EVALUATION OF PATIENT EXPECTATIONS FOR SURGICAL TREATMENT OF DEGENERATIVE DISEASE OF THE LUMBOSACRAL SPINE

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Objective. To determine the main demographic factors that influence preoperative expectations of patients with degenerative diseases of the lumbosacral spine.

Material and Methods. A cross-sectional study was performed for 103 patients with degenerative diseases of the lumbosacral spine who were scheduled for surgery in the period from 2019 to 2021. General demographic data, level of patient's education and the presence of previous surgeries were taken into account. Expectations for surgical treatment outcome were assessed using a translated and adapted Russian version of the Hospital for Special Surgery — Lumbar Spine Surgery Expectations Survey (HSS-LSSES) questionnaire. The quality of life of patients was assessed using the general questionnaires: European Quality of Life-5 Dimensions (EQ-5D-5L) and the 36-item Short-Form Health Survey (SF-36), as well as the disease-specific Oswestry Disability Index (ODI).

Results. It was found that, according to HSS-LSSES, patients' expectations for the upcoming surgical intervention are the higher, the older the patient's age, the higher the general and emotional state of health, vitality, ODI scores, as well as the severity of pain syndrome, and the lower the mental health score. Patients with a high level of education and prior spinal surgery have lower expectations for subsequent surgery.

Conclusion. The expectations of patients for the surgical treatment for degenerative disease of the lumbosacral spine depend on the patient's age, level of education, anamnesis and severity of decline in the quality of life.

Key Words: spine, degenerative disease, quality of life, expectations.

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Assessment of patients' expectations during surgical treatment of degenerative diseases of the lumbosacral spine is an essential goal of vertebrology. It allows understanding what expectations patients have before surgery and how these expectations are associated with indicators of quality of life after the procedure.

The quality of life is becoming increasingly a priority in evaluating the outcomes of surgeries, but it is a subjective indicator, and doctors should take into account the preferences and expectations of patients when planning and performing procedures. Preoperative expectations of patients may influence their satisfaction with the treatment outcomes, since the difference between expectations and actual outcomes may cause disappointment or, conversely, exceed expectations and cause contentment.

Mancuso et al. [1] developed the HSS-LSSES (Hospital for Special Surgery Lumbar Spine Surgery Expectations Survey) that during surgeries on the lumbar spine allows to assess patients' expectations for improving physical and social functions after surgeries. The HSS-LSSES has been adapted and validated for use in Russian-speaking patients suffering from degenerative diseases of the lumbosacral spine [2]. The questionnaire includes the following aspects: expectations for reducing pain, restoring motor activity, improving sleep quality and increasing overall vital activity.

The objective is to determine the factors that may influence preoperative expectations of patients with degenerative diseases of the lumbosacral spine. We aimed to identify the correlation between preoperative expectations and indicators of the quality of life before the procedure.

Material and Methods

A cross-sectional study was conducted at the Vreden National Medical Research Center for Traumatology and Orthopedics in 2019–2021. Inclusion criteria: (1) age over 18; (2) degenerative disease of the lumbar spine; (3) elective decompression and transforaminal interbody fusion through the posterior approach with transpedicular fixation of the segment. Patients were excluded from the study if they suffered from cognitive impairment or refused to participate in the survey. The studied patients had previously undergone unsuccessful non-surgical treatment for degenerative disease of the lumbar spine.

All patients filled out the Russian version of the HSS-LSSES before surgery. Each item of the survey has 5 possible answers ("return to normal condition or complete improvement", "a lot of improvement", "a moderate amount of improvement", "a little improvement", "I do not have this expectation, or this expectation does not apply to me") that give a score from 0 to 4. The two employment items are mutually exclusive. The total score of 20 items varies from 0 to 80. The final score (total score /80) × 100 varies from 0 to 100. A higher score points at higher expectations. Patients also filled out surveys to evaluate the quality of life associated with the disease and the overall quality of life associated with health, the HRQOL (Health-Related Quality of Life). The Oswestry Disability Index (ODI) was used as a disease-specific HRQOL scale. The ODI consists of 10 items evaluating pain and dysfunction. The total score varies from 0 to 100. Higher scores were related to a worse HRQOL. The Russian version of the ODI was validated in 2009 [3]. Moreover, the HRQOL general surveys validated in Russian were assessed: the European Quality of Life-5 Dimensions (EQ-5D-5L) and the 36-item Short-Form Health Survey (SF-36). The data collected using the EQ-5D-5L was shown as the value of the EQ-5D-5L index [4]. The health conditions according to the EQ-5D-5L are converted into a single index score using a scoring algorithm based on the preferences of the population. In this study, a Polish set of values and a scoring algorithm were used, since the scoring algorithm is not yet available in Russia. Potential values for this algorithm ranged from -0.590 to 1; values below 0 are conditions that are considered worse than death. SF-36 consists of 36 items that include 8 domains: physical functioning, role-physical, bodily pain, general health perceptions, vitality, social functioning, role-emotional and mental health. These 8 domains may be divided into two main components: total physical health and total mental health. Scores were given on a scale from 0 to 100, where a higher score means a better HRQOL. The SF-36 survey, originally developed and validated in English, has been translated into Russian [5].

Statistical analysis

Data analysis was performed using the R software environment for statistical computing (version 3.6.2, R Foundation), packages lmer4, psych, eq5d, dplyr, ggplot2, merTools and helper packages.

The initial correlation analysis was performed using univariant linear regression for the total score on the HSS-LSSES. Later, the most suitable parameters for fixed effects were selected in a hierarchical (mixed) regression model based on the value of $p < 0.1$ and the clinical significance of each parameter.

The levels of hierarchical regression (random effects) were identified as follows: level of education (secondary, vocational, higher) and the presence of previous spinal surgery (performed or not performed). The presence of random effects in the model made it possible to say whether there are significant differences in the evaluation of the expectation of spinal surgery outcomes, depending on level of education and history of previous surgical intervention.

Nevertheless, it is impossible to identify the direction of dependence empirically from this model. In this case, it is required to calculate these parameters on simulation samples. In this regard, we used the Gelman simulation method [6] to construct empirical Bayes estimators of the regression model (n. sim = 20000). The statistical significance of the parameters of the mixed regression is determined at the value of $p < 0.01$. The construction of confidence intervals (CI) with 95 % probability for regression models was performed by the bootstrap method (n = 2000).

Results

The study included 103 patients who met the inclusion/exclusion criteria. Summary data on the gender, age, disease peculiarities and physical function of patients are given in Tables 1 and 2.

The median of patients' age was 60 years (95 % CI: 57–61). The quarter of patients (23 %) had previously undergone lumbar spine surgery. There was no statistically significant difference between the groups of patients according to the presence of a surgical history. 34 % of patients have higher education; 37 % graduated from technical vocational schools; and 29 % have secondary education. There was no statistically significant difference between the groups of patients.

Later, correlation analysis was performed using univariant linear regression (Table 3).

From the data shown in the table it can be concluded that the most significantly correlating factors are ODI scores and age (positive correlation with HSS-LSSES scores). It can also be mentioned that a weak positive correlation is found in domains SF-36 (role-emotional and vitality). The results of modelling using a mixed (hierarchical) regression model are given in Table 4.

Interpreting the coefficients of mixed regression (fixed effects), it may be conclude that there is a negative correlation between the parameter "mental health" and the HSS-LSSES scale. A positive correlation is found between the other parameters (age, ODI, bodily pain, emotional state, general health perceptions and vitality). A negative mental health coefficient suggests that the lower its score, the higher the expectation of patients from the procedure. Meanwhile, the older the patient and the higher the general and emotional state of health, vitality, and ODI scores, as well as the severity of the

pain syndrome, the higher the expectations of these patients for the upcoming procedure. Random coefficients (random effects) are statistically significant in this model (coefficients are positive).

Analysis of Gelman simulation results (Fig.) revealed a similar correlation between fixed effects (negative correlation of mental health with the HSS-LSSES and positive for other variables). Interpreting the random coefficients on the second graph, it can be seen that the expectations for procedure outcomes was lower in the group of patients without prior surgical background and with secondary vocational education and higher in the group of patients without prior surgical background and with higher education (not statistically significant, the CI extend beyond the central line). Nevertheless, in the cohort of patients who underwent surgeries, patients with higher education have statistically significant underestimated expectations of the procedure outcomes (the CI do not extend beyond the central line). Patients with secondary general education demonstrate a trend towards overestimated expectations of the procedure outcomes if they have already been surgically treated on at least once (not statistically significant, the CI extend beyond the central line). Patients with secondary vocational education follow the same trend.

Discussion

We have studied the correlation between the preoperative status of patients and the expectations for surgical treatment of degenerative diseases of the lumbar spine. Using a regression model with mixed effects, it was revealed that age, ODI score, and SF-36 domains (bodily pain, general health perceptions, vitality and mental health) influenced the preoperative expectations of patients. The level of education and the history of spinal surgery were significant for preoperative expectations.

The patient's age is one of the most debated factors related to patients' preoperative expectations. A number of authors [7–11] declared that a younger age is associated with increased expectations for elective arthroplasty of the knee and hip joints and surgeries on the shoulder joint, cervical spine and lumbar spine. On the contrary, the developers of the HSS-LSSES survey, Mancuso et al. [12], when studying the expectations of patients with hip replacement, came to the opposite conclusion: expectations grow with increase in the age. There are also contradictions in the literature sources regarding the stratification of age groups and their predisposition to expectations from elective surgery [13]. In our study, we noticed that younger patients had lower expectations from the upcoming procedure, and with increase in the age, the evaluation of expectations according to the HSS-LSSES survey raised. Moreover, with an increased expectation in our cohort of patients, the indicators of vitality and general health perceptions according to the SF-36 questionnaire were higher. It is clear that more active patients had higher expectations for improving functions after spinal surgery.

The ODI score was the most strongly related to patient expectations out of all the variables we considered. This is partly due to the fact that both the ODI and the HSS-LSSES survey relate to physical well-being. We noticed increased expectations from surgeries with worsening quality of life indicators according to the ODI questionnaire. The assessment of the domains of the SF-36 question-

Table 1
Characteristics of patients and stratification by history of surgery on the lumbosacral spine

Variable		General cohort	No history of surgery	History of surgery	p
Patients, n		103	79	24	–
Age, years, mean (SD)		57.9 (11.6)	57.6 (11.8)	58.7 (11.4)	0.697
Level of education	Secondary general	30.0 (29.1)	23.0 (29.1)	7.0 (29.2)	0.491
	Secondary vocational	38.0 (36.9)	27.0 (34.2)	11.0 (45.8)	
	Higher	35.0 (34.0)	29.0 (36.7)	6.0 (25.0)	
HSS-LSSES, mean (SD)		47.2 (19.9)	47.3 (17.9)	46.8 (25.9)	0.917
ODI, mean (SD)		44.3 (17.4)	43.0 (17.2)	48.8 (17.7)	0.158
EQ-5D-5L, mean (SD)		0.7 (0.2)	0.7 (0.2)	0.7 (0.2)	0.229
SF-36 overall score, mean (SD)		41.5 (17.5)	42.4 (15.4)	38.5 (23.5)	0.339
Mental health, mean (SD)		46.3 (19.0)	47.0 (16.6)	44.0 (25.6)	0.502
Physical functioning, mean (SD)		36.8 (17.5)	37.9 (15.9)	33.0 (21.8)	0.231
Role-emotional, mean (SD)		30.4 (40.2)	33.3 (39.6)	20.9 (41.6)	0.186
Social functioning, mean (SD)		55.5 (25.1)	54.3 (23.2)	59.7 (30.9)	0.360
General health perception, mean (SD)		46.9 (16.7)	47.9 (15.1)	43.5 (21.0)	0.257
Vitality, mean (SD)		44.8 (18.5)	44.7 (17.2)	45.2 (22.6)	0.904
Pain, mean (SD)		35.2 (19.2)	34.7 (19.6)	36.8 (18.1)	0.638

SD = standard deviation.

naire proves the correlation between an increase in expectations for surgery and an increase in bodily pain. Patients suffering from more pronounced back pain expected a greater effect from surgery. Similar data were obtained in other studies evaluating expectations for elective surgery on the lumbar spine [10, 14].

Nevertheless, it should be noted that the HSS-LSSES survey also involves mental functions and thus reflects the impact of physical disability on mental well-being. This observation is proved by our results, according to which the scores on the HSS-LSSES survey correlated with the indicators of mental health on the SF-36 scale. This is consistent with the results of several other studies that have also revealed associations between expectations, physical disability and mental well-being [15–17].

Researchers have stated that the expectations for surgery are greater in patients with a higher level of education [11, 18]. The history of previous surgery also affects the expectations of patients. Nevertheless, the literature data regarding large joint replacement suggest both increased and decreased expectations for surgery if there was the history of surgical treatment [19–21]. We have not detected any differences in the studied indicators with direct stratification by the level of education and the history of surgery. The original HSS expectation survey also did not demonstrate the influence of the level of education and the history of surgery in patients with degenerative disease of the lumbar spine [10]. In our study, regression analysis showed that the selected random effects (level of education and history of surgery) affected the correlation between the HSS-LSSES survey and the studied indicators. For more scrutiny of random effects, we assessed the nature of the correlation using the Gelman simulation method. From our analysis, we see that preoperative expectations are most significantly changing downward in patients with higher education who have previously undergone spinal surgery.

The issue of patients' expectations demands close attention, as this is one of the ways to objectify the preoperative assessment. According to the literature [22], there is a correlation: the higher the expectations before the elective procedure, the better the postoperative outcome. A survey on the expected outcomes of surgery is reasonable since patients may have several sources of information and not only an attending physician's opinion. Excessively high, surreal preoperative expectations trigger a negative subjective patient's evaluation of the treatment outcomes [23]. We have introduced an available tool for quantifying preoperative expectations for surgical treatment of degenerative diseases of the lumbosacral spine. Evaluation of the procedure outcomes from the viewpoint of fulfilling the expectations for surgery is a patient-oriented approach to complement the traditional evaluation of satisfaction with treatment as well as the difference between pre- and postoperative indicators.

Conclusion

The expectations of patients in the surgical treatment of degenerative diseases of the lumbosacral spine depend on age, level of education, history and severity of impaired quality of life. Preoperative expectations are raising with increase in the age, ODI questionnaire indicators and such SF-36 questionnaire domains as "bodily pain", "emotional state", "general health perceptions", "vitality" and a decrease in the SF-36 domain "mental health". Patients with a high level of education and a history of spinal surgery have lower expectations of subsequent procedures.

Table 2

Characteristics of patients and stratification by level of education

Variable	General cohort	Secondary general education	Secondary vocational education	Higher education	p
Patients, n	103	30	38	35	–
Age , years, mean (SD)	57.9 (11.6)	59.6 (7.9)	60.0 (11.9)	54.2 (13.4)	0.067
History of surgery, %	24.0 (23.3)	7.0 (23.3)	11.0 (28.9)	6.0 (17.1)	0.491
HSS-LSSES, mean (SD)	47.2 (19.9)	49.2 (20.6)	43.2 (17.2)	49.8 (21.9)	0.303
ODI, mean (SD)	44.3 (17.4)	43.1 (19.4)	47.4 (17.3)	42.1 (15.7)	0.386
EQ-5D-5L, mean (SD)	0.7 (0.2)	0.7 (0.2)	0.7 (0.2)	0.7 (0.2)	0.417
SF-36 overall score, mean (SD)	41.5 (17.5)	45.9 (16.5)	39.1 (15.9)	40.4 (19.7)	0.263
Mental health, mean (SD)	46.3 (19.0)	50.2 (16.6)	45.1 (18.5)	44.1 (21.4)	0.392
Physical functioning, mean (SD)	36.8 (17.5)	41.5 (17.8)	33.1 (14.8)	36.7 (19.3)	0.147
Role-emotional, mean (SD)	30.4 (40.2)	30.0 (41.4)	36.8 (39.4)	23.9 (40.2)	0.393
Social functioning, mean (SD)	55.5 (25.1)	59.4 (27.6)	52.9 (21.5)	55.1 (26.8)	0.570
General health perception, mean (SD)	46.9 (16.7)	50.1 (11.5)	45.9 (17.8)	45.1 (19.0)	0.449
Vitality, mean (SD)	44.8 (18.5)	49.7 (17.0)	40.3 (17.0)	45.6 (20.4)	0.108
Pain, mean (SD)	35.2 (19.2)	36.3 (24.1)	34.2 (12.6)	35.3 (20.9)	0.902

SD = standard deviation.

Table 3
Coefficients of univariant linear regression of the studied domains according to the HSS-LSSES

Predictor	Value	Confidence interval	p
ODI	0.53	0.05–1.03	0.031
SF-36	60.90	-31.49–152.56	0.190
Age	0.48	0.16–0.92	0.004
EQ-5D-5L	3.25	-30.25–28.70	0.833
Role-physical	0.15	-0.23–0.47	0.389
Physical functioning	-30.46	-76.22–15.70	0.188
Bodily pain	0.26	-0.08–0.60	0.136
Social functioning	0.04	-0.31–0.43	0.809
Role-emotional	0.23	-0.03–0.55	0.076
General health perception	0.37	-0.16–0.94	0.202
Mental health	-31.62	-76.84–14.56	0.169
Vitality	0.59	-0.11–1.41	0.091

Table 4
Interpretation of mixed regression coefficients (fixed and random effects) according to the HSS-LSSES

Predictor	Value	Confidence interval	p
Age	0.48	0.21–0.71	<0.001
ODI	0.65	0.45–0.88	<0.001
Bodily pain	0.25	0.09–0.43	<0.001
Emotional state	0.21	0.06–0.35	0.010
General health perception	0.45	0.19–0.69	<0.001
Mental health	-0.88	-1.33–-0.45	<0.001
Vitality	0.43	0.18–0.69	<0.001
Random effects			
2	194.24		
00 Education	0.44		
11 Education / History of surgery	171.09		
11 Education / No history of surgery	61.54		
N (Education)	3		

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The authors declare that they have no conflict of interest.

The study was approved by the local ethical committees of institutions.

All authors contributed significantly to the research and preparation of the article, read and approved the final version before publication

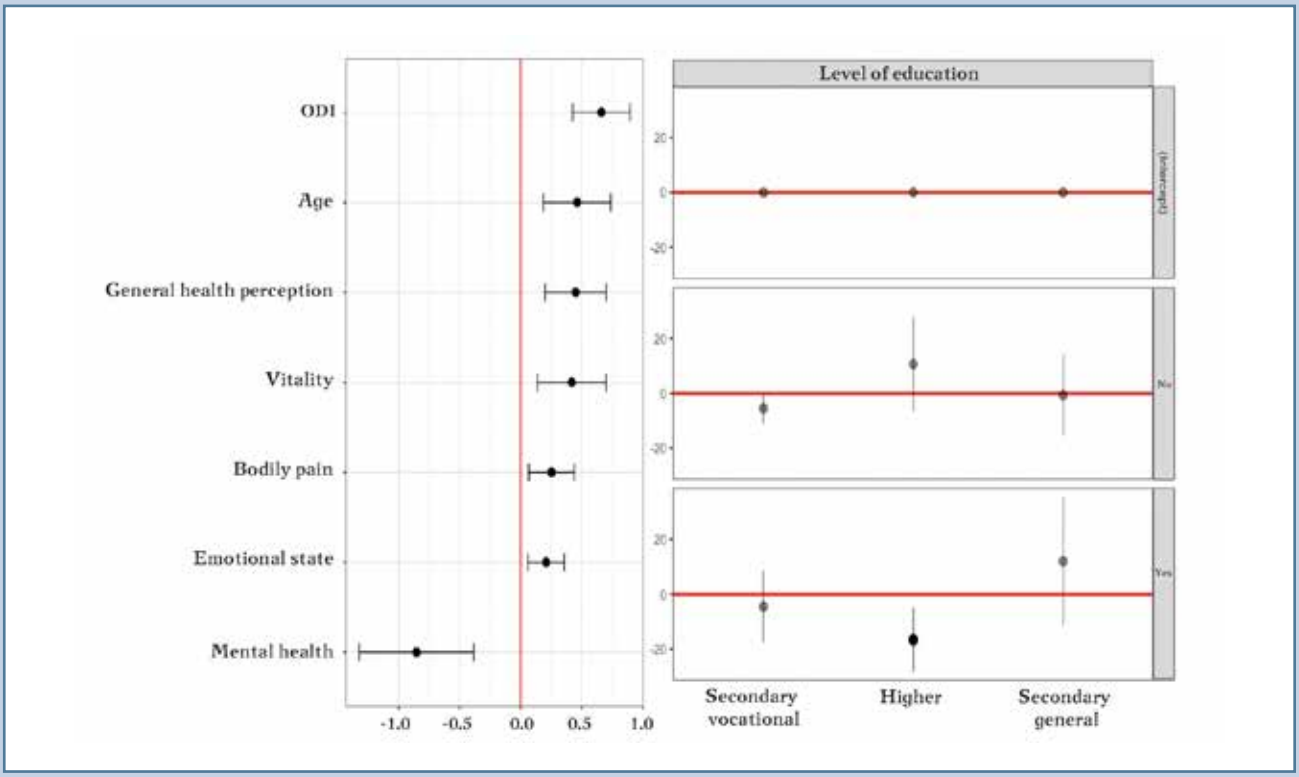

Fig.
Analysis of results of Gelman simulation method [6]: on the left – the ratio of fixed effects to HSS-LSSES scores; on the right – correlation between level of educational and HSS-LSSES scores depending on the presence of a history of surgical treatment with consideration of fixed effects in a mixed model

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