

Complications of Anterior Cervical Discectomy and Fusion Versus Posterior Cervical Fusion for Unstable Hangman's Fractures

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INTRODUCTION:

There is no clear consensus in the literature on the operative management for unstable Hangman's fractures. Surgical treatment options include C2-3 anterior cervical discectomy and fusion (ACDF), posterior C2 pars direct repair (Judet screw), C2-3 posterior cervical fusion (PCF), C2-3 PCF with temporary fixation of C1, C1-3 PCF, or a combined anterior-posterior fusion. Performing C2-3 ACDF is advantageous in that it preserves C1-2 motion that is lost with posterior fixation to C1, but it may be complicated by transient post-operative dysphagia, or even permanent dysphagia associated with increased morbidity, mortality, and costs. The objective of this study was to compare the rate of complications between ACDF and PCF for unstable Hangman's fractures. We hypothesized that there would be a higher rate of surgical complications, in particular dysphagia-related complications, in the ACDF group versus the PCF group.

METHODS: This is a retrospective review performed at a single Level 1 trauma institution. The study population included 85 operative cases performed by 12 fellowship trained spine surgeons for unstable Hangman's fractures over a 10-year period between January 2014 and December 2023. Inclusion criteria were age greater than 18 years of age and patients with C2-3 traumatic spondylolisthesis treated with either C2-3 ACDF or short segment posterior fusion (e.g. C2-3 PCF or C1-3 PCF). We excluded patients that underwent a combined anterior-posterior approach and prior history of instrumentation involving the upper cervical spine. The decision on surgical approach was left to the discretion of the attending surgeon. All anterior cervical approaches were performed via the standard Smith-Robinson approach. The rate of post-operative dysphagia, temporary tube feeds, percutaneous gastrostomy tube placement, surgical site infection, non-union, hardware failure, and need for revision surgery were compared. Statistical analysis will utilize t-test for continuous variables, Chi-square and Fisher's exact test for categorical variables. Informed consent was not required after IRB review of the study protocol.

RESULTS: The average follow-up was approximately 9.4 months. The mean age was significantly younger in the ACDF group (49.4 years ACDF vs 61.7 years PCF groups, $p < 0.05$). The majority were atypical Hangman's fractures in 59 (69%) patients. In the PCF group, 7 (11%) underwent C2-3 PCF while 58 (89%) included posterior fixation to C1. The total cohort included 19 (22%) injuries from low-energy mechanism, 41 (48%) patients with polytraumatic injuries, 35 (41%) patients with non-contiguous spine injuries, and 46 (54%) patients with blunt cerebrovascular injury identified on pre-operative computed tomography arteriography. The 30-day mortality rate was 2% and 1-year mortality rate was 11%. We observed a significantly higher rate of post-operative dysphagia in the ACDF group in 13 (65%) versus 14 (22%) in the PCF group ($p < 0.05$). There was persistent dysphagia in 1 (5%) versus 5 (8%) patients after ACDF and PCF, respectively. Four (20%) patients in the ACDF group required temporary tube feeds attributed to edema from the anterior cervical approach. In the ACDF group, 3 of 8 (37.5%) patients over 60 years and 1 of 12 (8.3%) patients under 60 years of age received temporary tube feeds. There were no hardware complications, non-unions, surgical site infections, or revisions in the ACDF group, while the PCF group had 2 (3.1%) hardware failures, 1 (1.5%) non-union, 3 (4.6%) surgical site infections, and 4 (6.2%) revisions.

DISCUSSION AND CONCLUSION:

In this retrospective review of 20 ACDF and 65 PCF procedures for unstable Hangman's fractures at a high-volume level 1 trauma center, the majority being atypical fractures in 59 (69%) patients, we found a significantly higher rate of post-operative dysphagia in the ACDF group, but no hardware failures, non-unions, surgical site infections, or revisions. In contrast, the PCF group had a non-significant but higher rate of hardware failure (3.1%), non-union (1.5%), surgical site infection (4.6%), and revision surgery (6.2%). When considering age as a potential risk factor for receiving temporary tube feeds after ACDF, there were 3 out of 8 patients (37.5%) over the age of 60 years and only 1 out of 12 patients (8.3%) under the age of 60 years. While both ACDF and PCF are effective treatment options for unstable Hangman's fractures, ACDF may be more favorable in younger patients with low rates of hardware failure, non-union, surgical site infection, and need for revision surgery, and avoids the loss of atlantoaxial motion from posterior fixation to C1.

Table 1: Patient Characteristics

	ACDF	PSIF	p-value
n	20	65	
Female (%)	10 (50%)	18 (28%)	0.0634
Age, mean (y)	49.4	61.7	0.0024
BMI, mean	27.4	29.0	0.0981
Current smoker (%)	5 (25%)	8 (12%)	0.1679
Diabetes (%)	3 (15%)	12 (19%)	0.7225
ASA status \neq 3 (%)	10 (50%)	41 (63%)	0.2965
Low energy mechanism (%)	2 (10%)	17 (26%)	0.1294
Polytrauma (%)	10 (50%)	31 (48%)	0.8567
Non-contiguous spine injury (%)	9 (45%)	26 (40%)	0.6911
Blunt cerebrovascular injury (%)	10 (50%)	36 (55%)	0.6726

Table 2: Complications

	ACDF	PSIF	p-value
Dysphagia (%)	13 (65.0%)	14 (21.5%)	0.0003
Persistent dysphagia (%)	1 (5.0%)	5 (7.7%)	0.6910
Temporary tube feeds (%)	6 (30.0%)	12 (18.5%)	0.2694
PEG tube placement (%)	2 (10%)	3 (4.6%)	0.3708
Hardware failure (%)	0	2 (3.1%)	0.4273
Non-union (%)	0	1 (1.5%)	0.5768
Surgical site infection (%)	0	3 (4.6%)	0.3290
Revision surgery (%)	0	4 (6.2%)	0.2658

Table 3: Fracture Classification

	ACDF	PSIF
Atypical	8 (40%)	51 (78%)
LE II	10 (50%)	8 (12%)
LE IIA	2 (10%)	2 (3%)
LE III	0	4 (6%)

Legend: LE = Levine and Edwards