

## Extent of Preoperative Depression Is Associated with Return to Work After Lumbar Fusion for Spondylolisthesis

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### Key words

- Depression
- Lumbar fusion
- Return to work
- TLIF

### Abbreviations and Acronyms

**BP-VAS:** Visual analog scale for low back pain

**EQ-5D:** Euro-QoI-5D

**LP-VAS:** Visual analog scale for leg pain

**ODI:** Oswestry Disability Index

**RTW:** Return to work

**TLIF:** Transforaminal lumbar interbody fusion

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### INTRODUCTION

Low back pain is a leading cause of disability in western societies. Approximately 80% of Americans experience an episode of back pain at some point in their life (14, 21, 23, 32, 36, 49). Three percent of people with back pain will require surgical intervention, including spinal decompression with or without lumbar fusion (1, 13, 15, 41, 47). Although spine surgery has been shown to be effective clinically, outcomes are not universally successful (26, 28). Turner et al. (48) reported successful outcomes in 65%–75% of spinal fusions, with a mean reoperation rate of 23%. Similarly, Hoffman et al. (24) observed a mean success rate of 65% with a reoperation rate of 10%. These inconsistencies in successful outcomes have lead health care researchers and policy makers to examine preoperative factors that may independently predict outcome.

Growing evidence suggests that the variability observed in outcomes after spine

■ **BACKGROUND:** The ability to understand factors associated with an increased duration of missed work postoperatively could be used to more effectively select patients with the greatest opportunity for a successful outcome. We set out to determine the effect of preoperative depression on postoperative return to work in patients undergoing transforaminal lumbar interbody fusion (TLIF) for degenerative spondylolisthesis.

■ **METHODS:** Fifty-eight patients undergoing TLIF for symptomatic grade I degenerative lumbar spondylolisthesis were included in this analysis. Patient demographics, clinical presentation, indications for surgery, radiologic studies, and operative variables were assessed for each case. Patient-assessed outcome measures were obtained prospectively at baseline and 2 years postoperatively. To understand the factors associated with prolonged return to work, univariate linear regression analysis and stepwise multivariate Cox proportional hazards model was used.

■ **RESULTS:** All patient-reported outcomes assessed were significantly improved 2 years after TLIF ( $P < 0.001$ ). Of the 32 patients working preoperatively, 26 (81%) returned to work postoperatively. Median time to return to work was 56 days (range, 10–150 days). Independent of patient age; preoperative pain, disability, and quality of life; and extent of postoperative improvement, increased preoperative Zung depression score remained associated with prolonged return to work ( $P = 0.02$ ).

■ **CONCLUSIONS:** Independent of postoperative improvement in pain, disability, and quality of life, the extent of preoperative depression was an independent predictor of time to return to work in patients undergoing TLIF for spondylolisthesis, suggesting that regardless of how successful TLIF surgery may be at improving a patient's pain, disability, or quality of life, greater depression will delay or prohibit their ability to return to work postoperatively.

surgery may be attributed partially to preoperative psychological predispositions. In the 1970s, Spengler and Freeman (41, 42), using the Minnesota Multiphasic Personality Inventory, demonstrated a strong correlation between psychologic factors and clinical outcomes in patients undergoing lumbar discectomy. Similarly, Junge et al. (26, 27) reported that baseline psychologic predispositions were useful in predicting poor clinical outcomes after lumbar discectomy. Since these studies, the association of preoperative psychological state and postoperative outcomes has been corroborated further (5, 8-10, 12, 13). Most recently, our group demonstrated

that the extent of preoperative depression is an independent predictor of outcomes for patients undergoing revision lumbar fusion (3).

Low back pain is the most expensive cause of work-related disability in the United States, with direct medical costs estimated at \$30 billion annually (31) and indirect costs due to lost productivity estimated at \$20 billion annually (44). Although indirect costs secondary to lost work productivity have been shown to account for a significant portion of total spine surgery costs, there is a relative paucity of data assessing factors that impact the ability of a patient to return to

work (RTW) postoperatively. The patients with prolonged missed work postoperatively account for a disproportionate percentage of overall indirect costs. In light of the societal and individual patient burden wrought by chronic low back pain, clinicians, case managers, and policymakers are tasked with navigating the constellation of variables that affect RTW for patients with chronic low back pain. These barriers include fear avoidance, limited availability of modified duty, poor employer-employee relations, high physical work demands, litigation issues, and medical impediments to performing essential job functions (7, 11, 35). The ability to understand factors associated with an increased duration of missed work postoperatively could be used to select more effectively patients with the greatest opportunity for a successful outcome while at the same time reducing the associated indirect costs of spine surgery.

Transforaminal lumbar interbody fusion (TLIF) is one of the most commonly performed spinal surgical procedures in contemporary practice. First described by Harms and Rolinger in 1982 (22), TLIF allows for a circumferential fusion via a single posterolateral approach and has been performed for many years with good clinical results (34). Although multiple previous studies have assessed outcomes after TLIF, there is a substantial knowledge gap in the literature pertaining to factors that affect the ability of these patients to RTW postoperatively. On the basis of previous reports in which authors showed that preoperative depression may negatively affect postoperative outcomes, we assessed the variability of postoperative missed work and determined the effect of preoperative depression on postoperative RTW in patients undergoing TLIF for degenerative spondylolisthesis.

## METHODS

### Patient Selection

Fifty-eight patients undergoing TLIF for symptomatic back and leg pain secondary to grade I degenerative lumbar spondylolisthesis were included in this analysis. The institutional review board approved this study. To be included, a patient had to have the following: 1) evidence on magnetic resonance imaging of grade I degenerative

lumbar spondylolisthesis; 2) mechanical low back pain and radicular symptoms; 3) nonresponsive to at least 6 weeks of conservative therapy; and 4) an 18–70 years of age. Patients were excluded if they had the following: 1) a history of a previous back operation; 2) an extraspinal cause of back pain or sciatica; 3) an active medical or workman's compensation lawsuit; 4) any preexisting spinal pathology; or 5) were unwilling or unable to participate with follow-up procedures. Patients with notable associated abnormalities such as inflammatory arthritis or metabolic bone disease also were excluded.

### Clinical Outcome Measures

Patient demographics, clinical presentation, indications for surgery, radiologic studies, and operative variables were assessed for each case. Patient-assessed outcome measures were prospectively obtained via phone interview. Preoperative and 3-year postoperative pain, disability, and quality of life were assessed by phone interview by an independent investigator not involved with clinical care. Questionnaires included visual analog scale for low back pain (BP-VAS) (19, 20, 37) and leg pain (LP-VAS) (20, 23), Oswestry Disability Index (ODI) (17, 18), Euro-Qol-5D (EQ-5D) (6, 25), North American Spine Society patient satisfaction index (40), and Zung self-rating depression scale (33, 45, 51). At each follow-up, productivity losses as the result of spine-related problem (i.e., missed work days) were recorded.

The Zung self-rating depression scale was used to assess preoperative depression. It is a 20-item questionnaire with well-established reliability and validity that rates the 4 common characteristics of depression: 1) the pervasive effect; 2) the physiologic equivalents; 3) psychomotor activities; and 4) other disturbances. The score of the Zung depression scale ranges from 20 “no depression” to 80 “major depression,” with a cut-off value greater than 49 indicating significant depressive symptoms.

### Statistical Analysis

All analyses were performed using JMP 7 (SAS Institute, Inc., Cary, North Carolina, USA) unless otherwise noted. Summary data were presented as means  $\pm$  standard deviations for parametric data and as medians with interquartile ranges for

nonparametric data. Percentages were compared via the Fisher exact test for intergroup comparison; the Student *t* test was used for parametric data and the Mann-Whitney *U* test for nonparametric data.

To understand the factors associated with prolonged RTW, we first performed univariate linear regression analysis between preoperative patient characteristics and time to RTW postoperatively. All variables associated with prolonged time to RTW in univariate analysis ( $P < 0.10$ ) were then included into a stepwise multivariate Cox proportional hazards model. Probability values with  $P < 0.05$  were considered significant.

## RESULTS

### Patient Population

A total of 58 patients were enrolled in this study. Overall, mean  $\pm$  standard deviation age at the time of surgery was  $54.4 \pm 12.0$  years. There were 17 (29%) male and 41 (71%) female patients. All patients presented with back and leg pain as well as radiographic evidence of grade I degenerative spondylolisthesis. Interbody fusion was performed at L3-4 in 6 (10%) patients, L4-5 in 36 (62%) patients, and L5-S1 in 16 (28%) patients. All cases were one-level fusions. Thirty-two (55%) patients were employed preoperatively. Twenty-two (69%) patients were employed in sedentary occupations, whereas 10 (31%) patients were employed in labor-intensive jobs. For all patients at presentation, mean BP-VAS and LP-VAS were  $7.9 \pm 2.9$  and  $6.2 \pm 3.6$ , respectively. Mean preoperative ODI and Zung depression scores were  $31.4 \pm 6.9$  and  $40.7 \pm 11.4$ , respectively. Mean preoperative EQ-5D perceived health state was  $0.33 \pm 0.22$  quality-adjusted life years.

### Postoperative Outcomes

All patient-reported outcomes assessed were significantly improved 2 years postoperatively ( $P < 0.001$ ). Mean improvements in BP-VAS and LP-VAS were  $5.1 \pm 3.5$  and  $3.9 \pm 4.3$ , respectively. Mean improvements in ODI and Zung depression scores were  $20.1 \pm 10.6$  and  $11.6 \pm 14.4$ , respectively. Mean improvement in EQ-5D was  $0.47 \pm 0.30$  quality-adjusted life years. Forty-eight (83%) patients responded that surgery met their expectations on the North American Spine Society patient satisfaction index.

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