

## TRANSPEDICULAR STABILIZATION OF THE SPONDYLOLESTHESIS OF THE LUMBOSACRAL SPINE

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### ABSTRACT

*This article presents the current state of the problem of surgical treatment of the lumbosacral spine using a transpedicular stabilizing system. Degenerative dystrophic diseases of the spine are a serious disease, manifested by neurogenic intermittent claudication, pain in the lower extremities and lower back. The same reason leads to poor results of surgical treatment, since many patients are operated on in a state of decompensation. At the moment, there is no unequivocal opinion about the indications for stabilizing operations. On the one hand, the implementation of only one decompression can trigger the development of further instability in one or several segments.*

**KEYWORDS:** *Spondylolesthesis, Transpedicular Stabilization, Lumbosacral Spine.*

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### INTRODUCTION

Spondylolisthesis in recent years has become a socially significant problem due to progressive prevalence, reaching 75-80% in the population, significant economic losses due to temporary and permanent disability, as well as costs of compulsory medical insurance and high-tech medical care [1].

Back pain is the second most common reason for seeking medical attention after respiratory illness and the third cause of hospitalization for patients. In most cases, lumbodynia is observed, which occurs in almost every person throughout life [2].

Spondylolisthesis of the lumbar spine is one of the urgent problems in vertebrology, as evidenced by the increasing number of publications and the number of inventions on this subject over the past 10 years [3].

Degenerative dystrophic diseases of the spine are a serious disease, manifested by neurogenic intermittent claudication, pain in the lower extremities and lower back. The incidence of lumbar stenosis is about 1000 cases [4]. Pain and intermittent claudication are often accompanied by paresis or plegia of the lower extremities, as well as severe impaired sensitivity, which leads the patient to a disability [5].

Conservative treatment of spinal spondylolisthesis is widespread today and gives positive results only in the early stages of the disease. However, after several years of drug therapy, patients are often forced to seek help from an orthopedic surgeon or a neurosurgeon [6].

Assessment of neurological changes from the degree of narrowing of the spinal canal, as well as the radicular tunnel and intervertebral foramen at the level of the lumbar spine, plays a key role in the success of surgical intervention. The recent appearance of imaging examinations, such as computed tomography and magnetic resonance imaging, greatly expanded the possibilities of diagnosing the disease and led to an increase in the number of surgical interventions for lumbar stenosis [7]. However, to date there are significant difficulties in the diagnosis of the disease and the choice of the correct adequate indications for surgical intervention. In many cases, there are no clear criteria and parallels between the clinical symptoms of the disease and the pattern of pathological changes visible on CT and MRI [8]. Quite often, signs of degenerative-dystrophic diseases of the lumbar spine are detected by chance, when the clinical manifestations of the disease are practically absent. This is due to the duration of the process and the formation of compensatory mechanisms. The same reason leads to poor results of surgical treatment, since many patients are operated on in a state of decompensation. In such cases, even a slight deterioration in blood circulation in the area of compressed nerve trunks or the spinal cord during surgery can lead to irreversible changes with the corresponding neurological pattern [9]. The currently used methods of surgical treatment of degenerative-dystrophic diseases of the lumbar spine are aimed at decompression of the caudal nerve roots. To date, the issues of stabilization during decompression of the spinal canal have not been resolved. Many authors [9] suggest that all patients with lumbar stenosis will perform transpedicular fixation. Others [10] believe that the stabilization of the vertebral segment after surgical intervention leads to the appearance of bone growths and the emergence of restenosis. The role of ventral decompression in the surgical treatment of degenerative stenoses of the lumbar spine, the causes and methods of treatment of the “unsuccessfully operated spinal syndrome” [11] has not been fully studied.

The transpedicular stabilization of the lumbar spine is a fundamentally new approach to solving the problem of surgical treatment of spondylolisthesis. The purpose of dynamic fixation is the elimination of instability of the affected vertebral segment while maintaining the physiological level of mobility in it. From the standpoint of biomechanics, transpedicular fixation of the vertebral segment compared with traditional methods of stabilization by spinal fusion - looks preferable because it allows you to evenly distribute the functional load on the spine, and therefore prevent overloading of the adjacent vertebral segments and their possible accelerated degeneration [12].

## **Goal of the work**

Determination of indications for the installation of systems for posterior transpedicular fixation and evaluation of the results of the surgical treatment of lumbar spinal spondylolisthesis.

## **Research methodology**

The study group included 102 patients operated in the period from 2012 to 2016. in the department of neurosurgery. Among them, 58 men and 44 women, aged 16 to 58 years, with an average age of 35 years. The main indications for this type of operation were: radiographically confirmed stenosis from moderate to severe, correlated with neurological symptoms, pain syndrome, intervertebral instability associated with recurrent hernias; massive primary disc herniation with sequesters: median and paramedian in the presence of intense, resistant to conservative therapy syndromes of horsetail root compression; stabilization of levels above or

below the segment of rigid spinal fusion to minimize the possible degeneration of adjacent segments.

## **Diagnostic criteria:**

1. Data of magnetic resonance tomography (MRI) of the lumbar spine: MRI allows you to assess the degree of degenerative changes in the vertebral segment, the state of the intervertebral disc, determine the topography of the hernia protrusion in the axial and sagittal planes, clarify the relationship between the hernia and spinal roots. The severity of degenerative changes in the intervertebral disc is estimated on the basis of MRI data according to the Pfirrmann classification. This classification identifies five degrees of degeneration of intervertebral discs, where the first degree corresponds to the norm, while the fifth degree indicates the most severe degenerative lesion of the disc [13].
2. Data of survey and functional spondylograms: the lateral radiographs taken in the neutral position assess the following radiographic parameters: the height of the disks in the anterior and posterior regions, the average height of the disk, the angle of the lumbar lordosis. The height of the intervertebral disks is calculated as the ratio of the size of the intervertebral gap to the height of the body of the overlying vertebra [14]. Since normally the height of the lumbar discs is at least 1/3 of the height of the body of the overlying vertebra, three degrees of disc height reduction are distinguished: from 33 to 25% of the height of the vertebral body - first degree, from 25 inclusive to 20% - second degree, less than or equal to 20% - the third degree [15].

Functional spondylography in the position of maximum possible flexion and extension made it possible to evaluate the mobility of the vertebral segments and to reveal the signs of segmental hypermobility. Segmental mobility was estimated based on the amplitude of linear motions (the amplitude of the sagittal translation) and the amplitude of the segmental angle, which were calculated by the method of White and Panjabi. The amplitude of linear motions was calculated as the difference in displacement between the inflection and extension, and the amplitude of the segmental angle was measured as the difference in the segmental angles between the extension and flexion positions. The amplitude of linear movements of more than 3 mm and the amplitude of a segmental angle of more than 10 ° were regarded as signs of excessive segmental mobility. The total range of movements in the lumbar spine was calculated from functional radiographs as the difference between the angles of the lumbar lordosis in the extension and flexion positions.

Clinical data: the degree of impairment of the functional activity of patients is assessed using the Oswestry questionnaire on a scale from 0 to 100% (ODI), as well as the severity of pain syndrome according to YOUR. The timing of the disease, the effectiveness of previously conducted conservative therapy are assessed.

Transpedicular stabilization was performed in 102 patients, including at the L4-L5 level in 73 patients (71%), at the L3-L4 level in 11 patients (11%), L2-L3 - 2 (2%), L5-S1 - 10 cases (9.5%), two patients underwent fixation at the level of L1-L2 (2%). In four cases, the operation was performed on two adjacent segments L3-L4-L5 (4.5%).

In these groups of patients, dynamic stabilization of one or two segments, as an independent and main type of operation, was performed in 94 cases. In two patients, the installation of the lamellae accompanied the transpedicular fixation with instability of several vertebral motor

segments of the lumbar spine. We used this system to “unload” the overlying segment, with the aim of slowing the progression of degenerative changes and instability in it. The group of observations from 6 people consisted of patients operated on two levels: using B-Twin interbody chords and dynamic stabilization of the adjacent segment. In one case, we applied the original solution: a combination of “hard” fixation of the L4-L5 segment with paired cages and transpedicular stabilization in the midline disc hernia with instability and installation of the system with a pedicle stabilization of the instability of the L3-L4 disc. In 68 patients, stabilization was carried out on the occasion of primary spondyloleostosis, accompanied by radiographic signs of segment instability, in cases of massive midline hernias; with relapses of previously operated disc hernias - 10 patients. In nine cases, stabilization supplemented decompressive interventions in case of stenosis of the spinal canal in one and more segments.

## **Results of the study and their discussion**

In the postoperative period during the first week, the majority of patients (94 out of 102) noted a complete or significant regression of the pain syndrome. This is due, primarily, to the elimination of compressing factors during the operation (spondylolsthesis, degenerative stenosis of the spinal canal). In 13 patients in the early postoperative period, the lumbalgic or lumbar ischialgic syndrome of varying severity remained, correlating with the level of surgical intervention and preoperative pain syndrome. This group of patients required the appointment of an additional course of nonsteroidal anti-inflammatory drugs, physiotherapy treatment. Taking into account the dynamics of regression of pain syndrome, postoperative bed - day ranged from 8 to 14 days (average - 11).

In 78 patients, the persistent positive effect achieved was maintained during the entire observation period. Ten patients needed repeated courses of conservative rehabilitation treatment up to one year after surgery. As regards the regress of neurological deficit, this process has been taking place for a longer time, being directly dependent on the severity before the operation, and on the timing of the disease. Residual neurological disorders were noted in 22.5% of cases (23 patients).

Evaluation of impaired functional activity of patients was carried out using the Osvester questionnaire on a scale from 0 to 100% (ODI). Prior to surgery, indexes ranged from 50% to 85%, averaging 67%. The dynamics of the index value changed depending on the timing of the postoperative period: 24–25% in the first month with regress to 19–20% by six months, and amounting to 18% in terms of up to one year after surgery.

## **CONCLUSION**

At the moment, there is no unequivocal opinion about the indications for stabilizing operations. On the one hand, the implementation of only one decompression can trigger the development of further instability in one or several segments. On the other hand, the rigid fixation of the spineboat causes a redistribution of the load on the higher and lower segments and, as a rule, the further development of the degenerative process in the previously intact intervertebral discs. At the same time, transpedicular stabilization cannot completely replace other types of stabilization, it allows to fill an empty niche between various types of stabilizing operations, using advantages, and having its indications, the transpedicular stabilization is more physiological, since it preserves the level of mobility of the vertebral segments simultaneously reducing the load on the

intervertebral joints and the posterior divisions of the intervertebral discs, due to which it has broad indications for application. Low invasiveness, ease of implementation and good clinical results have shown that this technique can be widely used both to eliminate and prevent segmental instability.

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