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# Epidural steroid injections in treatment of chronic lower back pain caused by degenerative-dystrophic spine damage

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## ABSTRACT

**Background.** The high incidence of degenerative-dystrophic spine damage with the variability of research results on the effectiveness of epidural steroid injections for treatment of chronic lower back pain is an urgent issue regarding treatment of this pain with epidural steroid injections only.

**Objective.** The aim of the study is to improve the effectiveness of treatment of chronic lower back pain caused by degenerative spine damage with monotherapy – epidural steroid injections only.

**Material and methods.** The early and long-term treatment outcomes with epidural steroid injections only of 120 patients with chronic lower back pain were analysed. The control group consisted of 36 patients with lower back pain treated conservatively. The results of treatment were assessed by the dynamics of pain regression using the visual analog scale (VAS), as well as the functional status by the Oswestry index. The assessment was performed three times: before treatment, after treatment and six months after it.

**Results.** In the early post-treatment period, reliable results of treatment of chronic lower lumbar pain was evidenced in both the main and control groups. There was no significant difference in treatment outcomes between these groups in the early period, although both the Oswestry index and the VAS by the Student's T-test showed that the differences were in favour of the main group. There was a significant difference in long-term treatment outcomes between the main and control groups both by the Oswestry index and the VAS in favour of monotherapy with epidural steroid injections.

**Conclusions.** The study proved a high effectiveness of monotherapy with epidural steroid injections for chronic lower back pain caused by degenerative-dystrophic spine damage.

**Keywords:** degenerative-dystrophic spine damage, chronic lower back pain, epidural steroid injections

## INTRODUCTION

Degenerative-dystrophic spine damage is a very common disorder at the present time. According to the WHO, 80% of the adult population suffer from back pain due to degenerative spine damage. The term degenerative-dystrophic spine damage includes osteochondrosis (the narrow meaning of the term) of intervertebral discs, intervertebral disc protrusion and hernias, deforming spondylosis, spondyloarthritis, and complications of osteochondrosis: spinal stenosis, spondylolisthesis. For the convenience and compactness of formulations, the term "spinal osteochondrosis" in a broad meaning, will be used as an equivalent of the term degenerative-dystrophic spine damage.

In the development of osteochondrosis of the spine congenital weakness of connective tissue is significant due to impaired collagen synthesis that leads to changes in collagen fibres of the fibrous ring; they are cracked and teared. Various factors (hereditary, mechanical, hormonal, vascular and others) cause depolymerization of acidic mucopolysaccharides, proteins, hyaluronic acid of the nucle-

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us pulposus of the intervertebral disc, which leads to dehydration of the disc and loss of bone damping. In the fibrous ring, the weave of the fibres becomes more complex, and the fibres are less elastic, loose and swollen [1]. The pathological process in osteochondrosis begins with an intervertebral disc; it spreads to other structures of the spine. Damage of the nucleus pulposus is the primary stage, the trigger in the osteochondrosis development [2]. There is no osteochondrosis without disc pathology [3].

Discogenic pain is caused by irritation of the roots of the spinal nerves and the endings of the sinuvertebral nerves due to intervertebral discs damage. The main pathogenetic factors in all these processes are compression mechanisms and reflex as well as chemical effects accompanied by inflammations or microcirculatory disorders; their combination more often. The established mechanisms and sources of pain in osteochondrosis of the spine are irritation of pain receptors, compression of nerve roots and nerve endings, oedema of nerve endings and discs, chemical inflammatory factors. The main mechanisms of the pathological process are autoimmune processes, inflammations, connective impairments, compression and ischemia. They are interrelated and form a vicious circle in pain resistance in cases of osteochondrosis of the spine; in this case oedema of the nerve ending or root is the principal pathogenetic factor [4].

Despite the variety of neurological manifestations of degenerative damage of the spine, pain is leading in the clinical picture. Low lumbar pain with homogeneous clinical manifestations is characterized by polymorphism of pathogenetic situations, chronic recurrent course, resistance to treatment. The mechanisms of sanogenesis of chronic pain syndrome in osteochondrosis of the spine were first revealed in the early 20$^{th}$ century. According to O'Connell, 1951 [5], reducing the oedema and swelling of the intervertebral disc is crucial for regression of pain syndrome. Recent studies confirm reducing the protrusion and the degree of hydration of the affected intervertebral disc in the remission of pain by dynamic magnetic resonance imaging [6].

Contemporary medicine lacks effective, universal and safe methods of treatment of degenerative-dystrophic impairments of the spine. Specialists of different profiles do not have a single approach to the treatment of pain caused by osteochondrosis of the spine. It is established that nonsteroidal anti-inflammatory drugs are most widely used to relieve lower back pain. Paracetamol can be used for analgesia according to the recommendations of the Committee on Health Policy and Research of the U.S. Department of Health & Human Services. The effectiveness of muscle relaxants has not been proven. The exercise therapy and sports help strengthen muscles, improve blood and lymph circulation and develop compensatory and adaptive mechanisms of balance in the affected mobile spinal segment. The main goal of therapeutic exercise in patients with osteochondrosis of the spine is to develop a muscular corset, regulate the tone of the back muscles and increase the mobility of the spine. Physiotherapy and balneological methods reduce inflammatory response, relieve vasospasm and muscle tension, improve blood flow, reduce pain.

The method of administration of drugs into the epidural space is intermediate between surgical and therapeutic techniques, which is both microinvasive surgery and active therapy. Most authors point to the analgesic nature of blockades in lumbar pain, which breaks the vicious circle: pain - muscle spasm - pain [7, 8]. As a rule, anaesthetics, restorative drugs, less often steroids in combination with anaesthetics are administered epidurally. However, the effect of epidural steroid injections on the compression and inflammatory mechanisms of pain has not been completely studied yet. As the inflammatory factor is crucial in the mechanism of pain, the drug administered epidurally causes a positive effect by blocking the receptors of the affected spinal segments as well as through action in thediscoradicular conflict area, reducing or eliminating the inflammatory response that is crucial in pain syndrome development. The corticosteroids have a powerful anti-inflammatory effect, as well as a combination of rapid and prolonged action with high safety of the drug. The efficacy of corticosteroids is as a result of their special microcrystalline structure.

The efficacy of epidural steroid injections as monotherapy for chronic lower lumbar pain caused by degenerative spine damage is being studied in order to avoid variability in the interpretation of treatment outcomes.

The aim of the research is to improve the effectiveness of treatment of patients with chronic lower lumbar pain caused by degenerative-dystrophic spine damage by development of evidence-based indications for epidural steroid injections.

## MATERIAL AND METHODS

Early and long-term treatment outcomes of 120 cases (66 female and 54 male patients aged 39 to 86 years old) with chronic lower lumbar pain caused by degenerative-dystrophic spine damage (main, experimental group) were analysed. The patients of the main group underwent monotherapy with epidural steroid injections. The control group involved 36 patients (19 women and 17 men aged 45 to 80 years) with lower back pain treated conservatively with nonsteroidal anti-inflammatory drugs; vascu-

lar, restorative, dehydration therapy and physiotherapy, exercise therapy, massage, acupuncture.

Epidural steroid injections were used only after the failure of conventional therapy. The technique of middle interlaminar access without fluoroscopic imaging was used (minimally invasive interventions were performed at outpatient settings). One or two epidural injections of corticosteroid were administered with an interval of 15-20 days. The number of epidural injections depended on the clinical manifestations (regression of pain syndromes). The mean number of epidural steroid injections per patient was 1.93 ± 0.12 (112 patients underwent two injections and 8 patients – one). Apart from epidural steroid injections, the main group of patients did not undergo any other treatment. At the end of monotherapy, the patients were recommended therapeutic exercise to form a muscular corset.

The results of treatment were analysed by assessing the dynamics of pain regression by the visual analog scale (VAS), as well as the functional state by the Oswestry index. The assessment was performed three times: before treatment, after treatment (early treatment outcomes) and in six months after it (long-term treatment outcomes).

Clinical features of the main and control groups of patients are presented in Table 1. According to clinical manifestations, the patients of the main and control groups were characterized by lower back pain, symptoms of paravertebral muscle tension at this level, and static-dynamic disorders.

The groups were comparable in age, sex, disease duration and structural changes of the lumbar spine (intervertebral disc protrusion and hernias, spondyloarthritis, spinal stenosis, spondylolisthesis). There was no significant difference between the study groups (Table 1). Preliminary selection of patients by sex, age, clinical course of the disease, anatomical and morphological changes of the spine was not performed.

The distribution of patients by the degree of damage of the spinal motor segment is presented in Table 2.

**Table 2.** Distribution of patients of the main and control groups according to the degree of dominant damage of the spinal motor segment

| Degree of spinal motor segment damage | Main group | Control group |
|---|---|---|
| L2-L3 | 2.5% | – |
| L3-L4 | 8% | 5.5% |
| L4-L5 | 48% | 52.8% |
| L5-S1 | 41.5 % | 41.7% |

The obtained data was statistically processed by the methods of parametric analysis of biometric indicators (according to the Student's t-test the differences were statistically significant at $p \leq 0.05$, with an inclination at $0.1 > p > 0.05$, and statistically insignificant difference at $p > 0.1$). The results were analysed using the agreement criterion of X2. Statistical analysis was performed on a personal computer using Microsoft Excel2000, Microsoft Access2000 in the Windows98 operating system.

## RESULTS

Assessment of the average indicators of pain syndrome and functional state of the patients of main and control groups are presented in Tables 3 and 4, respectively.

As presented in Tables 3 and 4, statistical significance of the early treatment outcomes was proved in both groups, but there was no significant difference in treatment results between the main and control groups in the early period, although the indicators of both the Oswestry index and VAS showed better results in the main group (inclination at $0.1 > p > 0.05$). However, a clear significant difference in long-term treatment outcomes between the main

**TABLE 1.** Clinical characteristics of the main and control groups of patients

| Clinical signs and indicators | Main group, n=120 | Control group, n=36 |
|---|---|---|
| Males | 54 (45.0±3.4%) | 17 (47.2±4.6%) |
| Females | 66 (55.0±3.4 %) | 19 (52.8±4.6%) |
| Average age | 64.4±2.23 | 59.8±2.14 |
| Average disease duration (years) | 13.4±1.81 | 11.1±2.62 |
| Average duration of exacerbation (months) | 2.8±0.62 | 2.1±0.54 |
| One segment affected | 6 (5%) | 3 (8.3%) |
| Two segments affected | 87 (72.5%) | 24 (66.7%) |
| Three and more segments affected | 27 (22.5%) | 9 (25.0%) |
| Average number of affected vertebral motor segments | 2.2±0.09 | 2.2±0.12 |
| Average size of intervertebral hernia (mm) | 4.9±0.64 | 4.2±0.41 |
| Spondylolisthesis | 9 (7.5%) | 2 (5.5%) |
| Spinal stenosis | 3 (2.5%) | 1 (2.8%) |
| Spondyloarthritis | 89 (74.0%) | 25 (80.5%) |

**TABLE 3.** Assessment of average indicators (according to VAS) of pain syndrome of the patients of main and control groups

| Groups of patients | Before treatment | After treatment | In half a year |
|---|---|---|---|
| Main | 7.12±0.14 (n=120) | 2.43±0.11 (n=120) | 3.42±0.12* (n=96) |
| Control | 6.61±0.21 (n=36) | 3.10±0.18 (n=36) | 5.67±0.18 (n=30) |

Note: * – p <0.05, significant difference in long-term treatment outcomes between the main and control groups by the VAS.

**TABLE 4.** Assessment of the functional state of patients (by the Oswestry index) in the main and control groups (points)

| Groups of patients | Before treatment | After treatment | In half a year |
|---|---|---|---|
| Main | 49±0.6 (n=120) | 23±0.5 (n=120) | 30±0.5* (n=96) |
| Control | 51±0.5 (n=36) | 31±0.4 (n=36) | 47±0.4 (n=30) |

Note: * – p<0.05, significant difference in long-term treatment outcomes between the main and control groups by the Oswestry index.

and control groups was evidenced both according to the Oswestry index and VAS in favour of monotherapy.

Structural and morphological changes of the spine in chronic lower back pain in the main and control groups are presented in Table 5.

As seen in the Table 5, intervertebral disc herniation and spondyloarthritis are structural and morphological causes of chronic lower back pain syndrome, spondylolisthesis and spinal stenosis much less often. The following Tables present the dependence of clinical outcomes on the predominant structural and morphological changes of the spine in cases of pain syndromes in the main (Table 6) and control groups (Table 7).

Epidural steroid injections caused no complications. Side effects have been reported in some patients. In 25% of patients with hypertension (4 of 16 patients) a short-term high blood pressure by an average of 30-40 mm Hg was evidenced. All patients with diabetes mellitus (3 patients) experienced an increase in blood glucose (maximum within 4 mmol/l for 3-4 days).

**TABLE 5.** Structural and morphological changes in chronic lower back pain in the main and control groups

| Determining structural and morphological changes | Chronic lower back pain syndrome, n = 120 (main group) | Chronic lower back pain syndrome, n = 36 (control group) |
|---|---|---|
| Intervertebral disk herniation | 106 | 32 |
| Spondylolisthesis | 9 | 2 |
| Spinal stenosis | 3 | 1 |
| Spondyloarthritis | 89 | 25 |

**TABLE 6.** Dependence of the functional state of patients by the Oswestry index on the major structural and morphological changes of the spine in the main group

| Structural and morphological changes | Before treatment | After treatment | In half a year |
|---|---|---|---|
| Intervertebral disk herniation | 45±0.6 | 22±0.6* | 29±0.6* |
| Spondylolisthesis | 49 ±0.4 | 27±0.5* | 36±0.6 |
| Spinal stenosis | 57±0.6 | 31±0.4* | 40±0.5 |
| Spondyloarthritis | 52±0.4 | 21±0.5* | 33±0.6* |

Note: * – p<0.05, a significant difference in the treatment results in the early period was established in all morphological groups, and in half a year – only in the group of patients with intervertebral disk herniation (average size of 4.9 mm) and spondyloarthritis.

**TABLE 7.** Dependence of the functional state of patients by the Oswestry index on the major structural and morphological changes of the spine in the control group

| Structural and morphological changes | Before treatment | After treatment | In half a year |
|---|---|---|---|
| Intervertebral disk herniation | 49±0.5 | 29±0.4* | 44±0.6 |
| Spondylolisthesis | 59±0.6 | 32±0.4* | 52±0.6 |
| Spinal stenosis | 56±0.6 | 34±0,6* | 54±0.7 |
| Spondyloarthritis | 54±0.5 | 33±0.6* | 48±0.5 |

Note: * – p <0.05, a significant difference in treatment outcomes was found in the early period in all morphological groups, and in half a year – no significant difference in any of the morphological groups.

The analysis of the obtained data proved that in the early period after treatment significant results of treatment of chronic lower back pain were obtained in both the main and control groups of patients with structural and morphological changes of the spine: intervertebral disk herniation, spondyloarthritis, spinal stenosis, spondylolisthesis. But the indicators, both by the Oswestry index and the visual analog scale, improved in the main group (inclination at 0.1> p >0.05). In the long-term period after treatment, significant results were obtained only in the main group and there was a clear significant difference in the long-term treatment results between the main and control group in favour of the monotherapy method. Significant treatment outcomes in the main group in half a year were evidenced in the patients with intervertebral disc herniation and spondyloarthritis, and in other structural and morphological changes (spondylolisthesis, spinal stenosis) improvements were not significant, although the level of functional state of patients was significantly higher than before treatment. However, significant results of chronic pain treatment in the control group in half a year were not obtained in any of the structural and morphological groups and the level of functional state of patients by the Oswestry index almost reached the level before treatment. It proved a significantly higher effectiveness (significant difference) of the method of monotherapy with epidural injections for chronic lower back pain in the long-term period and higher efficiency (no significant difference, with an inclination) in the early postoperative period, compare to conventional therapy. Thus, epidural steroid injection should be indicated for all of the listed structural and morphological causes of pain, especially for intervertebral disk herniation and spondyloarthritis. One or two steroid epidural injections for patients with chronic lower back pain reduce the treatment duration; improve the effectiveness of treatment; provide a stable and long-term remission; decrease the number of complications and relapses.

The results of the study using the technique of middle interlaminar access without fluoroscopic imaging allow recommending the widespread use of this technique for treatment of lower back pain caused by degenerative spine damage. Technically and technologically simple procedure of epidural steroid injection can be implemented at the outpatient medical care settings for patients with chronic lower back pain caused by degenerative spine damage.

## DISCUSSION

At present there are no sufficient prospective studies of adequate design to assess the efficacy of epidural glucocorticoids, or they contain contradictory information [9,10,11,12,13].

A large number of reviews are published on the analysis of the effectiveness of epidural glucocorticoid injections and methodological guidelines on how to perform them [14,15,16]. They are more often used in radiculopathy caused by disc herniation and spinal stenosis. There are some reports of intradiscal administration of glucocorticoids in discogenic radiculopathy [17].

It was established that epidural glucocorticoid injections in chronic lower back had relative effectiveness [18,19]. There were no significant differences in the efficacy of single and repeated epidural glucocorticoid injections [20]. There were also no differences between different glucocorticoids (40 mg triamcinolone or 6 mg betamethasone) [21] or their different doses (40 or 80 mg methylprednisolone) [22].

A large British randomized controlled trial WEST proved a low efficacy of epidural injections for nonspecific back pain. A Kaye et al. [23] published a meta-analysis of 52 controlled trials comparing injections of glucocorticoids, topical analgesics and placebo in chronic back pain associated with intervertebral disc herniation of the cervical, thoracic, and lumbar spine, and stenosis. This study confirmed the advantages of interventional methods: for all localizations of the damage, a high level of evidence (II), in which the effectiveness of active therapy exceeded the effect of "pacifiers".

VM Olkhov et al. [24] established positive outcomes of epidural blockade in 86.8% of cases. As a rule, the patients experienced a reduction in pain intensity immediately after the procedure, the effect increased within 2-3 days. 46 (13.2%) patients experienced no relief after epidural blockade; in these cases, surgery was performed due to intense pain. The authors have concluded that in neurosurgery practice epidural administration of corticosteroids and local anaesthetics is an effective method of treatment of lumbar spine and radicular pain caused by inflammation, has a low risk, is a necessary criterion for determining the necessity for surgery.

Many authors point out that the effectiveness of epidural glucocorticoid injections for back pain and radicular syndrome depends on the duration of the disease. Thus, PP Doshi [25] showed that in 90% of patients with pain lasting less than 3 months there was a positive outcome of epidural administration of glucocorticoids. With a duration of radiculopathy less than 6 months, the effectiveness of treatment was about 70%. If the pain lasted for more than 12 months, the effectiveness of treatment did not exceed that of placebo.

GR Butterman [26] proved the effectiveness of epidural injections in the acute stage of lower back

pain, a long-term effectiveness and its possible application as an alternative to surgical treatment of intervertebral disc herniation.

A number of authors consider the effectiveness of epidural injections depending on the need for surgery, which is one of the main and most objective criteria regarding the effectiveness of conservative therapy in nonspecific back pain. For example, German researchers studied the results of epidural injections with glucocorticoids and local anaesthetics in 356 patients with lumbosciatica. The authors were very positive of this technique, reporting that 97% of their patients had significant improvement after the first epidural injection. But very quickly pain worsened that required repeated medical procedures. Thus, despite the success of injection therapy, 19.4% of patients needed surgery [27].

Similar results were found by SM Leung et al [28]. The authors studied the treatment outcomes of 232 patients with lumbosciatica, who underwent epidural injections with glucocorticoids. A significant immediate pain reduction was evidenced in 80.2% of patients, but the effect of therapy was lost within 3 months in 51% of cases. As a result, 106 patients (45.7%) were referred for surgical treatment.

The ambiguity of data on the effectiveness of epidural glucocorticoids is caused by heterogeneity of selection of patients for interventional therapy and the choice of epidural administration method: interlaminar, transforaminal and caudal, as well as the methodology and technique of epidural administration and its accuracy less so.

Our study of using epidural steroid injections only in the treatment of osteochondrosis, which eliminates variability in the interpretation of the results, both in the early and in the long-term periods, has proven a high effectiveness of epidural steroid injections in patients with lower back pain syndrome caused by degenerative-dystrophic spine damage. A review of the literature, as well as the results of our studies has proven that the research on the effectiveness of epidural steroids in degenerative-dystrophic spine damage is not complete, the discussion continues, new issues are emerging.

## CONCLUSIONS

The results of the study prove a high effectiveness of monotherapy with epidural steroid injections in the patients with lower back pain caused by degenerative spine damage. Epidural steroid injections are indicated after the ineffectiveness of conservative therapy in cases of intervertebral disc herniation, spondyloarthritis, spinal stenosis, spondylolisthesis that cause chronic lower back pain. The results of treatment allow recommending wide introduction of monotherapy of chronic lower back pain caused by degenerative spine damage into neurology, neurosurgery, orthopedy and anaesthesiology practice.

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