Risk Factors and Clinical Outcomes of Dysphagia After Anterior Cervical Surgery in Patients With Degenerative Cervical Myelopathy: Results from the AOSpine International and North America Studies

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Introduction

Although dysphagia is a common complication after anterior cervical decompression and fusion, its impact on neurological and quality of life outcomes is not fully understood. The objective of this study is to determine the incidence and risk factors of postoperative dysphagia and to evaluate short- and long-term clinical outcomes in patients with this complication.

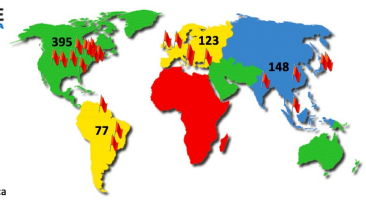
Methods

Four hundred and seventy patients undergoing an anterior or a 2-stage surgery were enrolled in the prospective AOSpine CSM-North America or International study at 26 global sites.

Enrollment Summary: AOSpine International and North American Studies

AOSPINE NORTH AMERICA
- 278 patients enrolled:
- 11 sites from the USA
- 1 site from Canada

AOSPINE INTERNATIONAL
- 479 patients enrolled:
- 6 sites from Asia Pacific
- 5 sites from Europe
- 3 sites from Latin America
- 2 sites from North America



Logistic regression analyses were conducted to determine important clinical and surgical predictors of dysphagia. Preoperatively and at each follow-up, patients were evaluated using the modified Japanese Orthopedic Association scale (mJOA), Nurick score, Neck Disability Index (NDI), and the SF-36. A mixed model analytic approach was used to evaluate differences in outcomes at 6- and 24-months between patients with and without dysphagia, while controlling for relevant baseline characteristics and surgical factors.

Results

Twenty-nine patients experienced dysphagia within 30-days of surgery, yielding an overall incidence of 6.17%. Eight (26.67%) subjects experienced symptoms of dysphagia on the day of surgery, 19 (65.52%) within five days and two (6.90%) between 6 and 30 days.

Overview of Patient Demographics

Variable	Means or Percentages
General Demographics	
Age (years)	53.23±11.30 (21-87)
Gender (%)	59.57 M
Body mass index (kg/m^2) (n=468)	27.34±5.72 (14.09-52.66)
Duration of Symptoms (months)	25.30±39.61 (0.25-432)
Smoker (%)	28.72
Baseline myelopathy severity (mJOA)	
mJOA	13.05±2.69 (4-18)
Nurick	3.11±1.09 (0-6)
Neck Disability Index (n=408)	39.45±20.45 (0-100)
SF-36 Physical Component Score (n=455)	34.73±9.18 (10.77-68.19)
SF-36 Mental Component Score (n=455)	40.10±13.44 (9.73-75.64)
Co-morbidities (%)	61.06
Cardiovascular (%)	40.21
Respiratory (%)	10.21
Gastrointestinal (%)	18.30
Endocrine	17.87
Psychiatric (%)	14.47
Rheumatologic (%)	4.04
Neurological (%)	6.17
Co-morbidity score	1.36±1.77 (0-13)
Diagnosis	
Spondylosis (%)	70.21%
Disc herniation (%)	82.98%
OPLL (%)	21.06%
HLF (%)	11.49%
Subluxation (%)	3.83%
Surgical Summary	
2-Stage Surgery (%)	4.83
Anterior Surgery (n=441)	
Discectomy (%)	79.59
Corpectomy (%)	2.95
Discectomy and Corpectomy (%)	17.46
Operative duration (min)	179.73±81.87 (48-575)
Number of operated levels	3.03±0.92 (1-6)
Operated Segments at C4 and/or above (%)	58.09

In terms of severity, 23 (79.31%) patients presented with mild dysphagia, four (13/79%) with moderate and two (6.90%) with severe. The majority received either no (n=15) or conservative (n=14) treatment. By last follow-up, the dysphagia resolved in 21 patients (14.38% with and 85.71% without residual sympotms) and continued in eight.

Univariately, the major risk factors for perioperative dysphagia were a higher co-morbidity score (OR:1.289,p=0.0019), the presence of cardiovascular (OR:2.584,p=0.0163) and endocrine (OR:4.234,p=0.0003) disorders, a 2-stage surgery (OR (ref=1-stage):6.506,p=0.0003) and a greater number of decompressed levels (OR:1.816,p=0.0022).

Important Risk Factors of Dysphagia: Results of Univariate Analysis

Clinical predictor	Odds Ratio	95% C.I.	p-value
Clinical Predictors of Dysphagia			
Age (by decade)	1.711	1.216, 2.408	0.0020
Gender (REF=male)	0.646	0.288, 1.452	0.291
Body mass index	1.016	0.954, 1.081	0.631
Duration of Symptoms*	1.112	0.844, 1.465	0.452
Smoker (REF=non-smoker)	1.562	0.717, 3.402	0.261
Baseline myelopathy severity			
mJOA	0.896	0.784, 1.025	0.111
Nurick	1.121	0.797, 1.575	0.511
NDI	1.013	0.994, 1.032	0.187
SF-36 PCS	0.949	0.906, 0.994	0.026
SF-36 MCS	0.999	0.971, 1.028	0.955
OPLL (REF=other forms of DCM)	0.976	0.386, 2.467	0.960
Co-morbidities (REF=absence)	2.087	0.873, 4.990	0.098
Co-morbidity score	1.289	1.098, 1.512	0.0019
Cardiovascular (REF=absence)	2.584	1.191, 5.604	0.0163
Respiratory (REF=absence)	1.015	0.296, 3.489	0.981
Gastrointestinal (REF=absence)	2.127	0.933, 4.851	0.073
Endocrine (REF=absence)	4.234	1.951, 9.187	0.0003
Psychiatric (REF=absence)	0.667	0.196, 2.269	0.517
Rheumatologic (REF=absence)	1.848	0.406, 8.413	0.427
Neurological (REF=absence)	1.842	0.523, 6.487	0.342
Surgical Predictors of Dysphagia			
Number of Stages (REF=1-stage)	6.506	2.344, 18.060	0.0003
Operative duration (by 15 minutes)	1.052	0.993, 1.15	0.083
Corpectomy + Discectomy (ref=corpectomy or discectomy)	0.736	0.212. 2.553	0.630
Number of decompressed levels	1.816	1.239, 2.662	0.0022
Including C4 or above level (REF=No operation at C4 or above)	0.837	0.377, 1.860	0.663

Important Risk Factors of Dysphagia: Results of Multivariate Analysis

Predictor	Odds ratio	95% C.I.	p-value
Endocrine Disorders (ref=absence)	3.686	3.686, 1.658	0.0014
Number of decompressed levels	1.522	1.000, 2.315	0.0498
Number of Stages (Ref=1-stage)	3.423	1.077, 10.883	0.0370

Based on multivariate analysis, patients were at an increased risk of perioperative dysphagia if they had diabetes (OR (ref=absence):3.686,p=0.0014), a greater number of decompressed segments (OR: 1.522,p=0.0498), and a 2-stage surgery (OR (ref=1-stage):3.423,p=0.037).

Clinical improvements, as evaluated by the Nurick and mJOA, were comparable between patients with and without dysphagia at both short- and long-term follow-up. In contrast, patients with dysphagia had significantly worse scores on the NDI at 6-months postoperative than patients without dysphagia; however, at 24 -months postoperative, there were no differences between groups.

Patients with dysphagia had an increased frequency of dysphonia (6.67%), superficial wound infection (10.00%), and other complications (16.67%) than those without dysphagia (dysphonia: 0.28%, p=0.0087; superficial infections: 1.92%, p=0.0262; other complications: 2.89%, p=0.0025).

Functional Impairment, Disability and Quality of Life Outcomes between Patients with and without Dysphagia

	Outcome	No dysphagia	Dysphagia	Difference	p-value
Functional and Quality of Life Outcomes at 6-months following Surgery					
Unadjusted*	ΔmJOA	2.14 (1.93, 2.36)	1.35 (0.46, 2.24)	0.80 (-0.12, 1.71)	0.088
	ΔNurick	1.09 (0.93, 1.25)	0.90 (0.28, 1.51)	0.19 (-0.44, 0.83)	0.549
	ΔNDI	12.76 (10.60, 14.92)	1.23 (-6.51, 8.96)	11.54 (3.50, 19.57)	0.0050
	ΔSF-36 PCS	5.77 (4.70, 6.85)	4.48 (0.40, 8.56)	1.30 (-2.92, 5.52)	0.546
	ΔSF-36 MCS	6.82 (5.45, 8.18)	0.95 (-4.21, 6.12)	5.86 (0.53, 11.20)	0.031
Adjustment Model 1†	ΔmJOA	2.12 (1.91, 2.34)	1.68 (0.76, 2.61)	0.44 (-0.51, 1.40)	0.362
	ΔNurick	1.09 (0.93, 1.26)	0.85 (0.21, 1.48)	0.25 (-0.41, 0.90)	0.461
	ΔNDI	12.69 (10.52, 14.86)	2.17 (-5.86, 10.20)	10.52 (2.16, 18.88)	0.014
	ΔSF-36 PCS	5.79 (4.71, 6.88)	4.23 (-0.0074, 8.47)	1.56 (-2.83, 5.96)	0.486
	ΔSF-36 MCS	6.77 (5.40, 8.13)	1.69 (-3.63, 7.01)	5.08 (-0.44, 10.60)	0.071
Functional and Quality of Life Outcomes at 24-months following Surgery					
Unadjusted*	ΔmJOA	2.61 (2.40, 2.83)	2.15 (1.28, 3.02)	0.46 (-0.43, 1.36)	0.311
	ΔNurick	1.51 (1.38, 1.65)	1.57 (1.03, 2.10)	-0.05 (-0.61, 0.50)	0.848
	ΔNDI	12.94 (11.16, 14.73)	11.17 (4.33, 18.02)	1.77 (-5.30, 8.84)	0.622
	ΔSF-36 PCS	6.68 (5.76, 7.60)	2.22 (-1.46, 5.90)	4.45 (0.66, 8.25)	0.022
	ΔSF-36 MCS	5.48 (4.31, 6.65)	4.41 (-0.25, 9.06)	1.07 (-3.73, 5.88)	0.660
Adjustment Model 1†	ΔmJOA	2.60 (2.38, 2.82)	2.35 (1.46, 3.24)	0.25 (-0.66, 1.17)	0.587
	ΔNurick	1.50 (1.37, 1.63)	1.75 (1.20, 2.30)	-0.25 (-0.82, 0.31)	0.288
	ΔNDI	12.83 (11.06, 14.61)	12.84 (5.76, 19.92)	-0.0037 (-7.34, 7.33)	0.999
	ΔSF-36 PCS	6.61 (5.69, 7.53)	3.26 (-0.54, 7.06)	3.36 (-0.57, 7.28)	0.094
	ΔSF-36 MCS	5.48 (4.32, 6.64)	4.40 (-0.40, 9.20)	1.08 (-3.88, 6.04)	0.669

Conclusions

The most important predictors of dysphagia are diabetes, a greater number of decompressed levels and a 2-stage surgery. Patients with postoperative dysphagia have reduced disability and quality of life improvements in the short-term but not in the long-term.