

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

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Background

The effect of preoperative mental health status has not been widely studied in cervical disc replacement (CDR)

Objective

To examine the effects of preoperative mental health status as measured by 12-Item Short Form Mental Composite Score (SF-12 MCS) on postoperative outcomes in patients undergoing CDR

Methodology: Data Collection

Inclusion Criteria		Exclusion Criteria	
<ul style="list-style-type: none"> • Primary, elective CDR • Preoperative SF-12 MCS scores 		<ul style="list-style-type: none"> • Diagnosis of infection, neoplasm, trauma • Missing SF-12 MCS data 	
Demographics	Preoperative	Intraoperative	Postoperative
<ul style="list-style-type: none"> • Age • Gender • Ethnicity • BMI • Hypertension • Smoking status • Diabetic status • Insurance coverage 	<ul style="list-style-type: none"> • Charlson Comorbidity Index (CCI) • American Society of Anesthesiologists (ASA) classification • Spinal diagnosis • Levels treated 	<ul style="list-style-type: none"> • Operative duration • Estimated blood loss 	<ul style="list-style-type: none"> • Postoperative Length of stay • Postoperative VAS pain score • Postoperative narcotic consumption

Patient-reported outcome measures (PROMs) collected preoperatively and postoperatively

- Patient-Reported Outcomes Measurement Information System Physical Function (PROMIS-PF)
- 12-Item Short Form Physical and Mental Composite Scores (SF-12 PCS/MCS)
- Visual Analog Scale (VAS) neck and arm
- Neck Disability Index (NDI)

Methodology: Statistical Analysis

- Patients were separated based on preoperative SF-12 MCS scores, SF-12 MCS < 48.9 and SF-12 MCS ≥ 48.9, based on previously established thresholds for sensitivity and specificity
- Demographics, perioperative characteristics, PROMs, and minimum clinically important difference (MCID) achievement rates were compared between cohorts through inferential statistics
- Postoperative improvement of PROMs was calculated through paired samples t-tests

Results: Characteristics

- 87 patients were identified
- Most patients were Caucasian, had ASA \geq 2, and had private insurance

Most patients:

- were diagnosed with herniated disc
- had 1-level CDR

Table 1. Patient Demographics

Characteristic	SF-12 MCS < 48.9 (n = 40)	SF-12 MCS \geq 48.9 (n = 47)	*p-value
Age (mean \pm SD, years)	44.4 \pm 10.1	45.9 \pm 11.0	0.508
Gender			0.585
Female	37.5% (15)	31.9% (15)	
Male	62.5% (25)	68.1% (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)	
BMI (mean \pm SD, kg/m ²)	29.8 \pm 5.1	28.7 \pm 5.8	0.399
Comorbidities			
Hypertensive	17.5% (7)	12.8% (6)	0.537
Diabetic	5.0% (2)	2.1% (1)	0.464
Smoker	7.5% (3)	10.6% (5)	0.614
ASA Classification			0.918
<2	30.8% (12)	31.8% (14)	
\geq 2	69.2% (27)	68.2% (30)	
CCI Score (Mean \pm SD)	0.6 \pm 0.2	0.4 \pm 0.2	0.588
Insurance Type			0.342
Medicare/Medicaid	2.5% (1)	4.3% (2)	
Workers' 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; Workers' Comp = workers' compensation
*p-values calculated using Student's t-test for continuous variables and chi-square analysis for categorical variables

Table 2. Perioperative Characteristics

Characteristic	SF-12 MCS < 48.9 (n = 40)	SF-12 MCS \geq 48.9 (n = 47)	*p-value
Spinal Pathology			
Herniated Nucleus Pulposus	100.0% (40)	97.9% (46)	0.353
Degenerative Disc Disease	7.5% (3)	10.6% (5)	0.614
Central Stenosis	45.0% (18)	57.5% (27)	0.247
Foraminal Stenosis	22.5% (9)	25.5% (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 \pm SD; min)	50.8 \pm 11.8	53.8 \pm 11.2	0.247
Estimated Blood Loss (Mean \pm SD; mL)	27.5 \pm 7.6	28.0 \pm 8.2	0.803
Length of Stay (Mean \pm SD; hours)	7.6 \pm 6.2	6.8 \pm 3.3	0.567
Postoperative Vas pain			
POD 0	4.3 \pm 2.3	4.3 \pm 1.3	0.981
Postoperative Narcotic Consumption POD 0	20.4 \pm 16.2	18.6 \pm 16.9	0.614

POD = postoperative day; mL = milliliters; SD= standard deviation

*p-values calculated using Student's t-test for continuous variables and chi-square analysis for categorical variables

Results: PROMs

- Patients reported significant improvement in physical function, pain, and disability outcomes independent of preoperative mental health
- Patients with greater preoperative mental health had superior physical function, mental function, neck pain, and disability outcomes

Table 3. Mean Patient Reported Outcomes

PROM	SF-12 MCS < 48.9	*p-value	SF-12 MCS ≥ 48.9	*p-value	†p-value
	Mean ± SD		Mean ± SD		
PROMIS-PF					
Preoperative	37.9±5.9	-	42.5±7.3	-	0.009
6-week	44.9±8.3	0.006	47.4±9.3	0.168	0.379
12-week	41.9±6.6	0.045	51.4±10.4	<0.001	0.001
6-month	47.4±10.4	0.001	53.9±14.7	0.002	0.158
1-year	47.4±9.9	0.023	52.8±12.6	0.007	0.246
SF-12 PCS					
Preoperative	32.7±8.6	-	36.3±8.9	-	0.063
6-week	38.4±9.2	<0.001	41.9±11.3	0.029	0.241
12-week	38.1±9.0	0.007	45.8±10.3	<0.001	0.007
6-month	43.0±11.4	0.003	45.0±13.2	0.045	0.694
1-year	37.5±10.0	0.425	41.0±11.4	0.029	0.471
SF-12 MCS					
Preoperative	39.6±6.8	-	56.9±4.7	-	<0.001
6-week	46.9±11.5	0.001	58.3±4.8	0.329	<0.001
12-week	48.3±11.3	0.001	58.2±4.6	0.168	<0.001
6-month	48.9±10.6	0.005	56.7±3.7	0.358	0.038
1-year	39.2±13.6	0.848	53.6±9.3	0.362	0.016
VAS neck					
Preoperative	6.7±2.2	-	6.2±2.3	-	0.343
6-week	3.7±3.1	<0.001	2.5±1.9	<0.001	0.098
12-week	3.0±2.4	<0.001	1.4±1.7	<0.001	0.007
6-month	2.9±2.1	<0.001	1.8±2.0	<0.001	0.100
1-year	2.8±2.6	<0.001	3.1±3.6	0.017	0.820
VAS arm					
Preoperative	6.2±2.4	-	5.5±2.7	-	0.204
6-week	3.2±3.2	0.001	1.9±2.1	<0.001	0.062
12-week	3.1±3.0	0.002	1.6±2.7	<0.001	0.064
6-month	3.2±2.8	<0.001	2.4±2.4	0.006	0.438
1-year	3.0±2.2	0.015	1.4±2.2	0.002	0.086
NDI					
Preoperative	47.2±16.4	-	34.9±17.2	-	0.001
6-week	33.9±23.6	0.001	21.2±12.5	<0.001	0.014
12-week	24.4±16.4	<0.001	13.6±14.7	<0.001	0.012
6-month	27.1±19.1	<0.001	18.4±12.9	<0.001	0.111
1-year	24.2±19.2	0.001	12.5±13.6	<0.001	0.100

*p-values calculated using paired sample t-test to determine preoperative to postoperative improvement

†p-values calculated using Student's t-test to compare mean PROMs between cohorts

Boldface indicates significance

Results: MCID Achievement

- Most patients achieved MCID in physical function, neck pain, and disability outcomes
- Patients with greater preoperative mental health had higher physical function MCID achievement rates
- Patients with lower preoperative mental health had higher mental function MCID achievement rates

Table 4. Minimum Clinically Important Difference

PROM	SF-12 MCS	SF-12 MCS ≥	*p-value
	< 48.9	48.9	
	%, (n)	%, (n)	
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	31.8% (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	63.6% (14)	27.6% (8)	0.010
6-month	64.3% (9)	20.0% (2)	0.032
1-year	53.9% (7)	25.0% (2)	0.195
Overall	66.7% (22)	34.3% (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)	78.4% (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% (8)	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% (8)	0.653
Overall	80.0% (28)	73.0% (27)	0.483

*p-values calculated using chi-square analysis

Boldface indicates significance

Discussion / Conclusion

- Independent of preoperative mental health, patients undergoing CDR reported significant improvements in physical function, pain, and disability outcomes
- Patients with greater preoperative mental health demonstrated superior physical function, mental function, neck pain, and disability outcomes
- MCID achievement rates for physical function and mental function were higher and lower in the greater preoperative mental function cohort, respectively.
- Managing mental health preoperatively may allow patients undergoing CDR to experience better outcomes