Single-Site Experience with Multilevel Hybrid Cervical Surgery

Jennifer A. Bowden[1,2], John R. Edwards[1]
[1]Summit Brain, Spine, and Orthopedics, Lehi, UT [2]Brigham Young University, Provo, UT
jenniferb@summitbrainandspine.com

AUTHOR DISCLOSURES: **J.A. Bowden:** None. **J.R. Edwards:** 5; Orthofix. 8; 33 Medical.

INTRODUCTION: For patients with multilevel cervical disc degeneration, treatment considerations include mobility, adjacent segment hypermobility and disease, and subsequent quality of life. Cervical hybrid surgery (CHS), involving a combination of adjacent anterior cervical discectomy and fusion (ACDF) and cervical disc arthroplasty (CDA), may be an appropriate option for patients with multilevel disease. Available data suggest hybrid surgery is a noninferior method to manage multilevel cervical disease; however, minimal research has examined hybrid procedures, especially in >2 level CHS.[1] This case series examines outcomes for 2-4 level hybrid procedures in a single surgeon cohort.

METHODS: This case series, retrospective records review included all CHS performed by a single surgeon from May 2020-2023. Outcome data were examined and compared with data published from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) registry from 2015-2019[1] with descriptive and inferential statistics (single tailed t-tests). Retrospective data was collected under IRB approval.
The surgical procedure resembled a multilevel ACDF with arthroplasty at select levels. Arthroplasty selection criteria includes fusion for spondylolisthesis and the most arthritic levels. With multiple arthritic levels, the middle segment was fused so arthroplasties protect adjacent segments. All cases used microscopy with full aggressive foraminal nerve decompression, sometimes removing the uncovertebral joint. Autograft was collected at all levels providing sufficient tissue for fusion levels without allograft. One technical advantage in 3-4 level disease was eliminating the more difficult 3-4 level plate. The M6 (Orthofix) was utilized off label as we have found good success routinely for CDA.

RESULTS: Cervical hybrid procedures were performed on 31 patients over the 3 year inclusion period with a total of 36 ACDF levels and 52 CDA levels. Statistical data for patient characteristics and surgical outcomes are reported in Table 1 and compared with data published from the ACS-NSQIP registry. No perioperative complications, readmission, or reoperation were reported within 30 days of procedure. No malunion, nonunion, or subsidence was found in patients with sufficient follow up imaging for evaluation. All available imaging described hardware as stable and well-placed. Perioperative NDI scores improved in most patients, with high patient satisfaction (Figure 1).

DISCUSSION: Hybrid procedures provided a safe alternative with good outcomes, as demonstrated in both this case series and the ACS-NSQIP registry.[1] This series had a highly significant lower average length of stay without perioperative complications for an older population and higher number of levels treated compared to ACS-NSQIP data.[1] Only one early case (1/1 ACDF/CDA) was revised (2-ACDF) due to arthritic changes, and subsequent treatment utilizes ACDF in similar patients. There is a potential reduction in adjacent segment disease with hybrid procedures and CDA with a known reduction in subsidence as compared with a multilevel ACDF, where we have seen a moderately high level of bottom level subsidence in 3-4 level fusions. Further long term study is needed.

SIGNIFICANCE/CLINICAL RELEVANCE: Hybrid cervical surgeries provided a safe alternative to multilevel fusions and multilevel arthroplasty with good short-term patient outcomes.

1. Michaelopolous GD, et. al. Hybrid surgery: a comparison of early postoperative outcomes between anterior cervical discectomy and fusion and cervical disc arthroplasty. J Neurosurg Spine. 2022. 36:575-584.

	Current study 2020-2023	ACS-NSQIP registry 2015-2019[1]	p Value
Number of cases	31	439	
Age	56.5 (10.1)	49.9 (10.5)	0.0003*
BMI	29.9 (5.6)	30.05 (6.5)	0.438
Female sex	16 (51.6%)	191 (43.5%)	
Diabetes Mellitus	4 (12.9%)	55 (12.5%)	
Hypertension	5 (16.1%)	138 (31.4%)	
Cardiovascular dis.	4 (12.9%)	Not reported	
Inpatient	16 (51.6%)	271 (61.7%)	
Hospital LOS	0.65 (0.66)	1.54 (2.9)	4.12E-25**
Levels treated	2.97 (0.66)	2.57 (0.8)	0.0005*
2 levels	7 (22.6%)	256 (58.3%)	
3 levels	18 (58.1%)	129 (29.4%)	
4 levels	6 (19.4%)	44 (10%)	
>4 levels	0	10 (2.3%)	
Readmission within 30 days	0	3 (0.7)	1.65E-284**
Reoperation within 30 days	0	1 (0.3)	7.62E-240**
Revision after 2m	1	Not reported	
Decompression >2m	2	Not reported	
Deaths	0	0	

Table 1. *Comparison of current study data with ACS-NSQIP data. There was a significantly shorter hospital length of stay with no readmission or reoperation in the current study data set. Values are shown as mean (SD) or number (percent); *significant; **highly significant*

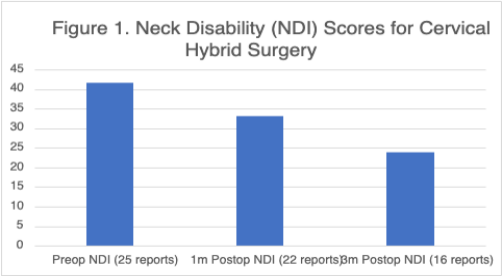

Figure 1. *Averaged pre- and postoperative neck disability (NDI) scores from current study data.*