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Clinical study

The impact of mental health on patient-reported outcomes in cervical radiculopathy or myelopathy surgery

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ABSTRACT

Optimizing functional outcomes and disability status are essential for effective surgical treatment of cervical spine disorders. Mental impairment is common among patients with cervical spine complaints; yet little is known about the impact of baseline mental status with respect to overall patient-reported outcomes. This was a retrospective analysis of patients with cervical spondylosis with myelopathy (CM) or radiculopathy (CR: cervical disc herniation, stenosis, or spondylosis without myelopathy) at 2-year follow-ups. Patients were assessed for several health-related quality of life (HRQL) measures at baseline and 24-months post-operatively: Neck Disability Index (NDI), Visual Analog Scale (VAS), Short Form-36 (SF) Physical (PCS) and Mental (MCS) Components. Patients were dichotomized by MCS score: LOW-MCS (SF-MCS < 40th percentile) vs. HIGH-MCS (SF-MCS > 60th percentile). Independent and paired *t*-tests compared improvement in each group for HIGH-MCS and LOW-MCS cohorts. 375 patients were analyzed (65.4yrs, 67.6%F). LOW-MCS radiculopathy patients showed significant improvement in NDI, VAS Neck and Arm Pain ($p < 0.05$). HIGH-MCS radiculopathy patients showed greater improvement in NDI score, VAS Neck and Arm Pain, and improvement in PCS (all $p < 0.05$). Comparing baseline and 2-year follow-up, LOW-MCS CM patients showed significant improvement in PCS, NDI, VAS Neck and Arm Pain ($p < 0.05$). HIGH-MCS myelopathy patients group showed marked improvement in NDI scores, VAS Neck and Arm Pain ($p < 0.05$). LOW-MCS CR patients were more likely to be less satisfied 2-years post-op ($p < 0.001$). Postoperative CR patients with lower baseline mental status saw less improvement and significantly worse outcomes than patients with higher baseline mental status. Improving baseline mental health may improve post-operative recovery. Implementing additional screening and care can optimize functional outcomes and disability status for patients with CR.

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1. Introduction

Cervical myelopathy (CM) and cervical radiculopathy (CR) are relatively common neurological conditions that cause debilitating motor, sensory, and reflex deficits [1–5]. After exhausting conser-

vative management, many patients seek surgical intervention to relieve their symptoms and prevent disease progression [6–8]. Following surgical treatment, pain and patient perceived disability drive the evaluation of surgical success and patient satisfaction [9–11].

Poor mental health has been previously suggested as a predictor of negative patient-reported outcomes (PRO) following orthopaedic surgery [12–14]. Diagnosis-specific metrics are popular to evaluate psychological distress, but the advantage to using a general mental health survey at baseline is the reduction of patient and

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data collection burdens, while retaining a useful assessment tool [15–17]. The SF-36 Mental Component Summary (MCS) score presents an effective tool in requisitioning information concerning mental burden. SF-36 MCS scores have been shown to correlate significantly with clinical outcome scores in lumbar spine literature [18–23]. However, in cervical spine literature, there is a lack of evidence demonstrating the relationship between baseline presentation of mental impairment and patient's reported outcomes. Moreover, there is a paucity of literature concerning the link between mental health status and patient satisfaction following cervical spine surgeries [24–26].

The objective of this investigation was to study the effect of pre-operative mental health status on PRO over a two-year post-operative period in the diagnosis-specific sub-populations of CM and CR. We hypothesize that lower baseline mental health scores will be predictive of worse two-year follow-up patient reported disability and satisfaction, in comparison to pre-operative patients with higher baseline mental health scores.

2. Materials and methods

2.1. Data source

This study was a retrospective analysis of a multi-institutional patient outcomes database consisting of patients with cervical pathologies. This prospective spine outcomes database incorporates baseline capture of 2221 patients with cervical spine pathologies for the following diagnosis categories: degenerative, myelopathy, pseudarthrosis, revision, infection, tumor, and kyphosis. Of these 2221 patients, 1818 received operative treatment and 403 underwent non-operative management. Appropriate institutional review board (IRB) approval was obtained for this study at each participating site.

2.2. Inclusion and exclusion criteria

Out of the 1818 operative cervical degenerative patients included in the database, 375 patients had complete baseline and two-year follow-up data required for inclusion in this study. Out of these 375 patients, 127 had a primary diagnosis of myelopathy and 248 had radiculopathy (described in more detail below).

2.3. Data collection

Patients included in this study were diagnosed with either cervical spondylosis with myelopathy (CM) or radiculopathy (CR) including cervical disc herniation, cervical stenosis, or cervical spondylosis without myelopathy. Post-operative patients with complete two-year follow-up were assessed. Baseline patient demographics, operative data and patient-reported health-related quality of life (HRQOL) scores were obtained for analysis. Demographic characteristics included age, gender and body mass index (BMI). The following health related quality of life (HRQOL) metrics were collected at baseline and 24-months: Neck Disability Index (NDI), Visual Analog Scale (VAS) Acute Pain Measurements, Short Form-36 (SF-36) Physical (PCS) and Mental (MCS) Component Summaries. To assess satisfaction following surgery, patients were asked to rate five statements on a scale from definitely true to definitely false. The statements were: "I can do the things that I thought I would be able to do after surgery;" "I was helped as much as I thought I would be by my surgery;" "Overall I am happy with the care I am receiving for my neck and/or arms;" "All things considered, I would have the surgery again for the same condition;" "My pain was reduced as much as I expected it to be after surgery;" "The benefits of my care outweighed the setbacks

it caused me;" "All things considered, I would have the surgery again for the same condition." Patients who answered "Mostly True" or "Definitely True" were considered satisfied.

2.4. Propensity matching and statistical analysis

Demographic analysis was conducted for the whole cohort and compared between diagnosis groups. Mean baseline MCS score for all included patients was dichotomized to generate two groups: LOW-MCS (patients with SF-MCS < 40th percentiles of the respective cohort) vs. HIGH-MCS (patients with SF-MCS > 60th percentiles of the respective cohort). Patients with MCS scores between the 40th- and 60th-percentiles were excluded from further analysis to control for the borderline effect and prevent confounding (N = 74) [27]. LOW- and HIGH-MCS groups were propensity score-matched (PSM) by NDI score at baseline to eliminate the confounding factor of greater disability on PRO after surgery (157 patients were lost during the PSM). After PSM, there were 19 HIGH-MCS and 19 LOW-MCS patients in the CM group and 53 patients in each CR group. Independent samples t-tests were performed to compare baseline SF-36 PCS and NDI scores between MCS groups in each diagnosis group. Student t-tests compared improvement in HRQOL metrics over the two-year post-operative period in each patient diagnosis group (CM and CR) for the LOW-MCS and HIGH-MCS cohorts. Chi-square analysis was employed to compare patient satisfaction between the groups. Regression model controlling for age, gender, comorbidities, and baseline HRQOL including MCS groups was utilized to identify independent predictors of satisfied patients. Statistical significance was set at $p < 0.05$. Statistical analysis was performed using the Statistical Package for the Social Sciences, Version 24.0 (SPSS Inc., Chicago, Illinois).

3. Results

There were 375 patients with cervical pathology included in analysis with complete baseline and 2-year post-operative data. Of the total cohort, 254 (67.7%) were females, the average patient age was 65.4 ± 10.2 years (range: 44 to 93 years), and the mean BMI was 28.5 ± 6.0 kg/m². There were 44 (11.7%) patients who were having a revision of a prior cervical surgery. The two diagnosis groups, myelopathy (CM) and radiculopathy (CR), had 127 and 248 patients (33.9% vs. 66.1%), respectively. CM patients were found to have a higher estimated blood loss than radiculopathy patients during the procedure ($p = 0.04$) and were more likely to have had previous spine operation (29.9% vs. 18.1%; $p = 0.004$). CR patients had slightly higher pre-operative narcotic use (Table 1). The rate of discectomies (CR: 69.0%, CM: 24.4%), and fusions (CR: 98.4%, CM: 66.1%) were higher for CR patients than CM (both $P < 0.001$), while decompression rates did not differ between the two

Table 1

Demographic and surgical information for myelopathy and radiculopathy groups. Comparisons included between groups via independent samples t-tests and chi-squared analysis.

	Myelopathy	Radiculopathy	p-Value
Age	65.85 ± 9.69	65.20 ± 10.4	0.558
Gender (%F)	62.2%	70.6%	0.104
BMI	28.53 ± 4.79	28.56 ± 6.50	0.976
Smoker Status	25.6%	27.5%	0.194
Prior Spine Surgery	29.9%	18.1%	0.004
Hospital LOS (Days)	1.73 ± 1.76	1.94 ± 2.04	0.304
EBL (cc)	171.59 ± 246.5	121.89 ± 149.4	0.040
Pre-Op Narcotic Use	18.9%	27.8%	0.060

Significance of bold values are $p < 0.05$.

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