. In reviewing the literature regarding epidural injection of steroids in cases of ischiadic conditions, more than 12.000 patients have been included through their questionnaires. Unfortunately, only a small percentage of these studies used randomised controlled tests and most of the controlled tests were of poor quality. Out of 12 assessed studies, six showed an improvement in the group using spinal epidural injections, and six studies showed no difference between the group with steroid injections and the group without steroids *(3)*. Recent research has shown that epidural injections of steroids are more effective with radicular pain and relatively inefficient with back pain caused by narrowing of the central spinal canal *(5)*.

Because of the procrastination of the steroids, with the transforaminal approach in the forward epidural space, i.e. in the area of pathology and source of pain, the hypothesis is raised of the epidural transforaminal injection of steroids to greater decrease pain, in relation to the interlaminar approach where the drug is delayed in the back epidural space. The aim of this study was to prove how the epidural injection of steroids is preferable, i.e. which approach offers more efficient pain relief, transforaminal or interlaminar.

MATERIALS AND METHOD

The research was approved by the Clinical Centre's Ethical Committee. In this longitudinally cohort controlled study, 50 patients were included by random choice, stratified according to their confirmed (by magnetic resonance imaging and electromyography) diagnosis of lumbar lateral spinal compression. The patients included had suffered from lumbar radicular pain for up to six months, with pain assessed as three or higher on the visual analogue scale. The visual analogue scale (VAS) is commonly used as the outcome measure for such studies. It is usually presented as a 10-cm horizontal line on

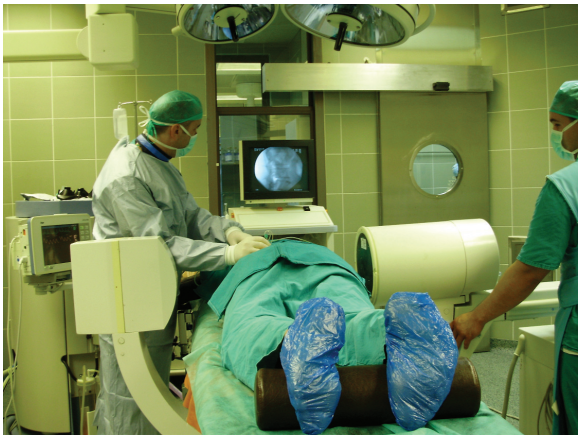

Figure 1. *Position of the patients for interlaminar and transforaminal lumbar epidural steroid injection.*

which the patient's pain intensity is represented by a point between the extremes of no pain at all and very intense pain . Its simplicity, reliability, and validity, as well as its ratio scale properties, make the VAS the optimal tool for describing pain-severity or -intensity *(6)*.

Patients were recruited from the Pain Management Unit and Department of Anaesthesiology, of the Clinical Centre Osijek. The patients selected were divided into two groups according to reception-path of the epidural steroids. In both groups 25 patients were randomly chosen to receive interlaminar and transforaminal epidural steroid injections. The non-ionic contrast media was then administered under fluoroscopic guidance in the lateral view, with the final images and confirmation of laterality of spread, obtained in the AP view (Figure 1).

Suspension of 80 mg depo-medrol with 10 ml 0.5% lidocain was injected with the interlaminar approach; and in comparison a suspension of 40 mg depo-medrola with 5 ml.0.5% lidocain was injected with the transforaminal approach. The patients received a series of up to three interlaminar or transforaminal lumbar epidural steroid injections, spaced 2–4 weeks apart. No anticon-

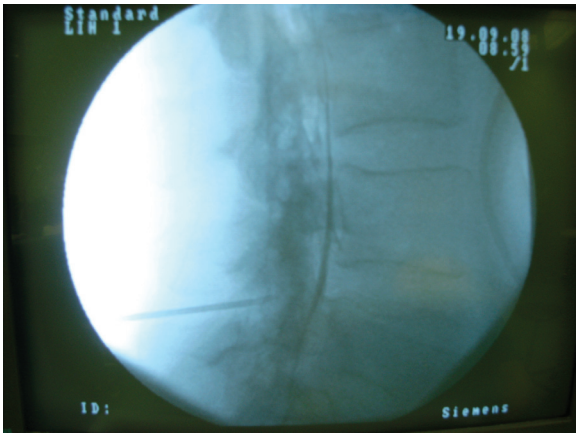

Figure 2. *Lateral radiograph of the lumbar spine during interlaminar lumbar epidural injection (after the contrast injection).*

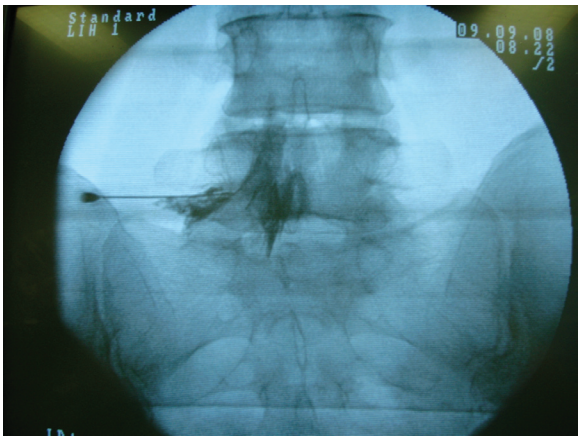

Figure 3. *Anterior-Posterior radiograph of the lumbar spine following lumbar transforaminal injection (after the contrast injection).*

vulsants or antidepressants were allowed during the period of the study. For breakthrough pain, patients were allowed to use tramadol, 1–2 tablets q 6 hours, as needed. The patients were advised to take additional analgesia if the pain exceeded 3 on the visual analogue scale. Patients were monitored and their pain assessed on the visual analogue scale at each visit and at visits three and six months following the first injection (using VAS scores).

The numerical data are shown in basic numbers of mean and dispersion. The descriptive data are presented in frequencies. For the comparison of the two dependent samples t-test of differentiation is used with the Wilcoxon test of range; and for the research of the differentiation in more dependant samples, the Friedman test is used. For the statistical analysis the program SAS Windows is used (8.2 versions, SAS Institute NC, USA) *(7)*. Statistical significance is shown at the level $p<0,05$.

RESULTS

The research was carried out with 50 patients, out of which 25 were subjected to the transforaminal and 25 the interlaminar epidural steroid injection. In both groups of 25 patients, 15 (60%) were women and 10 (40%) men. The average age in the interlaminar approach group was 48,08 years of age (SD±9,25), and in the transforaminal approach group the average age was 48,77 (SD±9,21).

The most frequent condition in which pain was experienced was for no apparent reason, within the the interlaminar approach group in 18 cases (72%) and in the transforaminal approach group in 21 cases (84%) (Table 1).

In Table 2 the intermediate values and the dispersion of assessed pain in the group with the interlaminar approach are shown by visits. The differences between them are considerable ($p<0,001$). Comparing by visits, considerable differences were determined in the intensity of assessed pain between the 1st and 2nd visit ($p=0,001$) and the 2nd and 3rd visit ($p=0,001$) (Table 2).

TABLE 1

Conditions under which pain was experienced.

	Interlaminar approach	Transforaminal approach	TOTAL
Accident at work	*N (%)*	*N (%)*	*N (%)*
Accident at home	3 (60)	2 (40)	5 (10)
Pain just started	1 (100)	0	1 (2)
At work, but without accident	18 (46,2)	21 (53,8)	39 (78)
TOTAL	3 (60)	2 (40)	5 (10)

In Table 3 the intermediate values and the dispersion of assessed pain in the group with the transforaminal approach are shown by visits. The differences between them are considerable ($p<0,001$). Comparing by visits, considerable differences in the intensity of assessed pain are between the 1st and 2nd visit ($p<0,001$) and the 2nd and 3rd visit ($p<0,005$) (Table 3).

The difference in assessed pain between the group with the transforaminal approach and the group with the interlaminar approach was not significant in our study (Figure 4).

DISCUSSION

The study is a prospective, randomized series, aiming at analyzing the repression of radicular pain with lateral lumbar spinal compression, by comparing the efficacy of two different techniques of application of epidural steroids; i.e. the transforaminal and the interlaminar approach under fluoroscopic control, and confirmation of

TABLE 2

Assessed pain in the group with interlaminar approach, by visits.

Assessed pain (VAS)	Min	Max	Central value	STD	p*
1. visit	3	10	6,83	1,92	
2. visit	2	10	5,20	2,57	
3. visit	0	8	3,42	2,38	**<0,001**
4. visit	0	9	3,42	2,55	
5. visit	1	8	3,58	1,97	
6. visit	0	8	3,71	2,29	
Comparison				p‡	
1. visit vs 2. visit				*0,001*	
2. visit vs 3. visit				*0,001*	
3. visit vs 4. visit				0,930	
4. visit vs 5. visit				0,469	
5. visit vs 6. visit				0,365	

*Friedman test, ‡Wilcoxon test

TABLE 3

Assessed pain in the group with transforaminal approach, by visits.

Assessed pain (VAS)	Min	Max	Central value	STD	p*
1. visit	2	10	7,24	1,76	
2. visit	0	10	4,96	2,19	
3. visit	0	9	3,84	2,30	**<0,001**
4. visit	0	9	3,83	2,22	
5. visit	0	8	3,64	1,90	
6. visit	0	9	3,32	2,37	
Comparison				p‡	
1. visit vs 2. visit				*<0,001*	
2. viit vs 3. visit				*0,005*	
3. visit vs 4. visit				0,975	
4. visit vs 5. visit				0,815	
5. visit vs 6. visit				0,182	

*Friedman test, ‡Wilcoxon test

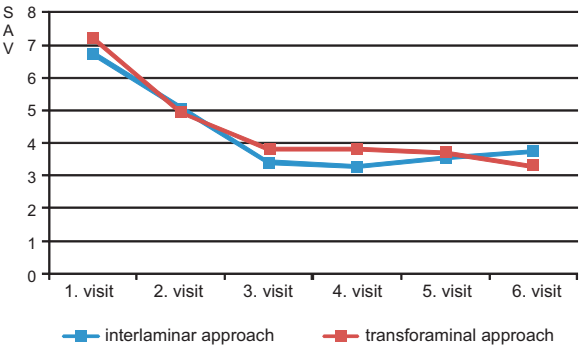

Figure 4. *The average assessed pain by approach to the steroid injection.*

the position of the needle by contrast media. In most studies up until today »blind epidural injections« were used, out of which 19% to 53% had a badly placed epidural syringe, even though experienced doctors performed the treatment using the loss of resistance technique *(8)*. Due to the poorly placed epidural syringe, and consequently also the medication, the studies performed without fluoroscopic control and contrast media are questionable. The use of fluoroscopic control and contrast media in our research, enabled a precise (100%) placing of the steroids and local anaesthesia in the epidural space, which lead to a significant decrease in pain during the first three visits, and also the mentioned decrease of pain was sustained to the end of our monitoring during six months, starting from the first epidural steroid injection. Our monitoring has shown that the injection of steroids is not merely a short-term improvement, but that it is long-term and lasts for many months - in our research for more than six months. After the first and second injection of steroids, an efficient decrease in pain was felt, but the tendency towards further decrease was not continued till after the third visit and the third injection of steroids and local anaesthesia. The tendency to decrease and maintain the level of pain was shown to be the same both with the interlaminar and with the transforaminal approach to steroid injections. Consequently, it may be concluded that two blockades are sufficient to achieve a decrease in radicular pain, but further research is needed to show how to maintain this improvement equally after three injections. The results of our study are in accordance with earlier studies by Botwy *et el.* (2002) where 75% of the monitored patients experienced a 50% decrease in pain a year after the transforaminal epidural steroid injection *(9)*. Other non-controlled series reported on the effect on transforaminal or flouroscopically guided caudal steroid injections for patients with radiographic evidence of spinal stenosis with either persistent back- and leg-pain or neural claudication (Delport *et al.* 2004), although only 32% of the patients experienced a decrease in pain for a period longer than two months *(10)*. The smaller percentage of successful pain treatment is the result of badly chosen patients for the epidural injection of steroids, as the epidural steroids are efficient with radicular pain, but not with pain caused by narrowing of the central spinal channel *(11)*. Patients with disc- herniations and leg-pain attained in most of the studies maximal improvement within 6 weeks. Interestingly, long-term success-rates for transforaminal epidural glucocorticoid injections ranged from 71% to 84% *(12)*. Recent systematic reviews and meta-analyses have concluded that epidural steroid injections seem to be efficacious as pain relief in patients with lumbosacral radiculopathy *(13)*.

To date, most studies that have examined lumbar epidural steroid injections, involved the use of the classical interlaminar approach, and only a few of the examinations were based on the transforminal approach to lumbal epidural injections of steroids. The use of this technique results in deposition of most of the medication in the posterior epidural space. Conversely, nerve--root and spinal cord pathology occurs also in the anterior epidural space. The transforaminal approach to epidural injections results in deposition of the steroids in the anterior epidural space in close proximity to the site of pathology. From all the aforementioned, we can establish a hypothesis, that the transforaminal injection of steroids at lumbar lateral spinal compression will result in greater pain relief over a longer period of time as well as melioration in functional capacities compared to a classical interlaminar approach *(14)*. The results of our research have proved that there is no difference in the efficacy of the epidural steroid injection regarding approach; i.e. the efficacy is the same both with the interlaminar approach and with the transforaminal approach. Thus, based on the obtained results we can discard the theory that the place of injection of steroids in relation to the pathological action, is of vital importance for the decrease of pain of lateral lumbar compression.

CONCLUSION

The transforaminal approach to steroid injection did not prove to be more efficient than interlaminar injections for lumbar radicular pain, as the decrease in pain was equal in both the transforaminal and interlaminar approach. Epidural steroid injections are efficient in decreasing lumbar radicular pain, both with the interlaminar and transforaminal approach of steroid injections.

Future research will have to determine which dosage is optimal in each approach and at which levels injections of steroids in cases of pathological changes at higher levels of the spine. Also, future research needs to focus more on the selection of patients in respect to the duration of lumbar pain and the location of the cause of pain, as well as age and gender of the patient.

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