

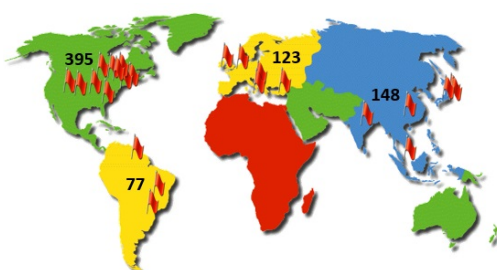
A Clinical Prediction Rule for Functional Outcomes in Patients Undergoing Surgery for Severe Degenerative Cervical Myelopathy: Analysis of an International AOSpine Prospective Multicentre Dataset of 254 Subjects

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Introduction

Patients with cervical spondylotic myelopathy (CSM) may be severely impaired, have reduced quality of life and present with deleterious signs. Patients with severe myelopathy often improve following surgery; however, they may have varying prognoses depending on a variety of factors. It is important to predict outcome in these patients and use this knowledge to manage patients' expectations.

Summary of Enrollment from 26 International Sites



254 (33.55%) from this sample had severe myelopathy

A prediction model was developed to distinguish between patients who improve to mild or moderate myelopathy postoperatively (mJOA=12) and those who remain significantly impaired (mJOA<12). Univariate analyses evaluated the relationship between this outcome and various clinical predictors. Multivariate logistic regression was used to formulate the final prediction model.

A. Univariate Analysis: Important Clinical Predictors of Outcome

Baseline severity score, hyperreflexia, lower limb spasticity, and age were significant predictors of a mJOA=12 following univariate analysis. The relationships between a score =12 and duration of symptoms, co-morbidity score, cardiovascular and respiratory co-morbidities, numb hands, bilateral arm paresthesia, L'Hermitte's phenomena, positive Hoffman's sign and broad-based unstable gait also yielded p-values <0.20 and were further evaluated.

Univariate Analysis: Clinical Predictors of Outcome

Predictor	Relative Risk	95% C.I.	p-value
Baseline Severity Score	1.07	1.02, 1.13	0.010
Age (by decade)	0.97	0.95, 0.99	0.0014
Gender (REF=Female)	0.98	0.84, 1.14	0.81
Duration of symptoms	0.96	0.92, 1.01	0.087
Smoking status (REF=non-smoker)	1.00	0.85, 1.19	0.97
Co-morbidities (REF=absence)	0.97	0.83, 1.14	0.72
Co-morbidity Score	0.96	0.92, 1.01	0.10
Cardiovascular	0.89	0.76, 1.03	0.12
Respiratory	0.79	0.56, 1.12	0.18
Gastrointestinal	0.95	0.74, 1.21	0.67
Renal	1.15	0.87, 1.51	0.32
Endocrine	1.05	0.88, 1.25	0.59
Psychiatric	0.94	0.72, 1.23	0.67
Rheumatologic	0.93	0.66, 1.30	0.66
Neurological	0.98	0.73, 1.31	0.88
Symptoms (REF=absence)			
Numb hands	0.83	0.68, 1.02	0.080
Clumsy hands	0.93	0.75, 1.15	0.50
Impaired gait	0.87	0.66, 1.14	0.32
Bilateral arm paresthesia	0.90	0.77, 1.04	0.15
L'Hermitte's phenomena	0.84	0.70, 1.02	0.087
Weakness	0.92	0.73, 1.17	0.51
Signs (REF=absence)			
Corticospinal motor deficits	0.93	0.79, 1.10	0.40
Atrophy of intrinsic hand muscles	1.03	0.89, 1.20	0.68
Hyperreflexia	0.83	0.72, 0.96	0.010
Positive Hoffman's sign	0.88	0.76, 1.03	0.10
Upgoing plantar responses	0.94	0.80, 1.09	0.40
Lower limb spasticity	0.75	0.65, 0.86	<0.0001
Broad-based unstable gait	0.89	0.75, 1.06	0.19

B. Multivariate Analysis: Final Clinical Prediction Model

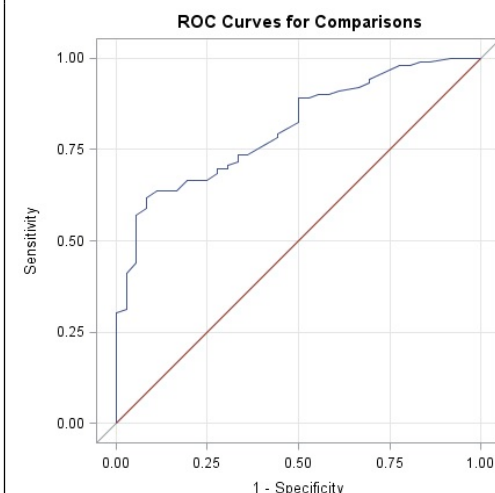
The final model consisted of three statistically significant variables and one clinically relevant predictor: baseline severity score (RR: 1.09, 95% C.I.: 1.03-1.15), duration of symptoms (RR: 0.94, 95% C.I.: 0.89-0.99) and co-morbidity score (RR: 0.96, 95% C.I.: 0.91-1.00) and lower limb spasticity (RR: 0.76, 95% C.I.: 0.66-0.87). Based on relative risks, patients were more likely to achieve a score =12 on the mJOA if they had a higher baseline mJOA score; a lower co-morbidity score (fewer and less severe concomitant disease); a shorter symptom duration; and if they did not have lower limb spasticity.

Multivariate Analysis: Final Clinical Prediction Model for Severe Patients

Predictor	Relative Risk	95% C.I.	p-value
Lower limb spasticity (REF=absence)	0.76	0.66, 0.87	<0.0001
Baseline severity score (mJOA)	1.09	1.03, 1.15	0.0028
Duration of symptoms	0.94	0.89, 0.99	0.012
Co-morbidity score	0.96	0.91, 1.00	0.066

The AUC for this model was 0.75 (95% C.I.: 0.67, 0.83), indicating good discriminative ability.

ROC Curve for the Final Clinical Prediction Model



The area under the curve is a measure of predictive performance and discriminative ability

Conclusions

Severe patients were more likely to achieve a score =12 on the mJOA if they had a higher mJOA score and a shorter duration of symptoms preoperatively; were healthier as reflected by number and severity of co-morbidities; and did not have lower limb spasticity.



Methods

Of the 757 patients enrolled in the CSM-North America or International studies, 254 (33.55%) presented with severe myelopathy with a modified Japanese Orthopaedic Association (mJOA) score <12 points.

Objective

This study aims to determine the most important clinical predictors of surgical outcome in patients with severe CSM.