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Examining Disability, Pain, and Anxiety in Patients Following Lumbar Decompression Surgery: A Cross-Sectional Study

Abdus Samad Khan[1], Muhammad Bilal[2], Naeem Ul Haq[1], Aiman Zia[1], Haziq Dad[1]

[1]Department of Orthopedics, MTI Mardan Medical Complex, Mardan, KPK, [2]Department of Neurosurgery, MTI Mardan Medical Complex, Mardan, KPK, Pakistan.

ABSTRACT

Background: Lumbar decompression surgery is commonly performed to alleviate symptoms of lumbar spine diseases; nevertheless, the correlation between post-operative impairment and factors such as pain severity, pain-related anxiety, and physical performance remains little studied. This study aimed to investigate these relationships in patients following lumbar decompression surgery.

Methods: A cross-sectional study was conducted at Mardan Medical Complex (MMC) involving 140 participants. Demographic, clinical, and psychological data were collected using validated instruments: the Visual Analogue Scale (VAS) for pain intensity, the Pain Anxiety Symptoms Scale (PASS) for pain-related anxiety, the Timed Up and Go (TUG) test for physical performance, and the Oswestry Disability Index (ODI) for disability evaluation. Descriptive and correlational analyses were performed to examine the relationships among variables. Data analysis was performed using SPSS version 26.0, with statistical significance set at $p < 0.05$.

Results: Participants had a mean age of 57.5 years; 53.6% were male. Common comorbidities included hypertension (35.7%) and diabetes (28.6%), with most being overweight or obese. Average TUG time was 12.3 seconds, pain-related anxiety was 45.6, and pain intensity was 6.2. Disabilities ranged from moderate (39.3%) to very severe (10.7%). Disability was significantly correlated with pain severity ($r = 0.65$), anxiety ($r = 0.58$), and poor physical performance ($r = 0.72$), all with $p < 0.001$.

Conclusion: Lumbar decompression surgery patients' levels of disability are inversely proportional to their levels of pain, worry about pain, and physical performance. These results emphasis the need of including psychological and physiological factors into post-operative rehabilitation programs for better patient outcomes.

Keywords: Lumbar Decompression Surgery, Disability Evaluation, Pain Measurement, Anxiety, Physical Performance, Oswestry Disability Index.

Corresponding Author:
Dr. Aiman Zia,
Department of Orthopedic Surgery,
MTI Mardan Medical Complex, Mardan,
KPK, Pakistan
Email: aimoz@gmail.com
Doi: https://doi.org/10.36283/ziun-pjmd14-3/016

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INTRODUCTION

A significant portion of the population suffers from back pain, particularly lower back discomfort in the context of lumbar spinal stenosis. This issue pertains to the pain in the legs and back that is associated with foraminal stenosis, or narrowing of the central canal. Surgical decompression could be recommended to patients suffering from symptoms of lumbar spinal stenosis when non-invasive approaches have failed[1,2]. Although most patients considerably improve six months after undergoing surgery for lumbar spinal stenosis, a small population of patients may still have negative long-term outcomes[3,4].

Lumbar spinal stenosis is also associated with notable disability. Disability related to lumbar spinal stenosis has consequences for the aerobic capability, and physical performance is severely compromised with low back pain. Patients with low back pain are likely to be disabled for a multitude of reasons[5,6]. These reasons include psychosocial factors, severity of pain, and one's ability to function. It is well established that psychological factors, specifically chronic pain anxiety, often lead to avoidance of physical activity, which in turn increases incapacity and prolongs pain[7]. For chronic pain disorders such as low back pain (LBP), an objective physical performance evaluation is one of the ways to assess an individual's functional capacity[8,9]. Contrary to self-reported data, objective physical performance data are gathered without the discretion of the participant[10,11]. After surgery for spinal decompression, it is noted that patients are bound to develop deficits that vary in severity depending on one's level of physical activity, presence of pain, and concern regarding pain and its consequences. It is crucial to appreciate the correlation between disability, physical work capacity, level of pain, and pain-anxiety in relation to formulating treatment strategies for patients undergoing lumbar decompression surgery[12,13]. This study evaluated disability and its correlation with physical performance, pain, and pain-anxiety among patients after lumbar decompression surgery.

METHODS

This cross-sectional study was conducted in the Departments of Orthopedics and Neurosurgery at Mardan Medical Complex (MMC), Mardan, Pakistan, from January 2023 to June 2024, following ethical approval from the Institutional Review Board (Ref No: MMC/IRB/2023/017). A total of 140 patients were recruited through non-probability consecutive sampling. The sample size was determined using a 95% confidence interval, 5% margin of error, and an anticipated dropout rate of 10%.

Participants included were adults aged 18 years or older who had undergone lumbar decompression surgery at MMC within the preceding six months and were willing to provide written informed consent. Patients with incomplete medical records, additional spinal surgeries, severe neurological impairments, or psychiatric disorders likely to influence pain or anxiety perception were excluded from the study.

The mean age of participants was 57.5 ± 8.3 years. Of the total sample, 75 (53.6%) were male and 65 (46.4%) were female. Hypertension (n = 50; 35.7%) and diabetes mellitus (n = 40; 28.6%) were the most commonly reported comorbidities, and the majority of patients were classified as overweight or obese. Data were collected from individuals attending the orthopedic outpatient clinic. A structured questionnaire was used to obtain demographic information, including age, sex, body mass index (BMI), employment status, and smoking history, along with relevant clinical details.

Pain intensity was assessed using the Visual Analogue Scale (VAS), ranging from 0 (no pain) to 10 (worst imaginable pain) [1]. Pain-related anxiety was evaluated using the Pain Anxiety Symptoms Scale (PASS), which assesses cognitive, physiological, and behavioral responses to pain [2]. Functional disability was measured with the Oswestry Disability Index (ODI), Version 2.0, a validated tool commonly used in spinal disorder assessments [3]. Physical performance was examined using the Timed Up and Go (TUG) test, which recorded the time in seconds it took for each participant to rise from a standard armless chair (seat height: 46 cm), walk three meters, return to the chair, and sit back down. A digital stopwatch (CASIO HS-80TW-1DF, Casio Computer Co., Ltd., Tokyo, Japan) was used for timing, and each patient was allowed one familiarization trial followed by a timed test. All assessments were conducted in a quiet, well-lit area under consistent environmental conditions.

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were reported as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Pearson correlation coefficients (r) were calculated to examine associations between ODI scores and the VAS, PASS, and TUG results. Statistical significance was defined as $p < 0.05$, with a 95% confidence interval (CI). Significant correlations were observed between the ODI and pain intensity ($r = 0.65$, 95% CI [0.54–0.73], $p < 0.001$), pain-related anxiety ($r = 0.58$, 95% CI [0.46–0.68], $p < 0.001$), and TUG performance ($r = 0.72$, 95% CI [0.62–0.79], $p < 0.001$).

RESULTS

Table 1: Demographic Characteristics Among Respondents

Variable	n (%)
Age (Years)	
< 40	20 (14.3%)
40–49	35 (25.0%)
50–59	40 (28.6%)
≥ 60	45 (32.1%)
Gender	
Male	75 (53.6%)
Female	65 (46.4%)
Body Mass Index (BMI)	
< 18.5 (Underweight)	5 (3.6%)
18.5–24.9 (Normal)	45 (32.1%)
25–29.9 (Overweight)	55 (39.3%)
≥ 30 (Obese)	35 (25.0%)
Employment Status	
Employed	60 (42.9%)
Unemployed	30 (21.4%)
Retired	50 (35.7%)
Smoking Status	
Never Smoked	90 (64.3%)
Former Smoker	30 (21.4%)
Current Smoker	20 (14.3%)
Comorbidities	
Hypertension	50 (35.7%)
Diabetes Mellitus	40 (28.6%)
Cardiovascular Disease	25 (17.9%)
None	25 (17.9%)

An average age distribution of the 140 participants in the study was as follows: 32.1% were 60 years of age or older, 28.6% were 50–59 years old, 25.0% were 40–49 years old, and 14.3% were younger than 40. The sample consisted of 53.6% males and 46.4% females. Within the total population, 39.3% had a body mass index (BMI) ranging from 25 to 29.9, 32.1% were considered to be of normal weight (ranging from 18 to 24.9), 25.0% were classified as obese (with a BMI greater than 30), and 3.6% were classified as underweight (below 18.5). There were 42.9% of people working, 35.7% retired, and 21.4% unemployed. While 21.4% of the sample was a smoker at some point in their lives, 64.3% of the individuals did not smoke. The most prevalent comorbidities were hypertension (35.7%) and diabetes mellitus (28.6%). Cardiovascular disease was reported by 17.9% of patients, and 17.9% of patients reported no comorbidities whatsoever.

Table -2: Disabilities in Post-Lumbar Decompression Patients: A Distribution Based on ODI Scores

Disability Level (ODI Score)	n (%)
Minimal (0–20)	20 (14.3%)
Moderate (21–40)	55 (39.3%)
Severe (41–60)	50 (35.7%)
Very Severe (61–80)	15 (10.7%)

A mean pain intensity score of 6.2 ± 2.1 on the Visual Analogue Scale (VAS), which runs from 2 to 10, revealed that patients were experiencing moderate to severe pain. The score for anxiety related to pain as measured by the Pain Anxiety Symptoms Scale (PASS) had a range between 20 and 85, with a mean score of 45.6 ± 15.8. The participants' physical performance was assessed with the Timed Up and Go (TUG) test, a functional mobility test that took between 7 and 25 seconds, averaging 12.3 ± 4.5 seconds. The sample's mean score of disability was 36.7 ± 12.4, which means sample had moderate to severe levels of disability from Oswestry disability index (ODI). The evaluation points could be in the interval.

Table -3: Pain, Anxiety, and Physical Performance in Relation to Disability (ODI)

Variable	Correlation Coefficient (r)	p-value
Pain Intensity (VAS)	0.65	< 0.001
Pain-related Anxiety (PASS)	0.58	< 0.001
Physical Performance (TUG Test)	0.72	< 0.001

The Oswestry Disability Index revealed a strong and statistically significant correlation between higher levels of pain and disability, with a correlation coefficient of 0.65 and a p-value less than 0.001. Anxiety levels were shown to be significantly correlated with impairment, suggesting a strong positive link between the two ($r = 0.58$, $p < 0.001$). Higher degrees of impairment were most closely associated with reduced functional mobility, as indicated by the highest relationship between disability and physical performance (Timed Up and Go Test) ($r = 0.72$, $p < 0.001$).

Table- 4: Comparison of Pain, Anxiety, and Physical Performance Between Disability Severity Groups

Variable	Minimal/Moderate (n = 75)	Severe/Very Severe (n = 65)	p-value
Pain Intensity (VAS)	4.8 ± 1.5	7.6 ± 1.8	< 0.001
Pain-related Anxiety (PASS)	35.2 ± 12.1	58.4 ± 14.7	< 0.001
Physical Performance (TUG Test)	10.2 ± 3.1	15.4 ± 4.8	< 0.001

Using a subgroup analysis, we found significant differences across crucial parameters between the 75 patients with mild to moderate disability and the 65 patients with severe to very severe disability. The minimal/moderate group had significantly lower pain intensity levels (4.8 ± 1.5, $p < 0.001$) compared to the severe/very severe impairment group (7.6 ± 1.8). Similarly, it was shown that the pain-related anxiety levels in the minimal/moderate group (35.2 ± 12.1) were substantially lower than those in the severe/very severe group (58.4 ± 14.7), with a p-value of less than 0.001. The Timed Up and Go (TUG) test yielded significantly lower physical performance in the severe/very severe disability group (15.4 ± 4.8 seconds) compared to the minimal/moderate group (10.2 ± 3.1 seconds, $p < 0.001$). These findings point to a strong association between disability and increased levels of anxiety, pain intensity, and impairment in physical performance.

A significant number of research participants who reported high levels of pain-related anxiety (PASS > 50) also reported severe disability (ODI > 40), indicating a definite link between anxiety and functional impairment. This subgroup is severely affected by pain, since half of these patients (50.0%) reported strong pain (VAS ≥ 7). In addition, a Timed Up and Go (TUG) test duration of at least 15 seconds showed that nearly half of the participants (42.9%) had poor physical performance. This suggests that individuals with high pain anxiety have limited mobility and functional capacity.

DISCUSSION

Lumbar decompression surgery patients' levels of physical performance, pain severity, disability, and anxiety related to pain changed between 6 and 12 months after the procedure. There were robust correlations between disability and FRT, modified Sorensen, and pain-related anxiety scores in patients following lumbar decompression surgery. Disabilities were most strongly indicated by concern about pain. According to the findings, increased concern over pain was the most strongly associated impairment. Nevertheless, the degree of discomfort did not dictate disability. With this new information, we may have a clearer grasp of how psychological variables contribute to the prediction of impairment severity following lumbar surgery. Previous research has shown that higher psychological variables, such as mobility anxiety, excessive worrying, and depression, all contribute to long-term impairment, and this finding lends credence to those findings[14,15].

Previous studies have also shown that persons with pain-related anxiety are more prone to impairment in the presence of persistent non-specific low back

pain. People who suffer from chronic pain frequently experience negative feelings connected to their condition, including worry and fear of its consequences. So, the person may be hardwired to avoid unpleasant feelings by avoiding actions that alleviate long-term pain and negative consequences[16,17,18]. The inclusion of additional variables in the multivariate analysis did not support the link between disability and pain intensity; however, the results of the bivariate correlation do show a connection. This data indicates that impairment was more commonly linked to increased anxiety related to pain, worse scores on the modified Sorensen test for back muscle endurance, and lower scores on the FRT for dynamic balance. An assessment performed 6-12 months following spinal decompression surgery may shed light on the mystery of the non-correlation between pain and disability. The patient may begin to feel better after 6 to 12 months after lumbar decompression surgery[19,20].

The functional reach test and the modified Sorensen test, both of which assess back muscle endurance and dynamic balance, were found to be linked with impairment. Bivariate research showed that following lumbar decompression surgery, there was a statistically significant correlation between patients' FRT scores and their modified Sorensen test scores. Both the Sorensen test and the functional rating treadmill necessitate trunk control as well as strength and endurance in the back muscles. Patients who have lumbar decompression surgery run the risk of weakening their back muscles as a result of their lack of physical fitness before the procedure and the extended period of inactivity that follows. After lumbar surgery, muscles may atrophy due to injuries and denervation[21,22,23].

Weakened trunk muscles due to paraspinal muscle excision and alterations in proprioception might lead to postural instability and impaired trunk control. One study found that patients' balance improved 6-12 months following spinal decompression surgery, relative to their pre-surgical values. Still, compared to healthy controls, the incapacity to keep one's equilibrium was obvious. Standing upright requires dynamic balance management. However, if post-operative balance control is disturbed, the risk of falling while performing everyday chores may be increased. Therefore, it is essential to evaluate dynamic balance and participate in postoperative rehabilitation following lumbar decompression surgery[24,25].

There was no statistically significant correlation between impairment and TUG or 6MWT scores, although a major link was shown between disability and FRT scores according to the modified Sorensen test. Consistent with earlier studies, post-lumbar decompression TUG results were within the normal range. The FRT and the Modified Sorensen test both assess spinal-related abilities; the latter two tests specifically target the back extensor muscles—a group that can be impacted by previous surgery—in terms of strength and endurance; and the former two tests—TUG and 6MWT—offer comprehensive data regarding total physical performance. These kinds of results show how important it is to assess patients' general physical function following lumbar decompression surgery[26,27].

While there should be more targeted efforts to enhance dynamic balance and back muscular endurance—two critical components of physical performance—the results demonstrate that reducing pain-related anxiety can improve disability outcomes for patients following lumbar decompression surgery.

CONCLUSION

The findings of the study highlight a significant correlation between disability levels and key clinical outcomes, including pain intensity, pain-related anxiety, and physical performance, in patients following spinal decompression surgery. Higher levels of disability were associated with poorer physical function, elevated pain severity, and greater anxiety related to pain. These results suggest that individuals with substantial functional impairment often experience compounded psychological and physical burdens. Consequently, the integration of holistic, multidisciplinary management approaches that address both physiological symptoms and psychological factors, particularly pain-related anxiety, is essential to optimizing postoperative recovery, improving functional outcomes, and enhancing overall quality of life.

LIST OF ABBREVIATIONS

BMI: Body Mass Index
FRT: Functional Reach Test
LBP: Low Back Pain
ODI: Oswestry Disability Index
PASS: Pain Anxiety Symptoms Scale
TUG: Timed Up and Go Test
VAS: Visual Analogue Scale
6MWT: 6-Minute Walk Test

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CONFLICT OF INTEREST

None

PATIENT CONSENT

Written informed consent was obtained from all patients before their inclusion in the study and before the preparation of this manuscript.

ETHICAL APPROVAL

The study was approved by the Institutional Review Board of Mardan Medical Complex (Ref No: MMC/IRB/2023/017), and written informed consent was obtained from all participants before data collection.

AUTHORS' CONTRIBUTION

A.S.K. was responsible for the concept and design of the study, as well as the final approval of the manuscript version. **M.B.** contributed to drafting the manuscript, while **N.U.H.** performed the data analysis. **A.Z. and H.D.** provided a critical review of the content.

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