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Prognostic Value of the SF-36 Questionnaire in the Surgical Treatment of Degenerative Spinal Stenosis

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ABSTRACT

Introduction: *The clinical-radiological dissociation in degenerative spinal stenosis (DSS) presents a significant challenge for surgical decision-making. This study aimed to investigate the predictive utility of preoperative health-related quality of life (HRQoL), as measured by the Short Form Health Survey-36 (SF-36), for determining postoperative outcomes following decompressive surgery in a geriatric cohort.*

Methods: *A prospective longitudinal study was conducted involving 108 patients (M = 73.2 years, SD = 5.3; 61.1% male) undergoing surgical intervention for DSS. Standardised clinical metrics, including the Visual Analogue Scale (VAS) for pain and the Oswestry Disability Index (ODI) for functional impairment, were recorded. Surgical success was operationalised using the Minimal Clinically Important Difference (MCID): reduction in VAS of at least 1 point, reduction in ODI of at least 1.5 points, or an increase in the total SF-36 score of at least 15 points. Predictive accuracy was assessed via Receiver Operating Characteristic (ROC) analysis and Spearman's correlation (rs).*

Results*: Significant longitudinal improvements were observed across all clinical parameters post-surgery ($p < .001$). Mean ODI scores decreased from 3.15 to 2.19, VAS scores shifted from 2.51 to 1.60, and total SF-36 scores improved from 49.11 to 69.02. ROC analysis identified the preoperative SF-36 as a robust predictor of surgical success, yielding an area under the curve (AUC) of .951. Notably, anatomical severity (Schizas grade) did not correlate significantly with baseline functional status, further highlighting the clinical-radiological mismatch.*

Conclusion: *Preoperative HRQoL is a potent, independent predictor of surgical success in geriatric DSS patients. These findings support the integration of the SF-36 into routine preoperative assessments to enhance patient stratification and optimise therapeutic outcomes.*

Keywords

Degenerative spinal stenosis, SF-36, Prognostic factors, Health-related quality of life (HRQoL), Surgical outcomes, Patient stratification.

Introduction

Degenerative spinal stenosis (DSS) is one of the most common diseases leading to surgical intervention in the elderly [1]. Despite the high efficacy of decompressive surgery in relieving symptoms, selecting patients who will derive maximum benefit from surgical treatment remains a challenge. Clinical scales such as the visual analogue scale (VAS) for pain and the Oswestry Disability Index (ODI) [2], as well as imaging classifications such as Schizas's [3] classification, are routinely used. Although classifications such as Schizas's are widely used, the lack of a clear correlation between morphological severity and functional status necessitates the inclusion of patient-oriented indicators, including patient-reported outcome measures, PROMs [1,4]. Health-related quality of life

(HRQoL), measured with common questionnaires such as the SF-36, can provide a more comprehensive assessment of a patient's well-being and potential for recovery. HRQoL is increasingly being used as an independent predictor of surgical success in degenerative spinal stenosis [5,6], and the use of HRQoL instruments such as the SF-36 allows for a more objective prediction of postoperative recovery beyond pure neurological decompression [7]. The aim of the present study was to investigate the prognostic value of the preoperative SF-36 in assessing the success of surgical treatment of DSS.

Methods

Study Population

The study was prospective and included a total of 108 patients undergoing surgical treatment (laminectomy or laminotomy) for degenerative spinal stenosis. Patients with severe somatic comorbidities, dementia, and a history of psychiatric illness were excluded from the sample. The demographic profile of the patients showed a mean age of 73.2 years (SD = 5.3) with a range of 61 to 83 years. The gender distribution included 66 men (61.1%) and 42 women (38.9%).

Measurement Instruments and Assessment

Patients were assessed twice: before surgery (preoperative measurement, t1) and six months after surgery (postoperative measurement, t2). The following instruments were used:

Pain intensity: Assessed using a three-point ordinal VAS scale for mild, moderate, and severe pain [8].

Degree of disability: Assessed using a five-point ordinal ODI scale [2].

Health-related quality of life (HRQoL): Assessed using the total (sum) score of the SF-36 questionnaire [9].

Anatomical severity of stenosis: Classified according to Schizas grade (A, B, C, D) based on preoperative magnetic resonance imaging [3].

For the purpose of ROC analysis, surgical "success" (outcome) was defined as achieving a minimal clinically important difference (MCID): a decrease in ODI of at least 1.5 points, a decrease in VAS of at least 1 point, or an increase in the total SF-36 score of at least 15 points [6,10]. Defining success by the MCID is a standard in modern spinal surgery to objectify subjective improvement [5]. Patients who achieved this threshold were classified as "positive" cases (n = 61) and the rest as "negative" (n = 47).

Statistical Analysis

Statistical analysis was performed using the IBM SPSS Statistics (Version 26) software package. Descriptive statistics (M, SD, frequencies), paired-sample t-tests for comparing t1 and t2 measurements, Spearman's correlation analysis (r_s) for assessing the relationship between ordinal scales (Schizas, VAS, ODI), and ROC analysis for determining the predictive power and optimal cut-off point of the SF-36 were used. Although the VAS and ODI scales are technically ordinal, for the purposes of this analysis, their numerical values were treated as interval data, an approach that is widely accepted and used in clinical research on spinal pathology [11]. The minimal clinically important difference (MCID) was applied to define therapeutic success, in view of the need to distinguish the mathematical significance of the results from their real clinical value for the patient and to establish the proportion of subjects with a tangible improvement in quality of life and functional status [12].

Results

Anatomical Severity According to the Schizas Scale

The distribution of patients according to the degree of spinal stenosis, as classified by the Schizas scale, is presented in (Table 1). The majority of patients were classified as Grade C (n = 68, 63.0%), indicating a predominant sample with severe anatomical stenosis.

Table 1: Distribution of Patients According to the Schizas Classification.

Schizas Grade	Frequency (n)	Percentage (%)
A	1	0.9
B	27	25.0
C	68	63.0
D	12	11.1
Total	**108**	**100.0**

Effectiveness of Surgical Treatment

The paired-samples t-test revealed a statistically significant improvement in all clinical parameters after surgery ($p < .001$ for all measurements), as shown in (Table 2).

Table 2: Comparison of Preoperative (t1) and Postoperative (t2) Clinical Parameters.

Variable	M($t1$)	M($t2$)	MD	t	p
ODI	3.15	2.19	0.96	11.13	< .001
VAS	2.51	1.60	0.91	12.69	< .001
SF-36	49.11	69.02	19.91	-10.98	< .001

Note. M= Mean, MD= Mean Difference, ODI = Oswestry Disability Index, VAS = Visual Analog Scale, SF-36 = Short Form-36 Health Survey.

Correlation Analysis Between Clinical and Anatomical Parameters

Spearman's correlation analysis (r_s) provides key data on the relationships between variables, as shown in (Table 3).

Table 3: Correlation Analysis Between Preoperative Parameters and Final Therapeutic Outcome.

Variable	Correlation (r_s) with SF-36 ($t1$)	p	Correlation (r_s) with Outcome	p
Schizas	.102	.294	-.287	.003
VAS ($t1$)	-.075	.437	-.027	.778
ODI ($t1$)	-.122	.210	-.129	.184
SF-36 ($t1$)	1.000	—	-.544	< .001

Note. r_s= Spearman's rho, SF-36 = Health-related quality of life (t1), Outcome = Surgical success (MCID).

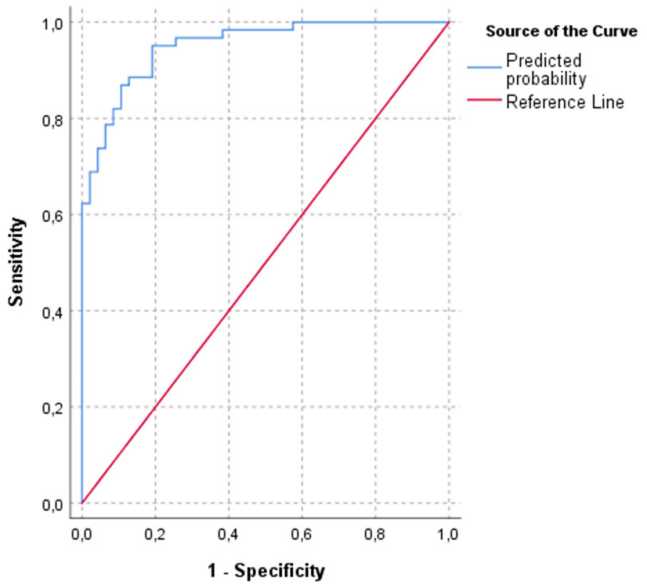
A lack of statistically significant correlation was reported between the anatomical Schizas grade and the baseline subjective parameters (SF-36, VAS, ODI), highlighting the presence of a clinical-radiological dissociation in the sample. This dissociation has been widely described in the literature as one of the main

challenges in the diagnosis of DSS [3,4].

ROC Analysis and Prognostic Value of SF-36

ROC analysis was conducted to assess the prognostic value of the SF-36 for surgical success, yielding exceptional results (see Figure 1). The area under the curve (AUC) was .951 (95% CI [.92, .98]), indicating high predictive accuracy. An optimal probability of success was approximately .652, providing a sensitivity of 86.9% and a specificity of 89.4%.

Figure 1: ROC Curve of Preoperative SF-36 Score as a Predictor of Surgical Success.



Note. The blue line represents the predicted probability of surgical success based on the SF-36 score. The red line represents the reference line (AUC = .50). AUC = .951.

The resulting area under the curve (*AUC* = .951) defines the preoperative SF-36 as an excellent predictor of final success, which is consistent with the latest prognostic models in spinal surgery [12].

Discussion

The findings of the present longitudinal study corroborate both the clinical efficacy of decompressive surgery for degenerative spinal stenosis (DSS) in a geriatric cohort and the exceptional prognostic utility of preoperative health-related quality of life (HRQoL) assessment via the SF-36 questionnaire. The substantial functional improvements observed in our sample (*M* = 73.2 years) align with contemporary evidence suggesting that advanced chronological age, in isolation, does not preclude excellent surgical outcomes [13].

Efficacy and Clinical Improvement

The results derived from the paired-samples *t*-test demonstrate a statistically significant and clinically meaningful improvement across all monitored parameters (VAS, ODI, and SF-36) postoperatively ($p < .001$). The mean increase in the total SF-36 score of approximately 20 points represents a substantial effect size, further validating the benefits of surgical intervention in appropriately selected elderly patients.

The Phenomenon of Clinico-Radiological Dissociation

A critical finding of the present analysis is the evident clinico-radiological dissociation, characterised by a lack of a statistically significant correlation between the anatomical severity of stenosis (as graded by the Schizas scale) and the patients' preoperative subjective status, including HRQoL, pain intensity (VAS), and disability (ODI).

This phenomenon, frequently documented in spinal research, suggests that morphological severity identified through imaging is not an absolute indicator of the symptomatic burden or functional limitations experienced by the patient [3,4]. Our data support the assertions of Minetama et al. [14], indicating that radiological findings represent only a singular component of the clinical profile and should not serve as the exclusive criterion for surgical indication. Relying solely on MRI or CT findings may lead to suboptimal treatment pathways, potentially resulting in either unnecessary intervention or the unjustifiable denial of surgery [1].

The SF-36 as a Robust Prognostic Instrument

In contrast to anatomical metrics and traditional clinical scales, the preoperative SF-36 emerged as the most potent predictor of surgical success (Spearman's $r_s = -.544$, $p < .001$). The exceptional area under the ROC curve ($AUC = .951$) reinforces the prognostic value of baseline HRQoL, consistent with findings by Khor et al. [15]. This high discriminative capacity establishes the SF-36 as a reliable screening tool for patient stratification.

Furthermore, the weak correlation identified between preoperative and postoperative SF-36 scores ($r = .074$) indicates that patients with severe baseline impairment retain a significant capacity for recovery. This aligns with the observations of Shabat [13] and Tripp [16], suggesting that a low baseline HRQoL should not be utilised as a restrictive criterion for surgical treatment. Patients presenting with severe baseline scores—who may be overlooked due to concerns regarding poor prognosis—often achieve substantial clinical gains.

Study Limitations

The utilisation of parametric statistical methods (*t*-test and Pearson correlation) for ordinal variables constitutes a potential limitation. However, given the robust sample size ($n = 108$) and the fact that non-parametric analyses (Spearman's r_s) corroborated the primary findings, the results are considered statistically reliable [9]. Furthermore, the application of MCID thresholds [5,12] ensures that the assessed outcomes reflect clinically tangible improvements rather than mere mathematical significance.

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