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ORIGINAL RESEARCH  
ОРИГИНАЛЬНОЕ ИССЛЕДОВАНИЕ

## Interventional surgery effectiveness in treatment of the cervical spine and shoulder joint chronic pain

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**Abstract. Relevance.** Degenerative diseases of the spine are among the most common pathologies that cause significant medical, social and economic losses. Thus, a retrospective analysis of the Humana database from 2008 to 2014 indicates a sharp increase in discogenic neurocompression lesions of the cervical spine, which is 42 %. Degenerative processes are characterized by metabolic and structural changes in the intervertebral discs (IVD), which lead to the loss of its properties. *The aim* of the study was to analyze the results of intervertebral disc nucleoplasty and radiofrequency denervation of the facet joints in patients with cervical joint hernias. *Materials and Methods.* Intervertebral disc nucleoplasty and radiofrequency denervation of the facet joints in patients with hernias of the cervical spine was performed in 55 patients aged 18 to 74 years (mean age  $36.28 \pm 2.19$  years), of which 56.36 % (31 patients) were men and 43.64 % (24 people) were women. *Results and Discussion.* The results demonstrate a significant improvement ( $p < 0.001$ ) in VAS and ODI in patients after treatment. The majority of patients (45.45 %) rated their health status as “good”, 41.82 % of respondents believe that after the intervention, their health status can be assessed as “excellent”. Only 3 patients (5.45 %) indicated an unsatisfactory condition, which may be due to individual psychological characteristics, comorbidities, or a reduced sensitivity threshold. *Conclusion.* Nucleoplasty of the intervertebral disc and radiofrequency denervation of the facet joints is an effective and safe method for the treatment of intervertebral hernias of the cervical spine.

**Key words:** chronic neck pain, degenerative-dystrophic diseases of the spine, disc herniation, interventional surgery, nucleoplasty, radiofrequency denervation.

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## Introduction

Degenerative diseases of the spine are among the most common pathologies, causing significant medical, social and economic losses. Thus, a retrospective analysis of the Humana database from 2008 to 2014. indicates a sharp increase in discogenic neurocompressive lesions of the cervical spine, which is 42 % [1, 2]. Degenerative processes are characterized by metabolic and structural changes in the intervertebral discs (IVD), which lead to the loss of its properties [3].

With changes in the area of the CS, stable pain occurs [4, 5]. According to the study by W. Yin, N. Bogduk, discogenic pain accounts for about 16 % of patients with neck pain [4, 6]. The problem of treating discogenic neurocompression syndromes, which is due to the severity of clinical manifestations, as well as the lack of a unified vision for the treatment of this pathology. Open cervical microdiscectomy with stabilization of the spinal motion segment remains the standard of surgical treatment for IVD hernias in the cervical spine [7, 8]. However, the widespread introduction of high-tech minimally invasive methods of surgical treatment of IVD hernias has led to a significant decrease in the number of disabled people, solving the social problem in society caused by this pathology [9].

Traditionally, in degenerative-dystrophic diseases of the spine, IVD is defined as the main source of pain, and interventions on the discs marked the beginning of the development of interventional methods of

treatment [10—12]. The differences between currently known IVD interventions are determined by the main target of the intervention and the pathological process they are aimed at [11—16].

There are controversies in evaluating the effectiveness of intradiscal techniques compared with conservative treatment of chronic neck pain [4, 10]. There is a less significant effect of intra-articular injections [4, 5—7]. Currently, a wide range of surgical techniques has been introduced for this pathology, but the effectiveness of interventional surgery in the treatment of chronic cervical pain has not been sufficiently studied. These issues deserve close attention and require further solutions, which determines the relevance of this topic.

The aim of the study was to analyze the results of nucleoplasty of the intervertebral disc and radiofrequency denervation of the facet joints in patients with hernias of the cervical joint.

## Materials and methods

In the period from 2019 to 2020, a case-control study was conducted. 55 patients aged 18 to 74 years (mean age  $36.28 \pm 2.19$  years) were included, of which 56.36 % were men (31 people), and 43.64 % were women (24 people). The study was carried out according to the standards of the Declaration of Helsinki and was approved by the ethics committee of the Peoples' Friendship University of Russia. Before the start of the study, all participants signed a voluntary consent.

The study included patients according to the following criteria: surgical interventions for primary single-level disc herniations of the cervical spine.

Patients with complete stenosis of the MMC, displacement of the vertebrae, instability of the spinal motor segment were excluded.

Case histories and MRI data were analyzed [17–20]. All patients underwent surgical treatment according to indications: CHD from 3 months (VAS > 4 points and/or ODI > 30 %); radicular pain syndrome and sensitivity disorders; lack of effect of conservative therapy; motor disorders (muscle strength 3 or less points). Comparison of treatment outcomes included back pain assessment (VAS) and quality of life assessment (ODI questionnaire and MacNab scale), which were measured before the intervention and after 12 months.

Statistical data processing was carried out using Microsoft Excel and Statistica 8.0 (StatSoft Inc.). The Mann-Whitney test and Fisher's exact test were used. Differences were considered statistically significant at  $p < 0.05$ .

## Results and discussion

The paper analyzes the results of surgical treatment of 55 patients with IVD hernias of the cervical spine. According to the classification of the World Health Organization (WHO, 1963), the distribution of patients by age periods was carried out. As follows from the presented data, males of working age predominated (Table 1 and Fig. 1).

**Table 1**

### Demographic and clinical data of patients

Characteristic	Number of observations	
	Abc.	%
Number of Patients, v. t. h	55	100
men	31	56,36
women	24	43,64
Age M ± SD, years	36,28 ± 2,19	
Age range, years	18,0–74,0	
Body mass index M ± SD	35,3±4,7	
ODI M ± SD	76,04 ± 10,91	
VASH M ± SD	7,69 ± 0,98	

Characteristic	Number of observations	
	Abc.	%
Duration from the onset of the disease to surgery		
2–6 month.	10	18,18
6–24 month.	26	47,27
24–60 month.	12	21,82
60–120 month.	5	9,09
> 120 month.	2	3,64
Level of surgery		
Level C3-C4	2	3,64
Level C4-C5	9	16,36
Level C5-C6	24	43,64
Level C6-C7	19	34,55
Level C7-Th1	1	1,82
Degree of degeneration MTD on Pfirman		
3,0–4,0	10	18,18
4,1–5,0	25	45,45
5,1–6,0	13	23,64
6,1–7,0	4	7,27
7,1–8,0	3	5,45
Types of IVD hernias relative to the spinal canal		
Median	32	58,18
Paramedian	19	34,55
Foraminal	4	7,27
Degree of degeneration MTD on Pfirman		
I	4	7,27
II	6	10,91
III	23	41,82
IV	19	34,55
V	3	5,45
Modic I	9	16,36
Modic II	15	27,27
Foraminal stenosis in Lee	10	18,18

One of the important criteria for optimizing further treatment tactics is the collection of an anamnesis of patients to assess the duration of the disease. Data on the duration of the disease indicate that most patients received treatment for up to 2 years (18.18 % from 2 to 6 months and 47.27 % from 6 to 24 months). It was a conservative therapy with the use of medications, physiotherapy and spa treatment.

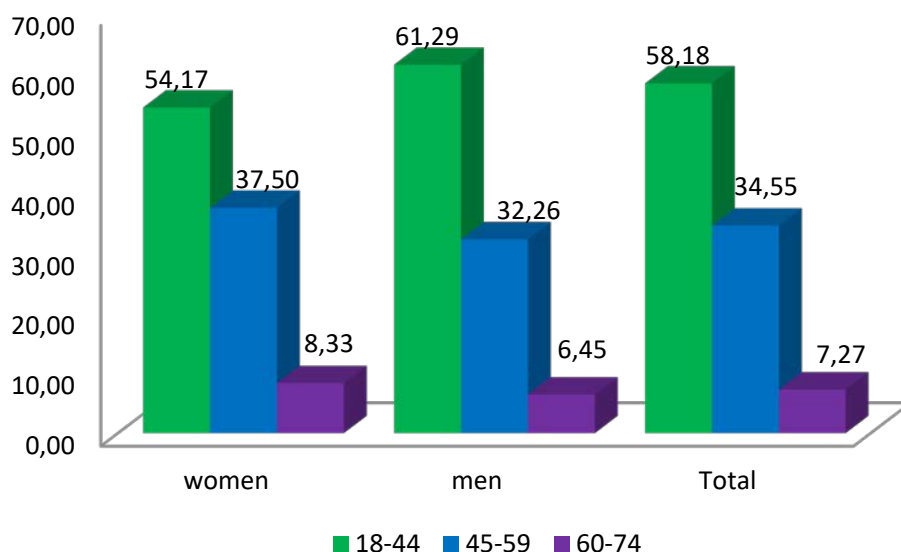


Fig 1. Distribution of observations by age,% of the age group

It was found that the onset of the disease or its exacerbation was often associated with physical activity or a sharp turn of the head — in 26 (47.27 %) patients. The second provoking factor was hypothermia — 10 (18.18 %) patients, in 5 patients (9.09 %) these factors were combined. In 4 (7.27 %) patients there was a history of spinal injury, in 2 (3.64 %) patients the exacerbation of the pain syndrome was preceded by ARVI. In 11 (20.00 %) patients, the direct etiological factor could not be identified.

According to MRI data, a significant predominance of patients with median IVD hernias in the cervical spine was revealed — 32 (58.18 %) paramedian hernias accounted for 34.55 % (19 patients) and foraminal hernias — 7.27 % (4 patients). The overwhelming majority were patients with lesions of the lower cervical region (C5-C6—43.64 % and C6-C7—34.55 %), which also corresponds to the literature data. According to MRI data, the main group consisted of patients with IVD hernias of the cervical spine up to 5.0 mm (18.18 % — from 3.0 to 4.0 mm and 45.45 % — from 4.0 to 5.0 mm).

Summarizing the results of observations for all 55 patients with hernias of IVD of the cervical spine, it should be noted that this pathology was most often detected in men of mature age;

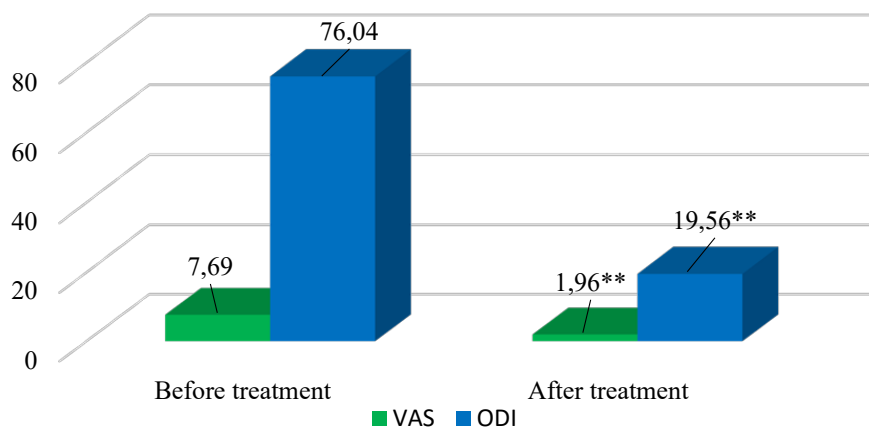
The dynamics of VAS ( $M \pm SD$ ) and ODI ( $M \pm SD$ ) before and after treatment is shown in Figure 2.

Thus, the mean VAS values before treatment were  $7.69 \pm 0.98$ , and after —  $1.96 \pm 0.92$  ( $p < 0.001$ ); the results of the ODI questionnaire also decreased significantly: from  $76.04 \pm 10.91$  at the beginning of the study to  $19.56 \pm 9.25$  after the treatment. The results obtained demonstrate a significant improvement ( $p < 0.001$ ) in VAS and ODI in patients after treatment.

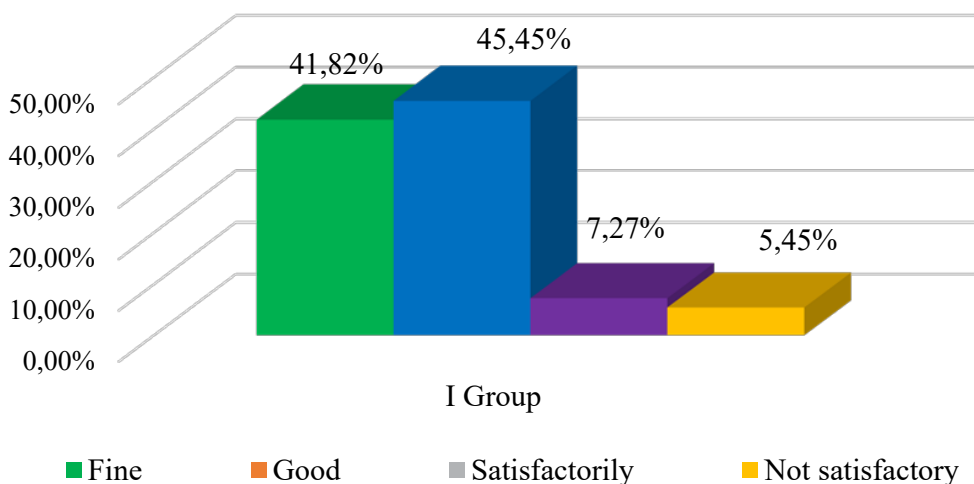
The data of the subjective assessment of the interventions performed on the MacNab scale are presented in Figure 3.

The data obtained showed that the majority of patients (45.45 %) rated their health status as “good”, 41.82 % of respondents believe that after the intervention their health status can be assessed as “excellent”. Only 3 patients (5.45 %) indicated an unsatisfactory condition, which may be due to individual psychological characteristics, comorbidities, or a reduced sensitivity threshold.

The processes of degeneration of the cervical spine are often associated with compression syndromes of the neurovascular formations of the spinal canal. It has been shown that in 50—80 % of individuals,



**Fig 2.** Results of YOUR, ODI indicators before and after treatment (quantitative ratio)



**Fig 3.** Results of subjective assessment of interventions on the MacNab scale, %

degenerative lesions of the spine lead to temporary disability, while the cervical region is affected in 10—15 % of cases [21, 22].

The introduction of modern instruments and equipment, the use of microsurgical techniques, the use of new surgical approaches at the present stage of development of diagnostics, neuroanesthesiology, have

led to a significant improvement in the results of surgical treatment of hernias of the cervical spine [23—25].

Despite the variety of surgical techniques that are used in the treatment of patients with cervical hernias, the main task facing the surgeon is to eliminate the compression factors of neurovascular formations while minimizing the risk of the surgical injury itself [26].

On the other hand, having a large number of surgical technologies in the arsenal, it is possible not only to eliminate compression factors, but also to prevent the occurrence of possible complications (hernia recurrence, hernia formation at adjacent levels, development of instability in the spinal motion segment) in the future [27, 28].

Radiofrequency denervation is comparable to intraforaminal administration of corticosteroids under X-ray control in terms of invasiveness, but it is distinguished by a longer analgesic effect [29—31]. The low invasiveness of the intervention allows the use of radiofrequency denervation on an outpatient basis.

In the present study, the effectiveness of intervertebral disc nucleoplasty in combination with radiofrequency denervation of the facet joints in patients with hernias of the cervical spine was considered. After the intervention, all 55 patients noted a decrease in pain and an improvement in vital functions. As a result of treatment, no neurological deficit was detected, and there were no septic complications. Before treatment, most patients noted that the pain was very severe, bordering on unbearable (VAS  $7.69 \pm 0.98$  points). A year after treatment, the VAS values decreased to  $1.96 \pm 0.92$  points (mild pain), i.e. 3.9 times ( $p < 0.001$ ). Similar data were obtained for the indicators of the ODI questionnaire; 3.9 times ( $p < 0.001$ ). For the treatment of IVD hernias, many methods of surgical interventions have been developed — decompression, stabilizing rigid and dynamic, decompression-stabilizing; recently, percutaneous procedures have become widespread.

Decompression interventions have become widespread due to the relative ease of execution and good immediate results. But often the choice of a treatment method (isolated decompression or in combination with spinal fusion) is determined not by the characteristics of the pathological process, but by the low-traumatic nature of the intervention due to the threat of possible complications.

At the same time, although the long-term results of minimally invasive procedures do not always satisfy patients and surgeons, the feasibility of large and complex open surgeries that provide sufficient stability of the operated segment has not been finally clarified.

Further research is needed in this direction, detailing the indications and contraindications for various types of interventions, depending on the specific clinical situation.

Nucleoplasty of the intervertebral disc and radiofrequency denervation of the facet joints is an effective and safe method for the treatment of intervertebral hernias of the cervical spine. The advantages of interventional treatment include: minimum damage to soft tissues; reduced recovery time after the intervention; the possibility of carrying out with the use of local anesthesia; optical magnification allows good visualization of intracanal structures, reducing the risk of nerve root damage; possibility of direct access to extrusion; slight risk of infectious complications.

## Conclusion

Nucleoplasty of the intervertebral disc and radiofrequency denervation of the facet joints is an effective and safe method for the treatment of intervertebral hernias of the cervical spine.










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## Эффективность интервенционной хирургии в лечении хронической боли шейного отдела позвоночника и плечевого сустава

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**Аннотация.** *Актуальность.* На сегодняшний день дегенеративные заболевания позвоночника относятся к наиболее распространенным патологиям, являясь причиной значительных медико-социальных и экономических потерь. Ретроспективный анализ базы данных Humana с 2008 по 2014 г. указывает на резкий рост дискогенных нейрокомпрессионных поражений шейного отдела позвоночника, который составляет 42 %. Дегенеративные процессы характеризуются метаболическими и структурными изменениями в межпозвонковых дисках (МПД), которые приводят к утрате его свойств. *Цель исследования* — проанализировать результаты нуклеопластики межпозвонкового диска и радиочастотной денервации дугоотростчатых суставов у больных с грыжами шейного сустава. *Материалы и методы.* У 55 пациентов от 18 до 74 лет (средний возраст — 36,28 ± 2,19 лет), из которых мужчины составляли 56,36 % (31 пациент), а женщины — 43,64 % (24 человека), проведена нуклеопластика межпозвонкового диска и радиочастотной денервации фасеточных суставов у больных с грыжами шейного отдела позвоночника и проанализированы результаты. *Результаты и обсуждение.* Полученные результаты демонстрируют достоверное улучшение ( $p < 0,001$ ) показателей ВАШ и ODI у пациентов после лечения. Большинство пациентов (45,45 %) оценили состояние своего здоровья как «хорошее», 41,82 % респондентов считают, что после проведенного вмешательства их состояние здоровья можно оценить как «отличное». Только 3 пациента (5,45 %) указали на неудовлетворительное состояние, что может быть связано с индивидуально-психологическими особенностями, сопутствующими заболеваниями или сниженным порогом чувствительности. *Выводы.* Нуклеопластика межпозвонкового диска и радиочастотная денервация фасеточных суставов — эффективный и безопасный метод лечения межпозвонковых грыж шейного отдела позвоночника.

**Ключевые слова:** хроническая боль в шее, дегенеративно-дистрофические заболевания позвоночника, грыжа диска, интервенционная хирургия, нуклеопластика, радиочастотная денервация.

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