Prevalence and Motion Characteristics of Degenerative Cervical Spondylolisthesis in Symptomatic Adults

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Introduction: Cervical spondylolisthesis has not been extensively studied when compared to lumbar spondylolisthesis. The prevalence and motion characteristics of cervical spondylolisthesis are not well defined. Additionally, the point at which cervical spondylolisthesis may be considered clinically unstable is unclear and the proportion of patients with spondylolisthesis that are clinically unstable is unknown. The purpose of this study was to define the prevalence of degenerative cervical spondylolisthesis in symptomatic patients and to describe the motion characteristics at the affected level. Specifically, we aimed to assess the association between the magnitude of spondylolisthesis and angular motion, translational motion, and canal diameter using kinetic magnetic resonance imaging (kMRI).

Methods: Four hundred and sixty-eight patients (240 female, 228 male) with a mean age of 49.8 (range 19-79) with neck pain with or without radiculopathy, and no history of trauma, underwent upright cervical kMRI in neutral, flexion, and extension positions. Segmental spondylolisthesis and spinal canal antero-posterior diameter were determined on T2 weighted mid-sagittal images of the neutral position. Angular motion (measured as the angle formed between lines extended from two adjacent vertebral endplates) and translational motion (measured as the antero-posterior movement of one vertebrae over another) were measured on flexion-extension T2 weighted mid-sagittal images. Spondylolisthesis was graded based on the magnitude of displacement and divided into three groups at each level: <2 mm (Grade 0), 2-3 mm (Grade 1), >3 mm (Grade 2). Instability was defined as segmental translational motion exceeding 3 mm. Translational motion, angular motion, spinal canal diameter and prevalence of instability were compared between the three groups for each cervical segment.
Results: Grade 1 spondylolisthesis at a minimum of one level was observed with a prevalence of 16.4% of all patients. Grade 2 was observed at a minimum of one level with a prevalence of 3.4%. The most affected levels were C4/5 and C5/6 followed by C3/4 and C6/7. Translational motion and angular motion were significantly greater in levels with Grade 1 or 2 listhesis compared with Grade 0. Translational instability (>3 mm) was observed with a prevalence of 16.7% in Grade 2, 4.3% in Grade 1, and 3.4% in Grade 0. Spinal canal diameter at the affected level was significantly decreased in Grade 1 (10.6 mm) and Grade 2 (10.6 mm) compared to Grade 0 (11.7 mm) (P<0.05). No significant differences in segmental motion or canal diameter were seen between levels with Grade 1 and those with Grade 2.

Conclusion: Cervical spondylolisthesis of at least 2 mm was observed in 20% of patients. Of the levels identified with spondylolisthesis greater than 2 mm, 7.3% demonstrated 3 mm or greater translational motion from flexion to extension. Even in patients with less than 2 mm spondylolisthesis, 3% were found to have greater than 3 mm of translation. The presence of spondylolisthesis of more than 2 mm at a cervical level was also associated with increased translational and angular motion, and a segmental decrease in spinal canal diameter. This study indicates that spondylolisthesis is a common finding with MR imaging in the cervical spine.