

No difference in Two-Year Revisions Between Hybrid Fusion and Two-Level Anterior Discectomy and Fusion: A national database study

Jon Raso, Pramod Kamalopathy, Kevin Mo¹, Lawal Abbas Labaran, Jesse Francis Wang², Hamid Hassanzadeh
¹Johns Hopkins University, ²University of Virginia

INTRODUCTION: Currently, anterior cervical discectomy and fusion (ACDF) is the gold standard for surgical management of cervical spine pathology providing durable fixation. Cervical disc arthroplasty (CDA) has become a widely accepted motion-sparing alternative to the standard ACDF in appropriately selected patients by preventing excessive load on adjacent discs. Hybrid surgery (HS) combines the benefits of both procedures, yet there is limited literature regarding postoperative outcomes following HS. Thus, the aim of this study was to employ a large national database to evaluate cost effectiveness, as well as both short-term and long-term complications following HS and two level-ACDF. We hypothesize that patients undergoing HS will have lower rates of revision and decreased postoperative complications compared to those undergoing two-level ACDF.

METHODS: This study used the PearlDiver Mariner dataset selecting for patients aged 18 and older who had at least 90-day active longitudinal follow-up who underwent two-level ACDF or two-level Hybrid surgery (single level ACDF and single level CDA). Patients with prior spinal trauma, infection, cancer, or posterior fusion were excluded. Primary outcomes measures were 90-day major and minor medical complications, ED visits, readmissions, as well as two-year revisions. Patients were also assessed for postoperative dysphagia, incidental durotomy, vascular injury, 90-day surgical site, and implant complications. Additionally, hospitalization and postoperative costs were evaluated.

RESULTS: There were 4,570 two-level ACDF surgeries and 888 hybrid surgeries. After matching the cohorts, no statistical differences in demographics were found. HS had a lower incidence of major (1.6% vs. 3.1%, $p = 0.003$) and minor complications (3.0% vs. 4.6%, $p = 0.009$) than ACDF. 90-day readmission was lower in the HS cohort (2.8% vs. 4.2%), $p = 0.024$. HS was associated with reduced hospitalization costs $-\$2614$ ($-\$3,916$ -- $-\$904$, $p 0.001$). 3,516 patients had ACDF, and 699 had HS with 2 years of follow-up. There were no differences in 90-day or 2-year reoperation rates, implant complications, or pseudarthrosis.

DISCUSSION AND CONCLUSION: The present study adds to the growing consensus that HS is a safe and effective surgical treatment for treating cervical disease in appropriately selected patients. HS provides a lower rate of 90-day complication and readmission than conventional ACDF and is associated with decreased total hospital costs. Long-term outcomes similar across both surgical procedures.

	ACDF n = 4,570	Hybrid n = 888	p-value
Age, years			1.00
<44	1,353 (29.6%)	261 (29.6%)	
45-54	1,736 (38.0%)	338 (38.0%)	
55-64	1,133 (24.8%)	221 (24.8%)	
65-74	283 (6.1%)	55 (6.2%)	
75-84	55 (1.2%)	13 (1.2%)	
Gender (Female)	2,476 (54.1%)	481 (54.2%)	1.00
Comorbidities			
Obesity (BMI>30 kg/m ²)	210 (4.6%)	42 (4.7%)	1.00
Chronic Kidney Disease	48 (1.1%)	12 (1.4%)	0.611
COPD	514 (11.6%)	107 (12.0%)	0.765
Diabetes Mellitus	463 (10.3%)	96 (10.8%)	0.843
Peripheral Vascular Disease	136 (3.1%)	29 (3.3%)	0.849
Congestive Heart Failure	30 (0.7%)	<11 (<1%)	0.891
Coronary Artery Disease	437 (9.8%)	90 (10.1%)	0.869
Hypertension	1,797 (40.7%)	363 (40.9%)	0.951
Hyperlipidemia	1,736 (39.3%)	351 (39.5%)	0.918
Substance use			
History of Tobacco Use	964 (21.8%)	195 (22.0%)	0.957

BMI, Body Mass Index; PVD, Peripheral Vascular Disease; COPD, Chronic Obstructive Pulmonary Disease

	ACDF n = 4,570	Hybrid n = 888	Hybrid vs. ACDF Adjusted OR (95% CI)	p-value
Major Complications	140 (3.1%)	14 (1.6%)	0.43 (0.23-0.75)	0.003
Minor Complications	212 (4.6%)	27 (3.0%)	0.58 (0.37-0.86)	0.009
Dysphagia	285 (6.2%)	41 (4.6%)	0.62 (0.35-1.04)	0.089
Implant	35 (0.8%)	<11	0.56 (0.16-1.45)	0.284
Durotomy	<11	<11	0.85 (0.04-5.06)	0.886
Vascular injury	<11	<11	5.24 (0.31-87.5)	0.248
90-Day ER Visit	552 (12.1%)	103 (11.6%)	0.91 (0.72-1.14)	0.458
90-Day Readmission	194 (4.2%)	25 (2.8%)	0.61 (0.39-0.92)	0.024
Infection 90 Days	55 (1.2%)	<11	0.52 (0.26-1.13)	0.139

PE, Pulmonary embolism; PNA, pneumonia; CVA, Cerebrovascular accident; AKI, acute kidney injury; UTI, urinary tract infection; DVT, deep vein thrombosis; MI, myocardial infarction. Bolded variables indicate significance with $P < .005$ (Bonferroni Correction)

	ACDF n = 4,570	Hybrid n = 888	F Value	Rate
Total in Hospital cost	\$11,048 (14,447)	\$6,813 (12,266)	<0.001	2011 (\$3166 - 994)
90-Day Postoperative Cost	\$2,088 (14,372)	\$2,478 (1,989)	8.189	-460 (2,181 - 217)

Reoperation	ACDF n = 3,516	Hybrid n = 699	Adjusted OR (95% CI)	p-value
90 days	491 (14.0%)	<11	0.70 (0.29-1.46)	0.380
1 year	341 (9.7%)	<11 (2.8%)	0.70 (0.36-1.40)	0.487
2 years	325 (9.2%)	14 (2.0%)	0.78 (0.43-1.34)	0.488
Implant complication (2 pt.)	131 (3.7%)	19 (2.7%)	0.89 (0.52-1.41)	0.636
Pseudarthrosis (2 pt.)	94 (2.7%)	<11	0.54 (0.25-1.03)	0.061