

ANALYSIS OF CLINICAL EFFICACY AND CAUSES OF UNSATISFACTORY OUTCOMES OF STAGED SURGICAL TREATMENT OF PATIENTS WITH TANDEM CERVICAL AND LUMBOSACRAL SPINAL STENOSES

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ABSTRACT

The concept of “tandem stenosis” includes simultaneous tandem cervical and lumbosacral spinal stenosis. Multiplicity of clinical manifestations complicates the choice of therapeutic and diagnostic tactics, which contributes to the use of clinically unjustified approaches to the implementation of surgical interventions.

Present study was aimed to analyze the clinical efficacy and causes of unsatisfactory outcomes of staged surgical treatment of patients with tandem cervical and lumbosacral spinal stenoses.

The study results of 51 patients with tandem cervical and lumbosacral spinal stenoses at two and more levels due to herniated intervertebral discs, hypertrophy of the yellow ligament and facet joint arthrosis were retrospectively evaluated. All patients underwent staged decompressive-stabilizing surgical interventions based on the Neurosurgery Center of the Road Clinical Hospital at Irkutsk-Passenger station JSC “Russian Railways”.

Significant reduction in the preoperative pain and improvement of the functional state were noted in patients with tandem cervical and lumbosacral spinal stenoses after staged decompressive-stabilizing interventions. The analysis also established that the disease duration of less than three years, initial surgical intervention on the cervical spine are associated with “excellent and good” postoperative outcomes in study group patients. “Satisfactory and unsatisfactory” postoperative results in study group are in direct correlation with the disease duration and features of the selected surgical tactics. Moreover, clinically significant postoperative adverse effects are identified in these patients in the form of scar-adhesive epiduritis and pseudoarthrosis both in the cervical and lumbar spine.

KEYWORDS: tandem stenosis, spinal canal, diagnostics, staged surgical treatment, complications.

INTRODUCTION

The concept of “tandem stenosis” includes simultaneous tandem cervical and lumbosacral spinal stenosis [Dagi T et al., 1987; Byvaltsev V et al., 2016].

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This pathology accounts for up to 25% of all degenerative spinal diseases and is found primarily in individuals older than 50 years [Aydogan M et al., 2007]. On the one hand, the combined lesion of several vertebral segments contributes to the appearance of various clinical symptoms, which significantly complicates the diagnosis and determination of treatment tactics for patients [Hsieh C et al., 1998]. On the other hand, the lack of instrumental

data on the presence of the common pathological process in several parts of the spine can lead to the deterioration in the condition of patients in the post-operative period due to prolonged non-physiological positioning [Deem S et al., 1991].

Along with permanent development of spinal surgery, approaches to the surgical treatment of patients with tandem stenoses are not sufficiently clarified. Some researchers point to the need for simultaneous decompression at all clinically relevant levels [Aydogan M et al., 2007], the others to high risks of surgical intervention in several regions of the spine and consider it necessary to perform stepwise manipulations in the area of the prevailing clinical picture [LaBan M, Green M, 2004; Molinari R et al., 2012].

Currently, there is little information in the specialized literature about the clinical efficacy of the results of staged decompressive-stabilizing surgical interventions in patients with cervical and lumbosacral spinal stenosis.

Present study was aimed to analyze the clinical efficacy and causes of unsatisfactory outcomes of staged surgical treatment of patients with tandem cervical and lumbosacral spinal stenoses.

MATERIAL AND METHODS

Over the period from January 2005 to December 2012, 1982 decompressive and decompressive-stabilizing surgical interventions have been performed on the cervical and lumbosacral spine in the Neurosurgery Center of the Road Clinical Hospital at Irkutsk-Passenger station JSC "Russian Railways".

Medical histories and outpatient medical records of 51 patients with symptomatic tandem cervical and lumbosacral spinal stenoses were retrospectively analyzed. All patients underwent comprehensive clinical and instrumental examination, including the study of neurological and orthopedic status, spondylography, magnetic resonance and multispiral computed tomographies and information about long-term postoperative period.

Anthropometric data (sex, age, body mass index), initial clinical symptomatology and disease duration were studied. Intraoperative characteristics of surgical interventions and peculiarities of the postoperative period (operation duration, extent of blood loss, activation time, length of hospi-

tal stay), clinical parameters, including the level of pain according to visual analogue scale, neck disability index, life quality of patients with back pain by Oswestry questionnaire [Fairbank J, Davies J, 1980], degree of patient satisfaction with performed operation by Macnab scale [Macnab D et al., 1987] and the objective dynamics of the neurological outcome by Nurick scale [Nurick S, 1972] and the presence of complications were assessed.

In all studied cases, staged decompressive-stabilizing interventions were performed: in 29 patients primary surgical intervention was performed at the cervical level, in 22 patients – at the lumbosacral.

In the cervical spine from the left-sided retropharyngeal access, suggested by R. Cloward (1958), discectomy or corpectomy, decompression of the spinal cord and its roots were performed followed by interbody fusion with the installation of a telescopic prosthesis, in some cases supplemented by fixation of the anterior cervical plate. Laminectomy with one- or two-sided facetectomy, foraminotomy, posterior interbody spondylodesis and transpedicular fixation was performed in the lumbar spine [Krutko A, 2012; Kalinin A, Byvaltsev V, 2015].

Statistical analysis of the study results was performed on a personal computer using Microsoft Excel and Statistica-8 database software. The criteria of non-parametric statistics were used in order to assess the significance of differences in sample populations. The level of $p < 0.05$ was considered as the lower confidence limit. The data are presented in median and interquartile range as Me (25%; 75%).

RESULTS

General information about the examined patients: Males (n=36, 70%) with mean age – 55 (47, 59) years, mainly of high weight (body mass index – 26.9 (23.6, 29.8) kg/m^2) prevailed in the study group of patients.

Clinical manifestations of tandem cervical and lumbosacral spinal stenosis before the surgical treatment are presented in table 1.

The analysis revealed that the examined patients had associated neurological symptomatology with the most common clinical picture of poli-radicular syndrome from the lumbosacral level (61%), gait disorder (71%), syndrome of caudogenic intermittent claudication (62%), movement disorders in the upper (61%) and lower (59%) ex-

tremities.

While studying the disease duration from the time of the onset of clinical symptoms until the first stage of treatment, a manifestation of neurological signs was detected in 82% (n=42) operated individuals – in terms of more than 3 years (Fig. 1).

Analysis of technical characteristics of surgical interventions: Summary data on the operation duration, extent of blood loss, incision length, activation time and length of hospital stay are presented in table 2.

Analysis of clinical outcomes: Characteristics of the parameters of study group patients according to the level of pain, neck disability index, life quality, objective data of changes in the neurological status and the degree of patient satisfaction with the performed operation are presented in table 3.

During the analysis of clinical outcomes a significant reduction of pain intensity both in cervical and lumbosacral spine assessed by visual analogue scale, as well as significant positive dynamics of the functional state was noted after surgery com-

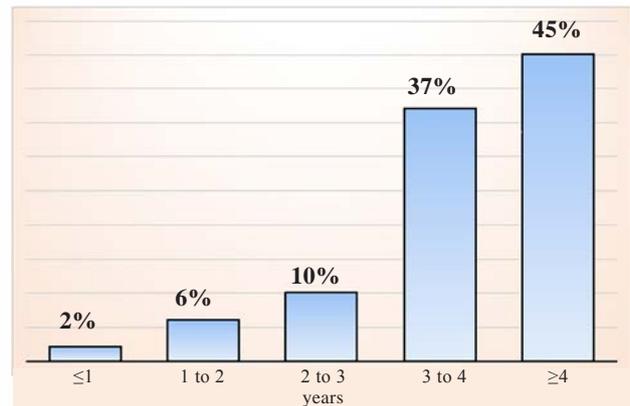


FIGURE 1. Distribution of patients by terms of the disease onset before surgery

pared with the preoperative Oswestry Disability Index value. Positive dynamics in the form of improvement of neck disability index ($p_w < 0.001$) was detected.

Analysis of postoperative complications: Revealed complications are divided into intraoperative, early and long-term postoperative complications associated with surgical intervention. The data are presented in figure 2.

TABLE 1

Clinical symptomatology of tandem cervical and lumbosacral spinal stenoses		
Symptoms	Signs	Study group (n=51)
Changes in reflexes of the upper limbs	Hypo-/areflexia	7 (14%)
	Hyperreflexia	18 (35%)
	Pathological reflexes	21 (41%)
Changes in the reflexes of the lower limbs	Hypo-/areflexia	13 (25%)
	Hyperreflexia	11 (21%)
	Pathological reflexes	16 (31%)
Sensitive disorders	Dermatomal	8 (16%)
	Segmental	13 (25%)
	Conduct	18 (35%)
Movement disorders	In the upper limbs	31 (61%)
	In the lower limbs	30 (59%)
	Quadriparesis	11 (21%)
Pain syndrome	Radicular pain in hands	13 (25%)
	Radicular pain in legs	13 (25%)
	Cervical pain	11 (21%)
	Lumbar pain	18 (35%)
Polyradicular syndrome		31 (61%)
Gait disorder		36 (71%)
Caudogenic intermittent claudication syndrome		32 (62%)
Pelvic disorders		21 (41%)

TABLE 2
 Technical features of surgical interventions and specificity of postoperative management of patients during cervical and lumbosacral spine surgery

Criteria	Study group (n=51)	
	Cervical spine surgery (n=29)	Lumbar spine surgery (n=22)
Operation time (min)	160 (135; 280)	205 (160; 220)
Extent of blood loss (ml)	300 (190; 450)	350 (300; 550)
Activation time (days)	2 (2; 4)	4 (3; 5)
Length of hospital stay (days)	28 (21; 34)	

TABLE 3
 Distribution of examined patients according to the clinical results of surgical treatment

Signs	Study group (n=51)		
	before surgery	in 24 months	
Visual analogue scale (cervical spine) (mm)	75 (64; 78)	25 (20; 35)	
Visual analogue scale (lumbosacral spine) (mm)	72 (68; 80)	30 (22; 40)	
Neck Disability Index (points)	46 (42; 48)	25 (20; 30)	
Functional state by Oswestry index (points)	72 (64; 80)	30 (25; 36)	
Subjective outcome by Macnab scale	Excellent	-	5 (10%)
	Good	-	22 (43%)
	Satisfactory	-	21 (41%)
	Unsatisfactory	-	3 (6%)
Objective outcome by Nurick scale	Full regression	-	4 (8%)
	Improvement	-	34 (67%)
	Without changes	-	12 (23%)
	Deterioration	-	1 (2%)

Among all intraoperative complications there was iatrogenic damage to the dura mater of the dural sac and/or spinal cord root, with this type of complication a microsurgical epidurography was performed with an additional application of fibrin glue.

In the group of early postoperative complications, pathological conditions associated with superficial infection of the postoperative wound with or without formation of an intermuscular hematoma, which were effectively stopped by conservative measures, were revealed. In the long-term postoperative period, complications associated with herniation at the level adjacent to the operation, formation of pseudoarthrosis, and instability of the fixation structure due to biomechanical re-

distribution of the load were revealed. In all cases, auditory decompressive-stabilizing interventions were performed in the form of discectomy and isolated spondylodesis, additional posterior fixation in the cervical spine, discectomy, interbody spinal fusion and prolongation of the posterior fixation system in the lumbosacral spine.

Verified absence of dynamics in the neurological symptomatology: at the cervical level is associated with insufficient back decompression (arthrosis of facet joints) with the preservation of posterior spinal cord compression – performed single-level laminectomy allowed to achieve a positive effect in the postoperative period; at the lumbar level – with incomplete primary decompression and underestima-

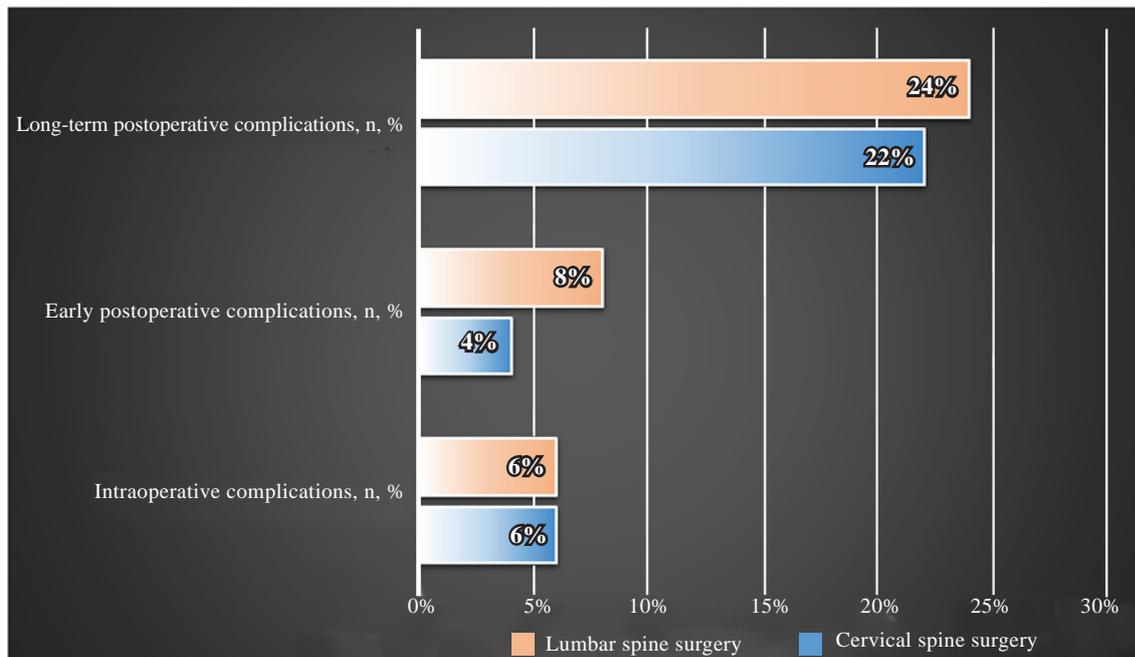


FIGURE 2. Characteristics of revealed complications in examined patients

tion of contralateral foraminal stenosis, isolated foramotomy contributed to the reduction of radicular pain from the opposite side. The selected group of complications in the form of neurologic symptomatology deterioration, not related to the above pathological conditions, was associated with the formation of postoperative epidural fibrosis.

Main clinical parameters that have a direct correlation with the clinical postoperative outcome and the level of life quality were the degree of pain according to visual analogue scale, functional state by Oswestry index and movement limitation in cervical spine. The correlation analysis of the above clinical components and anamnestic data (duration of the disease), the peculiarity of the accepted surgical tactics (primacy of the spine region during the intervention) and postoperative adverse effects (cicatrical epiduritis, development of pseudoarthrosis) was conducted.

A significant positive non-parametric correlation of the values of long-term surgical treatment results was revealed by visual analogue scale, Oswestry index and neck disability index with studied parameters (Fig. 3).

For the purpose of detailed analysis of the influence of anamnestic data (duration of the disease), peculiarities of the accepted surgical tactics (primacy of the spine region during the intervention) and postoperative adverse effects (cicatrical epidural, development of pseudoarthrosis) on the

clinical outcome and studies of the possibility for optimizing the tactics of patients treatment with tandem lumbar and spinal stenoses, the results of the study were divided into:

- “Excellent and good” postoperative outcomes, determined by the level of pain according to visual analogue scale – up to 15 mm, Oswestry index up to 15 points, neck disability index up to 20 points (as minimum permissible values, not limiting the daily activity of patients).
- “Satisfactory and unsatisfactory” postoperative outcomes, determined by the level of pain according to the visual analogue scale – more than 15 mm, Oswestry index of more than 15 points, neck disability index more than 20 points (as the values restricting everyday motor activity).

Comparative analysis of clinical data depending on the postoperative outcome is presented in table 4.

The analysis also established that the disease duration of less than 3 years, primary surgical intervention in the cervical spine are associated with “excellent and good” postoperative outcomes in the study group patients. “Satisfactory and unsatisfactory” postoperative results in the study group are in direct correlation with the disease duration and peculiarities of selected surgical tactics. Moreover, clinically significant postoperative adverse effects are identified in these patients in the form of scar-adhesive epiduritis and pseudoarthrosis both in the cervical and lumbar spine.

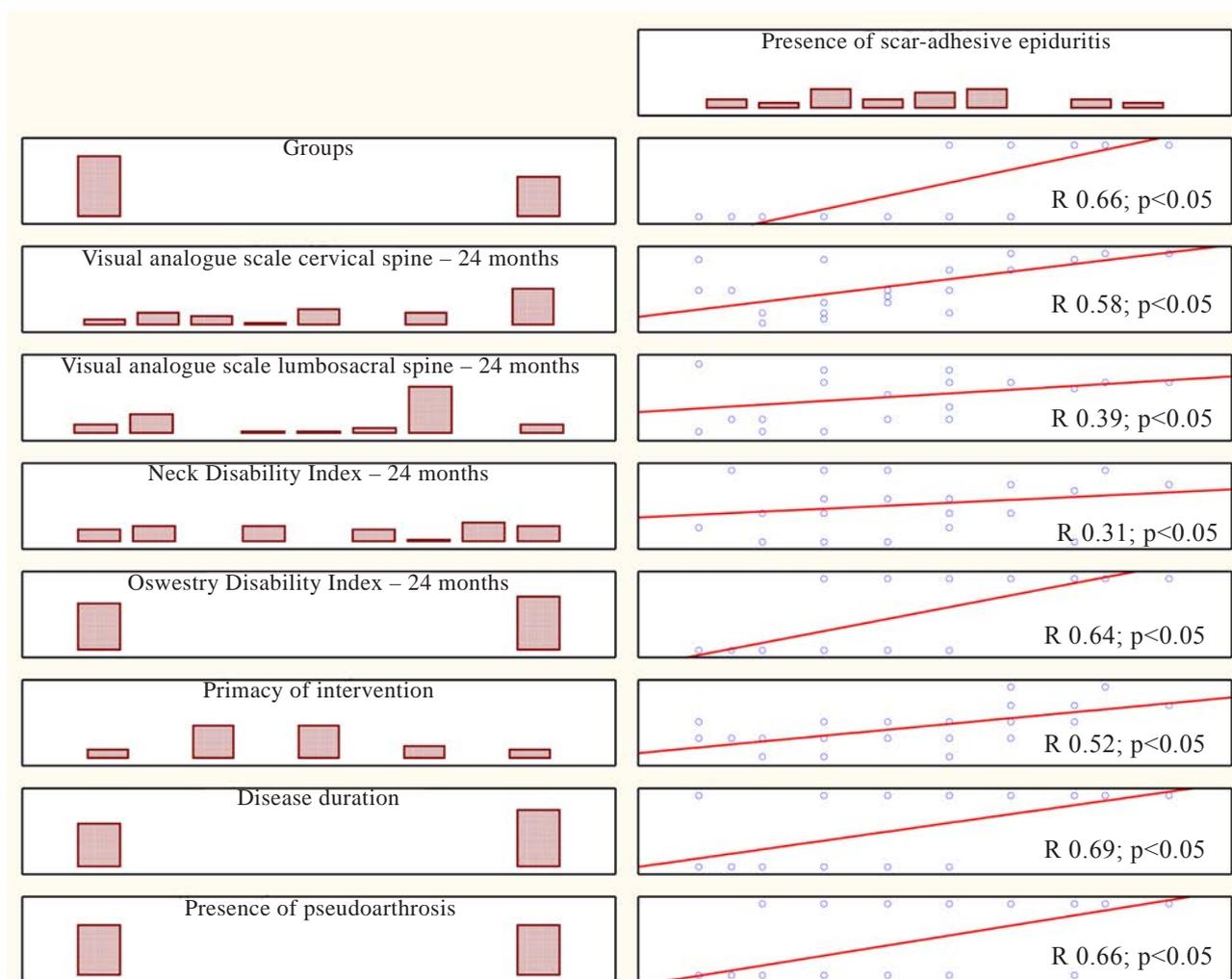


FIGURE 3. Overall correlation dependence of the long-term clinical outcome

DISCUSSION

The study of long-term clinical efficacy after decompression-stabilizing interventions, as well as the study of the causes of unsatisfactory outcomes, are necessary condition for the algorithmization of surgical treatment tactics in various nosological forms of degenerative spinal diseases [Byvaltsev V et al., 2015; 2016; Kalinin A, Byvaltsev V, 2015].

The absence of generally accepted approaches to the treatment of patients with tandem cervical and lumbosacral spinal stenoses stimulates researchers to search for diagnostic capabilities and optimal methods of surgical correction [Hsieh C et al., 1998; Shepelev V et al., 2016]. Difficulties in determining tactics in patients with common stenosis of the spinal canal are associated with a variety of clinical manifestations and the polyetiology

of the pathomorphological substrate [Dagi T et al., 1987; Hsieh C et al., 1998; Naderi S, Mertol T, 2002]. Thus, in the presence of a degenerative narrowing of the vertebral canal of the cervical spine, even in the presence of neuroimaging data on the compression of the vascular-neural formations in the lumbosacral area, neurological symptoms in the lower limbs may be due to compression of the spinal cord in the cervical region, wherefore the operation in the lumbar segments will be ineffective or will worsen clinical manifestations due to compression of the cervical spinal cord [Teng P, Papatheodorou C, 1964; Caron T, Bell G, 2007].

Multiregional symptomatic stenotic processes of the spinal canal most often are resistant to modern methods of conservative treatment, but traditional decompressive interventions are sufficiently effective [Arinzon Z et al., 2004; Yamashita K et

TABLE 4

Comparative analysis of clinical data depending on the postoperative result of the study group of patients

Indices	Study group (n=51)		p
	“Good and Excellent” outcomes (n=32)	“Satisfactory and Unsatisfactory” outcomes (n=19)	
Visual analogue scale cervical spine – upper limbs (in 24 months)	14 (12; 15)	23 (21; 26)	<0.01
Visual analogue scale lumbosacral spine – lower limbs (in 24 months)	13 (12; 15)	25 (20; 28)	<0.01
Neck disability index (in 24 months)	16 (14; 18)	20 (16; 24)	<0.01
Oswestry index (in 24 months)	12 (10; 14)	35 (28; 42)	<0.01

al., 2006]. However, approaches to surgical treatment of tandem stenoses are controversial, as some authors consider it necessary to perform one-stage decompression at all clinically significant levels [Teng P, Papatheodorou C, 1964; Aydogan M et al., 2007], and the others – step-by-step [LaBan M, Green M, 2004; Molinari R et al., 2012].

Conducted complex study of various factors, affecting the long-term clinical outcome, particularly, the anamnestic data (duration of the disease), peculiarity of the accepted surgical tactics (the primacy of the spine region during the intervention), made it possible to evaluate the possibility of controlling and monitoring the long-term postoperative result of patients with tandem cervical and lumbosacral spinal stenoses.

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