SURGICAL TREATMENT OF ELDERLY AND SENILE PATIENTS WITH DEGENERATIVE CENTRAL LUMBAR SPINAL STENOSIS

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Objective. To analyze the results of surgical treatment of patients of the older age group with central spinal stenosis at the lumbar level.
Material and Methods. A total of 107 patients of elderly and senile age with clinically significant degenerative central stenosis of the spinal canal were treated. They were divided into two groups: patients in Group 1 underwent bilateral decompression of nerve roots through unilateral approach; those in Group 2 — nerve root decompression supplemented with interbody fusion and transpedicular fixation.
Results. The surgery resulted in statistically significant reduction in pain, improvement of the quality of life, enlargement of spinal canal dimension parameters, and increase in the distance of walking. Statistical difference in the quality of life between Groups 1 and 2 was revealed for the indicator characterizing the psychological component of the SF-36 questionnaire ($p = 0.03$); there were no statistical differences for the remaining indicators. The key parameter for assessing central stenosis is the cross-sectional area of the dural sac.
Conclusion. Preoperative examination of patients of the older age group should be comprehensive and include CT myelography with 3D reconstruction. The cause of nerve root compression in central stenosis is a combination of various factors in 41.9 % of cases. Differential surgical tactics provides an improvement in the quality of life in 80 % of cases. Excessive decompression does not improve the quality of life of patients. Instrumental fixation does not improve the outcome of surgical intervention and should be used only for clinically significant instability of the spinal motion segment.
Key Words: central spinal stenosis, surgical treatment, elderly patients.

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Degenerative changes in the spine occur in 90–100 % of patients over 60 years of age and signs of spinal stenosis are observed in 80 % of patients at the age of 70 years [4]. The incidence of spinal stenosis is 5 per 100 000 of population per year [17]. Spinal stenosis is the most common cause of surgical interventions on the spine in patients older than 65 years [2, 4]. Hypertrophy of the yellow ligament, facet joints, and spondylosis are the result of the mechanism of re-stabilization, the fourth phase of the degenerative cascade described by Kirkaldy-Willis et al. [19], which lead to decrease in the size of the spinal canal and compression of nerve roots with development of clinical symptoms (Fig. 1).

The aims of surgical treatment of older patients with spinal stenosis are elimination of the pain syndrome, increase in the walking distance and improvement in the quality of life by eliminating the compression factors in the neurovascular structures [4, 12, 22, 23].

At present, there is no consensus on the tactics of surgical treatment of spinal stenosis in patients from the older age group. According to Lee et al. [20], the outcomes of surgical treatment did not differ for clinically significant spinal stenosis only and multilevel interventions. The researchers [25] note better outcomes of decompression and stabilization surgery as compared to decompression alone. According to Kalff et al. [18], instrumental fusion is indicated not only for clinically significant instability, but also for severe back pain. In case of clinically significant spinal stenosis and the need for bilateral crossover decompression, an instrumental fusion of the spinal motion segment is proposed both in the presence of kyphoscoliotic deformity and without it. Other authors [1] do not believe that it is necessary to use fusion techniques in such cases. Forsth et al. [11] reported no advantages of decompressiom and stabilization surgery as compared to decompression alone. The present study is aimed at clarifying the criteria for the use of decompression alone and decompression and stabilization surgery for degenerative lumbar spinal stenosis.

The aim of the study was to analyze the results of surgical treatment of patients of the older age group with lumbar spinal stenosis.

Material and Methods

A single-center, non-randomized retrospective cohort study was conducted in 2013-2017. The average duration of postoperative follow-up was 13 months.

The inclusion criteria were: elderly and senile age (60–75 and 75–90 years according to the WHO criteria of 1963), degenerative one-level lumbar spinal stenosis, confirmed by neuroimaging methods (CT, CT-myelography with 3D-reconstruction, MRI), manifesting as signs of nerve root compression, neurogenic intermittent claudication (at walking distance of 5–500 m), and failure of conservative treatment over the period of 6 weeks.

The exclusion criteria were: prior spinal surgeries, concomitant pathology of the spine (infections, tumor diseases, scoliotic deformity of the spine of more than 10° according to Cobb [8]), and mental illness.

The study included 107 patients (30 men and 77 women), the average age was 66 (60–85) years.

Most surgical interventions were performed at the level of L4– L5, 71 (66.5 %) patient, L3–L4, 24 (22.4 %), L2–L3, 6 (5.6 %), L5–S1, 4 (3.7 %), L1–L2, 2 (1.8 %). All patients had concomitant pathologies: in 6 (5.6 %) they were isolated, and in 101 (94.4 %), combined.

Standard scales and questionnaires were used to objectify and standardize the clinical manifestations of the disease: assessment of walking distance in meters prior to the onset of symptoms of neurogenic intermittent claudication, assessment of pain according to VAS [14], assessment of the quality of life according to Oswestry Index (ODI) [10], SF-36 (parameters of psychological and physical components of health) [33], CCI (Charlson Comorbidity Index) scale was used for assessment of the somatic status [7].

Prior to the surgery in order to clarify the factors of nerve root compression and to assess the instability of the spinal motion segment, the following instrumental methods were used:

– X-ray of the lumbar spine in two projections with functional tests according to the White-Panjabi criteria [34]: less than 5 points, there is no instability in the spinal motion segment; 5 or more points, there is instability.

– MRI, CT, CT-myelography with 3D-reconstruction to determine the parameters of the spinal canal at the level of clinically significant root compression:

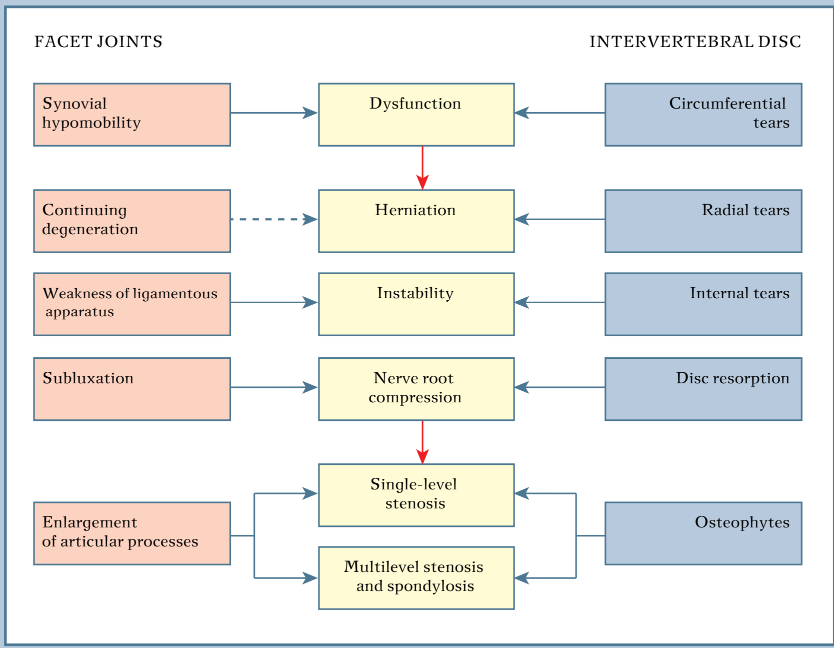

Fig. 1
Pathogenesis of the spinal stenosis according to Kirkaldy-Willis et al. [19]

the cross-sectional area of the dural sac (CSA_DS), the cross-sectional size of the spinal canal (CS_SC), and of the the dural sac (CS_DS), the sagittal size of the spinal canal (Sag_SC) and of the the dural sac (Sag_DS), and the interfacet distance (IfD; Fig. 2).

The criteria of lumbar spinal stenosis were a decrease in Sag_SC of less than 13 mm, in Sag_DS of less than 10 mm, in CS_SC of less than 15 mm, in IfD of less than 15 mm, and in CSA_DS of less than 130 mm^2 [17, 23, 32]. The classification by Schizas et al. [28], which is based on the analysis of axial T2-weighted MRI sections of the spinal canal, was used to determine the degree of spinal stenosis (Fig. 3).

In case of the absence of instability of the spinal motion segment, a minimally invasive bilateral decompression of nerve roots through unilateral approach was performed; in case of instability, the bilateral decompression of nerve roots was supplemented by interbody fusion and transpedicular fixation.

Three months after surgery, X-ray of the lumbar spine was performed in two projections with functional tests to assess the segmental instability; CT of the lumbar spine was used to analyze changes in the parameters of the spinal canal; the pain syndrome and the quality of life were also evaluated (VAS, ODI, SF-36).

The analysis and complex evaluation of the treatment results were carried out in two groups of patients designed according to the prevailing clinical and neurological syndrome: Group 1 included 55 (51.4 %) patients with predominant symptoms of root compression and neurogenic claudication without instability of the spinal motion segment; Group 2 included 52 (48.6 %) patients with symptoms of root compression, neurogenic claudication, with predominant vertebral pain syndrome caused by instability of the spinal motion segment (a total score of 5 points and more for White-Panjabi criteria).

The numerical data in the article are presented as the mean and standard deviation for normally distributed values, and for other data in the form of the mean/median [lower; upper quartile]. Two-sided Mann-Whitney test and the

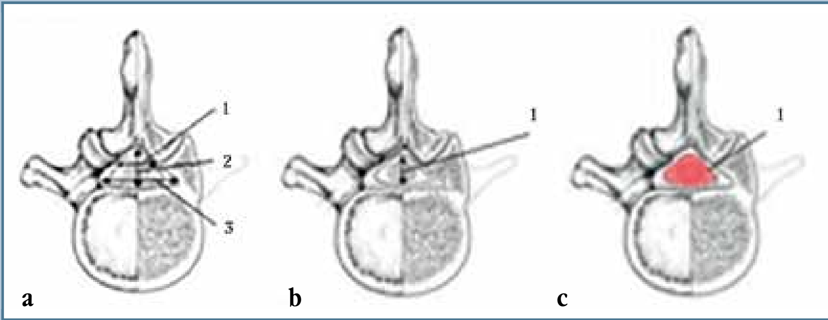

Fig. 2
Parameters of the spinal canal [21]: **a** – interfacet distance *(1)*, sagittal *(2)* and cross-sectional *(3)* dimensions of the spinal canal; **b** – sagittal dimension of the dural sac *(1)*; **c** – the dural sac cross-sectional area *(1)*

exact Fisher test were used to compare two independent sets; two-sided Wilcoxon test was used for the dependent sets. Multiple comparisons were carried out using Holm correction (pcorr). To determine the nature of the dependence of quality of life on anatomical indicators, nonparametric LOESS regression (2/3 of the interval, quadratic dependence) was used. $P < 0.05$ was adopted for the level of statistical significance. Calculations were carried out using version 3.3.1 of R software [31].

Results

Upon admission, all patients complained about the limitation in walking distance and pain in the lumbar spine of different degrees of severity. In 77 (72 %) cases, the symptoms of neurogenic claudication were combined with the symptoms of nerve root compression.

According to CT-myelography and MRI of the lumbar spine, the preoperative values of the spinal canal parameters met the criteria for lumbar spinal stenosis [15, 21, 30].

Based on Schizas et al. [28] criteria, the grade A4 stenosis was identified in 1 (1 %) patient, B, in 10 (9 %), C, in 44 (41 %), and D, in 52 (49 %).

The average walking distance before the surgery, at which the patients developed intermittent claudication, was 102 ± 88 (5–500) m.

In both groups of patients (Fig. 4–6) lumbar spinal stenosis was most often represented by a combination of compression factors (45 cases; 42. 0%), less often by hypertrophy of the yellow ligament and spondyloarthrosis (25 cases; 23.0 %), and by disc herniation (13 cases; 12.0 %), primarily by spondyloarthrosis (12 cases; 11.5 %), and herniated disc in combination with spondyloarthrosis (12 cases; 11.5 %).

After surgery, the indicators for radicular pain, back pain, disability and quality of life were significantly improved (Table 1).

The indices of pain in back and in lower extremities and of quality of life before and after surgery were compared in Groups 1 and 2 (Table 2).

After surgery, clinical indices of pain in the lower limb and in the back, vital signs and quality of life significantly improved in both groups of patients in 80 % of cases (86 patients); there were no clinical improvement in 12 % (13 patients); deterioration was observed in 8 % of cases (8 patients).

When comparing the results of decompression alone (Group 1) and decompression and stabilization (Group 2) surgery, it was established that the indices of pain in the back, in lower limbs, and of quality of life in Group 1 are somewhat better, however the statistical significance of this difference was confirmed only for the value of the psychological health component of the SF-36 questionnaire ($p = 0.03$).

According to the CT of the lumbar spine after surgery, there was statistically significant increase in the dimensions of the spinal canal: SCA_DS, Sag_SC and CS_SC, Sag_DS and CS_DS, IfD (Fig. 7).

The effect of the decompression on the impairment of vital functions and on the quality of life was assessed using the ODI and SF-36 questionnaires, respectively.

Fig. 8 shows the graphical relationships between ODI and SF-36 values and anatomical parameters after surgery which were calculated using nonparametric LOESS regression.

Based on the analysis of the relationships between the quality of life indicators in the ODI and SF-36 questionnaires and anatomical factors, it was established that the optimal value of the dural sac cross-sectional area achieved by decompression and associated with the improvement in the quality of life according to ODI and SF-36 is 0.8–1.6 cm^2 . For the sagittal dimension of the dural sac, the value is 7–12 mm, for the cross-sectional dimension, 12–16 mm. For other parameters of the spinal canal (Sag_SC, CS_SC, IfD), there is only weak correlation between the quality of life and the anatomical factor. If we exclude individual outlier data points, it becomes obvious that excessive increase in virtually all parameters of the spinal canal leads to a deterioration in the quality of life.

Repeated surgery was performed in 11 (10.20 %) patients: continued degeneration of the spinal motion segment with neurogenic claudication, repeated decompression surgery in 4 (26.60 %) patients; decompression and stabilization surgery for pseudoarthrosis and failure of the transpedicular fixation system in 5 (33.30 %) patients; underestimation of clinical symptoms at the adjacent segment with subsequent decompressive intervention in 2 (13.30 %) patients. A total of 5 (4.67 %) repeated surgeries were performed after decompression interventions, and 6 (5.60 %) were performed after decompression and stabilization interventions.

Residual phenomena in the lower extremities in the form of feelings of numbness, hypalgesia, paresis, and nagging pain of varying severity were observed in 47 (43.10 %) patients after surgery.

Complications were reported in 16 (14.68 %) cases (Table 3).

In the group of decompression and stabilization interventions, complications were more frequent (21 %) than in the group of decompression alone (9 %), but the difference was statistically insignificant (p = 0.105).

Discussion

The identification of clinically significant level of nerve root compression at the stage of preoperative planning is often difficult in older patients due to pronounced and extended degenerative changes in the spine [16]. The question of the use and diagnostic value of various neuroimaging methods remains controversial. According to Bartynski et al. [3], the X-ray myelography has the greatest value in diagnosis of the level and substrate of nerve root compression (sensitivity of the method is 93–95 %), followed by MRI (71–72 %) and CT-myelography (62 %). Morita et al. [24] point out greater value of CT-myelography (reliability factor is 0.86) as compared with MRI (0.72).

In our study, when it was difficult to identify the level of nerve root compression in the spinal canal from the data of MRI and CT-myelography axial sections, the root compression was visualized from the 3D reconstruction of the CT-myelogram in 20 % of cases. Patient examination should be comprehensive and include not only an MRI, but also CT-myelography with 3D reconstruction.

The most common cause of the spinal canal root compression in elderly and senile patients is the combination of compressing factors, which occurred in 41.9 % of cases. There is no published analysis of the incidence of the root compression factors and their combinations in the spinal canal. The identification of compression substrates is important at the stage of preoperative planning, since it allows purposeful and differential elimination of the compression depending on the prevalence of stenosis components: disc herniation, hypertrophy of facet joint, yellow ligament, marginal bony proliferation of vertebral bodies.

All our patients exhibited clinical manifestations of central stenosis in combination with pain syndrome in the lumbar spine of different degrees of severity. The analysis of clinical data revealed that in 51.4 % of cases the symptoms of root compression prevailed, while 49.6 % of cases were dominated by vertebral pain syndrome. In these patients functional lumbar spondylograms revealed instability of the spinal motion segment; White-Panjabi criteria were selected to objectify the findings [34], which made

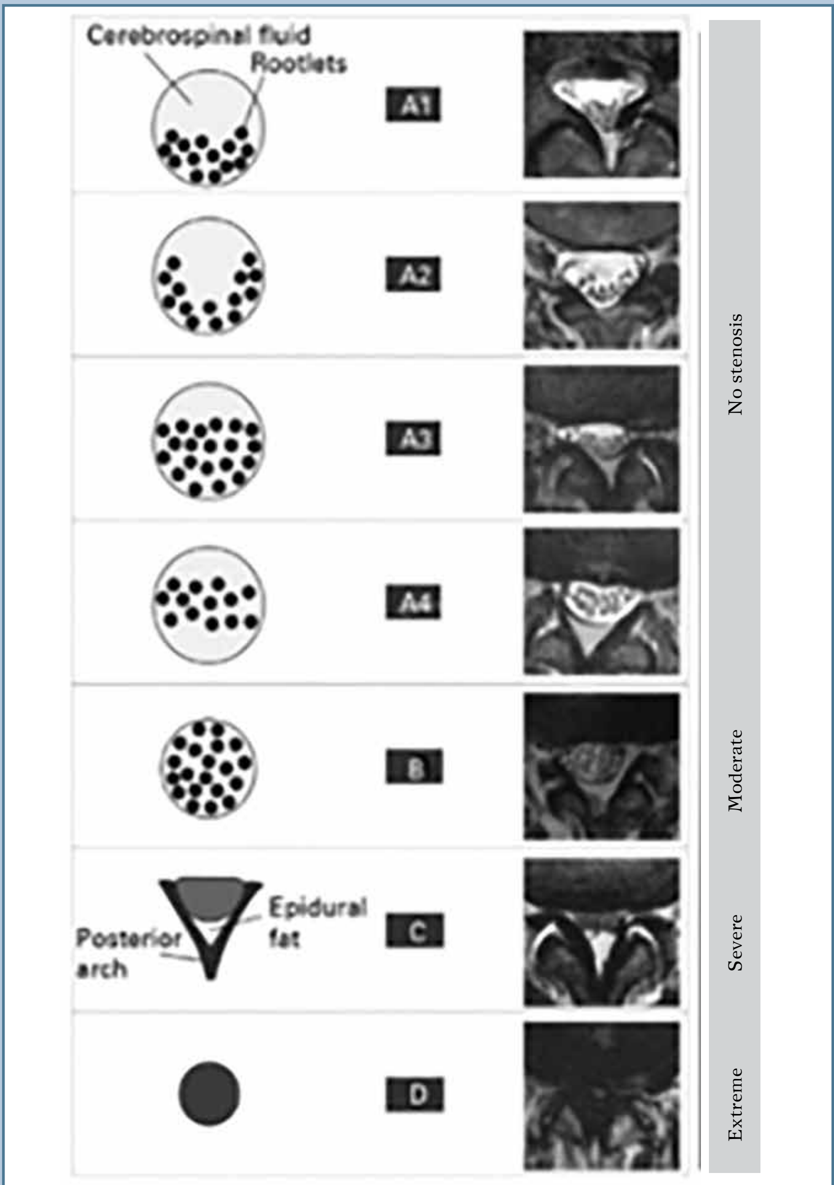

Fig. 3
Determination of the degree of central stenosis by Schizas et al. [28]

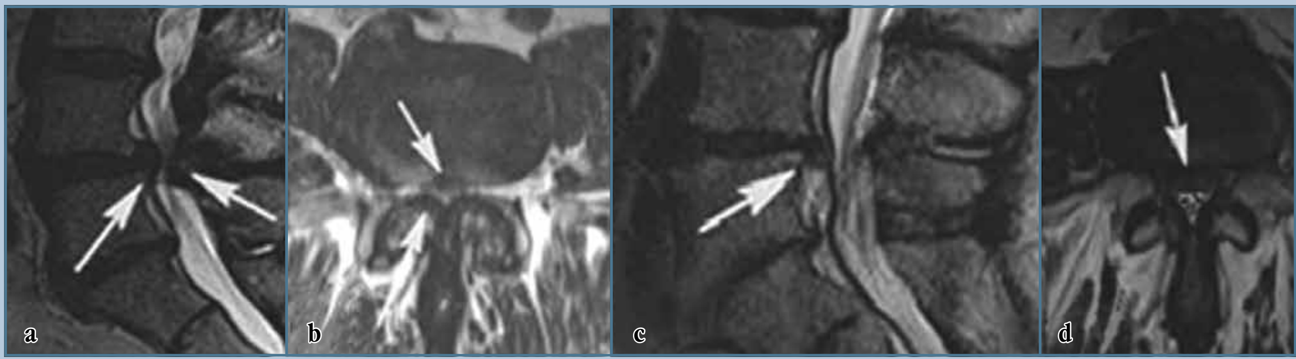

Fig. 4
On MRI, combination of nerve root compression factors (**a**, **b**, white arrows): on the sagittal T2-weighted section on the left: the disc herniation, marginal bone-cartilaginous proliferations of the vertebral bodies; on the right: hypertrophy of the yellow ligament, facet joints; on the axial section: hypertrophy of the facet joints, yellow ligament, disc herniation; middle hernia of the disc (**c**, **d**, white arrows) as a factor of nerve root compression: sagittal and axial T2-weighed sections

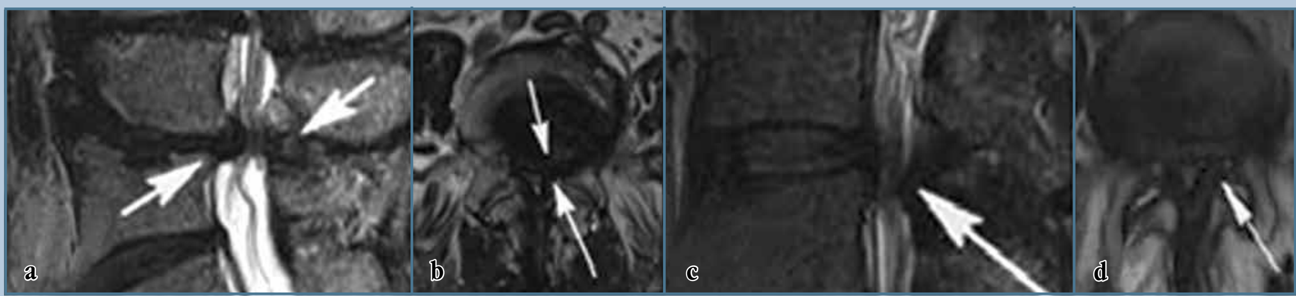

Fig. 5
On MRI, the median hernia of the disc and hypertrophy of the facet joints (**a**, **b**, white arrows) as factors of nerve root compression: sagittal and axial T2-weighted sections; preferential formation of the central stenosis due to hypertrophy of the yellow ligament (**c**, **d**, white arrows): sagittal and axial T2-weighted sections

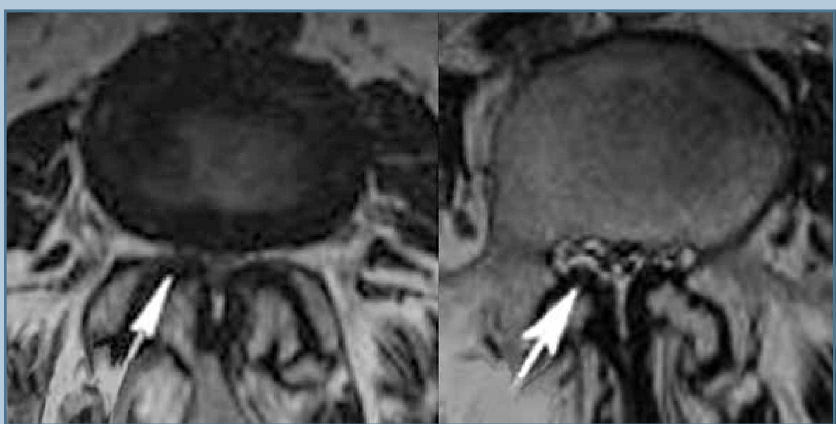

Fig. 6
On MRI, the predominant formation of the central stenosis due to facet joint hypertrophy (white arrows): sagittal T2-weighted sections

it possible to divide patients into two groups: less than 5 points, patients with predominance of clinical signs of root compression without clinically significant instability (51.4 %), 5 or more points, patients with predominant vertebral pain syndrome in the presence of clinically significant instability (49.6 %). According to a number of authors [18, 27, 29], indications for instrumental fixation include non-fixed spondylolisthesis, degenerative deformity of the lumbar spine in combination with severe back pain. However, this choice is often due to the preferences of surgeons [29] and no quantitative criteria for objectifying the instability are described in literature.

Table 1

Results of VAS, ODI, and SF-36 questionnaires

Questionnaire	Before surgery	After surgery	p	p_{corr}
VAS (leg), points	6.0/6.0 [5.0; 8.0]	3.2/3.0 [1.0; 4.8]	p < 0.001	p < 0.001
VAS (back), points	5.7/6.0 [4.0; 7.0]	3.3/3.0 [2.0; 4.0]		
ODI	54.7/54.8 [42.7; 64.4]	35.4/34.4 [27.7; 44.0]		
SF-36 (physical component)	25.7/25.5 [22.3; 28.6]	34.1/33.3 [29.4; 38.1]		
SF-36 (psychological component)	28.0/26.6 [20.8; 32.9]	36.8/34.8 [31.0; 42.7]		
Walking distance	102.9/100.0 [50.0; 137.5]	970.6/800.0 [500.0; 1500.0]		

In evaluation of pre- and postoperative parameters of the spinal canal, we used the data of Mamisch et al. [21], Hughes et al. [15], and Steurer et al. [30] to determine the key dimensions and their impact on the quality of life after surgery. Preoperative parameters of the spinal canal met the proposed criteria of central stenosis [15, 21, 30], statistically significant increase in these dimensions was observed after surgery. The following questions remain controversial in the literature: how a change in size affects the patients' quality of life, how much decompression is required, and which parameters are clinically significant in describing central stenosis. Better outcomes of decompression interventions are reported for the initial cross-sectional area of the dural sac of less than 50 % of the norm when compared to those in patients with a lesser degree of stenosis (decrease of 32–47 % of the norm) [24]. In addition, there was no correlation between the severity of stenosis and its clinical manifestations, in particular, the walking distance [35]. An increase in the dural sac cross-sectional area from 102 to 164 mm was reported during one-month follow-up after surgery [26].

Of the many parameters of the spinal canal used to describe central stenosis [15, 21, 30], only some are used to evaluate the effectiveness of surgical treatment.

As a rule, only one parameter is used: the dural sac cross-sectional area [24, 26, 35]. An analysis of the effect of magnitude of changes in the parameters of the spinal canal on the quality of life according to the ODI and SF-36 questionnaires showed that when certain threshold values (of the dural sac cross-sectional area (0.8–1.6 cm2), the dural sac cross-sectional dimension (12–16 mm), and the dural sac sagittal size (7–12 mm) are reached, it can significantly improve the quality of patient's life, which is proven by statistical methods.

However, further increase in these parameters does not lead to an improvement in the quality of life. For the remaining parameters (sagittal and cross-sectional dimensions of the spinal canal, interfacet distance), the quality of life was weakly correlated with the anatomical factor. Therefore, the key parameter of the spinal canal in central stenosis is the dural sac cross-sectional area; the sagittal and cross-sectional dimensions merely define its area (Hamanishi et al. [13]). Exceeding these thresholds when performing decompression does not lead to an improvement in the patients' quality of life. Clinical improvement, first of all, is associated with an increase in the dural sac cross-sectional area due to resection of the yellow ligament, facet joints, and marginal bony proliferation of vertebral bodies. The increase in the area of the dural sac is limited by the size of the dural sac itself, so further exces-

Table 2

Assessment of pain syndrome, quality of life, walking distance and their comparison before and after the surgery in two groups of patients

Period	Questionnaire	Decompression group (n = 55)	Decompression and stabilization group (n = 52)	p	p_{corr}
Before surgery	VAS (leg)	5.6/6.0 (4.0; 7.5)	6.5/7.0 (5.0; 8.0)	0.05441	0.218
	VAS (back)	5.0/5.0 (4.0; 6.0)	6.4/6.0 (5.0; 8.0)	0.001411	0.008
	ODI	52.2/53.3 (42.2; 63.0)	57.4/57.7 (48.6; 67.1)	0.0841	0.252
	SF-36 (physical component)	26.1/26.5 (22.8; 28.8)	25.2/24.0 (22.0; 27.6)	0.1802	0.360
	SF-36 (psychological component)	29.7/29.1 (23.6; 36.6)	26.2/24.3 (20.4; 32.3)	0.03252	0.163
	Walking distance	99.3/100.0 (45.0; 125.0)	105.2/100.0 (50.0; 112.5)	0.4396	0.440
After surgery	VAS (leg)	3.0/3.0 (1.2; 4.0)	3.4/3.0 (1.0; 5.0)	0.3514	1.0
	VAS (back)	3.2/3.0 (2.0; 4.8)	3.3/3.0 (1.8;4.0)	0.7883	1.0
	ODI	35.4/34.0 (28.2; 40.4)	35.5/35.6 (26.9; 44.2)	0.798	1.0
	SF-36 (physical component)	35.2/35.1 (30.7; 39.2)	33.0/32.9 (28.8; 36.5)	0.08002	0.4
	SF-36 (psychological component)	38.4/38.4 (33.4; 44.9)	35.2/34.0 (29.2; 38.4)	0.03534	0.2
	Walking distance	1009.8/950.0 (500.0; 1500.0)	929.8/750.0 (375.0; 1500.0)	0.3971	1.0

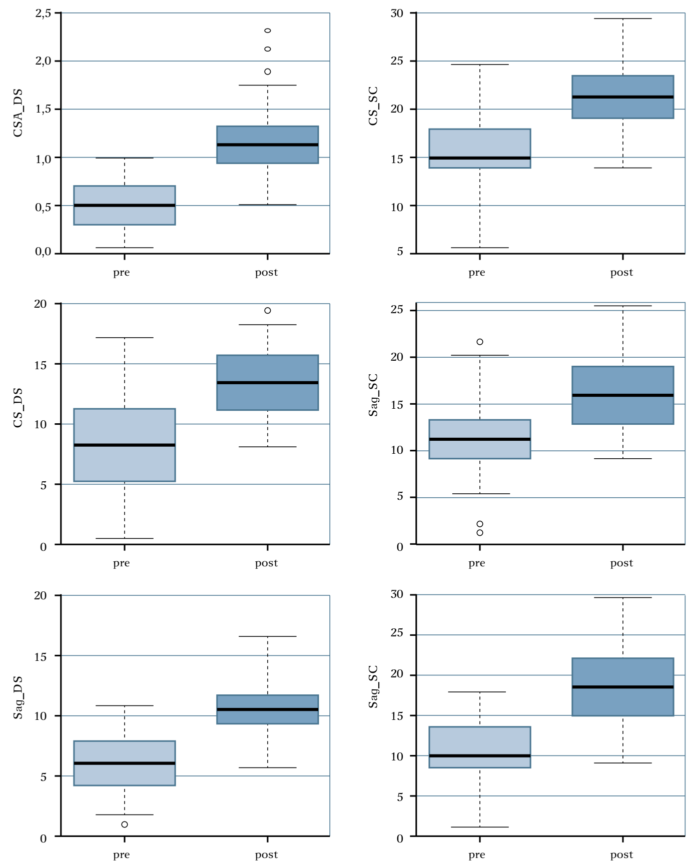

Fig. 7
The dural sac cross-sectional area (CSA_DS), the sagittal (Sag_SC), and the cross-sectional (CS_SC) dimensions of the spinal canal, the sagittal (Sag_DS) and the cross-sectional (CS_DS) dimensions of the dural sac, the interfacial distance (IfD) to (pre) and after (post) surgery differ in the level of statistical significance ($p < 0.05$)

Table 3
Complications of surgical treatment of lumbar spinal stenosis in patients of the older age group, n (%)

Complications	Group 1 (n = 55)	Group 2 (n = 52)
Intraoperative damage to the dura mater	4 (7.2)	6 (11.5)
Increased neurologic deficit in the early postoperative period	1 (1.8)	3 (5.7)
Failure of the postoperative wound	0 (0.0)	1 (1.9)
Malpositioning of the transpedicular screw with radicular pain syndrome	0 (0.0)	1 (1.9)

sive decompression does not increase the axial dimensions of the dural sac [6]. In addition, aggressive excessive decompression, laminectomy, can worsen the quality of life due to greater operational trauma, soft tissue injury, destabilization of the spinal segment [23].

The issues of the advantages of decompression and stabilization operations over decompression approaches remain controversial. For example, Munting et al. [25] in their study compared the results of decompression methods (interlaminectomy, hemilaminectomy, laminectomy) and laminectomy in combination with instrumental fusion in 6,752 patients and reported statistically significant better indicators of pain in the back (VAS, 3.0 points) and lower extremities (VAS, 2.1 points) after decompression and stabilization interventions in comparison with decompressive alone (VAS pain in the back, 3.5–4.3, in lower extremities, 3.6–4.8 points). However, this comparison was performed in patients of all age groups (in our study, only the groups of elderly and senile patients were compared). Son et al. [29] using the example of 67 patients and Forsth et al. [11] using the example of 5,390 patients over 50 years of age who were operated on for spinal stenosis, concluded that there is no statistically significant difference in the quality of life according to ODI ($p = 0.45$), pain syndrome in the back ($p = 0.30$) and in lower limbs ($p = 0.69$) in patients after decompression alone and decompression and stabilizationfusion operations for degenerative stenosis. Our study has similar results: when comparing two groups of patients distributed based on the predominant clinical and neurological syndrome, it was noted that postoperative indices of pain in the back and in lower extremities, and the quality of life and walking distance in the decompression group were somewhat better, but the statistical significance was not confirmed in this sample of patients (taking into account the correction for multiple comparisons).

In this study, the division of patients into two groups according to the dominant clinical and neurological syndrome

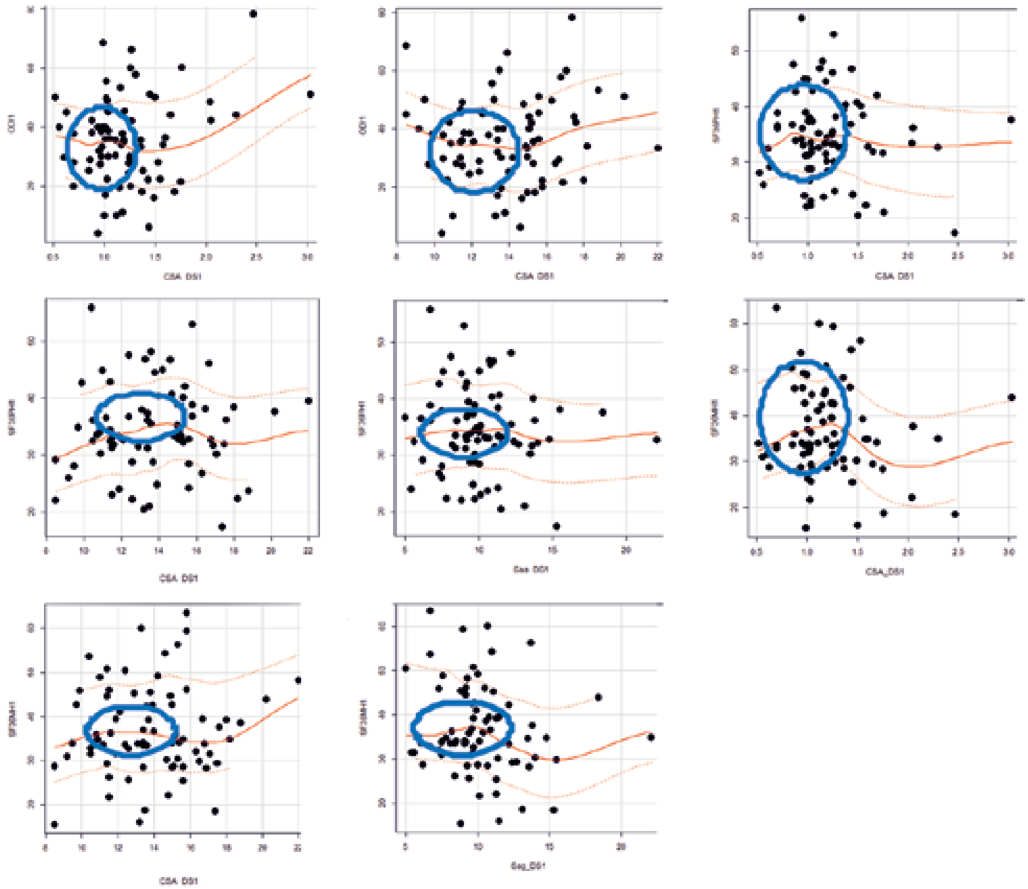

Fig. 8
Relationships between the ODI and SF-36 questionnaire values in patients after the surgery and the dural sac cross-sectional area (CSA_DS), sagittal (Sag_DS) and cross-sectional (CS_DS) dimensions of the dural sac, sagittal (Sag_SC) and cross-sectional (CS_SC) dimensions of the spinal canal: solid lines on the graphs correspond to lines of non-parametric LOESS regression (dotted line represents 95 % confidence interval)

plays the key role: patients in Group 1 with prevalence of clinical manifestations of nerve root compression had no severe vertebral pain syndrome and clinically significant instability (less than 5 points according to the White-Panjabi criteria) and underwent decompression intervention; patients in Group 2 with clinical manifestations of nerve root compression had predominant vertebral pain syndrome caused by clinically significant instability in the spinal motion segment (5 or more points according to the White-Panjabi criteria), and decompression intervention was supplemented by instrumental fusion. This tactic of treatment of patients from the older age group with the lumbar spinal stenosis ensured the achievement of comparable outcomes of the surgery.

These data indicate that instrumental fixation, in and of itself, does not improve the outcome of the surgical intervention in surgeries for degenerative stenosis of the spinal canal and the quality of life.

In addition, decompression and stabilization interventions have higher incidence of complications, as confirmed by many studies: Deyo et al. [9], who analyzed the results of interventions in 32,152 patients, showed that decompression interventions are accompanied by major complications in 1.7 % of cases and by wound complications in 3.0 %, while decompression and stabilization interventions are associated with 4.6 % of major complications and 4.1 % of wound complications; complications of decompression interventions are observed in 5.3–9.7 % of cases; complications of decompression and stabilization interventions, in 9.9–27.6 %. Similar data were obtained in our study: the higher incidence of complications was observed in the group of decompression and stabilization interventions (21.0 %), and the

Table 4

Complications of surgical treatment of spinal stenosis according to literature

Authors	Types of complications		Number, %
Morgalla et al. [23], n = 108	Minimally invasive decompression interventions	Major complications	1.70
		Wound complications	3.00
		Mortality	0.60
	Decompression and stabilization interventions	Major complications	4.60
		Wound complications	4.11
		Mortality	1.20
Deyo et al. [9], n = 12,154; Son et al. [29], n = 60	Decompression interventions		2.3–9.7
	Decompression and stabiliziation interventions		5.6–27.6

lower, in the group of decompression interventions (9.0 %).

Our work shows that repeated surgery were performed more often after decompression and stabilization interventions (8 patients) than after decompression ones (7 patients). Similar results were noted in Son et al. [29]: the incidence of repeated surgery in the group treated with the instrumental fusion methods was higher (10.3 %) than in the group which underwent decompression interventions (6.5 %). In Forsth et al. [11], decompression and stabilization interventions also have higher re-operation rate (8.1 %) than decompression alone (7.0 %).

The questions of the influence of concomitant pathology on the incidence of complications and the quality of life of elderly and senile patients continue to be studied. Our study did not identify the effect of age and concomitant pathology on the incidence of complications and the quality of life of patients. Wang et al. [32], using the Charlson Comorbidity Index (CCI), ASA, also did not found any effect of age and concomitant pathology on the incidence of postoperative complications. However, Genevay et al. [12], Bronheim et al. [5] note that age and concomitant pathology are a factor of an increased risk of complications after the surgery.

Conclusion

Preoperative examination of patients from the older age group should be comprehensive and include not only an MRI, but also CT-myelography with 3D reconstruction.

In case of lumbar spinal stenosis in patients of the older age group, the cause of nerve root compression is a combination of various factors in 41.9% of cases and it must be taken into account in preoperative planning.

The use of differential surgical treatment tactics for elderly and senile patients with lumbar spinal stenosis, which is based on identification of the predominant clinical and neurological syndrome, provides an improvement in the quality of life in 80 % of cases. In the group of decompression alone, an improvement in the quality of life was reported in 80 % of cases, and in the decompression and stabilization group, in 73 %.

The dural sac cross-sectional area is the key parameter for assessing the adequacy of the decompression performed in spinal stenosis. Excessive decompression does not improve the quality of life of patients.

Instrumental fusion in surgeries for degenerative spinal stenosis does not improve the outcome of surgical intervention and quality of life, but is associated with an increased risk of repeated operations and complications and should be used only in case of clinically significant instability of the spinal motion segment.

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