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Source / Izvornik: **European Neurology, 2013, 69, 27 - 32**

Journal article, Published version
Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

https://doi.org/10.1159/000338265

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:239:674326

Original Paper

European Neurology

Eur Neurol 2013;69:27–32
DOI: 10.1159/000338265

Received: March 11, 2011
Accepted: March 18, 2012
Published online: November 1, 2012

painDETECT Questionnaire and Lumbar Epidural Steroid Injection for Chronic Radiculopathy

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Key Words
painDETECT questionnaire · Lumbar epidural steroid injections · Radicular pain

Abstract
Background: The painDETECT questionnaire (PD-Q) is a fast and uncomplicated way to ascertain the percentage of neuropathic pain in 'total pain' and is designed to detect neuropathic pain components in back pain. The purpose of this randomized, prospective study is to compare, with the assessment of the PD-Q, the efficacy of interlaminar (IL) and transforaminal (TF) steroid injections in patients with unilateral chronic lumbar radicular pain. ***Methods:*** Patients were treated fluoroscopically with epidural steroids, using the IL or TF method and with confirmation of the epidural space by contrast, using random computerized classification. The patients received a series of three IL or TF epidural steroid injections (ESI) at 2-week intervals. The patients were monitored for 6 months from the first steroid injection. ***Results:*** By analyzing the average values of the total sum of points in the PD-Q a dropping trend is confirmed for both groups. The trend equation ($y = -1.1393x + 25.269$) for the TF ESI shows a faster recovery than the IL ESI ($y = -0.8089x + 26.654$). The statistically significant difference in the two groups is proved between the first and the sixth visit (IL ESI, $p = 0.014$; TF ESI, $p = 0.001$). There is no statistically significant difference in the efficiency of the two dosages and the volumes of steroids between the IL and TF distribution of steroids. ***Conclusions:*** Steroids are efficient; besides alleviating the overall pain, they also reduce the neuropathic component in chronic lumbar radicular pain, whether it is distributed epidurally by the IL or TF approach.

Introduction

The pathophysiology of back pain is complex and nociceptive. Neuropathic pain-generating mechanisms are thought to be involved, which established the term 'mixed pain syndrome' [1]. The painDETECT questionnaire (PD-Q) is a fast and uncomplicated way to ascertain the percentage of neuropathic pain in 'total pain', and it is designed to detect neuropathic pain components in back pain. Lumbar epidural steroids may be distributed via interlaminar (IL), transforaminal (TF) or caudal approach. Studies which prove the efficiency in decreasing radicular pain in the lower extremities exist for each of these paths of distribution of steroids [2–5]. Recent studies on epidural distribution of steroids mainly include the classical IL approach [6] (http://www.anesthesia-analgesia.org/cgi/ijlink?linkType=ABST&journalCode=rheumatology&resid=27/4/295).

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The TF approach to epidural injections results in the deposition of steroids in the anterior epidural area, closer to the place of pathological cause of radiculopathy, and may require a lower steroid dose in comparison to the IL method, where the steroid is injected into the back epidural area [5]. Therefore, our hypothesis is that the epidural application of steroids by the TF approach will be more efficient in the treatment of chronic lumbar radicular pain (CLRP), as well as reducing the neuropathic components of the total pain. It is a prospective randomized study which aims at (1) proving or rejecting the effects of steroids on CLRP assessed with the PD-Q; (2) proving or rejecting the effects of epidural lumbar application of steroids (IL and TF approach) on the neuropathic component in CLRP assessed with the PD-Q, and (3) comparing the analgetic response in two different approaches of the epidural application of steroids with CLRP in various dosages (80 mg Depo-Medrol with the IL approach and 40 mg Depo-Medrol with the TF approach) assessed with the PD-Q, designated for the number of patients with CLRP with whom a clear component of neuropathic pain is present.

Materials and Methods

The randomized prospective research was approved by the ethical committee of the University Hospital Centre Osijek and the Medical School of the J.J. Strossmayer University in Osijek. In the longitudinal, cohort-controlled study the patients were divided into two groups, IL or TF, depending on the mode of application of the epidural steroids. The randomization was carried out until all 32 patients in the separate groups had been completely monitored. Patients who, for any reason, did not complete the monitoring during the six visits were not included in the statistical process. The patients were treated fluoroscopically with epidural steroids, IL or TF, with confirmation of the epidural space by contrast, using random computerized classification. In order to be included in the study, the candidates had to qualify according to the following criteria: aged 18–80 years; unilateral lumbar radicular pain which had not responded to traditional treatments within the last 6 months (pharmacotherapy and physical therapy); magnetic resonance imaging and electromyoneurographically confirmed pathology of the lumbar radicular pain; absence of a remarkable motor deficit or bowel/urine incontinence, and intensity of pain above 5 on the numerical scale 0–10. Exclusion factors in this study were: under 18 or over 80 years of age; pregnant or nursing women or women of generative age without appropriate contraception; diabetes; progressive neurological disorders; bilateral radicular pain; prior surgery of the lumbar spine; history of allergic reactions to local anesthesia, opiates, contrast or steroids; epidural injections of steroids within the last year; history of opioid abuse or currently on long-term opioid treatment, and intensity of pain below 5 on the numerical scale 0–10. Patients complying with even one of the exclusion criteria could not be included in the study. The IL epidural steroid injection (ESI) is performed with a 20-gauge Touhy needle and with 80 mg Depo-Medrol (methylprednisolone), mixed with 8 ml of 0.5% lidocaine. The TF ESI is performed with a 22-gauge needle and with a solution of 40 mg Depo-Medrol in 3 ml of 0.5% lidocaine [7]. The patients received a series of three IL or TF ESIs, at 2-week intervals. During the observation period, the patients did not receive any anticonvulsants or antidepressants. For breakthrough pain, the patients received 50 mg tramadol as the rescue medication, as needed (with a daily maximum of 400 mg). The PD-Q was filled out by the patients before each ESI (baseline, 2 weeks and 4 weeks), 2 weeks after the third ESI (6 weeks), and also after 3 (12 weeks) and 6 months (24 weeks) from the first ESI.

The statistical analysis includes the basic methods of descriptive statistics. The differences in the categorical variables were treated with a χ^2 test.

The Student t test or Mann Whitney U test were used for comparing means. The Wilcoxon test and the t test of differentiation were used in determining the differences between the two gaugings. In ascertaining the differences by all measurements (visits) within each group, regarding the manner of injection of the steroids, analysis of variance (ANOVA) was used for the reoccurring measurements. Statistical analysis was completed by using of the SPSS program for Windows, version 9.0 (SPSS, Cary, N.C., USA) with a 0.05 significance level.

Table 1. Mean age by gender and group

	IL		TF	
	mean (SD)	min–max	mean (SD)	min–max
Male	49.8 (7.3)	40–64	49.6 (7.1)	37–68
Female	47.9 (12.1)	31–70	47.3 (10.8)	30–58
Total	49.2 (8.9)	31–70	48.8 (8.5)	30–68

Results

By random selection, a total of 70 patients were included, and a total of 64 patients completed the study. No statistically significant difference in gender was noticed between the two groups. The average age of the patients was 49 years and there was no statistically significant difference in age between the two groups (table 1).

With the PD-Q, we were able to assess the intensity of the current, strongest and average pain during the previous 4 weeks with a numerical scale (fig. 1–3), as well as the percentage of neuropathic pain in each patient (tables 2, 3).

The trend equation of the average values of the current pain shows an equal drop in the assessed score on the strongest pain in both the TF ESI ($y = -0.55x + 8.9$) and the IL ESI ($y = -0.54x + 8.41$) groups.

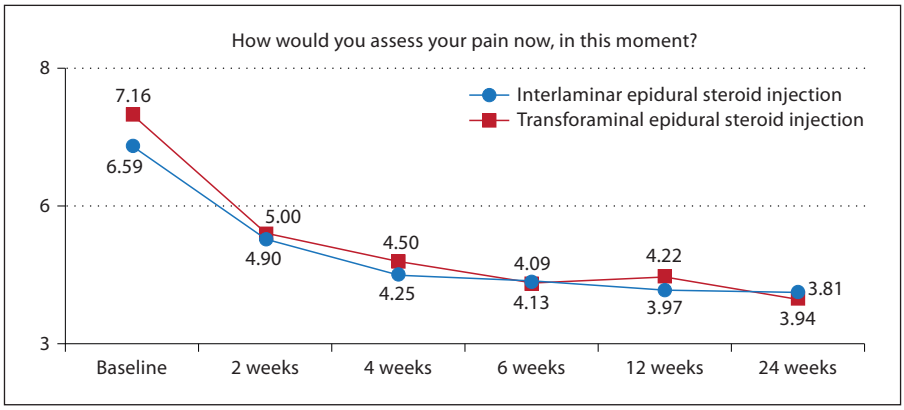

Fig. 1. Assessment of the intensity of the current pain by group.

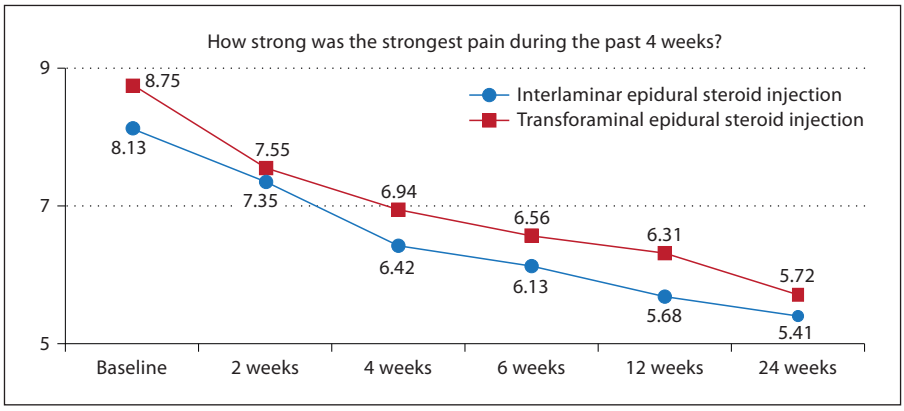

Fig. 2. Assessment of the intensity of the strongest pain by group.

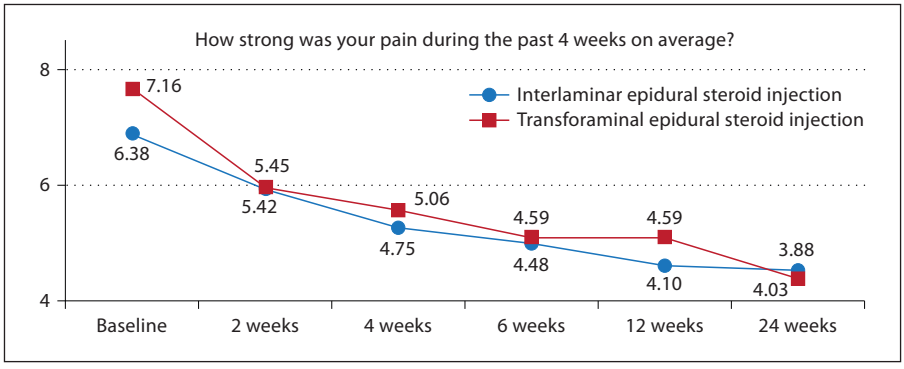

Fig. 3. Assessment of the intensity of the average pain by group.

The trend equation of the average values of the strongest pain in the previous 4 weeks shows a somewhat faster drop in the TF ESI (y = –0.56x + 6.75) than in the IL ESI (y = –0.46x + 6.25) group.

The trend equation of the average values of the average pain in the previous 4 weeks shows a somewhat faster drop in the assessed score on the average pain in the TF ESI (y = –0.45x + 6.25) than in the IL ESI (y = –0.46x + 6.25) group. Comparing the first and the sixth measurement, we reach a statistically significant difference in both groups (Mann Whitney, p = 0.030) with the assessment of average pain in the previous 4 weeks.

Analyzing the average values of the total sum of points in the PD-Q, a dropping trend is confirmed for both groups. The trend equation for the TF ESI (y = –1.1393x + 25.269) shows a faster recovery than the IL ESI (y = –0.8089x + 26.654). A statistically significant difference in the two groups is proved (IL ESI, p = 0.014; TF ESI, p = 0.001; ANOVA; table 2).

Table 2. Average sum of points by the PD-Q by visits and group

Visits	IL ESI		TF ESI		p t test
	mean	SD	mean	SD	
Baseline	26.03	6.92	26.63	6.38	0.723
2 weeks	24.96	7.70	26.50	5.79	0.373
4 weeks	23.75	8.23	25.41	7.87	0.414
6 weeks	22.90	8.03	23.28	6.98	0.831
12 weeks	22.50	6.55	23.41	6.52	0.581
24 weeks	22.00	6.98	21.47	7.39	0.769

Table 3. Distribution of neuropathic pain by group

Visits	IL ESI n (%)	TF ESI n (%)	Total n (%)	p χ^2 test
Baseline				
Negative (<15%)	1 (3.1)	0	1 (1.6)	0.468
Unclear	3 (9.4)	5 (15.6)	8 (12.5)	
Positive (>90%)	28 (87.5)	27 (84.4)	55 (85.9)	
2 weeks				
Negative (<15%)	2 (6.3)	0	2 (3.1)	0.247
Unclear	5 (15.6)	3 (9.4)	8 (12.5)	
Positive (>90%)	25 (78.1)	29 (90.6)	54 (84.4)	
4 weeks				
Negative (<15%)	3 (9.4)	2 (6.3)	5 (7.8)	0.645
Unclear	5 (15.6)	3 (9.4)	8 (12.5)	
Positive (>90%)	24 (75.0)	27 (84.4)	51 (79.7)	
6 weeks				
Negative (<15%)	2 (6.3)	2 (6.3)	4 (6.3)	0.989
Unclear	7 (21.9)	7 (21.9)	14 (21.9)	
Positive (>90%)	23 (71.9)	23 (71.9)	46 (71.9)	
12 weeks				
Negative (<15%)	2 (6.3)	2 (6.3)	4 (6.3)	0.776
Unclear	7 (21.9)	5 (15.6)	12 (18.7)	
Positive (>90%)	23 (74.2)	25 (78.1)	48 (75.0)	
24 weeks				
Negative (<15%)	3 (9.4)	4 (12.5)	7 (10.9)	0.570
Unclear	6 (18.8)	9 (28.1)	15 (23.4)	
Positive (>90%)	23 (71.9)	19 (59.4)	42 (65.6)	
Total	32 (100)	32 (100)	64 (100)	

The number of examined patients who graded the neuropathic pain positively can be seen to decrease in both groups. The neuropathic pain was graded positively by 28 (87.5%) patients at the first visit in the IL group and by 27 (84.4%) in the TF group. During the sixth visit, 6 months after the first visit, the neuropathic pain was graded positively by 23 (71.9%) patients in the IL group and by 19 (54.9%) in the TF group (table 3).

Discussion

In our study, we compared the efficiency of the two ESI methods for chronic radicular pain by using the PD-Q. All ESIs, in both groups, were performed by the same physician and in that way the risk of altering performance was lowered, in comparison to several physicians administering the ESI. The average age of our patients was 49 years of age, which is in accordance with the previous research of Awald and Moskovich [8], which proved that the peak of lumbar disc herniation is in the fifth decade of life. Currently, CLRP is the most common neuropathic pain syndrome. Chronic back pain is characterized by a combination of neuropathic and nociceptive mechanisms of pain generation [9]. Kelly [10] suggests that pressure on the nerve results in functional loss and is rarely linked to pain. Certain facts corroborate this. The pathology of the disc and spinal stenosis with compression of the disc are considered to be asymptomatic findings in the patient [11–13]. The potent inflammatory properties of the nucleus pulposus include the presence of inflammatory mediators which cause an inflammatory reaction in the area of nerve roots and lead to continuous ectopic break outs, demyelination, decreased blood inflow in the ganglia dorsal horn, augmented endoneurial pressure, and slower execution of nervous impulses [14, 15]. Inflammatory reactions usually lead to an immunological response, which may cause an abnormally large generation of antibodies attacking the nerve tissue. Adjudged, it may also be connected to the growth of chronic radicular pain. Such inflammatory process worsens when influenced by pressure on the nerve root. The lumbosacral nerve root seems, possibly by means of its singularly delicate drainage system, to be particularly sensitive to the effect of pressure, and even minimal compression may lead to an edema of the nerve root, intraneural inflammation and hyperalgesia [16]. Therefore, it is clear that steroids used as anti-inflammatory drugs definitely have their place in the treatment of CLRP. Patients who experienced radiculopathy for a period shorter than 6 months had a positive response to the ESI in 70% of the cases, and patients experiencing symptoms for a period longer than 1 year had a positive response to the ESI in 50% of the cases [17]. Butterman [18] has shown 42–56% treatment efficiency with patients who had an IL ESI, while the

study of Schaufele et al. [19] reports a treatment efficiency of 45%, which is defined by an improvement by two or more points in the verbal numerical scale. Vad et al. [5] have reported 84% success with patients with lumbosacral radiculopathy and TF ESI, and with Schaufele et al. [19] the success is 70%. The WEST study [20] has shown that the epidural distribution of steroids only offers a temporary improvement of symptoms for a period of 3 weeks with patients suffering from radicular pain, but that there are no sustained benefits in terms of pain, function or need for surgery. The contradictory results of the studies to date may be explained by numerous methodological faults and technical deficiencies [18, 19, 21, 22]. Studies by Ackerman and Ahmad [23] and Schaufele et al. [19] have proved that the TF approach is more efficient than the IL approach in the application of steroids. In our study, based on assessments of strongest and current pain during the previous 4 months, we cannot come to such a conclusion. In our study, all the inclusive symptoms lasted for more than 8 months, and the acquired results prove that the IL and TF approaches to using steroids are effective in decreasing radicular pain 6 months after the first injection, but there is no statistical significance between them. In our research, besides the difference in approach, we also used different dosages of steroids, which may be an objection towards this study. The total injected volume of local anesthetics and steroids during the IL usage spreads into a larger epidural space and thus only a smaller part of that volume may surround the nerve root causing the radicular pain. With the TF approach, a smaller volume is needed to surround the root of the damaged nerve because the injected volume spreads into a smaller space, and so the possibility of compressive damage with the injected volume is decreased. This was the reason for using different dosages of injection solutions during our research. Owlia et al. [24] compared the efficiency of Depo-Medrol in doses of 40 and 80 mg with the IL approach, but without fluoroscopic control, and so proved that a dose of 40 mg is as efficient as one of 80 mg after 3 months.

The results of the selection on the presence of neuropathic pain are divided into three groups by the total sum of points in the PD-Q. The sum may be between 0 and 38. If the sum is between 0 and 12 the component of neuropathic pain is probably not present (less than 15%); if the sum is between 13 and 18 the result is indeterminate, but the component of neuropathic pain may be present. If the sum is between 19 and 38 the component of neuropathic pain is probably greater than 90%. The PD-Q is a reliable screening tool with high sensitivity, specificity and positive predictive accuracy; these were 84% in a palm-top computerized version and 85, 80 and 83%, respectively, in a corresponding pencil-and-paper questionnaire. In an unselected cohort of chronic lumbar back pain patients, 37% were found to have predominantly neuropathic pain [25]. In our study there was a clear neuropathic pain component present in a total of 55 patients (85.9%) before the steroid injection. By comparing the groups, it is clear that the neuropathic pain was reduced in both groups during the study, to a somewhat higher degree in the TF group, but without statistically significant differences between the groups. Determining the pathophysiology of pain is of particular importance for the results of analgetic treatment, considering that some drugs are only efficient with nociceptive pain and some drugs only for neuropathic pain, and sporadic drugs are partially effective for both nociceptive and neuropathic pain. According to our results, it is clear that there is a relevant neuropathic pain component with patients with radicular pain and a statistical significance of diminishing pain in both groups (IL and TF) in the period between the first and the sixth visit, but there is no statistical significance between the IL and TF group. The ability to identify neuropathic pain mechanisms should lead to individualized treatment, resulting in improved pain control in this group of patients with chronic low back pain and CLRP.

Conclusion

From our results, it is clear that neuropathic pain is present in 85% of patients suffering from CLRP. Steroids are also efficient in the decrease of the total CLRP, both by way of IL and TF approach, and not just in acute pain as has been put forward in research done up to this point [19, 20, 26]. Steroids are efficient; besides alleviating the overall pain, they also reduce the neuropathic component in CLRP, be it distributed epidurally by the IL or TF approach. There is no statistically significant difference in the efficiency of the two dosages and the two volumes of steroids with the IL and TF distribution of steroids (i.e. 40 mg steroids in 3 ml of 0.5% lidocaine with the TF approach is as efficient as a dose of 80 mg steroids in 8 ml of 0.5% lidocaine).

Disclosure Statement

The authors have no conflicts of interest to disclose.

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