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Clinical Study

Outcomes and presurgery correlates of lumbar discectomy in Utah Workers' Compensation patients

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Abstract

BACKGROUND CONTEXT: Lumbar discectomy is the most common type of back surgery performed in the United States. Outcomes after this procedure can be variable and it appears that Workers' Compensation patients might be at increased risk for poor outcomes.

PURPOSE: To examine long-term multidimensional outcomes of lumbar discectomy within a cohort of Workers' Compensation patients from Utah and identify presurgical biopsychosocial factors related to poor outcomes.

STUDY DESIGN/SETTING: A retrospective cohort study consisting of a review of presurgical medical records and assessment of patient outcomes via a telephone survey. Outcomes were assessed at least 2 years postsurgery.

PATIENT SAMPLE: A consecutive sample of 271 workers from Utah who underwent lumbar discectomy from 1994 to 1999. A total of 134 patients were surveyed at the time of follow-up.

OUTCOME MEASURES: Patient satisfaction, Roland-Morris Disability Questionnaire, SF-36v2, and Stauffer-Coventry Index.

METHODS: A retrospective review of presurgical biopsychosocial variables and outcome assessment via telephone survey was conducted.

RESULTS: Work disability rate for the cohort was 12.7% (17/134). Analysis of patient satisfaction, back pain-related dysfunction, and the Short-Form Health Survey-36 subscales indicated approximately 25% of patients experienced poor outcomes. Older age, number of comorbid health conditions, assigned case manager, litigation, and time delay from injury to surgery were consistently statistically significant predictors ($p<.05$) of poor outcomes.

CONCLUSIONS: Results of this study suggest that compensated back surgery patients are at greater risk for poor lumbar discectomy outcomes than noncompensation patients. Presurgery correlates of poor outcomes may be useful in identifying high-risk compensation patients.

Keywords: Lumbar discectomy; Patient outcomes; Biopsychosocial; Prediction

Introduction

Low back pain (LBP) represents a significant health problem for many individuals and is associated with staggering economic consequences [1,2]. For instance, approximately 80% of the US population experience LBP at some point in their lives for an estimated overall cost of nearly $171 billion [3,4]. Relative to individuals without LBP, those suffering from LBP account for a disproportionate amount of the economic impact on health-care expenditures and accumulate 60% more costs [5]. In terms of workplace

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injuries, LBP represents approximately 16% of all workplace compensation claims filed and accounts for nearly 33% of total claims costs [6]. At least 5% of LBP patients do not respond to conservative therapies (eg, physical therapy, patient education, over-the-counter pain relievers, light exercise) and experience chronic and disabling pain [7]. Notably, many of these individuals, particularly injured workers, will turn to surgical intervention as a next possible solution.

Annually, approximately 326,000 individuals will undergo lumbar discectomy [8]. The medical rationale for lumbar discectomy is that a bulging or herniated vertebral disc can put pressure on delicate nerve roots exiting the spine and consequently cause chronic LBP, sciatica (pain in legs), and associated neurological deficits (eg, reflex changes, parasthesias, loss of sensation). Lumbar discectomy involves identifying the bulging or herniated disc via imaging studies (computed tomography, magnetic resonance imaging) and excising the bulging or protruding part of the disc that is likely provocating the chronic pain. A number of discectomy techniques are used today, including percutaneous microdiscectomy, which is completed via arthroscopic instruments, and open discectomy, which requires a wider surgical exposure.

Lumbar discectomy has been criticized for producing inconsistent results [9–14]. For instance, Carragee et al. [9] noted via a literature review of nine studies that between 20% and 40% of patients who had open discectomy for herniated lumbar disc had persistent or recurrent sciatica, chronic back pain, or recurrent disc herniation. Donceel and Du Bois [10] reported that success rates for disc surgery varied from 70% to 90%, whereas Hoffman et al. [13], in a literature synthesis, noted an average discectomy success rate of 67%. Moreover, Workers' Compensation patients may be at an increased risk for poor outcomes after spinal surgery [15–17]. One study in particular [11] found that 43% of injured workers had a poor outcome after lumbar discectomy.

Given the high costs and risk of residual disability associated with spinal surgery, researchers and clinicians have sought to identify presurgical medical and psychosocial factors that portend outcomes for these patients [18–27]. The search for medical predictors for back surgery outcomes has been perplexing, as investigators have found that presurgical diagnoses are often not predictive of outcomes [22,23]. Two more recent studies [24,25] found that a diagnostic severity index based on presurgical imaging studies (magnetic resonance imaging, computed tomography) was not predictive of lumbar fusion patient outcomes. Other demographic and psychosocial risk factors have been shown to be more consistently predictive of patient outcomes. For example, older age, history of smoking, duration of chronic pain, number of prior back operations, presence of litigation, and presence of depression have been shown to be predictive of lumbar fusion outcomes [22–26]. In Utah for instance, we have found that poor lumbar fusion outcomes can be predicted by the following presurgical variables: increased number of prior low back operations, lower income at time of injury, older age, presence of litigation, alcohol use, and presence of depression [24,25,27]. Screening patients for such presurgical factors should allow for identification of patients at high risk for poor outcomes. Although such predictive factors have been identified for injured Utah workers who underwent lumbar fusion, it is unclear whether a similar predictive model will remain valid for lumbar discectomy patients.

Therefore, the purpose of the present study was to characterize the presurgical and postoperative biopsychosocial status of a cohort of compensated LBP patients who received lumbar discectomy. A secondary purpose was to examine the correlations of a number of presurgical biopsychosocial variables with long-term patient outcomes.

Methods

Study design

This was a retrospective cohort study consisting of a coding of presurgical information documented in patient medical records and a telephone outcome survey conducted with patients at least 2 years after their surgeries. The Institutional Review Board of Utah State University approved this study and the Workers' Compensation Fund of Utah (WCFU) provided permission to access patient medical records and contact patients for follow-up.

Patient sample

All patients who had undergone lumbar discectomy surgery from June of 1994 to December of 1999 and were at least 2 years postsurgery at the time of follow-up were eligible for inclusion (N=271). Patients were identified via Current Procedural Terminology (CPT) codes in WCFU databases. For each patient, lumbar discectomy surgery resulted from a verified workplace low back injury and the WCFU system covered medical and rehabilitation expenses and lost wages. Workers covered by federal worker compensation systems and self-insured employers were excluded because of inability to access data. The WCFU insures approximately 55% of eligible Utah workers.

Medical record information

Presurgical medical record data were gathered via an independent and objective review of medical chart information contained within the WCFU computer databases. A review form was created that included a specific coding scheme for all presurgical variables of interest. Data abstractors were two trained psychology doctoral students who were not involved in treatment of study patients. Quality assurance of this data collection was assured through systematic training of graduate students by the lead author involving review of numerous prior coding examples, practice codings, weekly meetings to resolve coding questions/problems, and data entry verification for a random sampling of cases. The sociodemographic variables coded for this study included gender, age at time of injury, education level at time of injury, average weekly income at time of injury, number of prior low back surgeries, number of physical comorbid health conditions (eg, diabetes, heart disease, stroke, arthritis, asthma, hypertension, colitis, cancer history, trauma history, infectious history, autoimmune history, steroid usage, and ‘‘other’’ category), depression (defined as current Diagnostic and Statistical Manual of Mental Health Disorders-4th Edition (DSM-IV) diagnoses of major depressive disorder, dysthymia, or adjustment disorder with depressed mood in preoperative medical records), nurse case management (NCM) services at time of surgery, litigation as defined by patient private lawyer involvement in the compensation case at the time of surgery, type of discectomy operation (open or percutaneous), and time delay from injury to surgery.

Patient outcome survey

An objective outcome instrument, including an interview script for telephone interviewers, was created. This instrument included three *patient satisfaction items* (quality-of-life improvement as a result of lumbar discectomy surgery, perceived back/leg pain improvement, satisfaction with back condition at time of follow-up) drawn from a recent study of compensated fusion patients [22]. We have also used these same satisfaction measures in a number of prior lumbar fusion studies involving injured Utah workers [24,25,27]. *Disability status* at the time of follow-up was assessed by asking subjects if they were currently receiving total disability benefits for their back condition. The *Roland & Morris Back Pain Disability Questionnaire* (DQ) was also used and is a 24-item self-report measure designed to evaluate dysfunction associated with LBP [28,29]. The *Stauffer-Coventry Index* was selected as a clinical surgical outcome measure [30]. This measure is used for assessing low back surgical outcomes and has been used as the central outcome measure in two systematic reviews of back surgery literature [23,31]. We have also used this in our prior studies of Utah lumbar fusion patients [24,25]. This measure is designed for post-surgery administration and consists of four multiple response self-report questions regarding pain reduction, return to work, limitations of physical activities, and medication usage. The response alternatives for each question reflect Good, Fair, and Poor outcomes. Good outcome anchors across the four subscales included: 76% to 100% relief in leg and back pain, return to previous work status, minimal or no restriction of physical activities, occasional mild analgesics or no analgesics; (b) Fair outcome anchors: 26% to 75% relief of leg and back pain, return to lighter work, moderate restrictions of physical activities, regular use of non-narcotic analgesics; and (c) Poor outcome anchors: 0% to 25% relief of leg and back pain, no return to work after surgery, severe restrictions of physical activities, occasional or regular use of narcotic analgesics. The Short-Form Health Survey-36 (SF-36) is a 36-item general health survey that was used to assess eight general subjective dimensions of physical and mental health-related quality of life [32,33]. The eight distinct health dimensions assessed by this measure include 1) Physical Functioning: extent to which health interferes with performance of a variety of behavioral activities (eg, sports, carrying groceries, climbing stairs, and walking); 2) Role Physical: extent to which health interferes with usual daily activities such as work, housework, or school; 3) Bodily Pain: intensity of bodily pain during last month and extent to which it interferes with normal work; 4) General Health: current evaluation of personal health; 5) Vitality: degree to which a person feels full of pep and energy or worn out and tired; 6) Social Functioning: extent to which health interferes with normal social activities like visiting friends during the past month; 7) Role Emotional: degree to which emotional problems resulted in problems with work or daily function; and 8) Mental Health: degree to which a person feels nervous and depressed. Authors of the SF-36 indicate that the eight subscales may be aggregated into Mental Health (MCS) and Physical Health (PCS) Component Summary scales [33]. These summary scales capture 80% to 85% of the variance in the eight SF-36 scales and allow researchers to perform statistical analyses on two higher-order constructs (MCS/PCS) rather than separate analyses for each of the eight SF-36 subscales.

Telephone outcome survey procedures

Initial contact with patients occurred via a patient letter sent to their most recent address identified in medical records. This letter was sent to all patients who met the inclusion criteria and explained the research purposes of the study, procedures and assurances of confidentiality, and a request for their participation. A self-addressed and stamped card was included so that patients could inform researchers of any changes in address or telephone numbers and of their agreement to participate in the study. Patients who mailed cards back were immediately contacted by telephone for the survey. Patients who did not send back cards were sent as many as two additional contact letters requesting their participation. If patients still did not respond, a telephone contact was attempted and if the patient verbally consented, the survey was completed at that time. The telephone outcome surveys were completed by a number of Utah State University graduate and undergraduate students who had no treatment contact with patients. The interviewers were trained in basic interviewing skills and also used a detailed written script to follow when conducting the survey. Quality assurance of these data was assured through careful training, weekly meetings with interviewers to discuss coding issues, and redundant data entry of a random sampling of cases. All surveys were completed in one session taking between 20 to 75 minutes to complete. The possibility of winning a drawing of $500 was offered to patients as an incentive to participate.

Results

Presurgical patient and follow-up data

A total of 271 patients were included in the study cohort. Patients received their surgeries between June 1, 1994 and December 30, 1999. There were 223 men (82.3%) and 48 women (17.7%) whose medical charts were reviewed. Ninety-four percent of the participants were Caucasian, 5.2% were Hispanic, 0.4% were black, and 0.7% were ‘‘other.’’ Preoperative diagnoses for the 271 patients were as follows: disc herniation (90.0%), degenerative disc disease (1.8%), degenerative spondylolisthesis (0.4%), spinal stenosis (0.4%), disc herniation and degenerative disc disease (4.4%), and disc herniation and spinal stenosis (3.0%). There were a total of seven patients who did not have a diagnosis of disc herniation based on operative report review. Of these patients, five had a diagnosis of degenerative disc disease, one had a diagnosis of degenerative spondylolisthesis, and one had a diagnosis of spinal stenosis. On reading the operative reports, it was clearly evident that a disc herniation was evident and treated via discectomy in the particular cases. Patients received either percutaneous discectomy (46.1%) or open discectomy (53.9%). These discectomies were performed on the following vertebral levels: L5–S1 (50.9%), L4–L5 (37.3%), L3–L4 (4.1%), L2–L3 (0.7%), L5–L6 (0.4%), and multiple levels (6.6%). In terms of radiating LBP: 11.9% of patients had back pain radiating to the thigh; 54.5% had back pain radiating to the leg; 30.6% had back pain radiating to the foot, and 3.0% reported no pain radiation. Fifty-five percent of patients had lower extremity motor deficits. Seventy surgeons were involved in the 271 operations. The overall follow-up rate for the patient outcome survey was 49.4% (134/271). Average time to follow-up was 4.9 years (SD=1.1). The minimum time to follow-up was 2.4 years and maximum was 7.2 years. A Multivariate Analysis of Variance (MANOVA) comparing respondents versus nonrespondents on the 11 presurgical characteristics was conducted to determine possible response biases. This analysis (see Table 1) determined respondents were slightly younger and less likely to have legal representation than nonrespondents. Because these differences were very small [please see eta-squared value and standardized mean difference (SMD) values in Table 1], it was assumed that results of the outcome survey were not differentially biased based on presurgical characteristics.

Table 1
Comparisons of presurgical characteristics for respondents versus nonrespondents[a]

	Respondents (N=134)	Nonrespondents (N=137)	t or Chi-square p value	Effect size[b]
Presurgical variable	Means or proportion	Means or proportion	p Value	(Eta-Squard/SMD)
Gender			0.81	−0.01
Male	81.8%	82.8%		
Female	18.2%	17.2%		
Age	36.55	40.24	0.00	−0.35
Education			0.06	0.20
<12 y	8.2%	17.5%		
HS degree/GED	46.3%	44.5%		
Some college	20.1%	15.3%		
Trade school/AA	16.4%	19.7%		
College degree	7.5%	2.9%		
Graduate degree	1.5%	0.0%		
Average weekly income	$587.61	$535.58	0.22	−0.15
Prior low back surgery			0.59	0.08
None	91.0%	88.3%		
One	6.7%	9.5%		
Two	2.2%	1.5%		
Three	0.0%	0.7%		
Number comorbid health conditions			0.39	0.12
None	44.8%	54.7%		
One	37.3%	29.2%		
Two	11.9%	12.4%		
Three	5.2%	3.6%		
Four	0.7%	0.0%		
Depression	13.4%	19.0%	0.22	0.22
Case management	19.4%	24.8%	0.28	−0.06
Lawyer involvement	11.9%	24.1%	0.01	−0.16
Discectomy type				
Open	49.3%	58.4%	0.13	0.09
Percutaneous	50.7%	41.6%		
Time delay from injury to surgery (days)	407.4	274.0	0.09	0.20

[a] Wilks' Lamda=0.904 (df=11, 259), F=2.512, p=.005.
[b] Effect sizes based on univariate analyses.
SMD=Standardized Mean Difference; HS=High School; GED=General Educational Development; AA=Associate of Arts.

Patient satisfaction items

Patient responses to the three patient satisfaction items are presented in Table 2. The coefficient alpha for the three satisfaction items was 0.73, which is indicative of acceptable internal consistency. As may be seen in Table 2, approximately 76% of patients reported they had little to great improvement in their quality of life as a result of their surgery. Approximately, 22% of patients had back/leg pain that was worse than they had expected and 40% of patients were either somewhat to extremely dissatisfied with their back condition at time of follow-up.

Disability status

Thirteen percent (17/134) of the follow-up cohort were totally and permanently disabled at follow-up.

Table 2
Patient satisfaction outcomes

Outcome category	Frequency	Percentage
Quality-of-life improvement resulting from lumbar discectomy surgery		
A great improvement	49	36.6
A moderate improvement	35	26.1
A little improvement	17	12.8
No change	14	10.4
A little worse	1	0.7
Moderately worse	8	6.0
Much worse	10	7.5
Is your back or leg pain problem better than, worse than, or what you expected it to be at this point		
Much better	41	30.6
Somewhat better	35	26.1
What I expected	14	10.4
No expectations	15	11.2
Somewhat worse	21	15.7
Much worse	8	6.0
Satisfaction with back condition as it is right now		
Extremely dissatisfied	14	10.4
Very dissatisfied	17	12.7
Somewhat dissatisfied	23	17.2
Neutral	13	9.7
Somewhat satisfied	46	34.3
Very satisfied	13	9.7
Extremely satisfied	8	6.0

Roland & Morris DQ

Patients obtained a mean score of 8.3 (SD=6.60) with a minimum score of 0 and a maximum score of 24. On the basis of the recommendation from the original articles, a cutoff of 14 or more points was used to determine poor outcome [28,29]. Consequently, 25.4% of the follow-up group fell into the poor outcome range. This relatively high percentage of poor outcomes stands in contrast to the 15% that was found in the original standardization sample of LBP patients (nonsurgical) [28,29].

Stauffer-Coventry data

The four subscale items for the Stauffer-Coventry Index are presented in Table 3. The coefficient alpha for the four items was 0.74 which reflects acceptable internal consistency. The percentages of good outcomes ranged from 39.6% for Physical Limitations (minimal or no restrictions) to 60.4% for Medication Usage (Occasional or no use of mild analgesics). The average percent of good outcomes across the four items is approximately 50%. The percentages of fair outcomes ranged from 17.9% for the Pain Medication item (regular use of non-narcotic analgesics) to 43.3% for the Physical Limitations item (moderate restrictions). The average percent of fair outcome across the four items was approximately 32.3%. The percentages of poor outcomes ranged from 13.4% for the Pain Relief item (0–25% Improvement in Pain) to 21.6% for the Medication Usage item (occasional or regular use of narcotic analgesics). The average percent of poor outcomes across the four items was approximately 17.7%.

SF-36

Table 4 contains the follow-up sample means and standard deviations for the six SF-36 subscales along with normative means and standard deviations for the General US Population and patients with back pain/sciatica [32,33]. Standardized mean difference for each sample/norm comparison is also provided. In comparing the discectomy sample means to the general population means, effect sizes range from 0.0 to 0.8. As expected, effect sizes were generally large in magnitude for scales loading more on physical quality of life (physical functioning, role physical, pain). Effect sizes were quite modest for the other scales. In comparing the discectomy means with the back pain specific norms, overall effect sizes were quite modest. It appeared that the discectomy patients, who were at least 2 years postsurgery, had slightly lower physical functioning and higher mental health functioning than the back pain normative group.

Using presurgical variables in prediction of patient outcomes

Tables 5a–12 contain results of correlational analyses using the eight presurgical variables to predict patient

Table 3
Stauffer-Coventry Index: subscale scores and aggregate ratings

Pain relief			Employment status			Physical limitations			Medication usage		
Category	Frequency	%	Category	Frequency	%	Category	Frequency	%	Category	Frequency	%
Good (76–100% improvement)	70	52.2	Good (return to previous work status)	64	47.8	Good (minimal or no restrictions)	53	39.6	Good (occasional or no use of mild analgesics)	81	60.4
Fair (26–75% improvement)	46	34.3	Fair (return to lighter work)	45	33.6	Fair (moderate restrictions)	58	43.3	Fair (regular use on non-narcotic analgesics)	24	17.9
Poor (0–25% improvement)	18	13.4	Poor (no return to work)	25	18.7	Poor (severe restrictions)	23	17.2	Poor (occasional or regular use of narcotic analgesics)	29	21.6

Note. Percentages based on follow-up n of 134 patients.

Table 4
Descriptive statistics for Short-Form 36v.2 health survey subscales

SF-36 (v.2) subscale	Utah discectomy sample (SD)	General population, mean (SD)[a]	General population effect size[b]	Back pain/sciatica mean (SD)[c]	Back pain/sciatica effect size[b]
Physical Functioning (6 items)	43.8 (11.3)	50.0 (10.0)	−0.6	46.6 (11.3)	−0.2
Role Functioning (2 items)	43.9 (11.6)	50.0 (10.0)	−0.6	46.4 (11.4)	−0.2
Pain Severity (1 item)	42.9 (11.0)	50.0 (10.0)	−0.7	44.6 (9.28)	−0.2
General Health (5 items)	47.6 (11.0)	50.0 (10.0)	−0.2	46.5 (10.6)	+0.1
Vitality (5 items)	47.6 (11.1)	50.0 (10.0)	−0.2	46.5 (10.2)	+0.1
Social Functioning (5 items)	48.4 (11.3)	50.0 (10.0)	−0.2	46.9 (11.2)	+0.1
Role-Emotional Functioning (1 item)	48.9 (9.8)	50.0 (10.0)	−0.1	47.6 (11.3)	+0.1
Mental Health Functioning (1 item)	50.4 (11.3)	50.0 (10.0)	0.0	47.6 (10.9)	+0.3
Physical Component Summary	42.4 (11.1)	50.0 (10.0)	−0.8	45.6 (10.8)	−0.3
Mental Component Summary	51.6 (10.0)	50.0 (10.0)	+0.2	47.9 (11.0)	+0.3

[a] General US Populations norms (N=1,982).
[b] Standardized mean difference=differences between means divided by normative sample SD.
[c] Defined as attacks of back pain or sciatica within last months (N=766).

outcomes. It should be noted that based on reviewers' suggestions, three additional presurgical/surgical variables were examined to determine their potential impact on outcomes. Specifically, motor deficits, time to telephone survey follow-up, and number of levels operated on during surgery did not demonstrate consistent correlations with outcomes. Therefore, these additional variables were not included in these analyses. Tables 5a and 5b contain Pearson r correlations among presurgical variables with outcome variables. Age, number of comorbid health conditions, assigned case manager, lawyer, and time delay from injury to fusion appeared to be consistent predictors of patient outcomes. Table 6 contains results of a multiple logistic regression analysis of the presurgical patient variables on postsurgical disability status. For this analysis, the chi-square was statistically significant as were four presurgical variables (age, case manager, lawyer, time delay). The corresponding odds ratios (Exp β) for each of the variables are also presented. The sensitivity and specificity of this model were 59% and 98%, respectively. The positive predictive value of this model was 89%. These values suggest adequate clinical utility for this model. Results of a simultaneous entry multiple linear regression of the presurgical model on the Roland & Morris DQ are presented in Table 7. The model accounted for 24% of variance in DQ total score. The presurgical variables of age at time of surgery and lawyer were statistically significant predictors. Tables 8–10 contain results of three simultaneous entry multiple linear regression equations of the presurgical model on the Return to Work, Physical Restrictions, and the Pain Medication items of the Stauffer-Coventry Index. The regression model for the Pain Reduction item was not statistically significant and was thus not included. As may be seen in Table 8, older age, lower education, referral for case management, lawyer, and time delay were all statistically significant predictors of the Return to Work scale and the overall model accounted for 37% of the variance. As may be seen in Table 9, older age, numbers of prior back operations, case manager, and lawyer were all statistically significant predictors accounting for 25% of the variance of the Physical Restrictions item. As may be seen in Table 10, time delay from injury to surgery was the only statistically significant predictor of Pain Medication Usage, accounting for

Table 5a
Correlations of presurgical variables with outcome variables

	Outcome variables					
Predictor variable	Disability status	Disability Questionnaire	SC: Pain relief category	SC: Return to work status	SC: Physical restrictions	SC: Pain meds
Gender	0.00	0.10	0.00	0.04	0.14	0.00
Age	0.34*	0.29*	0.22*	0.22*	0.35*	0.20*
Educational level	−0.20*	−0.22*	−0.11	−0.30*	−0.15	−0.02
Average weekly income	−0.07	−0.02	−0.10	−0.12*	−0.01	−0.05
Number prior low back operations	0.07	0.15	0.11	0.14	0.23*	0.04
Comorbid health conditions	0.34*	0.23*	0.11	0.14	0.25*	0.15
Depression	0.11	0.14	0.18*	0.12	0.03	0.08
Case manager assigned	0.27*	0.24*	0.11	0.41*	0.21*	0.19*
Lawyer involvement	0.34*	0.26*	0.17	0.29*	0.24*	0.09
Type of discectomy	−0.12	−0.06	−0.08	−0.10	−0.08	−0.05
Time delay injury to surgery	0.39*	0.21*	0.03	0.29*	0.15	0.22*

*$p \leq .05$. SC=Stauffer-Coventry Index.

Table 5b
Correlations of presurgical variables with Short-Form 36 subscales and Composite scales

Predictor variable	Outcome variables: Physical Functioning	Role Functioning	Pain Severity	General Health	Vitality	Social Functioning	Role-Emotional Functioning	Mental Health Functioning	PCS	MCS
Gender	−0.14	0.02	−0.07	−0.06	−0.09	−0.02	−0.01	−0.07	−0.07	−0.03
Age	−0.37*	−0.34*	−0.28*	−0.33*	−0.32*	−0.30*	−0.21*	−0.21*	−0.38*	0.20*
Educational level	0.20*	0.19*	0.17	0.18*	0.09	0.13	0.11	0.13	0.21*	0.08
Average weekly income	0.01	−0.04	0.10	0.06	−0.08	−0.02	0.10	0.13	−0.01	0.08
Number prior low back operations	−0.15	−0.08	−0.07	−0.11	−0.05	−0.02	−0.10	−0.06	−0.11	−0.04
Comorbid health conditions	−0.28*	−0.27*	−0.20*	−0.21*	−0.21*	−0.36*	−0.20*	−0.13	−0.28*	−0.18*
Depression	−0.26*	−0.16	−0.17*	−0.14	−0.26*	−0.18*	−0.16	−0.21*	−0.19*	−0.19*
Case manager assigned	−0.20*	−0.16	−0.11	−0.09	−0.14	−0.18*	−0.32*	−0.27*	−0.09	−0.29*
Lawyer involvement	−0.25*	−0.19*	−0.21*	−0.18*	−0.16	−0.24*	−0.03	−0.07	−0.27*	−0.05
Type of discectomy	0.14	0.07	0.06	0.13	0.05	0.01	0.10	0.02	0.12	0.01
Time delay injury to surgery	−0.22*	−0.22*	−0.14	−0.21*	−0.06	−0.14	−0.02	−0.08	−0.25*	0.00

*p≤.05.

25% of the variance. Tables 11 and 12 contain the regressions of the eight presurgical variables on the SF-36 Physical (PCS) and Mental Composite (MCS) scales. The model predicted 30% of the variance in the PCS with age, depression, lawyer, and time delay each accounting for statistically significant amounts of variation. The model predicted 14% of the MCS with case manager being the only statistically significant predictor. In summary, the most robust predictors across a multidimensional array of outcomes were age, comorbid health conditions, assigned case manager, lawyer, and time delay from injury to discectomy surgery.

Discussion

The results of this study indicate that approximately 40% of compensated lumbar discectomy patients were somewhat to extremely dissatisfied with their results and 13% were disabled at the time of study follow-up. Twenty-five percent of patients exceeded the clinical cutoff for poor outcomes on the Roland & Morris DQ. Patients evidenced lower scores on SF-36 subscales than US general population norms. In general, most outcome variables were predicted by age at time of injury, depression, number of comorbid health conditions, whether a case manager was assigned, lawyer, and time delay from injury to surgery.

The outcomes of this study appear to be commensurate or a bit better than other studies of compensated medical patients who have undergone lumbar discectomy for disc herniation [34,35]. For example, Atlas et al. [35] reported a 17% disability rate at 5- to 10-year follow-up and an average Modified Roland-Morris score of 16.8 for compensation patients versus 13% and 8.3 in the present study, respectively. Another study of compensated discectomy patients noted 43% of workers have poor outcomes after discectomy [11]. The overall outcomes in this study suggest that a significant number of compensated discectomy patients had less than optimal outcomes and this highlights the need to further ascertain why some patients seem to do worse than other patients. At least part of this variation

Table 6
Logistic regression equation predicting disability status with nine presurgical variables as predictors[a]

Variable	β	p Value	Exp β	95% Confidence intervals
Age	0.116	.007	1.123	(1.031–1.222)
Education	−0.967	.068	0.380	(0.135–1.075)
Prior low back operations	−0.651	.478	0.522	(0.086–3.150)
Comorbid health conditions	0.718	.129	2.050	(0.811–5.186)
Depression	0.368	.733	1.446	(0.174–12.039)
Case manager assigned	1.773	.054	5.886	(0.967–35.83)
Lawyer	2.599	.004	13.451	(2.277–79.47)
Time delay	0.001	.004	1.001	(1.000–1.002)
(constant)	−12.479	.0004	0.000	

[a] Wald=55.20, p=.000; model correctly predicted 93.3% of cases.

Table 7
Simultaneous entry multiple regression: predicting Disability Questionnaire total score with presurgical variables as predictors[a]

Variable	Coefficients: Unstandardized coefficients β	SE	Standardized coefficients β	p Value
Age	0.136	4.651	0.219	.012
Education	−0.764	0.053	−0.133	.097
Prior low back operations	0.990	0.457	0.057	.488
Comorbid health conditions	0.461	1.424	0.063	.476
Depression	1.556	1.540	0.081	.314
Case manager assigned	2.526	1.351	0.152	.064
Lawyer	4.072	1.652	0.201	.015
Time delay	0.001	0.001	0.144	.079
(constant)	−5.419	3.843		.161

[a] R-squared=0.247; p value for model=.000; SE=Standard Error.

Table 8
Simultaneous entry multiple regression: predicting Stauffer-Coventry return to work subscale with presurgical variables as predictors[a]

	Coefficients			
	Unstandardized coefficients		Standardized coefficients	
Variable	β	SE	β	p Value
Age	0.012	0.006	0.169	.034
Education	−0.115	0.049	−0.173	.019
Prior low back operations	0.074	0.151	0.037	.626
Comorbid health conditions	−0.029	0.069	−0.034	.675
Depression	0.083	0.164	0.037	.614
Case manager assigned	0.656	0.143	0.341	.000
Lawyer	0.517	0.175	0.220	.004
Time delay	0.000	0.000	0.233	.002
(constant)	−0.001	0.408		.998

[a] R-squared=0.366; p value for model=.000; SE=Standard Error.

Table 10
Simultaneous entry multiple regression: predicting Stauffer-Coventry pain medication usage subscale with presurgical variables as predictors[a]

	Coefficients			
	Unstandardized coefficients		Standardized coefficients	
Variable	β	SE	β	p Value
Age	0.012	0.007	0.151	.106
Education	0.038	0.062	0.053	.537
Prior low back operations	−0.058	0.192	−0.027	.763
Comorbid health conditions	0.043	0.087	0.047	.620
Depression	0.088	0.208	0.037	.674
Case manager assigned	0.344	0.182	0.166	.061
Lawyer	0.119	0.223	0.047	.594
Time delay	0.000	0.000	0.209	.019
(constant)	0.275	0.518		.596

[a] R-squared=0.12; p value for model=.042; SE=Standard Error.

may be explained by differences in presurgical patient characteristics, which were shown to influence outcomes. For example, the number of comorbid health conditions proved to be a relevant variable as 55.2% of the sample had at least one physical comorbid condition and the total number of conditions was a predictor of multiple outcomes. These findings are consistent with other studies that have studied physical comorbidities among spine pain patients [36,37]. For instance, Von Korff et al. [36] found 55.3% of spinal pain patients had at least one comorbid physical condition and the total number of physical conditions were positively related to role disability. The authors of this study indicated that conceptualizing spine pain within the context of multiple physical and mental health complaints is prudent and justifies a battery of approaches (surgery and psychological treatment) for chronic pain versus a singular approach (ie, surgery). Hagen et al. [37] suggested that spine pain might be a specific symptom within a syndrome of generalized muscle pain, sleep problems, anxiety, and depression. Medical and psychiatric comorbidity certainly appears to be the norm for many compensated back surgery patients and may help to explain why some patients are at higher risk for poor outcomes.

Another interesting and consistent predictor associated with poor outcomes was patient assignment to NCM. Referral to NCM is typically made when a back pain patient is thought to be at risk for prolonged disability and failing to return to work. NCM typically involves a nurse accompanying the patient to all or most medical appointments and facilitating an appropriate treatment plan for a patient that hopefully will allow the patient to return to work. The nurse case manager will work to coordinate various treatment providers and will work with the patient's adjustor to optimize the appropriate treatment options for the patient. An interesting finding from the present study is the association of NCM with worse patient outcomes. This is somewhat counterintuitive as it is expected that NCM should be associated with improved patient outcomes. However, another recent study found a small positive association between early referral to NCM and disability

Table 9
Simultaneous entry multiple regression: predicting Stauffer-Coventry physical restrictions subscale with presurgical variables as predictors[a]

	Coefficients			
	Unstandardized coefficients		Standardized coefficients	
Variable	β	SE	β	p Value
Age	0.019	0.006	0.274	.002
Education	−0.040	0.050	−0.064	.425
Prior low back operations	0.326	0.155	0.172	.038
Comorbid health conditions	0.074	0.070	0.093	.293
Depression	−0.076	0.168	−0.036	.650
Case manager assigned	0.287	0.147	0.158	.054
Lawyer	0.390	0.180	0.176	.032
Time delay	0.000	0.000	0.049	.546
(constant)	0.331	0.419		.431

[a] R-squared=0.250; p value for model=.000; SE=Standard Error.

Table 11
Simultaneous entry multiple regression: predicting Short-Form Health Survey-36 Physical Composite subscale with presurgical variables as predictors[a]

	Coefficients			
	Unstandardized coefficients		Standardized coefficients	
Variable	β	SE	β	p Value
Age	−0.329	0.086	−0.316	.000
Education	1.312	0.741	0.136	.079
Prior low back operations	0.542	2.306	0.019	.815
Comorbid health conditions	−0.841	1.045	−0.068	.423
Depression	−5.277	2.495	−0.163	.036
Case manager assigned	0.659	2.189	0.024	.764
Lawyer	−7.729	2.675	−0.227	.005
Time delay	−0.003	0.001	−0.190	.017
(constant)	67.709	6.225		.000

[a] R-squared=0.301; p value for model=.000; SE=Standard Error.

Table 12
Simultaneous entry multiple regression: predicting Short-Form Health Survey-36 Mental Health Composite subscale with presurgical variables as predictors[a]

	Coefficients			
	Unstandardized coefficients		Standardized coefficients	
Variable	β	SE	β	p Value
Age	−0.132	0.086	−0.141	.126
Education	0.164	0.739	0.019	.825
Prior low back operations	−0.740	2.300	−0.028	.748
Comorbid health conditions	−0.955	1.043	−0.086	.362
Depression	−3.720	2.488	−0.128	.137
Case manager assigned	−6.042	2.183	−0.240	.007
Lawyer	0.011	2.668	0.000	.997
Time delay	0.000	0.001	0.027	.757
(constant)	68.624	6.208		.000

[a] R-squared=0.140; p value for model=.013; SE=Standard Error.

duration among LBP patients [38]. It may be that patients referred for NCM are at higher risk for poor outcomes initially but this risk is somewhat reduced through NCM although not to a point where outcomes are ultimately commensurate with non-NCM patients. This is certainly an interesting finding that is worthy of more controlled studies.

Litigation proved another fairly robust predictor and this is consistent with our prior studies of compensated lumbar fusion patients in Utah [24,25,27]. Litigation among compensated low back patients appears to be a consistent factor associated with poorer clinical and cost outcomes. It now appears appropriate to begin studies examining the differences among litigated versus nonlitigated patients in terms of psychosocial and behavioral characteristics that might place them at higher risk for poor outcomes. It may be the involvement of a lawyer implies a contested aspect of the Workers' Compensation case, and it may be this conflict, rather than the lawyer, that is driving the negative influence on outcome. It might be appropriate to conduct some interview-based studies, which inquire about the patients thinking and motivational processes involved in deciding to hire a lawyer.

As in prior studies of lumbar fusion [24,25,27], we found that older age at time of injury and time delay from injury to surgery were additional predictors of outcomes. Older age might be associated with less biophysical resources to heal and recover after a surgery and hence its association with poor outcomes. A greater time delay from injury to surgery may be associated with greater physical deconditioning and this may be associated with an increased chance of poor outcomes [24]. Delay in surgery may also reflect a different clinical situation that is less responsive to surgery. Many cases with delayed surgery may have less obvious indications for surgery. Sometimes a surgeon may provide an operation for marginal indications after being worn down by multiple patient requests. Further, a patient might continue to consult multiple surgeons (a time-consuming process) until they find one who is willing to operate for marginal indications. Depression was also found to be a predictor of poor outcomes and this is consistent with prior studies [24–27]. Depression is likely involved in the maintenance and exacerbation of a chronic pain experience. Future studies would benefit from using more structured and objective assessments of depression as the psychometric properties of clinician-provided DSM-IV depression diagnoses used in the present study are uncertain.

There were also some interesting variables that proved to be not consistent predictors of patient outcomes including income at time of surgery and number of prior low back operations. In prior studies of lumbar fusion, we have found income and number of prior back injuries to be consistent predictors of both clinical and cost outcomes [24,25,27]. There were very low rates of patients in this study with prior back surgeries (9%) and this lack of variability likely limited the degree of association with outcomes. The fact that lower income level has been clearly associated with poor lumbar fusion outcomes [24] but not discectomy outcomes is interesting and may reflect that income becomes more predictive as a person progresses through a number of back surgery procedures. It may be that the prospect of returning to a low paying job after a lumbar fusion and lengthy rehabilitation is much less motivating than after a simple discectomy and typically a much less complicated recovery.

A central limitation of this study includes a fairly poor follow-up rate and this raises the possibility of sample bias and problematic generalizability to the target population (compensated lumbar discectomy patients in Utah). Respondents were slightly younger and less likely to have legal representation than nonrespondents. Because older age and legal representation are consistently predictive of worse outcomes, we would expect to see somewhat worse discectomy outcomes in the overall population than in the present sample. We also note this is an ethnically nondiverse sample, which likely limits generalizability of study findings to non-white ethnic groups. It is also acknowledged that some of the outcome measures used in this study (Stauffer-Coventry Index and Patient Satisfaction Items), while used with some frequency in the spine literature, lack evidence of acceptable psychometric properties. Although we have reported some evidence of acceptable internal consistency for these measures in the present study, it would be prudent to further clarify the reliability and validity of these measures in future studies. This study also used a retrospective design and lacked an appropriate control group, which necessarily limits our assertions regarding efficacy of this procedure.

Despite these limitations, this study demonstrates that significant number of compensated back surgery patients reports poor outcomes. Patients at risk for poor outcomes may be identified before surgery based on biopsychosocial characteristics often available in a patient's chart. If such higher-risk patients can be identified before surgery, an appropriate presurgical intervention consisting of patient education regarding likely outcomes and a referral to a rigorous multidisciplinary functional restoration program might lead to better outcomes and patient satisfaction associated with this procedure.

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