

Comparison of Cervical Disc Replacement Outcomes by Insurance: Workers' Compensation vs. Private

Madhav Patel, Kevin C Jacob, Hanna Pawlowski¹, Timothy J Hartman, James Nie², Eileen Zheng, Keith R. Macgregor¹, Omolabake Oyetayo², Kern Singh¹

¹Midwest Orthopaedics At Rush, ²Rush University Medical Center

INTRODUCTION: Little to no literature has evaluated the influence of workers' compensation (WC) insurance status on outcomes following cervical disc replacement (CDR). We aim to evaluate perioperative characteristics, patient-reported outcome measures (PROMs), and rates of minimal clinically important difference (MCID) achievement among WC vs. privately insured patients undergoing CDR.

METHODS:

A retrospective dataset of a single surgeon was used to identify WC and private insurance patients undergoing 1-level or 2-level CDR. Patients who had Medicare/Medicaid, unavailable insurance status, or had surgery performed for trauma, infection, or malignancy were excluded. Patients were divided into two groups, those presenting with or without WC insurance. Demographic characteristics, perioperative variables, and preoperative spinal pathologies were collected and compared between groups. PROMs evaluating pain, disability, and physical function were collected preoperatively and postoperatively at 6-weeks, 12-weeks, 6-months, and 1-year. At each timepoint, PROMs were compared within groups to preoperative baseline scores and between groups. MCID achievement was determined using established threshold values for change in PROMs from preoperative to each postoperative timepoint and compared between groups.

RESULTS:

A total of 121 patients met the inclusion criteria with most being non-obese (64.5%) and male (62.8%). Ethnicity, smoking status, and hypertension were significantly varied by insurance status ($p \leq 0.027$, all). No other demographic differences were present between cohorts. Majority of patients presented with herniated nucleus pulposus (98.4%), followed by myeloradiculopathy (85.7%), and central stenosis (51.2%), with no differences in the proportion of diagnoses among cohorts. The majority of procedures were single-level (71.9%), with 34 double-level CDRs (28.1%), and no difference in the proportion of 1- vs. 2-level surgeries between cohorts. No perioperative variables significantly differed between cohorts. While non-WC patients improved for all PROMs at all timepoints, except for SF-12 PCS at 1-years ($p=0.072$), WC patients did not improve for VAS arm at 6-weeks, NDI at 6-weeks and 1-year, SF-12 PCS from 6-weeks until 1-year, or PROMIS-PF at 6-weeks, 12-weeks, or 1-year ($p \geq 0.050$, all). WC patients experienced significantly higher neck pain at 6-weeks and 6-months postoperatively, arm pain at 6-weeks postoperatively, and disability preoperatively and at all postoperative timepoints following CDR ($p \leq 0.048$, all). WC patients reported lower levels of physical function for PROMIS-PF at 6-weeks and SF-12 PCS at 6-weeks, 12-weeks, and 1-year following surgery. MCID achievement rates were significantly lower among WC patients for VAS neck at 6-months ($p=0.045$) and NDI throughout the overall postoperative period and all individual timepoints, except for NDI at 12-weeks ($p \leq 0.020$, all). No other differences were observed between WC and private insurance patients for MCID attainment.

DISCUSSION AND CONCLUSION: CDR is a safe procedure for WC patients, as no differences were observed for mean operative time, blood loss, hospital stay, or acute postoperative pain/narcotic consumption when compared to privately insured counterparts. However, as significant pre- to postoperative improvements were less frequent and mean ratings for disability, physical function, and 6-week back/leg pain were poorer among WC claimants, this patient population may suffer from inferior postoperative recovery. Nevertheless, while clinically meaningful improvements for disability were less likely among WC patients, MCID achievement for pain and physical function was unaffected. Future research is

necessary to verify and strengthen our findings.

Table 1. Patient Demographics

| Characteristic | Total (n=121) | Workers' Compensation (n=73) | Private Insurance (n=48) | *p-value |
|----------------------------|---------------|------------------------------|--------------------------|----------|
| Age (mean \pm SD, years) | 60.2 (12) | 61.2 (11) | 59.1 (13) | 0.541 |
| Sex | | | | |
| Male | 64.5% (79) | 59.4% (43) | 66.2% (36) | 0.033 |
| Female | 35.5% (43) | 40.6% (30) | 33.8% (17) | |
| Ethnicity | | | | 0.002 |
| Caucasian | 61.3% (75) | 61.3% (45) | 61.3% (30) | |
| African American | 7.5% (9) | 16.1% (12) | 4.0% (2) | |
| Hispanic | 8.4% (10) | 22.0% (17) | 3.4% (2) | |
| Asian | 2.5% (3) | 0.0% (0) | 5.0% (3) | |
| Other | 0.3% (0) | 0.0% (0) | 0.0% (0) | |
| Diabetic Status | | | | 0.784 |
| Non-Diabetic | 97.5% (119) | 90.9% (67) | 97.9% (47) | |
| Diabetic | 2.5% (3) | 9.1% (7) | 2.1% (1) | |
| Smoking Status | | | | 0.007 |
| Non-Smoker | 90.9% (110) | 81.3% (59) | 94.6% (48) | |
| Smoker | 9.1% (11) | 18.7% (14) | 5.4% (3) | |
| Hypertension Status | | | | 0.002 |
| Non-Hypertensive | 13.2% (16) | 35.0% (26) | 0.0% (0) | |
| Hypertensive | 86.8% (105) | 65.0% (48) | 100.0% (50) | |
| AHA Classification | | | | 0.018 |
| I | 31.3% (38) | 27.0% (20) | 35.0% (18) | |
| II | 68.7% (83) | 73.0% (54) | 65.0% (32) | |
| CCT Classification | | | | 0.339 |
| < 2 | 64.5% (79) | 64.5% (47) | 64.5% (32) | |
| 2-3 | 35.5% (43) | 35.5% (26) | 35.5% (18) | |
| Insurance | | | | 0.001 |
| Medicare/Medicaid | 0.0% (0) | 0.0% (0) | 0.0% (0) | |
| Workers' | 60.3% (73) | 60.3% (45) | 60.3% (24) | |
| Private | 39.7% (48) | 39.7% (29) | 39.7% (19) | |

Table 2. Preoperative Characteristics

| Characteristic | Total (n=121) | Workers' Compensation (n=73) | Private Insurance (n=48) | *p-value |
|----------------------|-----------------|------------------------------|--------------------------|----------|
| Spinal Pathology | | | | 0.420 |
| Myelopathy | 1.7% (2) | 1.4% (1) | 2.1% (1) | |
| Radiculopathy | 8.3% (10) | 9.7% (7) | 6.9% (3) | |
| Myelofasciculopathy | 85.7% (104) | 87.9% (64) | 84.6% (40) | |
| HNP | 98.4% (119) | 98.4% (71) | 98.4% (48) | 0.666 |
| Central Stenosis | 51.2% (62) | 53.4% (39) | 49.0% (23) | 0.368 |
| Furrowed Surface | 24.0% (29) | 25.0% (18) | 23.0% (11) | 0.731 |
| Operative Time | | | | 0.943 |
| (Mean \pm SD, min) | 51.0 \pm 16.6 | 52.1 \pm 22.2 | 51.9 \pm 14.3 | |
| (Mean \pm SD, min) | 26.8 \pm 7.3 | 25.8 \pm 4.5 | 27.2 \pm 8.0 | 0.530 |
| (Mean \pm SD, min) | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 0.644 |
| (Mean \pm SD, min) | 51.0 \pm 16.6 | 52.1 \pm 22.2 | 51.9 \pm 14.3 | 0.943 |
| (Mean \pm SD, min) | 26.8 \pm 7.3 | 25.8 \pm 4.5 | 27.2 \pm 8.0 | 0.530 |
| (Mean \pm SD, min) | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 0.644 |
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| (Mean \pm SD, min) | 26.8 \pm 7.3 | 25.8 \pm 4.5 | 27.2 \pm 8.0 | 0.530 |
| (Mean \pm SD, min) | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 0.644 |
| (Mean \pm SD, min) | 51.0 \pm 16.6 | 52.1 \pm 22.2 | 51.9 \pm 14.3 | 0.943 |
| (Mean \pm SD, min) | 26.8 \pm 7.3 | 25.8 \pm 4.5 | 27.2 \pm 8.0 | 0.530 |
| (Mean \pm SD, min) | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 24.5 \pm 5.8 | 0.644 |

Table 3. Mean Patient Reported Outcome

| PROM | Workers' Compensation (Mean \pm SD) | Private Insurance (Mean \pm SD) | *p-value |
|--------------|---------------------------------------|-----------------------------------|----------|
| VAS neck | 6.3 \pm 2.3 | 6.5 \pm 2.3 | 0.683 |
| 6-weeks | 4.2 \pm 2.4 | 4.3 \pm 2.4 | <0.001 |
| 12-weeks | 2.0 \pm 1.5 | 1.8 \pm 1.3 | <0.001 |
| 6-months | 2.0 \pm 1.6 | 1.7 \pm 1.2 | <0.001 |
| 1-year | 2.7 \pm 1.0 | 2.9 \pm 1.3 | 0.983 |
| VAS arm | 5.7 \pm 2.6 | 5.8 \pm 2.6 | 0.943 |
| 6-weeks | 3.9 \pm 2.9 | 4.0 \pm 2.9 | <0.001 |
| 12-weeks | 2.1 \pm 2.0 | 2.0 \pm 1.9 | <0.001 |
| 6-months | 2.1 \pm 2.0 | 2.0 \pm 1.9 | <0.001 |
| 1-year | 2.5 \pm 2.4 | 2.6 \pm 2.3 | 0.599 |
| NDI | | | |
| Preoperative | 45.6 \pm 10.3 | 39.8 \pm 17.9 | 0.048 |
| 6-weeks | 41.0 \pm 10.2 | 31.4 \pm 14.8 | <0.001 |
| 12-weeks | 32.1 \pm 2.0 | 35.6 \pm 15.9 | <0.001 |
| 6-months | 34.0 \pm 14.6 | 38.3 \pm 15.1 | <0.001 |
| 1-year | 27.2 \pm 10.7 | 35.6 \pm 15.1 | <0.001 |
| SF-12 PCS | | | |
| Preoperative | 31.3 \pm 8.5 | 35.4 \pm 9.1 | 0.031 |
| 6-weeks | 33.4 \pm 8.4 | 41.4 \pm 10.9 | <0.001 |
| 12-weeks | 39.1 \pm 7.7 | 41.6 \pm 10.2 | <0.001 |
| 6-months | 39.0 \pm 14.6 | 41.5 \pm 13.7 | <0.001 |
| 1-year | 35.2 \pm 10.0 | 43.8 \pm 13.3 | <0.001 |
| PROMIS-PF | | | |
| Preoperative | 36.7 \pm 6.6 | 41.2 \pm 7.9 | 0.142 |
| 6-weeks | 39.9 \pm 6.2 | 47.2 \pm 14.4 | 0.003 |
| 12-weeks | 45.3 \pm 6.6 | 49.3 \pm 10.5 | <0.001 |
| 6-months | 45.1 \pm 15.7 | 51.6 \pm 12.7 | <0.001 |
| 1-year | 45.2 \pm 9.1 | 52.8 \pm 11.1 | 0.003 |

Table 4. Minimum Clinically Important Difference

| PROM | Workers' Compensation (%) | Private Insurance (%) | *p-value |
|-----------|---------------------------|-----------------------|----------|
| VAS neck | 35.3% | 56.8% | 0.132 |
| 6-weeks | 33.3% | 53.3% | 0.130 |
| 12-weeks | 33.3% | 53.3% | 0.130 |
| 6-months | 33.3% | 53.3% | 0.130 |
| 1-year | 33.3% | 53.3% | 0.130 |
| VAS arm | 64.8% | 73.9% | 0.369 |
| 6-weeks | 18.8% | 41.9% | 0.009 |
| 12-weeks | 23.6% | 48.9% | 0.101 |
| 6-months | 15.7% | 36.9% | 0.026 |
| 1-year | 31.4% | 55.0% | 0.508 |
| NDI | | | |
| 6-weeks | 30.0% | 50.0% | 0.121 |
| 12-weeks | 67.0% | 79.0% | 0.012 |
| 6-months | 68.0% | 80.0% | <0.001 |
| 1-year | 82.0% | 85.0% | <0.001 |
| 6-months | 68.0% | 80.0% | 0.002 |
| 1-year | 82.0% | 85.0% | 0.003 |
| SF-12 PCS | | | |
| 6-weeks | 31.3% | 42.1% | 0.174 |
| 12-weeks | 29.0% | 39.6% | 0.267 |
| 6-months | 29.0% | 39.6% | 0.267 |
| 1-year | 42.9% | 50.0% | 0.048 |
| PROMIS-PF | | | |
| 6-weeks | 40.0% | 53.3% | 0.102 |
| 12-weeks | 50.0% | 66.7% | 0.148 |
| 6-months | 77.8% | 77.8% | 0.771 |
| 1-year | 77.8% | 77.8% | 0.681 |
| 6-months | 77.8% | 77.8% | 0.681 |
| 1-year | 77.8% | 77.8% | 0.681 |

MCID = Minimum Clinically Important Difference; CCT = Cervical Classification; HNP = Herniated Nucleus Pulposus; VAS = Visual Analog Scale; NDI = Neck Disability Index; SF-12 PCS = Short Form-12 Physical Component Summary; PROMIS-PF = Patient-Reported Outcomes Measurement Information System - Physical Function subscale. *p < 0.05 indicates statistical significance. †p < 0.001 indicates statistical significance. ‡p < 0.0001 indicates statistical significance. §p < 0.01 indicates statistical significance. ¶p < 0.05 indicates statistical significance. ††p < 0.001 indicates statistical significance. †††p < 0.0001 indicates statistical significance. ‡‡p < 0.01 indicates statistical significance. ‡‡†p < 0.001 indicates statistical significance. ‡‡‡p < 0.0001 indicates statistical significance.