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Original Article

A Follow-up Study for Long-Term Impact of Lumber Spinal Surgery on Patients' Pain, Disability and Quality of Life

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BACKGROUND: The long-term impact of lumbar spine surgery on the patients' outcomes particularly pain, disability and quality of life has been the focus of several studies.

OBJECTIVE: The objective of this retrospective study was to evaluate patients who had lumbar discectomy in a 3-year duration for surgical outcomes.

METHODS: The retrospective part of the study included extraction of the data of all patients who had lumbar discectomy between 2020 and 2023. Prospectively, communication was performed with these patients to inquire about their satisfaction with the surgical outcomes, and complaining patients were asked to attend the clinical evaluation for their pain frequency, severity, and its impacts on their daily life activities using the defined evaluation questionnaires.

RESULTS: Revision of the file registry defined 664 files of patients who had lumbar discectomy. Communications defined 495 patientswho were satisfied with the surgical outcome, and 69 patients (11.9%) who were still complaining and were asked to attend for re-evaluation, and 6 patients were missed. Thirty-nine patients had partially alleviated pain and 19 patients had recurrent pain, while 5 patients had persistent pain with the same severity. Pain and kinesiophobia (Tampa scale of kinesiophobia (TSK-11)) scores were positively correlated with female gender and body mass index (BMI). Patients' satisfaction scoring showed a negative significant correlation with age, BMI, pain, and TSK-11 scores. Statistical analyses defined high pain and TSK-11 sores as negative predictors of patient satisfaction and high BMI as the significant predictor for pain severity.

CONCLUSION: Pain and the ability to move freely are the main determinants of patients' satisfaction with the surgical outcome. The correlation between pain scores and patients' demographics especially BMI indicated the necessity for proper preoperative evaluation of patients for their demographic data.

KEYWORDS: Kinesiophobia, Lumbar discectomy, Obesity, Pain, Surgical outcomes.

INTRODUCTION

Persistent spinal pain syndrome type-2 (PSPS-2), formerly termed failed back surgery syndrome (FBSS), was defined according to the international association for the study of pain as lumbar spinal pain of unknown origin that was persistent, insufficiently ameliorated, exacerbated, or appeared after surgical intervention for spinal pain originally present in the same location[1]

PSPS-2 is characterized by marked heterogeneity among patients despite its debilitating effect and by the multiplicity of causative etiologies ranging from an inappropriate procedure, technical failure, biomechanical sequelae, or complications of surgery to undetermined etiology.[2]

Continued uncontrolled back and/or lower extremity pain following lumbar spine surgery was related to the number of prior lumbar spine surgeries and may impact the pain relief outcomes of various therapeutic modalities.[3] Dysfunction in the sacroiliac joint can result in a spectrum of clinical conditions, especially low back pain, and lower limb radiculopathy, and may manifest after a previous spinal surgery especially transforaminal lumbar interbody fusion.[4] Spinal column shortening for patients with tethered cord syndrome is characterized by abnormal attachment of neural components to surrounding tissues to shorten the vertebral column, release tension on the spinal cord/neural elements, and alleviate associated symptoms, but displays variability in postoperative (PO) outcomes.[5]

The heterogeneity of causes underlying the pathogenesis of PSPS-2 and its relative prevalence among the population having back surgery,[2] indicated the necessity of meticulous PO follow-up of patients who received back surgery for early detection and distinguishing patients with manifest PSPS-2 to arrange for management.

The aim of this study was to evaluate patients who had lumbar discectomy in a 3-year duration for surgical outcomes particularly pain, disability and quality of life.

PATIENTS AND METHODS

The current study aimed to evaluate patients who had lumbar spinal surgery from 2020 through 2023 for their satisfaction with surgical outcomes with special regard to pain, disability, and quality of life. The study design was a retro-prospective follow-up study which was conducted in the Department of Neurosurgery, Faculty of Medicine, Helwan University. Ethical committee approval was

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obtained in and written, informed consent was obtained from all patients.

The study protocol consisted of two parts; the retrospective part entailed a revision of the file registry for all patients who had lumbar spinal surgery from 2020 through 2023. The prospective part consisted of communication with the enrolled patients asking them to qualify their satisfaction by surgical outcomes. Dissatisfied patients were invited to attend the outpatient clinic of Neurosurgery for one month of the recall for clinical evaluation of their pain frequency and severity and its impacts on their daily life activities using the defined evaluation questionnaires. Patients were asked to answer the questions included in these questionnaires and to rate their satisfaction with the surgical outcomes. Moreover, during file registry revisions, patients' enrolment demographic, clinical data including the levels of disc disease, and operative data were extracted from the files and were evaluated as predictors of the study outcomes

Inclusion criteria included all patients who had lumbar spinal surgery for disc prolapse, irrespective of the levels. Exclusion criteria included patients who had lumbar spinal surgery for indications other than disc prolapse disease or had discectomy and fixation, All patients were evaluated for pain using the pain verbal rating scale (VRS), which is a self-report powerful tool consisting of several statements designed to describe pain intensity and duration.[6] VRS includes five-point sets of descriptors; none, mild, moderate, Severe, and Very severe, which facilitate pain evaluation. For comparative purposes, each descriptor was numerically evaluated by 20 points, with none being scored as 0, mild as 0-20, moderate as >20-40, severe as >40-60, and very severe as >60.[7] The impact of pain on patients' well-being was assessed by the pain unpleasantness numeric rating scale (PU-NRS) which is a 10-point scale that ranges between no unpleasantness (score =1) to the most intense unpleasantness (score=10).[8] The effects of the intensity of the current pain on patients' sensation and effective functions were determined using the short-form McGill pain questionnaire (SF-MPQ): SF-MPQ consists of 15 items; 11 sensory and 4 affective for evaluation of the present pain intensity. These items were evaluated on a 4-point scale with 0 = none, 1 = mild, 2 = moderate, or 3 = severe, and the total score was calculated.[9] The extent of fear of movement was quantified by the short-form Tampa scale of kinesiophobia (TSK-11) which consisted of eleven items that were quantified on a 4-point Likert scale for a total score of 11-44, which indicated no or negligible kinesiophobia or increasing degrees of kinesiophobia.[10,11] The impact of pain on quality of life (QOL) was determined using the 36-item short-form survey instrument (SF-36) that evaluates bodily pain, general and mental health, physical functioning, role-emotional, role-physical, social functioning, and vitality. The items of these 8 sub-scales were scored and the total score was calculated.[12,13] Finally, patients' satisfaction with the outcome of the applied surgical procedure was scored using a visual analogue scale of 0-100 with a higher score indicating higher satisfaction.[14]

The study outcomes were both primary and secondary, primary outcome was defining the impact of the applied surgical procedure on patients' complaints; pain and disability while the secondary outcome was patients' satisfaction with surgical outcomes and defining the predictors for such satisfaction

Statistical analysis

Results were analyzed by one-way analysis of variance (ANOVA), and Chi-square test (X2 test). Pearson's correlation analysis was used to assess the relation between the evaluated scores and each other and patients' data. The receiver characteristic curve analysis was used to determine the significant predictors of patients' satisfaction with the surgical outcome using IBM® statistical package for social sciences (SPSS) Statistics (Version 22, 2015; Armonk, USA) at a P value of <0.05 as a cutoff point for the significance of the results.

RESULTS

The revision of the patients' file registry defined 664 files of patients who had lumbar spinal surgery for disc prolapse. Unfortunately, no way for communication was detected in 67 files and 19 files had missing data so these 86 files were excluded. Communication with the remaining 578 patients showed 337 patients (58.3%) who were satisfied by the surgical outcomes and could move independently and were independent of analgesia, 124 patients (21.5%) documented satisfaction but with occasional need for analgesia, 34 patients (5.9%) who were pain-free but can't move independently, 9 patients (1.6%) who were on regular epidural injection therapy and 5 patients (0.9%) who had a redo surgery in another institute, these 509 were not invited for re-evaluation. Sixty nine patients (11.9%) were still complaining and invited for re-evaluation, but 6 patients were missed and re-evaluations included 63 patients (10.9%) as illustrated in **(Fig. 1).**

Pre-evaluation discussion with the attendants about their description of pain during the period since surgery defined 39 patients (61.9%) who assured that preoperative pain was alleviated to some extent but was still limiting their activity and affecting their quality of life unless they received analgesics to control pain. Nineteen patients (30.2%) complained of recurrent pain after complete relief but with less severity than the preoperative pain. Five patients (7.9%) assured persistence of pain with the same severity **(Fig. 2).**

The mean duration since pain recurrence for patients who had recurrent pain was 10.9±4.8 months; 12 of these 19 patients (63.2%) had pain recurrence since <12 m and 7 patients (36.8%) had recurrent pain since >12 months **(Fig. 3).** The data extracted from patients' files are shown in **(Table 1).**

According to VRS pain severity scoring, 30 patients (47.6%) had pain of mild severity, 23 patients (36.5%) had pain of moderate severity, and 10 patients (15.9%) had severe pain for a mean VRS score of 23±13.2. Evaluation

of the impact of pain on patients' psychological status using PU-NRS defined 21 patients (33.3%) showed mild unpleasantness with a score of <3 and 35 patients (55.6%) showed moderate unpleasantness within a score range of 3-6, while 7 patients (11.1%) documented severe unpleasantness with a PU-NRS score of >6 and mean PU-NRS of 3.7±1.9 **(Fig. 4).**

The pain had a mild effect on the sensory and affective function of 15 patients (23.8%) with SF-MPQ score <15, while 41 patients (65.1%) had a moderate effect with score range of 15-30 and 7 patients (11.1%) had severe affection with score ranging between >30-45 for a mean total score of 20.2±6.8. Three patients (4.8%) had severe kinesiophobia, while 35 patients (55.5%) had moderate and 25 patients (39.7%) had mild kinesiophobia for a mean TSK-11 score of 23±13.2 **(Fig. 5).**

According to the SF-36 score for evaluation of the quality of life, 13 patients (20.7%) had poor and 22 patients (34.9%) had fair QOL, while 21 patients (33.3%) and 7 patients (11.1%) had good or very good QOL after surgery. The mean patients' satisfaction score by the surgical outcomes was 35.6±16.1 with 6 patients (9.5%) satisfied and 19 patients (30.2%) graded their satisfaction by the surgical outcome as good, while 26 patients (41.3%) graded it as fair and 12 patients (19%) graded it as poor **(Table 2).**

Pearson's correlation analysis showed a negative significant correlation between VRS pain sores, PU-NRS, and TSK-11 sores and male gender. However, VRS pain score and PU-NRS scores were positively correlated, while TSK-11 scores were negatively correlated with BMI. Also, TSK-11 scores were positively correlated with the surgery on multiple spinal levels. Moreover, PU-NRS scores were positively correlated with VRS pain scores and TSK-11. Patients' satisfaction scoring of surgical outcomes showed a negative and significant correlation with age, BMI, VRS pain, and TSK-11 scores **(Table 3).**

The Receiver operating characteristic (ROC) curve analysis of the determinants of high satisfaction score, defined high VRS pain and TSK-11 sores as negative predictors for high patients' satisfaction with significant area under the curve (AUC), while the AUCs for other variables were insignificant in comparison to area under the reference line **(Table 4, Fig. 6).** Multivariate regression analysis defined high VRS pain scores as the significant predictor for low satisfaction by surgical outcomes (β=-0.427, P<0.001). The ROC curve analysis of the factors affecting pain sensation as a surgical outcome defined obesity with high BMI as the significant predictor for PO pain which seriously affects patients' satisfaction **(Fig. 7).** Regression analysis assured the bad impact of obesity on pain sensation and defined high BMI as the significant predictor for high PO pain VRS score (β=0.364, P=0.003).

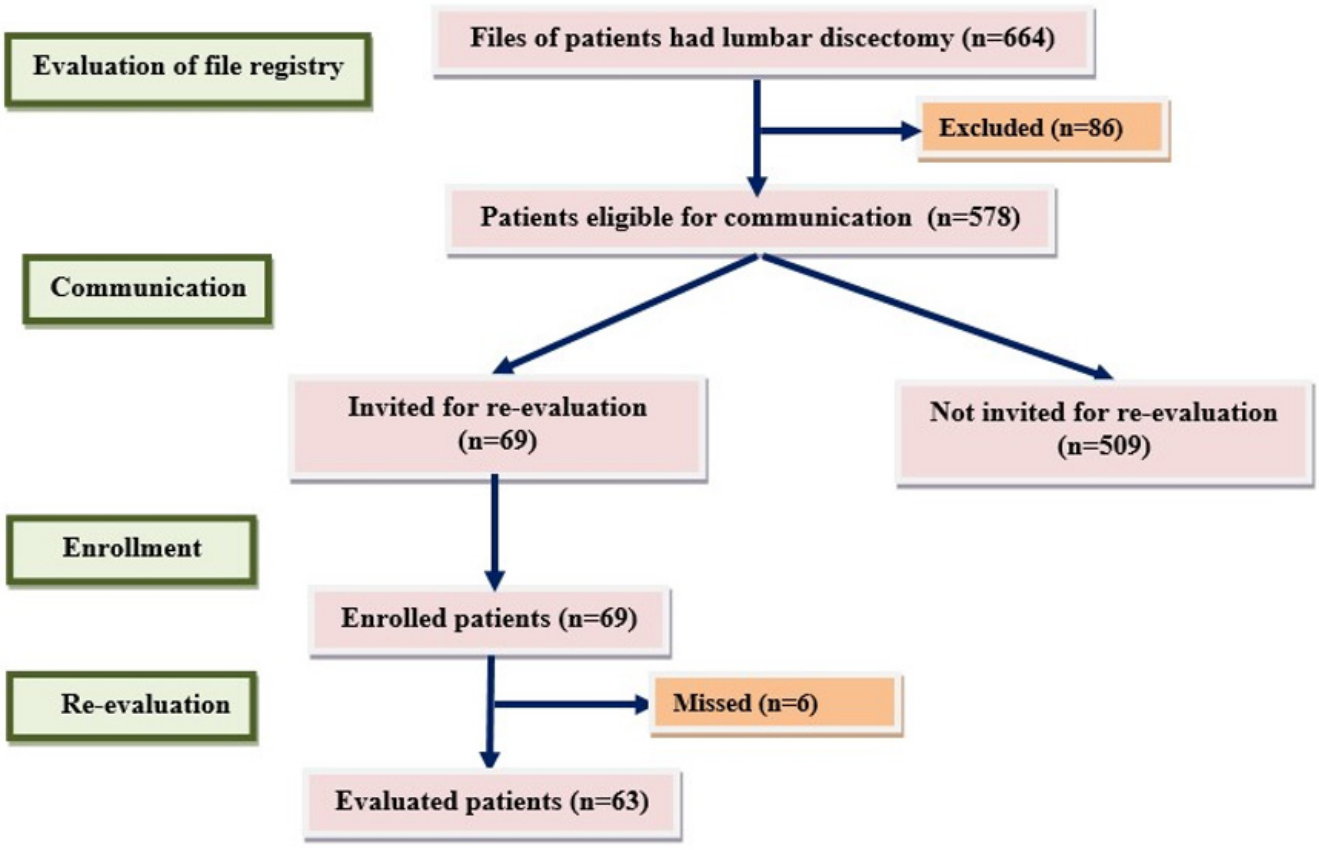

Fig 1: Patients' flowchart.

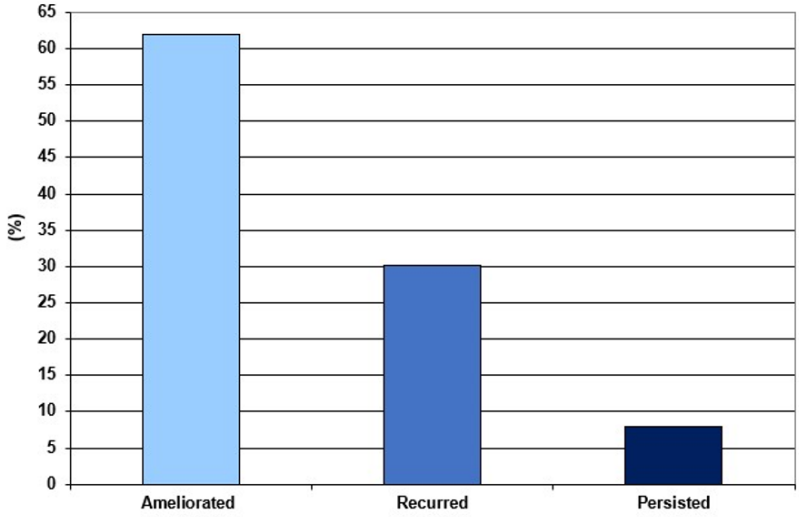

Fig 2: Patients distribution according to their evaluation of surgical outcomes regarding pain.

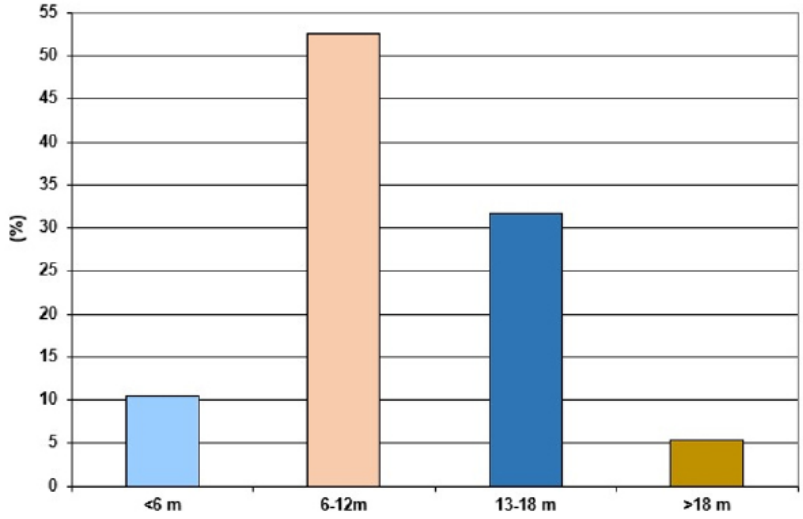

Fig 3: Distribution of patients that had recurrent pain according to the duration since pain recurrence.

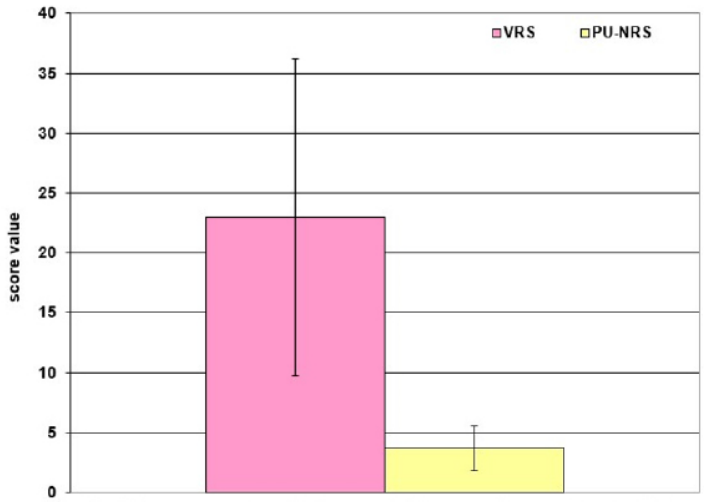

Fig 4: The mean value of VRS and PU-NRS score of the re-evaluated patients.

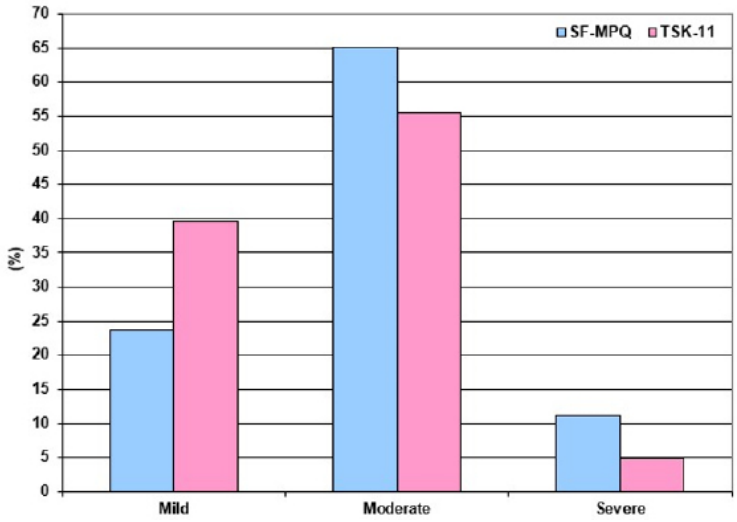

Fig 5: Patients' distribution according to SF-MPQ and TSK-11 scoring cards.

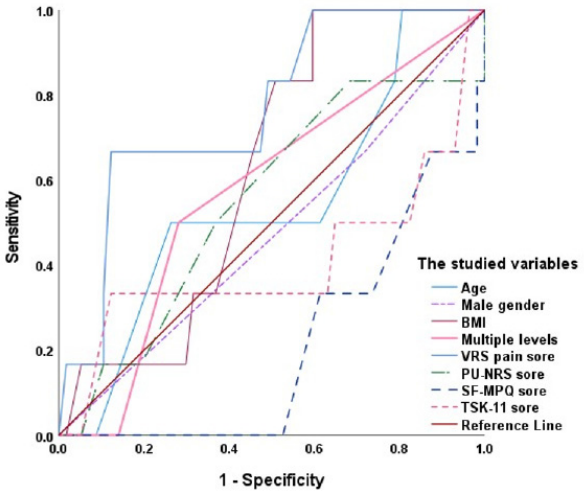

Fig 6: The ROC curve analysis for the significant determinants of patients' satisfaction with surgical outcomes.

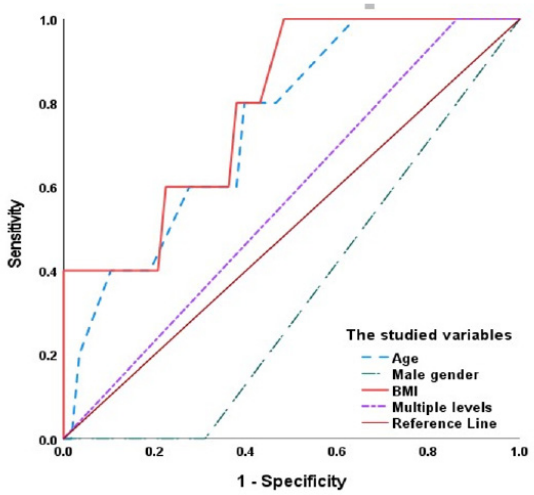

Fig 7: The ROC curve analysis for the significant determinants of patients' VRS pain PO score.

Table 1: The extracted patients' data

Data		Findings
Age (years)	<40	3 (4.8%)
	40-49	39 (61.9%)
	>50	21 (33.3)
	Mean (SD)	48.2 (±5.4)
Gender	Males	30 (47.6%)
	Females	33 (52.4%)
Body mass index (kg/m²)	Average weight	16 (25.4%)
	Overweight	27 (42.9%)
	Obese	20 (31.7%)
	Mean (SD)	28.4 (±3.2)
Operative spinal segments	One	44 (69.8%)
	Two	11 (17.5%)
	>2	8 (12.7%)
Duration since surgery (months)	<12	9 (14.3%)
	12-24	36 (57.1%)
	>24	18 (28.6%)
	Mean (SD)	19.9 (±7.2)

Table 2: The patients' re-evaluation data

Data		Findings
Pain Verbal Rating Scale (VRS)	Mild	30 (47.6%)
	Moderate	23 (36.5%)
	Severe	10 (15.9%)
	Mean (SD)	23 (±13.2)
Pain Unpleasantness Numeric Rating Scale (PU-NRS)	<3	21 (33.3%)
	3-6	35 (55.6%)
	>6	7 (11.1%)
	Mean (SD)	3.7 (±1.9)
Short-form McGill Pain Questionnaire (SF-MPQ)	<15	15 (23.8%)
	15-30	41 (65.1%)
	>30-45	7 (11.1%)
	Mean (SD)	20.2 (±6.8)
Short-form Tampa Scale of Kinesiophobia (TSK-11)	11-20	25 (39.7%)
	21-30	35 (55.6%)
	31-40	3 (4.8%)
	>40	0
	Mean (SD)	23 (±13.2)
36-Item Short-form Survey Instrument (SF-36)	Excellent	0
	Very good	7 (11.1%)
	Good	21 (33.3%)
	Fair	22 (34.9%)
	Poor	13 (20.7%)
Patients' satisfaction	Very satisfied	0
	Satisfied	6 (9.5%)
	Good	19 (30.2%)
	Fair	26 (41.3%)
	Poor	12 (19%)
	Mean (SD)	35.6 (±16.1)

Table 3: Pearsons' correlation analysis of the re-evaluated items

Variates	VRS pain score		PU-NRS		SF-MPQ		TSK-11 score		Satisfaction score	
	"r"	P	"r"	P	"r"	P	"r"	P	"r"	P
Age	0.210	0.099	0.146	0.252	-0.143	0.264	0.198	0.119	-0.252	0.046
Male gender	-0.285	0.024	-0.307	0.014	0.093	0.468	-0.285	0.024	0.173	0.175
BMI	0.561	<0.001	0.255	0.044	-0.080	0.534	0.307	0.014	-0.321	0.013
Multiple levels	0.220	0.083	0.191	0.133	-0.103	0.424	0.268	0.034	-0.211	0.096
VRS pain score	-	-	0.276	0.029	-0.163	0.201	0.318	0.011	-0.427	<0.001
TSK-11 sore	0.318	0.011	0.425	<0.001	-0.116	0.365	-	-	-0.386	0.002

Table 4: The receiver operating characteristic (ROC) curve analysis of the re-evaluated items

Variates	Predictors of high satisfaction score				Predictors of high VRS pain score			
	AUC	Std.	P	95 CI	AUC	Std.	P	95 CI
Age	0.545	0.124	0.717	0.302-0.788	0.747	0.097	0.069	0.937-0.556
Male gender	0.474	0.127	0.833	0.225-0.722	0.345	0.100	0.253	0.148-0.542
BMI	0.626	0.088	0.314	0.453-0.799	0.791	0.091	0.032	0.613-0.970
Multiple levels	0.575	0.116	0.550	0.348-0.802	0.569	0.120	0.611	0.334-0.804
VRS pain score	0.768	0.094	0.032	0.582-0.953				
PU-NRS	0.551	0.128	0.682	0.300-0.802				
SF-MPQ	0.408	0.155	0.461	0.105-0.711				
TSK-11 sore	0.211	0.080	0.020	0.053-0.368				

DISCUSSION

The file exploration and patients' communication detected that 63 patients, of the 578 patients who were eligible for communication, had manifestations of failed back surgery syndrome (FBSS) with an incidence of 10.9%. This figure coincided with that reported in multiple recent systematic reviews and retrospective studies where Xu et al.retrospectively detected an incidence of 16.8% for FBSS after open posterior lumbar surgery for degenerative spinal lumbar disease.[15] Alshammari et al. in a systematic review, reported that the pooled prevalence of persistent pain after spinal surgery was 14.97% in 16 studies evaluating 85,643 patients. Also, in a similar retro-prospective study,[16] Gonzalez-Ramos et al.detected a frequency of FBSS of 8%,[17] and Xu et al.retrospectively detected an incidence of 8.98% of postoperative sacroiliac joint pain which is a common manifestation of FBSS among patients who had a posterior lumbar interbody fusion.[17,18]

The reported high percentage of patients (85.6%) who documented the success of surgery was manifested as high satisfaction for the disappearance or minimization of pain sensation with improved kinesiophobia which was reflected as improved quality of life ensured the accuracy of the provided surgical procedure and the competence of the surgeons. Per this, Xu et al. retrospectively documented that open posterior lumbar surgery is an effective treatment for degenerative lumbar disease which provides pain reduction with an improved lumbar curve and a considerable satisfaction rate.[15]

These findings pointed to the possibility of other conflicting factors that lead to the persistence/recurrence of manifestations and development of FBSS. In line and support of this suggestion, recent studies provided various attributions to the development of FBSS. Qian et al. experimentally documented that dysregulated inflammatory cascade signal and over-expression of transforming growth factor beta-1 (TGF-β1)1 via the TGF-β/Smad3 pathway could jeopardize tissue homeostasis leading to fibrosis and development of epidural fibrosis, which is a primary cause for FBSS.[19] Also, Mei et al.suggested neutrophil infiltration of the surgical site leads to the generation of neutrophil extracellular traps that contribute to the initiation of epidural fibrosis which is a primary contributor to the failure of laminectomy surgeries, and the development of FBSS.[20]

Correlation analysis defined a positive correlation between the high VRS pain score and patients' age, female gender, obesity, and multiplicity of the prolapsed spinal discs, and this correlation was significant with obesity that was defined as the significant predictor for high pain scores which in turn was significantly and negatively correlated with patients' satisfaction with the surgical outcome and was defined as a predictor for patients' dissatisfaction.

In line with these findings, Garcia et al. detected a higher prevalence of obesity among the high-risk patients for FBSS than among the low-risk patients; 59.5% versus. 37.2%.[21] Also, Mesregah et al.reported that in a single-level fusion group, patients with chronic hyperlipidemia had a higher incidence of perioperative complications,[22]

including FBSS Gonzalez-Ramos et al. in their retro-prospective study detected a statistically significant relationship between the severity of manifestations and mood disorder, smoking, and obesity, especially in females with FBSS.[17] Then, Xu et al.retrospectively found patients who developed sacroiliac joint pain after posterior lumbar interbody fusion surgery had a higher BMI with greater abdominal obesity than patients who were free of such complications.[18]

Moreover, statistical analysis detected a negative significant correlation between patients' satisfaction scores and kinesiophobia scores and patients with high TSK-11 scoring ensured that their pain and kinesiophobia limited their activity, especially for males. This finding supported that previously reported by Ounajim et al. who observed that among patients with FBSS, health-related quality of life is impacted by functional disability and by pain perception, especially males that perceive their work as physical were more impacted by disability than pain intensity.[23]

The application of patients' demographic, disease-related, and surgery-related data as predictors for surgical outcomes coincided with the previously reported by O'Donnell et al. that preoperative opioid use is a negative predictor of returned-to-work rates after lumbar diskectomy and long-term preoperative opioid use was associated with FBSS, Müller et al.found none of the investigated 14 quantitative sensory tests could predict FBSS in multivariable analyses adjusted for sociodemographic, psychological and clinical and surgery-related data.[25]

CONCLUSION

The persistence or recurrence of manifestations of lumbar disc disease is not an uncommon complication for open lumbar discectomy. Pain and the ability to move freely are the main determinants of patients' satisfaction with the surgical outcome. The reported correlation between pain scores and patients' demographics especially BMI indicated the necessity for proper preoperative evaluation of patients planned for lumbar discectomy for their demographic data especially the presence of obesity which may jeopardize the outcomes irrespective of the competence of the surgical procedure

Recommendations

Wider scale multicenter studies are required to define the factors imposing a high risk of persistence/recurrence of lumbar disc disease especially patients' demographics and disease-related factors. Also, further studies are recommended to evaluate the outcomes of various conservative or minimally invasive therapies for FBSS-related manifestations.

List of Abbreviations

ANOVA: Analysis of variance.
AUC: Area under the curve.
BMI: Body mass index.
FBSS: Failed back surgery syndrome.
PO: Postoperative.
PSPS-2: Persistent spinal pain syndrome type-2.
PU-NRS : Pain unpleasantness numeric rating scale.
QOL: Quality of life.
ROC: Receiver operating characteristic.
SF-36: 36-item short-form survey instrument.
SF-MPQ : Short-form McGill pain questionnaire.
SPSS: Statistical package for social sciences.
TGF-β: Transforming growth factor-beta.
TSK: Tampa Scale of Kinesiophobia.
VRS: Verbal rating scale.

Disclosure

The authors report no conflict of interest in the materials or methods used in this study or the findings specified in this manuscript.

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