Impact of Gender on Outcomes after Cervical Disc Replacement

Timothy J. Hartman, MD[1]; James W. Nie, BS[1]; Eileen Zheng, BS[1]; Keith R. MacGregor, BS[1]; Omolabake O. Oyetayo, BS[1]; Kern Singh, MD[1,2]

[1]Department of Orthopaedic Surgery, Rush University Medical Center

[2]Professor, Co-Director of the Minimally Invasive Spine Institute at Rush University Medical Center; Founder and President, Minimally Invasive Spine Study Group

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Background

There is limited literature on the potential influence of gender on outcomes after cervical disc replacement

Objective

The goal of this study is to determine the effect that self-reported gender may have on patient reported outcome measures (PROMs) and achievement of minimum clinically significant difference (MCID) following cervical disc replacement surgery

Methodology: Data Collection

Inclusion Criteria	Exclusion Criteria
• Single-level, elective CDR	• Missing gender data • Traumatic, infectious, or malignant etiologies

Demographics	Preoperative	Intraoperative	Postoperative
• Age • Gender • Ethnicity • BMI • Hypertension • Smoking status • Diabetic status • Insurance coverage	• Charlson Comorbidity Index (CCI) • American Society of Anesthesiologists (ASA) classification • Spinal diagnosis • Operative level	• Operative duration • Estimated blood loss	• Postoperative Length of stay • Postoperative VAS pain score • Postoperative narcotic consumption • Day of discharge

PROMs collected preoperatively and at 6-weeks, 12-weeks, 6-months, and 1-year postoperatively:

- Visual Analog Scale (VAS) Neck and Arm
- Neck Disability Index (NDI)
- 12-Item Short Form Physical Component Score (SF-12 PCS)
- Patient-Reported Outcomes Measurement Information System Physical Function (PROMIS PF)

Methodology: Statistical Analysis

- Patient were divided into two cohorts by gender
- PROMs were compared between groups via Student's t-tests
- Improvement in PROMs were compared within each group via paired t-tests
- Delta PROMs were calculated as the difference between preoperative and each postoperative value and compared to literature values of established Minimal Clinically Important Difference (MCID) values
- MCID achievement rates were compared between cohorts

Results: Baseline and Perioperative Characteristics

Table 1. Patient Demographics

Characteristic	Total (n=84)	Female Gender (n=35)	Male Gender (n=49)	*p-value
Age (mean ± SD, years)	45.8±10.1	47.0±10.0	45.0±10.3	0.361
Ethnicity				0.554
Caucasian	80.5% (66)	80.0% (28)	80.9% (38)	
African-American	8.5% (7)	11.4% (4)	6.4% (3)	
Hispanic	8.5% (7)	8.6% (3)	8.5% (4)	
Asian	2.4% (2)	0.0% (0)	4.3% (2)	
BMI (mean ± SD, kg/m^2)	28.4±6.4	26.9±6.4	29.4±6.2	0.080
Comorbidities				
Smoker	11.9% (10)	11.4% (4)	12.2% (6)	0.909
Diabetic	1.2% (1)	2.9% (1)	0.0% (0)	0.234
Hypertensive	13.1% (11)	11.4% (4)	14.3% (7)	0.702
ASA Classification				0.872
<2	33.3% (27)	34.4% (11)	32.7% (16)	
≥2	66.7% (54)	65.6% (21)	67.4% (33)	
CCI Score (Mean ± SD)	0.5±0.7	0.6±0.8	0.4±0.6	0.542
Insurance Type				0.108
Medicare/Medicaid	2.4% (2)	5.7% (2)	0.0% (0)	
Workers' Comp	25.0% (21)	17.1% (6)	30.6% (15)	
Private	72.6% (61)	77.1% (27)	69.4% (34)	

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	Total (n=84)	Female Gender (n=35)	Male Gender (n=49)	*p-value
Spinal Pathology				
Herniated Nucleus Pulposus	98.8% (83)	100.0% (35)	98.0% (48)	0.723
Degenerative Scoliosis	1.2% (1)	2.9% (1)	0.0% (0)	0.234
Degenerative Disc Disease	9.5% (8)	14.3% (5)	6.1% (3)	0.209
Central Stenosis	45.2% (38)	45.7% (16)	44.9% (22)	0.941
Foraminal Stenosis	26.2% (22)	20.0% (7)	30.6% (15)	0.360
Operative Level				0.247
C3-C4	3.6% (3)	2.9% (1)	4.1% (2)	
C4-C5	3.6% (3)	0.0% (0)	6.1% (3)	
C5-C6	60.7% (51)	71.4% (25)	53.1% (26)	
C6-C7	32.1% (27)	25.7% (9)	36.7% (18)	
Operative Time (Mean ± SD; min)	47.3±17.0	45.1±15.0	48.8±18.3	0.351
Estimated Blood Loss (Mean ± SD; mL)	24.7±2.4	25.0±0.0	24.5±3.1	0.413
Length of Stay (Mean ± SD; hours)	8.6±6.9	10.2±9.3	7.1±3.1	0.124
Postoperative VAS pain POD 0	3.5±2.0	3.1±2.9	4.0±0.6	0.589
Postoperative Narcotic Consumption POD 0	18.5±16.5	22.0±15.5	16.2±16.8	0.118

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

Both female and male cohorts showed significant improvement at one or more postoperative time points for each PROM

There were no significant differences in mean PROM scores between the cohorts at any preoperative or postoperative time point

Table 3. Mean Patient Reported Outcomes

PROM	Female Gender Mean ± SD	*p-value	Male Gender Mean ± SD	*p-value	†p-value
PROMIS PF					
Preoperative	40.0±6.2	-	40.4±6.0	-	0.815
6-week	44.6±6.3	**0.026**	46.2±11.5	0.190	0.624
12-week	45.1±9.0	**0.042**	50.6±11.4	**<0.001**	0.140
6-month	54.7±9.0	**<0.001**	49.2±14.2	**0.015**	0.259
1-year	51.5±7.5	**0.015**	45.5±12.0	0.190	0.236
SF-12 PCS					
Preoperative	34.7±7.0	-	35.5±10.4	-	0.749
6-week	36.8±7.8	0.625	37.8±10.0	0.123	0.748
12-week	42.6±10.1	**0.036**	43.3±10.0	**0.018**	0.845
6-month	45.6±7.9	**0.004**	41.9±12.8	0.092	0.464
1-year	42.3±13.1	0.173	36.4±8.6	0.903	0.272
VAS neck					
Preoperative	6.9±2.2	-	6.2±2.2	-	0.225
6-week	3.4±2.8	**0.007**	3.3±2.6	**<0.001**	0.919
12-week	2.7±2.7	**<0.001**	1.9±1.9	**<0.001**	0.244
6-month	1.6±1.9	**<0.001**	2.2±2.2	**<0.001**	0.426
1-year	3.8±3.7	0.241	3.5±3.4	**0.024**	0.867
VAS arm					
Preoperative	5.9±2.7	-	5.7±2.5	-	0.782
6-week	2.1±3.0	**<0.001**	2.7±2.3	**<0.001**	0.459
12-week	2.0±2.6	**<0.001**	2.3±2.7	**<0.001**	0.749
6-month	2.3±3.0	**0.004**	2.5±2.6	**0.006**	0.832
1-year	1.7±2.0	0.115	3.5±2.4	0.053	0.137
NDI					
Preoperative	41.4±16.4	-	39.7±19.3	-	0.712
6-week	28.2±18.5	0.264	28.3±20.3	**<0.001**	0.998
12-week	23.9±19.6	**<0.001**	15.0±12.5	**<0.001**	0.070
6-month	17.5±17.1	**<0.001**	21.1±18.2	**<0.001**	0.562
1-year	16.7±17.5	**0.005**	20.9±20.0	**0.012**	0.670

*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 both cohorts

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Results:
MCID Achievement

Gender did not affect rates of MCID achievement

Table 4. Minimum Clinically Important Difference

PROM	Female Gender %, (n)	Male Gender %, (n)	*p-value
PROMIS PF			
6-week	57.1% (8)	46.2% (6)	0.568
12-week	50.0% (6)	82.3% (14)	0.064
6-month	90.9% (10)	75.0% (9)	0.315
1-year	66.7% (4)	57.1% (4)	0.725
Overall	48.7% (18)	51.4% (19)	0.940
SF-12 PCS			
6-week	28.6% (4)	29.4% (5)	0.959
12-week	41.7% (5)	35.3% (6)	0.728
6-month	77.8% (7)	44.4% (4)	0.147
1-year	50.0% (3)	11.1% (1)	0.095
Overall	52.2% (12)	47.8% (11)	0.167
VAS neck			
6-week	46.7% (7)	44.0% (11)	0.870
12-week	75.0% (12)	64.3% (18)	0.463
6-month	80.0% (12)	72.2% (13)	0.604
1-year	50.0% (3)	36.4% (4)	0.585
Overall	39.0% (16)	61.0% (25)	0.607
VAS arm			
6-week	42.9% (6)	29.2% (7)	0.391
12-week	43.8% (7)	40.0% (10)	0.812
6-month	53.9% (7)	28.6% (4)	0.182
1-year	50.0% (3)	27.3% (3)	0.349
Overall	39.1% (9)	60.9% (14)	0.870
NDI			
6-week	50.0% (7)	54.2% (13)	0.804
12-week	75.0% (12)	74.1% (20)	0.946
6-month	73.3% (11)	66.7% (12)	0.678
1-year	83.3% (5)	54.6% (6)	0.235
Overall	41.5% (17)	58.5% (24)	0.848

*p-values calculated using chi-square analysis

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Discussion / Conclusion

- Both male and female cohorts demonstrated significant improvement in physical function, pain, and disability outcomes after CDR
- There were no significant differences between gender cohorts with regard to PROM scores or MCID achievement rates
- Gender may not affect patient-reported outcomes following CDR