


# Factors Associated With Return to Work After Surgery for Degenerative Cervical Spondylotic Myelopathy: Cohort Analysis From the Canadian Spine Outcomes and Research Network

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## Abstract

**Study design:** Retrospective analysis of prospectively collected data from the multicentre Canadian Surgical Spine Registry (CSORN).

**Objective:** Degenerative cervical myelopathy (DCM) is the most common cause of spinal cord dysfunction in North America. Few studies have evaluated return to work (RTW) rates after DCM surgery. Our goals were to determine rates and factors associated with postoperative RTW in surgically managed patients with DCM.

**Methods:** Data was derived from the prospective, multicenter Canadian Spine Outcomes and Research Network (CSORN). From this cohort, we included all nonretired patients with at least 1-year follow-up. The RTW rate was defined as the proportion of patients with active employment at 1 year from the time of surgery. Unadjusted and adjusted analyses were used to identify patient characteristics, disease, and treatment variables associated with RTW.

**Results:** Of 213 surgically treated DCM patients, 126 met eligibility, with 49% working and 51% not working in the immediate period before surgery; 102 had 12-month follow-up data. In both the unadjusted and the adjusted analyses working preoperatively and an anterior approach were associated with a higher postoperative RTW ( $P < .05$ ), there were no significant differences between the postoperative employment groups with respect to age, gender, preoperative mJOA (modified Japanese Orthopaedic Association) score, and duration of symptoms ( $P > .05$ ). Active preoperative employment (odds ratio = 15.4, 95% confidence

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interval = 4.5, 52.4) and anterior surgical procedures (odds ratio = 4.7, 95% confidence interval = 1.2, 19.6) were associated with greater odds of RTW at 1 year.

**Conclusions:** The majority of nonretired patients undergoing surgery for DCM had returned to work 12 months after surgery; active preoperative employment and anterior surgical approach were associated with RTW in this analysis.

## Keywords

degenerative, cervical, myelopathy, return to work, surgery

## Introduction

Degenerative cervical myelopathy (DCM) is the most common cause of spinal cord dysfunction in North America and one of the most frequent indications for cervical spine surgery globally.<sup>1,2</sup> While most commonly observed in the elderly, DCM can also affect younger and middle-aged individuals leading to losses in productivity and absence from work.<sup>3,4</sup>

Traditionally, DCM surgery has been performed with the stated goal of decompressing the spinal cord to arrest functional deterioration, with little expectation of clinical improvement.<sup>5</sup> More recently, however, several large multicenter prospective studies have shown that decompressive surgery mostly results in clinically significant improvements in functional status, disability, and quality of life regardless of symptoms severity.<sup>6,7</sup> As a consequence, 2017 clinical practice guidelines recommended surgery for all patients presenting with moderate or severe DCM to help facilitate improvements in clinical outcomes.<sup>8,9</sup>

Although there has been a substantial increase in evidence supporting the positive effects of surgery, few studies have investigated how operative intervention in DCM affects patients' ability to return to work (RTW). RTW following surgery not only has positive effects for the individual patient but also for society in general. RTW following DCM surgery requires not only physical healing from the procedure itself but also improvement in myelopathy related impairments that may limit individuals' capacity to work preoperatively. Obtaining an improved understanding of those likely (and not unlikely) to RTW postoperatively has the potential to improve doctor-patient communication in the clinical realm helping surgeons quantify expectations across the care pathway.

In the current study, we used a large prospective national spine registry to determine rates and predictors of postoperative RTW in DCM to facilitate personalized patient counseling with respect to occupational expectations. We hypothesized that preoperative employment status in addition to the severity of preoperative functional deficits would predict postoperative RTW.

## Methods

### Study Design

We performed a retrospective analysis of prospectively collected data from the multicenter Canadian Surgical Spine Registry (CSORN). This national registry has been described in

detail in previous publications.<sup>10</sup> In brief, CSORN includes 50 neurosurgical and orthopedic spine surgeons in 18 academic and nonacademic hospitals across Canada; they collect standardized clinical and radiological data elements pertaining to the assessment and management of adult patients with common surgical spinal disorders, including DCM. At all sites, trained research assistants perform standardized data collection in both the preoperative and postoperative periods at prespecified time points. All sites have obtained research ethics board approval prior to data collection. Patient identification is anonymized prior to input into the central electronic database.

### Eligibility

Inclusion criteria were the following: (1) a clinical diagnosis of cervical myelopathy leading to surgical treatment, (2) MRI (magnetic resonance imaging) evidence of degenerative-related cervical spinal cord compression, (3) identified as non-retired preoperatively, and (4) 1-year follow-up after primary surgery. Included nonretired patients were either unemployed, employed but not working, or actively working preoperatively. We excluded those with myelopathy secondary to other compressive etiologies such as tumor, infection, or trauma in addition to those undergoing revision cervical surgery. Moreover, patients on worker compensation were excluded from these analyses.

### Surgical Procedure

Cervical procedures performed included anterior and/or posterior decompression with or without instrumented fusion in the homogenous study population. Decisions surrounding surgical approach were made at the discretion of the attending surgeon involved with each case.

### Baseline Variables Considered

Potential parameters of RTW included preoperative age, gender, duration of symptoms, occupational status (retired vs working), active or pending medicolegal claims, and surgical approach (anterior vs posterior). Preoperative patient reported questionnaires considered were the following: numerical rating scale (NRS) for neck pain and arm pain, the SF-12 physical component summary (PCS) and mental component summary (MCS),<sup>11</sup> the EQ-5D general health care score,<sup>12</sup> and the neck

**Table 1.** Comparison of Characteristics Between Retired and Nonretired DCM Patients Treated With Surgery.

Variable	Retired	Nonretired	P value <sup>a</sup>
Females	27 (31.0%)	56 (44.4%)	<.049
Males	60 (69.0%)	70 (55.6%)	
Symptom duration			>.05
≤2 years	43 (50.6%)	63 (52.5%)	
>2 years	42 (49.4%)	57 (47.5%)	
Surgical approach			<.01
Ant	20 (23.0%)	56 (44.4%)	
Posterior	65 (74.7%)	68 (54.0%)	
Combined	2 (2.3%)	2 (1.6%)	
Age	69.9 (±7.5)	54.3 (±10.7)	<.01
Preoperative mJOA	12.1 (±2.8)	13.0 (±2.5)	<.01
Preoperative Neck Pain	5.6 (±2.5)	5.6 (±3.2)	>.05
Preoperative Arm Pain	5.7 (±3.1)	5.7 (±2.9)	>.05
Preoperative SF12 PCS	34.1 (±8.8)	35.7 (±8.9)	>.05
Preoperative SF12 MCS	47.9 (±9.7)	46.1 (±9.7)	>.05
Preoperative NDI	39.8 (±18.4)	42.6 (±21.0)	>.05

Abbreviations: DCM, degenerative cervical myelopathy; mJOA, modified Japanese Orthopaedic Association; PCS, physical component summary; MCS, mental component summary; NDI, neck disability index.

<sup>a</sup>Results of comparison testing using *t* test for comparing means and Fisher exact test for comparing proportions.

disability index (NDI).<sup>13</sup> Also, the modified Japanese Orthopaedic Association (mJOA) score<sup>14</sup> was assessed.

### Outcome Parameters

The inception point of the study was the date of surgery and the primary endpoint was the postoperative RTW date. The RTW rate was defined as the proportion of patients with active employment at 1 year from the time of surgery.

### Statistical Analysis

The study cohort was characterized using means and standard deviations to describe continuous variables and proportions to describe categorical variables. Unadjusted bivariable analyses were completed using unpaired Student's *t* tests to compare means and  $\chi^2$  or Fisher's exact test to compare proportions. Multivariable logistic regression analyses were performed on variables of greatest theoretical importance with respect to the outcome of RTW (age, preoperative mJOA, preoperative work status, surgical approach). A *P* value below .05 was used as criterion for statistically significant difference throughout all analyses. All statistical calculations were performed with the SPSS software (IBM).

### Results

Out of the 213 surgically treated DCM patients, 126 (59.2%) were considered nonretired preoperatively. Table 1 displays a comparison of characteristics between retired and nonretired patients. In summary, there were a greater proportion of males

**Table 2.** Comparison of Characteristics Between Patients Who Did Return to Work (RTW) and Did Not Return to Work (Not-RTW) at 1 Year Following Surgery for DCM.

Variable	Not-RTW	RTW	P value <sup>a</sup>
Females	19 (45.2%)	23 (38.3%)	>.05
Males	23 (54.8%)	37 (61.7%)	
Symptom duration			>.05
≤2 years	26 (65.0%)	32 (56.1%)	
>2 years	14 (35.0%)	25 (43.9%)	
Surgical approach			=.02
Ant	14 (33.3%)	34 (56.7%)	
Posterior	28 (66.7%)	24 (40.0%)	
Combined	0	2 (3.3%)	
Working preoperative			<.01
Working	7 (20.6%)	41 (75.9%)	
Not working	27 (79.4)	13 (24.1%)	
Claims			>.05
Yes	11 (23.9%)	13 (18.3%)	
No	35 (76.1)	58 (81.7)	
Age	55.1 (±10.2)	52.9 (±11.6)	>.05
Preoperative mJOA	12.7 (±2.5)	13.7 (±2.3)	>.05
Preoperative Neck Pain	6.4 (±2.9)	4.8 (±2.9)	>.05
Preoperative Arm Pain	6.4 (±2.7)	5.0 (±2.8)	=.02
Preoperative SF12 PCS	31.1 (±8.7)	39.4 (±7.8)	<.01
Preoperative SF12 MCS	44.9 (±10.6)	48.6 (±7.8)	>.05
Preoperative NDI	52.6 (±18.8)	33.4 (±16.9)	<.01

Abbreviations: DCM, degenerative cervical myelopathy; mJOA, modified Japanese Orthopaedic Association; PCS, physical component summary; MCS, mental component summary; NDI, neck disability index.

<sup>a</sup>Results of comparison testing using *t* test for comparing means and Fisher exact test for comparing proportions.

and posterior only procedures, as well as a higher mean age among retired patients (*P* < .05). Among the nonretired patients, 19.6% were not employed, 31.4% were employed but not currently working, and 49% were actively working preoperatively. As such, 51% were not working preoperatively and 49% were currently working despite their myelopathy.

There was no statistically significant difference in work status by anterior/posterior surgical approach (*P* < .229); however, those treated with a posterior approach had significantly lower mJOA scores (12.1 vs 14.0, *P* < .0001), were older (58.7 vs 48.9 years, *P* < .0001), and had more operated levels (3.2 vs 1.4, *P* < .0001).

Of the 126 nonretired patients, RTW data was available for 102 patients at 1-year postoperatively, of which 60 patients (58.8%) had returned to work, while 42 (41.2%) were not working. Of those who were working preoperatively, 75.9% returned to work, whereas 24.1% of those who were not working preoperatively returned to work. In unadjusted analyses, active employment immediately before surgery, anterior surgical procedures were associated with a greater likelihood of RTW at 1 year, higher preoperative arm pain, and NDI scores, as well as lower SF-36 PC scores were associated with a lower likelihood of RTW (Table 2).

In multivariable analyses, only active preoperative employment (odds ratio [OR] = 15.4, 95% confidence interval [CI] =

**Table 3.** Results of Multivariable Logistic Regression Analysis Relative to the Outcome of Return to Work at 1 Year Following Surgery for DCM.

Variable	B	SE	OR	95% CI	P value
Age	0.007	0.030	1.007	0.95, 1.07	$P > .05$
Preoperative mJOA	-0.083	0.136	0.921	0.71, 1.20	$P > .05$
Anterior approach	1.584	0.722	4.877	1.18, 20.10	$P = .03$
Working preoperative	2.732	0.623	15.358	4.53, 52.08	$P < .01$

Abbreviations: DCM, degenerative cervical myelopathy; SE, standard error; OR, odds ratio; CI, confidence interval; mJOA, modified Japanese Orthopaedic Association.

4.5, 52.4) and anterior surgical procedures (OR = 4.7, 95% CI = 1.2, 19.6) were associated with greater odds of RTW at 1 year (Table 3).

## Discussion

While extensively explored in the context of lumbar degenerative disease, occupational disability after cervical spine surgery, in particular DCM, is an underinvestigated problem.<sup>15,16</sup>

We queried the CSORN DCM prospective study to determine RTW rates among patients undergoing surgery for DCM. To our knowledge, this cervical myelopathy study is one of the largest multicenter series focusing on RTW in a surgical cohort. We determined that the majority (58.8%) of nonretired patients undergoing DCM surgery had returned to work 12 months postoperatively. Active employment prior to surgery and anterior surgical approach were significantly associated with RTW within 1 year.

There is some previous literature on RTW rates for DCM patients undergoing surgery. Bhandari et al reported a 62% RTW rate at 1 year postoperatively among radiculopathy and/or myelopathy patients undergoing anterior cervical surgery.<sup>17</sup> Similarly, Faour et al reported a RTW rate of 63% at 1 year among Workers' Compensation patients undergoing ACDF (anterior cervical discectomy with fusion) for radiculopathy.<sup>18</sup> Finally, a recent analysis of the US Quality Outcomes Database (QOD) registry found that 82% of patients returned to work 3 months after cervical spine surgery for degenerative cervical disease.<sup>19</sup> Direct comparison of RTW rates between studies is inherently challenging given differences in the characteristic of the cohorts considered, definitions of RTW, and length of follow-up period.

Perhaps more important than understanding RTW rates is understanding factors associated with this outcome. In the current study, three quarters of those that were actively employed returned to work, whereas only one quarter of those without active preoperative employment experienced the same. Although the specific rates differ, this finding largely comports with the results of the QOD study where almost 90% of patients working immediately before cervical spine surgery returned to work at 3 months, while only 52% of those not working preoperatively were able to do the same.<sup>19</sup> Additional analyses

identifying factors associated with the outcome after lumbar spine surgery have also pointed to preoperative employment as a critical variable.<sup>20,21</sup> Based on the consistency of this finding in the literature, preoperative work status appears to be one of the most influential factors affecting individuals' likelihood of return to employment following spine surgery. Other factors such as young age, high education status, full-time employment, lower intensity occupation, and short symptom duration were also found to be favorable regarding return to work after cervical spine surgery.<sup>19</sup>

The association between anterior only procedures and increased odds of RTW is intriguing given that, in at least a proportion of cases in which there is equipoise related to the surgical approach, this represents a modifiable risk factor within control of the surgical team. To our knowledge, no previous analyses have found an association between anterior cervical surgery and increased likelihood of RTW; however, anterior surgery for DCM has been associated with improved outcomes. Namely, a prospective cohort study by Ghogawala et al found greater improvements in health-related quality of life in patients treated with anterior versus posterior surgery, in which either operation was a reasonable option.<sup>22</sup> It is possible that improved clinical outcomes among patients treated with anterior surgery are being translated into earlier return to work rates; however, it is also possible that in our study, anteriorly treated patients had less severe and more often single-level disease rather than an intrinsic RTW benefit related to the surgical approach. Importantly, the Cervical Spondylotic Myelopathy Surgical Trial (CSM-S), a multicenter prospective study randomizing cervical myelopathy patients to anterior versus posterior patients, has recently completed enrolment.<sup>23</sup> While the primary outcome is health-related quality of life, return to work is a secondary outcome of interest; hence, the CSM-S study is poised to offer a more definitive answer regarding the impact of surgical approach on RTW for myelopathy.

There are some study limitations. Namely, we did not collect data specific to the nature of employment undertaken by patients preoperatively and postoperatively. Also, we did not include any radiological variables related to extent of spinal cord compression, cord signal change, or alignment parameters. Analyzing the impact of such variables on employment-related outcomes will be the focus for future research. Moreover, we did not capture what happened with the patients who did not go back to work or what was the cause. We can hypothesize that patients who were not working preoperatively did not improve enough to resume their work functions. As neurological deterioration is very rare postsurgical decompression, new functional limitation secondary to the surgical intervention likely explains why patients who were actively working preoperatively did not go back to work postoperatively. Strengths of this study include the prospective multicenter nature of the data collection, the size of the DCM cohort and the large geographical representation of the registry.



## Conclusion

In this multicenter analysis of prospectively collected data on DCM, obtained from the multicenter CSORN database, the majority (58.8%) of nonretired patients undergoing surgery had returned to work 1 year after surgery. Among that group, patients actively working preoperatively and patients who had anterior surgery had a higher rate of RTW. These results may help inform preoperative patient counseling sessions, enable economic analyses, and serve as a focus for future quality improvement efforts.

## Authors' Note

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