Tandem Gait: Is It a Good Predictor of Myelopathy?

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Degenerative cervical myelopathy (DCM) represents the most common cause of degenerative, non-traumatic spinal cord impairment adults. The diagnosis of DCM is based on the combination of subjective complaints and clinical exam findings in the setting of radiographically-confirmed cervical stenosis. Among other symptoms, patients often report a history of gait disturbance. Clinically, a tandem gait test is utilized to evaluate for cervical myelopathy. The severity of gait disturbance is a major component of the Nurick or modified Japanese Orthopaedic Association (mJOA) scales. These scales, however, are limited by the subjectivity of their questionnaires and assessments. While some studies have found gait analysis to be helpful in predicting the severity of DCM, formal gait analysis is limited by time, cost, and space constraints. Although tandem gait is often utilized as a screening tool, there is limited evidence demonstrating the ability of the test to predict the presence of clinical myelopathy. Additionally, no studies have evaluated whether tandem gait predicts the presence of radiographic findings of DCM. The purpose of this study is to determine whether a graded 10-step tandem gait test predicts the presence of clinical myelopathy and radiologic findings of DCM. METHODS:

A retrospective review of prospectively collected data from patients referred to our spine clinic for evaluation of any cervical pathology over a six-week period was performed. Inclusion criteria were age \geq 18 and cervical MRI obtained within two years prior to the clinic visit date. Exclusion criteria included alternative pathology contributing to gait disturbance, chronic non-ambulatory status, prior cervical surgery, and inadequate quality of cervical MRI precluding accurate assessment of cervical stenosis. Data collected included patient demographics, BMI and medical history, subjective symptoms, and physical examination. Cervical MRIs were reviewed by an orthopaedic spine surgeon and radiologist; the severity of cervical stenosis was scored using the Kang grading system. Our primary outcome was to determine if a graded 10-step tandem gait predicts the presence of clinical myelopathy. Our secondary outcome was to determine if a graded 10-step tandem gait predicts the severity of cervical stenosis on MRI as well as the severity of Nurick and mJOA classifications. Statistical analyses consisted of one-way analysis of variance (ANOVA) and linear regression. Statistical significance was set at a value of p < 0.05. RESULTS:

Fifty-nine patients were included. The mean age was 60.1 years, and 31 (52.5%) were male. The average BMI was 30.6. Tandem gait was associated with age (p=0.003), history of falls (p=0.0159), and balance and gait disturbance (p=0.0023), but not neck pain or with BMI. Importantly, tandem gait was associated with the Nurick and mJOA classifications (p < 0.0001 for both). Severity of stenosis was otherwise not associated with BMI or signs of clinical myelopathy including weakness, history of falls, balance and gait disturbance, 10-second grip release, finger escape, or Romberg. Importantly, severity of cervical stenosis was not associated with the Nurick or mJOA classifications. DISCUSSION AND CONCLUSION:

Upon preliminary analysis of our first 59 patients, a standardized 10-step tandem gait test was associated with signs of clinical myelopathy including history of falls and balance and gait disturbance. Notably, tandem gait was also associated with the Nurick and mJOA classifications, validating its utility as a clinical screening tool. Severity of cervical stenosis was otherwise not associated with any signs of clinical myelopathy or the Nurick or mJOA classifications.

The utility of tandem gait analysis in predicting the presence of cervical myelopathy remains controversial. In this study, a standardized 10-step tandem gait test was useful in predicting clinical myelopathy but was not useful in predicting severity of cervical stenosis. Additionally, severity of cervical stenosis was not useful in predicting the presence of clinical myelopathy. Overall, studies with larger sample sizes are needed to further delineate the relationships between tandem gait, clinical myelopathy, and cervical stenosis.

Comparison of Variables	Statistical Analysis	P-value
TG vs Age	One-way ANOVA, Linear regression	p = 0.003, p < 0.001
TG vs Nurick	One-way ANOVA, Linear regression	p < 0.001, p < 0.001
TG vs mJOA	One-way ANOVA, Linear regression	p < 0.001, p < 0.001
TG vs BMI Category	One-way ANOVA	p = 0.7918
TG vs BMI	One-way ANOVA	p = 0.5386
TG vs MRI	One-way ANOVA, Linear regression	p = 0.5894, p = 0.0981
MRI vs Age	One-way ANOVA	p = 0.0813
MRI vs mJOA	One-way ANOVA, Linear regression	p = 0.1496, p =0.2396
MRI vs Nurick	One-way ANOVA, Linear regression	p = 0.4014, p = 0.1358
MRI vs Age	Linear regression	p = 0.3012
MRI vs BMI Category	One-way ANOVA	p = 0.5258
MRI vs BMI	One-way ANOVA	p = 0.6432