

# Operative Level Influences Reoperation Risk but Not Patient-Reported Outcomes in 3-Level Anterior Cervical Discectomy and Fusion

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**INTRODUCTION:** Anterior cervical discectomy and fusion (ACDF) is a widely used surgical procedure for cervical degenerative disc disease (DDD). While one- and two-level ACDFs have been well-studied, less is known about the outcomes of three-level ACDFs. Prior research has suggested that multi-level ACDFs carry increased risks of complications like dysphagia and pseudarthrosis. Furthermore, the specific levels involved may affect outcomes. For example, more cranial constructs have been linked to higher dysphagia rates and longer hospital stays. A more granular understanding of how outcomes vary by operative level could improve patient counseling and surgical planning. Thus, the current study aimed to compare clinical outcomes and patient-reported outcome measures (PROMs) for 3-level ACDFs, stratified by the fusion level: C3-C6, C4-C7, and C5-T1. We hypothesized that operative level would influence complication and reoperation rates but not significantly affect PROM improvement or the achievement of a minimally clinically important difference (MCID) at one year.

**METHODS:** This was a retrospective, single-institution study of adult patients who underwent a primary 3-level ACDF between 2014 and 2020. Patients with operative indications of infection, cancer, trauma, or deformity were excluded. Patients with incomplete preoperative or 1-year postoperative PROMs (mJOA or NDI scores) were also excluded. Demographic and perioperative data were collected via Structured Query Language (SQL) search, including age, sex, race, body mass index (BMI), comorbidities, operative time, length of stay (LOS), and complications. PROMs, including SF-12, VAS Neck, VAS Arm, mJOA, and NDI, were assessed preoperatively and at 3, 6, and 12 months postoperatively. One-year MCID achievement was calculated using established thresholds. Patients were categorized into C3-C6, C4-C7, and C5-T1 groups. A *P*-value of less than 0.05 was considered statistically significant.

**RESULTS SECTION:** Of the 200 patients included, 59 (29.5%) had C3-C6 fusions, 130 (65.0%) had C4-C7 fusions, and 11 (5.5%) had C5-T1 fusions. Patients with C3-C6 fusions were significantly older than those with C4-C7 fusions (62.7 versus 58.1 years, *P* = 0.007). No other significant differences were found in demographics or other perioperative variables, though a difference in preoperative myelopathy rates was found when comparing all three operative levels (*P* = 0.032). Postoperatively, there was a significant difference in nerve palsy (*P* = 0.040) and hematoma/seroma rates (*P* = 0.035) when comparing the three groups. While 1-year reoperation rates were comparable, the 2-year reoperation rate was significantly higher in the C5-T1 group compared to the C4-C7 group (18.2% vs. 0.77%, *P* = 0.048). In terms of PROMs, the C4-C7 group had higher preoperative VAS Arm scores than the C3-C6 group (5.58 vs. 4.38, *P* = 0.026) and greater improvement in VAS Arm scores at 1 year (-3.45 vs. -2.27, *P* = 0.047). Three months postoperatively, the C4-C7 group had higher NDI scores than the C3-C6 group (28.5 vs. 21.9, *P* = 0.044), but this difference was not sustained by six months. Importantly, the rate of MCID achievement for all PROMs was comparable across all three groups.

**DISCUSSION:** Our findings reveal important differences in 3-level ACDF outcomes based on operative level. The association between higher, more cranial fusions (C3-C6) and older patients aligns with existing literature suggesting that older patients are more likely to undergo ACDF for myelopathy at higher levels. The higher 2-year reoperation rates in the C5-T1 group compared to the C4-C7 group may be attributable to biomechanical differences, particularly at the C6-C7 level, which has been associated with lower fusion rates due to its higher mobility. Despite these variations in patient profiles and reoperation risks, the current study found that the likelihood of achieving a clinically meaningful improvement in PROMs is similar across all three fusion levels.

**SIGNIFICANCE/CLINICAL RELEVANCE:** These findings suggest that while surgeons should counsel patients on specific risks associated with different fusion levels, they can also reassure patients that the potential for functional benefit is comparable regardless of the operative level.