

Impact of Mental Health Scores on Clinical Outcomes in Cervical Disc Replacement

James Nie¹, Timothy J Hartman, Eileen Zheng, Keith R. Macgregor², Omolabake Oyeta¹, Kern Singh²

¹Rush University Medical Center, ²Midwest Orthopaedics At Rush

INTRODUCTION: The effect of preoperative mental health status has not been widely studied in cervical disc replacement. We aim to examine the effects of preoperative mental health status on demographic, perioperative characteristics, and postoperative outcomes in patients undergoing cervical disc replacement.

METHODS: Patients undergoing primary cervical disc replacement were collected in a retrospective single-surgeon database. These patients were separated into two groups by SF-12 MCS scores at 48.9, as specified in previous studies. Exclusion criteria were patients without preoperative SF-12 MCS scores or diagnosis of infection, malignancy, or trauma. Demographic information, perioperative characteristics, and patient-reported outcome measures (PROMs) were collected and analyzed through Student's t-test for continuous variables and chi-square analysis for categorical variables. PROMIS-PF, SF-12 PCS, SF-12 MCS, VAS neck, VAS leg, and NDI at preoperative, 6-week, 12-weeks, 6-months, and 1-year timepoints were the PROMs analyzed using paired t-test for improvement from preoperative baseline and Student's t-test for differences between cohorts. MCID achievement was calculated by determining the change in mean PROMs from preoperative and postoperative values to established values found in the literature. Chi-square analysis was used to compare MCID achievement between cohorts.

RESULTS:

Of the 87 patients undergoing CDR, 40 patients had SF-12 MCS < 48.9, while 47 patients were identified having SF-12 MCS ≥ 48.9. No significant differences were determined between cohorts for demographic and perioperative characteristics. For PROMs, both cohorts had significant improvement from preoperative baseline, aside from SF-12 PCS and SF-12 MCS at 1-year for the depressed cohort and SF-12 MCS at all timepoints. The non-depressed cohort was associated with significantly higher PROMIS-PF at preoperative and 12-weeks, SF-12 PCS at 12-weeks, and SF-12 MCS at all timepoints compared to the depressed cohort. This cohort was associated with decreased VAS neck at 12-weeks and NDI at preoperative and 12-week timepoints. For the depressed cohort, overall MCID was achieved in most patients with PROMIS-PF, SF-12 MCS, VAS neck, and NDI, while the non-depressed cohort achieved overall MCID in the majority of patients in all PROMs, aside from SF-12 MCS. The non-depressed cohort was associated with higher MCID achievement for PROMIS-PF at 12-weeks, while a higher proportion of the depressed cohort achieved MCID at 6-week, 12-week, and 6-month timepoints and overall compared to the non-depressed cohort.

DISCUSSION AND CONCLUSION:

After stratifying patients based on SF-12 MCS score, no significant differences were noted between cohorts with respect to demographic or perioperative characteristics. With PROMs, both cohorts were associated with significantly improved values from baseline, though the non-depressed cohort was associated with higher physical function and mental health and decreased pain and disability at various timepoints relative to the depressed cohort. Overall MCID was achieved in most patients in the non-depressed cohort, aside from SF-12 MCS, while the depressed cohort achieved MCID in most patients in SF-12 MCS and NDI. The non-depressed cohort, relative to the depressed cohort, had a higher proportion of patients achieving MCID at 12-weeks, while the depressed cohort had a higher achievement of MCID with SF-12 MCS at every timepoint except 1-year. These findings may be useful in managing expectations for patients undergoing cervical surgery.

Table 1. Patient Demographics

Characteristic	SF-12 MCS < 48.9 (n = 40)	SF-12 MCS ≥ 48.9 (n = 47)	*p-value
Age (mean ± SD, years)	44.6(10.1)	45.9(11.0)	0.588
Gender			
Female	37.5% (15)	31.3% (15)	0.385
Male	62.5% (25)	68.7% (32)	
Ethnicity			0.772
Caucasian	77.5% (31)	80.9% (38)	
African American	7.5% (3)	8.5% (4)	
Hispanic	12.5% (5)	6.4% (3)	
Asian	2.5% (1)	2.1% (1)	
Other	0.0% (0)	2.1% (1)	
Diabetic Status			0.464
Non-diabetic	95.0% (38)	97.9% (46)	
Diabetic	5.0% (2)	2.1% (1)	
BMI (mean ± SD, kg/m ²)	29.8(5.1)	28.7(5.8)	0.399
Smoking Status			0.414
Non-smoker	92.5% (37)	89.4% (42)	
Smoker	7.5% (3)	10.6% (5)	
Hypertension Status			0.537
Non-hypertensive	82.5% (33)	87.2% (41)	
Hypertensive	17.5% (7)	12.8% (6)	
ASA Classification			0.918
<2	30.8% (12)	31.8% (14)	
≥2	69.2% (27)	68.2% (30)	
CCI Score (Mean ± SD)	0.6(0.2)	0.4(0.2)	0.588
Insurance Type			0.342
Medicaid/Medicare	2.5% (1)	4.3% (2)	
Worker's Comp	30.0% (12)	17.0% (8)	
Private	67.5% (27)	78.7% (37)	

BMI = body mass index; CCI = Charlson Comorbidity Index; ASA = American Society of Anesthesiologists; SD = standard deviation; Worker's Comp = workers' compensation. *p-values calculated using Student's t-test for continuous variables and chi-square analysis for categorical variables. Boldface indicates significance.

Table 2. Perioperative Characteristics

Characteristic	SF-12 MCS < 48.9 (n = 40)	SF-12 MCS ≥ 48.9 (n = 47)	*p-value
Spinal Pathology			
Herniated Nucleus Pulposus	100.0% (40)	97.9% (46)	0.333
Degenerative Disc Disease	7.5% (3)	10.6% (5)	0.614
Central Stenosis	60.0% (18)	57.5% (27)	0.247
Foraminal Stenosis	25.5% (9)	35.5% (12)	0.742
Levels treated			0.128
1-level	75.0% (30)	59.6% (28)	
2-level	25.0% (10)	40.4% (19)	
Operative Time (Mean ± SD, min)	50.8(13.8)	53.8(11.2)	0.247
Estimated Blood Loss (Mean ± SD, mL)	27.5(17.6)	28.0(18.2)	0.803
Length of Stay (Mean ± SD, days)	7.6(6.2)	6.8(3.1)	0.567
Postoperative VAS pain (Mean ± SD, mm)	4.3(2.3)	4.3(1.3)	0.981
Postoperative Narcotic Consumption (Mean ± SD, mg)	20.4(16.2)	18.6(16.9)	0.614

SD = standard deviation; VAS = visual analog scale. *p-values calculated using Student's t-test for continuous variables and chi-square analysis for categorical variables. Boldface indicates significance.

Table 3. Mean Patient Reported Outcomes

PROM	SF-12 MCS < 48.9 (n = 40)	SF-12 MCS ≥ 48.9 (n = 47)	*p-value	†p-value
PROMIS-PF				
Preoperative	37.9(5.9)	42.5(5.3)	0.009	-
6-week	44.0(8.3)	47.6(8.5)	0.168	0.379
12-week	41.9(6.6)	51.4(10.4)	<0.001	0.001
6-month	47.4(10.4)	53.9(14.7)	0.002	0.158
1-year	47.4(9.9)	52.8(12.6)	0.007	0.246
SF-12 PCS				
Preoperative	32.7(8.6)	36.3(8.9)	0.063	0.063
6-week	38.4(9.2)	41.9(11.3)	0.029	0.281
12-week	38.1(9.0)	45.8(10.3)	<0.001	0.007
6-month	43.0(11.4)	45.0(13.2)	0.065	0.094
1-year	37.5(10.0)	42.5(11.4)	0.029	0.071
SF-12 MCS				
Preoperative	39.6(6.8)	56.9(4.7)	<0.001	<0.001
6-week	46.0(11.5)	58.3(8.8)	0.319	<0.001
12-week	48.3(11.3)	58.2(8.6)	0.168	<0.001
6-month	48.0(10.6)	58.7(8.7)	0.310	0.009
1-year	39.2(13.6)	53.6(9.3)	0.362	0.016
VAS neck				
Preoperative	6.2(2.2)	6.2(2.3)	0.543	0.341
6-week	3.7(2.1)	3.5(1.9)	<0.001	0.008
12-week	3.0(2.4)	1.4(1.7)	<0.001	0.007
6-month	2.9(2.1)	1.8(2.0)	<0.001	0.190
1-year	2.8(2.2)	3.1(3.6)	0.017	0.820
VAS arm				
Preoperative	6.2(2.4)	5.5(2.7)	0.204	0.204
6-week	3.3(2.2)	1.9(2.1)	<0.001	0.002
12-week	3.1(3.0)	1.6(2.7)	<0.001	0.004
6-month	2.7(1.9)	1.8(4.1)	<0.001	0.111
1-year	2.5(2.2)	1.5(2.1)	<0.001	0.150
NDI				
Preoperative	47.2(16.4)	34.9(17.2)	<0.001	0.014
6-week	33.9(22.6)	21.2(12.5)	<0.001	0.012
12-week	24.1(16.4)	13.6(11.7)	<0.001	0.001
6-month	27.1(19.9)	18.4(11.6)	<0.001	0.001
1-year	25.2(19.2)	15.2(11.6)	<0.001	0.001

*p-values calculated using paired t-test for continuous variables and chi-square analysis for categorical variables. †p-values calculated using Student's t-test for continuous variables and chi-square analysis for categorical variables. Boldface indicates significance.

Table 4. Minimum Clinically Important Difference

PROM	SF-12 MCS < 48.9 (n = 40)	SF-12 MCS ≥ 48.9 (n = 47)	*p-value
PROMIS-PF			
6-week	62.5% (10)	40.0% (8)	0.180
12-week	40.0% (6)	76.9% (20)	0.018
6-month	73.3% (11)	73.3% (11)	1.000
1-year	60.0% (6)	72.7% (8)	0.537
Overall	72.0% (18)	76.5% (26)	0.697
SF-12 PCS			
6-week	33.3% (8)	41.7% (10)	0.551
12-week	31.3% (7)	51.7% (15)	0.155
6-month	57.1% (8)	50.0% (5)	0.729
1-year	30.8% (4)	50.0% (4)	0.378
Overall	48.5% (16)	57.1% (20)	0.475
SF-12 MCS			
6-week	66.7% (16)	20.8% (5)	0.001
12-week	63.0% (14)	27.6% (6)	0.010
6-month	64.3% (9)	20.0% (2)	0.032
1-year	53.9% (7)	25.0% (2)	0.195
Overall	62.9% (22)	28.2% (12)	0.008
VAS neck			
6-week	50.0% (13)	51.9% (14)	0.893
12-week	56.0% (14)	73.3% (22)	0.178
6-month	72.7% (16)	64.7% (11)	0.590
1-year	58.3% (7)	58.3% (7)	1.000
Overall	62.9% (22)	78.8% (29)	0.148
VAS arm			
6-week	38.5% (10)	37.0% (10)	0.915
12-week	43.5% (10)	48.3% (14)	0.730
6-month	35.3% (6)	46.2% (6)	0.547
1-year	33.3% (4)	66.7% (6)	0.102
Overall	37.4% (12)	55.6% (20)	0.110
NDI			
6-week	65.4% (17)	48.2% (13)	0.206
12-week	68.0% (17)	73.3% (22)	0.665
6-month	72.7% (16)	64.7% (11)	0.590
1-year	75.0% (9)	66.7% (6)	0.653
Overall	80.0% (28)	73.0% (27)	0.483

*p-values calculated using chi-square analysis. Boldface indicates significance.