Clinical Neurology and Neurosurgery 155 (2017) 40–44

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

The prognostic value of preoperative participation in activities of daily living on postoperative outcomes following lumbar discectomy

Dana A. Leonard, Andrew J. Schoenfeld*, Mitchel B. Harris, Christopher M. Bono

Department of Orthopaedic Surgery, Brigham and Women's Hospital, Harvard Medical School, 75 Francis Street, Boston, MA 02115, United States

ARTICLE INFO

Article history:
Received 9 January 2017
Received in revised form 8 February 2017
Accepted 15 February 2017
Available online 20 February 2017

Keywords:
Activities of daily living
Discectomy
Prognostic
Personal care
Oswestry Disability Index

ABSTRACT

Objectives: In other surgical fields, preoperative level of participation in activities of daily living (ADLs) has been found to be important in predicting outcomes. To date, postoperative ADL measurements have only been used to characterize outcomes following lumbar discectomy. The present study's goal was to determine if patients' preoperative ability to perform ADLs correlates with their postoperative outcomes after lumbar discectomy at 3 months and 1 year.

Patients and methods: This retrospective study was performed using prospectively collected data from patients prospectively enrolled in a randomized clinical trial. All patients were 18 years or older, spoke English, had not previously had lumbar surgery, and underwent discectomy for a single-level lumbar disc herniation. Oswestry disability index (ODI) and visual analogue scale (VAS) back and leg pain scores were collected preoperatively and at 3 months and 1 year postoperatively. Simple linear regression analysis was performed to detect any significant correlations between three preoperative ODI domain values and postoperative scores. Additionally, regression analysis was used to determine the correlation between the preoperative ODI domains and percentage of good and poor outcomes, where an improvement of at least 18.8 points for ODI and at least 2 points for VAS constituted a good outcome.

Results: 90 subjects satisfied inclusion criteria (average age 42, 53 males, 37 females). Patients' ability to take care of themselves and to stand preoperatively were correlated with improvement in ODI post-operatively, with worse ability corresponding to more improvement ($p < 0.001$ for both). Only personal care scores correlated with good improvement in leg pain. No significant correlations were found with back pain. When evaluating patients by dichotomized outcome (good or poor), only preoperative ability to participate in personal care was consistently significantly correlated to a good outcome.

Conclusion: This is the first study to suggest that lower preoperative ability to take part in personal care might predict better surgical outcomes after discectomy. The current data might prompt reassessment of the importance of ADLs in pre-operative patient evaluation and may help anticipate outcomes following lumbar discectomy.

1. Introduction

Over 300,000 lumbar discectomies are performed each year in the United States [1]. The efficacy of this procedure has been demonstrated in a number of studies [2,3]. Though commonly cited to be successful in about 80% of cases, reported rates have ranged from 49% to 90%, depending on the definition of success [4,5]. Given the imperfect success rate, any additional information that could improve patient selection and forecast results would be useful.

A few previous studies have identified prognostic factors for surgical outcome after lumbar discectomy. These include patient characteristics, such as psychological status, and condition-specific characteristics, including symptom duration and size of the herniation [5–9]. In other areas of surgery, preoperative participation in activities of daily life (ADLs) has been found to predict surgical success and the degree of improvement in postoperative ADL scores [10–12]. While ability to participate in activities of daily living and other measures of patient function have been used to define successful surgical outcomes in lumbar discectomy, the predictive value of preoperative ADLs upon postoperative results of lumbar disc surgery has not been previously investigated.

Since the Oswestry Disability Index (ODI) is readily collected in many spine practices, the authors identified three ODI domains

* Corresponding author.
E-mail addresses: dleonard7@partners.org (D.A. Leonard), ajschoen@neomed.edu (A.J. Schoenfeld), mbharris@partners.org (M.B. Harris), cmbono@me.com (C.M. Bono).

http://dx.doi.org/10.1016/j.clineuro.2017.02.010
0303-8467/

that were thought to reflect importantADL aspects. The three were ability to complete personal care, walking ability, and standing ability. The current study sought to determine whether these data are predictive of successful surgical outcomes by relating them to postoperative ODI and VAS score changes at 3 months and 1 year postoperatively. The authors' hypothesis was that the level of participation in ADLs as indicated by ODI domains prior to surgical intervention would be predictive of functional and pain improvements after surgery.

2. Methods

2.1. Patient sample

The data for this study were initially collected as part of a prospective, randomized, controlled trial at three academic hospital centers [13]. The current analysis was performed on this data set retrospectively as a post-hoc study. IRB approval was obtained for this analysis separate from the original IRB-approval for the randomized trial.

The inclusion criteria for the study were: 18 years or older, English-speaking, single-level lumbar disc herniation, no previous lumbar surgery, primary radicular pain, and failure of nonoperative management prior to lumbar discectomy. Baseline demographical data was collected and preoperative modified ODI and VAS back and leg pain questionnaires were completed. Following lumbar discectomy, patients completed the same questionnaires at 3 months and 1 year postoperatively. One-year outcomes were the primary outcome measure, with three-month outcomes considered because it is the end of the postoperative recovery period, when patients would be expected to return to normal levels of function. Three individual components of the modified ODI were considered separately for the statistical analysis: ability to complete personal care, walking ability, and standing ability [14,15]. Those three were selected because they were representative of activities of daily living (ADLs) as identified in Barthel's ADL Index [16].

2.2. Surgical procedure

All patients underwent a standard lumbar discectomy with either loupe or microscope magnification. The manner of retraction (i.e. standard open retractors versus tubular retractors) was not controlled. However, all underwent a standard "fragmentectomy" that included removal of the herniated disc material without an aggressive disc space curettage.

2.3. Statistical analysis

The analysis was performed in two ways. A preliminary simple linear regression analysis was performed to determine significant correlations between preoperative Oswestry domain values in personal care, walking ability, and standing ability and improvement in postoperative scores for the ODI as a whole, VAS back pain, VAS leg pain) at 3 months and 1 year follow-up.

Second, postoperative scores were divided into "good" and "poor" outcomes. For ODI, a good outcome was defined as an improvement of at least 18.8 points, which has been defined as a substantial clinical benefit (SCB) in the literature [17]. For VAS back and leg pain, a good outcome was defined as an improvement of at least 2 points (of a 10 point scale), which has previously been defined as the minimum clinically important difference (MCID) for this measure [18]. Logistic regression was used to assess the relationship between good postoperative outcomes and preoperative scores for the three ODI domains included in the first analysis at 3 months and 1 year postoperatively. $p = 0.05$ was used as the significance cutoff.

Table 1
Baseline features of the study cohort.

Feature	No. patients (% of study cohort)
Demographic characteristics	
Age, yr	
<40	41 (45.56)
40–60	42 (46.67)
>60	7 (7.78)
Sex	
Female	37 (41.11)
Male	53 (58.89)
Race	
White	80 (88.89)
Black	2 (2.22)
Hispanic	3 (3.33)
Other	5 (5.56)
Occupation[a]	
Professional	44 (48.89)
Manual/skilled manual	7 (7.78)
Other	14 (15.56)
Unemployed	14 (15.56)
Retired	5 (5.56)
Clinical factors	
History of spinal injections[b]	
Yes	74 (83.15)
No	15 (16.85)
History of physical therapy[b]	
Yes	71 (79.78)
No	18 (20.22)

[a] Not reported in 6 subjects.
[b] Not reported in 1 subject.

3. Results

Baseline demographical information of the group is listed in Table 1. A total of 90 patients underwent surgery between 2009 and 2012. There were 3 perioperative complications: a deep infection, a dural tear, and a case of pneumonia. There were 7 reherniations during the study period. Sixty-eight percent of patients followed up at 3 months and 61% followed up at 1 year.

3.1. Correlation with postoperative improvement in ODI scores

Simple linear regression was used to evaluate the change in ODI from baseline to one year postoperatively (ΔODI) based on the patients' ability to take care of themselves, walk, and stand at baseline (Table 2). For personal care, ΔODI increased 8.4 points ($p < 0.001$) for every increase in the baseline personal care domain score, which means patients with more difficulty caring for themselves at baseline tended to have more functional improvement postoperatively. For walking, ΔODI increased 7.2 points ($p < 0.001$) for every increase in the baseline walking domain score, which means patients with more difficulty walking at baseline tended to have more functional improvement postoperatively. For standing, no significance was found ($p = 0.119$), which means patients' ability to stand at baseline did not correlate to functional improvement postoperatively.

3.2. Correlation with postoperative improvement in VAS back and leg pain scores

Simple linear regressions were also used to predict the change in VAS leg pain and VAS back pain from baseline to one year postoperatively (ΔVAS) based on the same preoperative abilities as the ODI analysis. For personal care and ΔVAS leg pain, ΔVAS leg pain increased 8.5 points ($p = 0.004$) for every increase in the base-