JAOA Original contribution

Predicting factors of successful recovery from lumbar spine surgery among workers' compensation patients

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It is commonly believed that patients who are compensated for a work-related injury have less incentive to return to work. This study evaluated how various factors affected the outcomes of lumbar spine surgery in terms of pain relief, functional status, return to work, and general health. Eighty-seven workers' compensation patients had spinal fusion or microdiskectomy. Subjects were evaluated preoperatively and postoperatively using the Oswestry disability scale and the Visual Analog Scale for Pain.

The type of surgery performed significantly affected patient outcomes, while such factors as gender, age, smoking, and litigation were insignificant. Microdiskectomy patients, for example, had greater reduction in pain and disability than did fusion patients ($P < .01$). Return-to-work status was negatively affected by fusion ($P < .01$). Overall, 55% of patients did return to work in some capacity, but the rate was 72% for microdiskectomy patients versus 43% for fusion patients. While outcomes significantly improved, postoperative scores remained severe. This did not correlate with return-to-work rates, suggesting that outcomes measures may not be effective.

(Key words: low back pain, workers' compensation, surgery)

More than 5 million Americans are disabled by back pain, and half of these individuals have a permanent condition. In 1990, the direct and indirect costs resulting from low back pain totaled more than $50 billion in the United States alone. Furthermore, many of these low back problems are the result of work-related injuries that are covered by workers' compensation benefits. Back pain is a common symptom in work-related injuries and is the third leading cause of total work disability, accounting for approximately 40% of all compensation costs.[1-3] The annual cost of workers' compensation related to the low back totals more than $11 billion, with 70% to 90% of these expenditures resulting from chronic disabilities.[4] Clearly, work-related injuries have become a significant medical and economic problem.

Previous studies have attempted to identify factors that might adversely affect a patient's chances of a successful recovery following spinal surgery. In addition to organic factors (diagnosis, treatment, muscle strength, endurance, age, and gender), several nonorganic factors have been linked to lower rates of surgical success.[5,6] These nonorganic factors include psychological profile and educational status of the patient, work environment, compensation, perception of injury, attorneys, and duration of disability.

It has been suggested that workers' compensation has a negative effect on the recovery of patients from work-related injuries.[7,8] Many authorities assume that patients who are compensated for work-related injuries have less incentive to return to their previous level of functioning, an impression that has significant historical precedent. Rigler[9] coined the term *compensation neurosis* in 1879 to describe the increased rate of disability following railway accidents due to the introduction of compensation legislation. Also, a previous study reported that 91% of the patients represented by counsel were not working at the time of their examinations, whereas only 77% of those not represented were off of work. This suggests that iatrogenic and "jurisgenic" factors have a direct effect on the prolongation of medical care, which contributes to the high cost of compensation.[10] Others have compared the recovery periods of workers' compensation patients with other patients and determined that payment of compensation delays recovery from low back injury.[9,11-13] Leavitt[13] tried to ascertain whether the level of physical exertion, rather than compensation itself, accounted for disability status, but his research determined that on-the-job injury leads to prolonged disability time regardless of the type of job performed.

While compensation may play a significant role in a patient's rate of recovery, other nonorganic factors also warrant investigation. Factors such as gender, smoking, age, and surgery type may be used to determine which patients within the workers' compensation population are most likely to recover.

Some researchers have reported that significantly more men than women were classified as unfit for work and that settlement of compensation claims resulted in reduced Oswestry disability scores in women but not in men.[1,9] However, another study reported that female patients had worse postsurgical results than males.[14]

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Smoking has been reported to contribute to degenerative disk disease, and the rate of pseudoarthrosis after fusion among smokers is three to four times higher than the rate for nonsmokers.[15] Additionally, Silcox and others[16] established a direct relationship between nonunion of the spine following fusion and the presence of systemic nicotine in an animal model. Fifty-six percent of control animals in that study were determined to have solidly fused lumbar spines; however, those animals receiving nicotine exhibited no solid fusions.

Age also contributes to disability problems. Patients older than 50 years return to work less frequently than do those younger than 50 years, and the risk of poor outcome increases by 37% for each 10-year increase in age.[11,12,17]

The optimal choice of surgical procedure for treating spinal disorders remains a matter of debate.[18-21] While lumbar fusion is commonly performed, indications for doing so are not well defined. In a comprehensive review of the literature, Sonntag and Marciano[20] reported that definitive indications for fusion include trauma, tumor and infection, iatrogenic instability, and ischemic spondylolisthesis. Relative indications were degenerative spondylolisthesis, mechanical pain, and abnormal movement visualized on dynamic films with appropriate pain or neurologic deficit.

The objective of this study was to examine various demographic and surgical factors that may contribute to successful recovery from lumbar spinal fusion and microdiskectomy. We evaluated functional and pain outcome measures along with return-to-work status to determine if these factors were valid predictors for surgical success among workers' compensation patients. We hypothesize that the identification of factors that affect the surgical outcomes of workers' compensations patients can lead to more appropriate and effective treatment methods for this patient population.

Methods

A retrospective review was conducted of 87 consecutive workers' compensation patients who underwent fusion, microdiskectomy, or both between November 1994 and December 1997. Surgical indications included herniated disk, degenerative disk disease, and spinal stenosis. All patients included in the study had previously failed conservative management. Postoperative data were available for 73 patients (84% return rate). Time between injury and surgery ranged from 0 to 252 months (mean, 16.2 months). Forty-eight (66%) patients were male, and 25 (34%) were female. Ages ranged from 23 to 68 years (mean, 43.1 years). Forty-one (56%) patients were smokers, and 28 (38%) were involved in litigation. Two orthopedic spinal surgeons performed all of the procedures. Thirty-six (49%) patients received fusion and diskectomy or fusion alone, and 37 (51%) patients received microdiskectomy.

Demographic, personal, physical, and surgical data were collected prior to surgery. To evaluate the outcomes of the surgeries, patients completed the Oswestry Back Pain Disability Questionnaire (OSW) to assess functional capacity and the Visual Analog Scale for Pain (VAS) to evaluate pain. Preoperative and postoperative OSW and VAS scores were compared with the standard paired two-sample *t*-test to determine statistically significant improvement in scores. Independently evaluated factors included age, gender, smoking, litigation, and surgical procedure (fusion vs. microdiskectomy). To determine which factors were indicative of successful recovery from lumbar spinal surgery, the data were grouped and analyzed using analysis of variance (ANOVA). Statistically significant differences in the change from preoperative to postoperative OSW and VAS scores were investigated for each factor.

In addition, patients were monitored to establish if they returned to work in some capacity following surgery. Furthermore, the data were analyzed using ANOVA to determine if any factor had a statistically significant effect on return-to-work status.

Postoperatively, patients completed the Short Form 36 Questionnaire (SF-36) to assess their physical and mental status. These scores were compared with those of a generalized population with back pain.

Results

The combined population reported preoperative OSW and VAS scores of 54% and 7.5, respectively. Postoperative scores were 42% and 5.3, respectively. The changes in both of these outcomes measures were analyzed using a paired *t*-test and determined to be statistically improved following surgery ($P < .01$). The outcomes data were categorized according to age, surgery type, gender, litigation, and smoking, after which they were analyzed using ANOVA. The percent changes in the OSW and VAS scores following surgery and the corresponding *P* values are given in *Table 1*. Significant variations were revealed in terms of surgery type and gender.

Microdiskectomy patients had significantly greater improvements in both OSW (−37.6% vs. +8.5%) and VAS (−37.7% vs. −14.7%) as compared with fusion patients ($P < .05$). Overall, males had significantly greater improvement in OSW (−25.8% vs. +2.6%) as compared with females ($P < .05$). However, when males and females were divided according to surgery type, there was no significant difference with respect to gender ($P > .05$). Fusion patients and females had worse OSW scores postoperatively than they did preoperatively. The study identified no significant variations in OSW or VAS scores with respect to age, litigation, or smoking ($P > .05$).

Next, the return-to-work status was evaluated following surgery. Preoperatively, 34 (47%) patients were working, and 39 (53%) were off work. Of the 39 patients who were not working, 14 (36%) returned to work after surgery. Eight (24%) of the 34 patients who were working prior to surgery discontinued working after surgery. For the combined population, 40 (55%) returned to work in some capacity, while 33 (45%) did not return to work—though many were given restrictions and could have returned to work. No patients were placed in a sedentary category; all patients were capable of at least light duty.

Table 1
Summary of Change in Oswestry Disability Ratings (OSW), Visual Analog Pain Scale (VAS), and Return-to-Work Status Following Spinal Surgery*

Factor	OSW (%)	*P* value	VAS (%)	*P* value	Return-to-work status, No. (%)	*P* value
■ **Age (y)**		.77		.44		.17
□ 20 to 29 (n=6)	−22.5		−16.7		2 (33.3)	
□ 30 to 39 (n=24)	−23.7		−32.4		16 (66.7)	
□ 40 to 49 (n=26)	−4.5		−31.1		14 (53.8)	
□ 50 to 59 (n=9)	−14.5		−5.5		2 (22.2)	
□ 60 to 69 (n=8)	−28.4		−23.6		5 (62.5)	
■ **Type of surgery**		.01		.05		.01
□ Microdiskectomy (n=36)	−37.6		−37.7		26 (72.2)	
□ Fusion (n=37)	+8.5		−14.7		16 (43.2)	
■ **Gender**		.05†		.79		.86
□ Male (n=48)	−25.8		−25.3		26 (54.1)	
□ Female (n=25)	+2.6		−27.9		13 (52.0)	
■ **Litigation**		.75		.57		.06
□ Yes (n=28)	−13.2		−22.7		12 (42.9)	
□ No (n=45)	−17.6		−28.4		27 (60.0)	
■ **Smoker**		.99		.59		.67
□ Yes (n=41)	−16.1		−28.5		21 (51.2)	
□ No (n=32)	−15.8		−23.2		18 (56.3)	

*Changes are given in mean percent difference (+% indicates exacerbation of condition; −% indicates improvement in condition).
†No significant difference was revealed with respect to gender when analysis was performed according to surgery type.

The return-to-work data were then categorized according to age, surgery type, gender, litigation, and smoking and analyzed using ANOVA. The percentage of patients returning to work following surgery and the corresponding *P* values are also given in *Table 1*. A statistically significant variation was revealed in terms of surgery type (72% of microdiskectomy patients returned and 43% of fusion patients returned). No significant variations were found with respect to age, smoking, litigation, or gender ($P > .05$).

Postoperative SF-36 scores are summarized in *Table 2* for the workers' compensation patients and for the generalized population with back pain. The workers' compensation patients had significantly lower scores in terms of physical functioning, role physical, bodily pain, social functioning, and mental health ($P < .05$). Their scores were within the normal range for patients with back pain in terms of general health, vitality, and role emotional.

SF-36 scores were analyzed according to surgery type, and significant differences were revealed between microdiskectomy and fusion patients in all components except for the general health component ($P < .05$). SF-36 scores for microdiskectomy patients were within normal ranges for the back pain population in five of the eight components. However, microdiskectomy patients scored significantly lower than the normal range for generalized back pain population in terms of physical functioning, bodily pain, and mental health ($P < .05$). Fusion patients scored significantly lower than the back pain population in seven of eight components ($P < .05$). They were within normal range only for general health.

Comments

Low back pain is a significant medical problem in our society and generates numerous economic, social, and psychological repercussions. Estimates indicate that at least 80% of the population will have one or more episodes of low back pain at some point in life.[22] Fortunately, most of these episodes are of short duration, with approximately 90% of cases resolving within 6 weeks regardless of treatment methods.[4] Individuals performing repetitive or heavy lifting are at risk of developing work-related back injuries. Because of the high cost associated with these injuries in terms of medical expenditures and lost productivity, numerous studies have attempted to develop reliable predictors of successful treatment.

Workers' compensation patients are traditionally viewed as having inferior

Table 2
Summary of Postoperative SF-36 Scores for Patients on Workers' Compensation and for the Generalized Population With Back Pain

SF-36 component	Mean score*				Clinical expression of low score
	Micro-diskectomy	Fusion	Total	Back pain population	
☐ Physical functioning	49†	26†	39†	66 (54 to 78)‡	Limited in all physical activities including bathing or dressing
☐ Role physical	27	4†	18†	47 (24 to 70)	Problems with daily activities
☐ Bodily pain	43†	20†	32†	59 (44 to 74)	Very severe and limiting pain
☐ General health	53	46	49	58 (40 to 76)	Personal health is poor and expected to worsen
☐ Vitality	44	27†	36	52 (36 to 68)	Feels tired all the time
☐ Social functioning	59	26†	43†	81 (55 to 107)	Extreme and frequent interference with normal social activities due to physical or emotional problems
☐ Role emotional	55	28†	43	71 (43 to 99)	Problems with work or other daily activities as a result of emotional problems
☐ Mental health	56†	39†	48†	75 (61 to 89)	Feelings of nervousness and depression all the time

*Scores are given with surgery types (microdiskectomy vs fusion) separately and for the combined population.
†Score that is significantly lower than that for the population with back pain ($P < .05$).
‡Numbers in parentheses indicate the range of scores.

recovery rates after spinal surgery compared with the general population. This lack of surgical success has been attributed to decreased motivation to return to work due to compensation, litigation, and attorneys.[7,8] The purpose of this study was to determine if any factors within the workers' compensation population can be used to effectively predict recovery from spinal surgery.

Surgical outcomes were assessed using results from the OSW, the VAS, and the SF-36 questionnaire. These tools have been used in previous studies to effectively monitor changes in pain and functional capacity following spinal surgery.[23-25]

The OSW is calculated from a patient questionnaire that covers ten areas: pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and traveling. The VAS is a 0 to 10 scale which the patient uses to indicate his or her pain intensity on a typical day, with 0 meaning "no pain" and 10 meaning "pain as bad as you can imagine." The SF-36 questionnaire evaluates patients' responses to eight aspects of daily life: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. These scores provide a subjective view of the patient's overall status and can be compared with standardized scores for other patients with low back pain to provide an objective analysis. In this study, the improvements in each of the outcomes measurements were found to be statistically significant ($P < .01$).

This study identified significant differences in outcomes based on surgery

type. Patients who had microdiskectomy had significantly greater improvement in both OSW and VAS scores. While lumbar fusion is performed routinely with high success rates, it is possible that many patients may be effectively treated with microdiskectomy alone. This is a less invasive procedure and involves a shorter recovery period, which could explain the greater improvements in outcomes scores. It is also possible, however, that the microdiskectomy patients generally had less severe conditions before surgery than did the patients receiving fusion. The greater success among the microdiskectomy patients is supported by previous studies of work-related back injuries.[17]

While females at first appeared to have worse recovery than males, there was no difference with regard to gender when patients were divided according to surgery type. This is because females had many more fusion procedures than microdiskectomies, and the effects of the fusion surgeries caused the females to appear worse than they actually were. Previous studies have been contradictory in the role of gender as an outcomes predictor.[9,14] Also, females have been reported to be more likely than males to undergo a subsequent procedure following failure of diskectomy.[1]

Using changes in OSW or VAS as predictors of surgical success needs to be done cautiously. A greater initial pain level might cause the change in Oswestry score to be higher than would be the case for less severe preliminary pain. Little and others[14] found that patients who underwent fusion and did well had reported higher initial disability scores, and they found that a lower initial disability score correlated negatively with outcome.

While the reduction of pain and disability is of primary concern to the physician, enabling the patient to return to work is an equally important goal. Return-to-work status is not guaranteed to be positively associated with either OSW or VAS, because pain and functional level do not independently determine successful return to work.[7] Pihlajamaki and others[26] reported no correlation between relief of pain and return to work.

While positive results were obtained in returning 14 (36%) patients to work who were not working preoperatively, there also were 8 (24%) patients who were working preoperatively and who did not return to work postoperatively. It should be noted that each of these 8 patients was working at a restricted work level, and they were all cleared to return to at least this level postoperatively. They chose not to do so.

Our study also correlated each of the independent factors to the return-to-work status of the patients. We noted an overall return-to-work rate of 55% for all patients. Our analysis revealed a significant variation in the return-to-work status in terms of surgery type. Specifically, patients undergoing microdiskectomy were more likely to return to work than were patients undergoing fusions (72% vs. 43%). This finding was in agreement with the results of the OSW and VAS. The ability to return to work is likely due to the less invasive nature of the microdiskectomy.

Patients involved in litigation were less likely to return to work than patients not involved in litigation, though this only approached significance ($P = .06$). This result tends to confirm previous reports suggesting that patients who have hired an attorney are less likely to return to work than patients who are not represented by an attorney.[8,10]

An unexpected result of this study was the finding that smoking and age were not significant factors in predicting either successful outcomes or return to work. Previous studies have identified these factors as inhibiting a successful recovery from spinal surgery.[11,12,16,17] However, Carpenter and coworkers[27] also reported that age did not correlate with successful outcomes.

A comparison of SF-36 values to the generalized individual with back pain revealed that the workers' compensation patients had significantly lower scores (functioning on a lower level) in terms of physical functioning, role physical, bodily pain, social functioning, and mental health. *Table 2* summarizes the clinical expression of the low SF-36 scores for each of the categories. As with the other outcomes measures, the SF-36 scores were significantly better for the microdiskectomy patients than for the fusion patients. The microdiskectomy patients also were within normal limits for back pain patients in terms of five of eight SF-36 components, while fusion patients were within the norm for only one of eight components.

It is important to note that although significant improvements in VAS and OSW were noted for the combined population, the postoperative scores remained in the severe range. Additionally, the postoperative SF-36 scores were significantly lower than for general patients with back pain. These results do not correlate well with our return-to-work rates. Based on these findings, we conclude that the current outcomes measures (VAS, OSW, and SF-36) do not accurately represent the improvements following spinal surgery. Future studies are necessary to confirm these results and to develop modified outcomes measurements that will better assess spinal surgery.

While it is generally accepted that workers' compensation patients present a significant challenge, factors are likely to exist within this group that can predict surgical outcomes and return to work. This study has investigated the role of age, surgery type, gender, litigation, and smoking on the successful recovery from work-related spinal surgery. Fusion had a significantly adverse affect on all of the outcomes parameters and return-to-work status. However, low back pain is a subjective complaint, which makes absolute predictors of recovery unlikely. Each patient needs to be approached individually, but it is hoped that the information provided in this report can be combined with each patient's goals and motivation to allow for more appropriate and effective treatment protocols.

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