ELSEVIER

The Spine Journal 6 (2006) 182S–189S

THE SPINE JOURNAL

The assessment of cervical myelopathy

Frank J. Salvi, MD, MS[a,*], John C. Jones, MD[b], Bonnie J. Weigert, MD[a]

[a]*Department of Orthopedics and Rehabilitation, University of Wisconsin, 6630 University Avenue, Middleton, WI 53562-3036, USA*
[b]*Department of Neurology, University of Wisconsin, 600 Highland Avenue, Madison, WI 53792-7375*

Abstract The assessment of cervical myelopathy can be challenging, especially early in the course of the disease. Typical symptoms, including pain, neck stiffness, paresthesias, weakness, clumsiness, disequilibrium, difficulty with bladder control and functional deficits, and signs, including decreased cervical range of motion, sensory abnormalities, weakness, spasticity, and gait disturbance, become more obvious as the disease progresses. Disease specific functional assessments can aid in the diagnosis. A detailed clinical assessment should always be interpreted in conjunction with supplemental assessment tools, including imaging and electrodiagnostic studies. This article will review typical clinical findings, the differential diagnosis, and the utilization of supplemental assessment tools for the evaluation of cervical myelopathy.

Keywords: Cervical myelopathy; Spondylosis; Axial neck pain; Radiculopathy

Increasing age, progressive disc dehydration, and altered biomechanics may lead to spondylosis, with osteophytosis at the discovertebral junction, enthesopathy and calcification of the anterior and posterior longitudinal ligaments, hypertrophy of the ligamentum flavum, and joint space narrowing, hypertrophy, and osteophytosis of the uncovertebral and facet joints [1,2]. These progressive changes have the potential to narrowing of the spinal canal, lateral recess, and neural foramina. Compression of vascular and neural elements can lead to ischemia and demyelination of ascending and descending spinal pathways [3–11]. Changes in the lateral columns, especially the corticospinal tract, the anteromedial portion of the posterior columns, and the nerve roots are more prevalent than changes in the anterior spinal tracts [1]. These changes are accentuated in patients with congenitally narrow cervical spinal canals, bulging or herniated discs, and segmental instability. Because the level and degree of cervical spinal cord compression is not well correlated with symptoms or signs, such as commonly used myelopathic hand signs [12–14], a detailed clinical examination should always be interpreted in conjunction with supplemental assessment tools.

The typical cervical myelopathy patient is a male (by a ratio of 2.4:1) and in his fifties (range 35 to 80 years) [4,15]. The C5–C6 level is most frequently involved, followed by C6–C7, C4–C5, and then C3–C4 [16]. Although there seems to be no difference in disease manifestation based on the age of onset, as people age, the stiffer lower segments can lead to hypermobile upper segments [17], and the site of focal conduction block seems to shift upwards from C5–C6 and C6–C7 to C3–C4 and C4–C5 [18]. Symptomatic cervical spondylosis can be subdivided into axial neck pain, radiculopathy, myelopathy, or some combination of these three based on clinical findings [9], radicular (lateral), central (medial), combined (medial and lateral), or vascular syndromes based on the predominant area of compression [19], or as transverse lesion, motor system, central cord, Brown-Sequard, or brachialgia cord syndromes, based on the differential susceptibility of various spinal cord tracts [16].

The history should assess for both axial and radicular pain, cervical range of motion limitations, paresthesias (especially common in the upper extremities), weakness, clumsiness, disequilibrium, difficulty with bladder control, and functional deficits. Localizing the source of axial neck pain can be challenging, with potential contributions from the degenerative processes described above, muscular strain, regional myofascial pains, and pain referred to the neck from other areas, such as the shoulder or heart. Radiculopathy implies a distribution of symptoms along nerve roots, which may or may not be accompanied by neck pain.

FDA device/drug status: not applicable.

Nothing of value received from a commercial entity related to this manuscript.

* Corresponding author. 6630 University Avenue, Middleton, WI 53562-3036. Tel.: (608) 263-8640.

E-mail address: fjsalvi@wisc.edu (F.J. Salvi)

1529-9430/06/$ – see front matter
doi:10.1016/j.spinee.2006.05.006

The vague nature of early myelopathic symptoms, lower extremity weakness [7], or gait abnormality [10] often leads to a delay in diagnosis. Standardized, disease-specific assessment tools have also been developed to facilitate monitoring and the comparison of outcomes between different treatment options [20]. The European Myelopathy Score [21] and Japanese Orthopedic Association Score [22] are standardized, disease-specific assessment tools that focus on functional criteria that can be gathered by interview or questionnaire. These tools have subscales for upper motor neuron function with questions about gait and bowel and bladder function; lower motor neuron function with questions about handwriting and use of utensils for eating; posterior column function (proprioception and coordination) with questions about ease of getting dressed; and posterior cervical roots with questions about paresthesias or dysesthesias. Lower scores are consistent with higher levels of dysfunction. Postoperative recovery rates are calculated as follows: (postoperative score – preoperative score)/(maximum score [18] – preoperative score) × 100. Other disease-specific instruments that assess disability include the Neck Disability Index [23], the Odom criteria [24], and the Nurick Criteria [8].

The physical examination should start up at the head with cranial nerves and cervical range of motion and include a neuromuscular examination of the upper and lower extremities. Evaluation of gait and balance, especially in a dark environment where visual cues are less helpful at substituting for proprioceptors in the feet, is also important.

Classic findings include limitations in cervical range of motion; spasticity, with increased muscle tendon reflexes below the level of canal compromise; a positive Babinski sign; absent abdominal reflexes; decreased joint position and vibratory sensation; and an abnormal gait [1,4,7,15,25,26]. Care should be taken to assess for concomitant lumbar spinal stenosis, which can be present in 15% to 33% of patients with cervical spondylotic myelopathy, and may result in lower extremity hyporeflexia [27] (Table 1).

Cervical posture, range of motion, and tenderness should be assessed. To assess cervical range of motion, active (or physiologic) and passive flexion, extension, side bending and rotation from a neutral posture, and rotation from a flexed posture should be measured [28]. Stretching symptomatic myofascial tissues, compressing symptomatic joints, and narrowing the foramen through which symptomatic nerves pass can increase pain. The passive range of motion allows for some stretch of noncontractile elements, such as the ligaments, and limits pain from inflamed muscles, so is typically greater than active range of motion. With increasing age, all ranges of motion will decrease with the exception of rotation from a flexed posture, as this position blocks the rotational contribution from the mid and lower cervical spine, isolating the atlantoaxial joint, which is less commonly affected by degenerative changes. Significant decreases in cervical rotation from a flexed compared with a neutral posture, therefore, suggest arthritic involvement of the atlantoaxial joint, whereas similar ranges from flexed and neutral postures suggest arthritis of the mid and lower cervical spine. Significant facet arthropathy tends to limit extension more so than flexion. Deficits in cervical side bending and rotation are also common in the direction ipsilateral to more significant degenerative changes. Cervical extension, side bending, and axial compression that reproduces ipsilateral radicular pain along the involved dermatome (Spurling maneuver), and the relief of radicular pain after placing the ipsilateral hand on top of the head (shoulder abduction maneuver [29]) can point to a radicular contribution to the symptoms. When myelopathy is present, cervical flexion can elicit an electric pain along the spine radiating to the extremities (Lhermitte's sign).

Strength, sensory and reflex testing looks to differentiate between radicular, peripheral nerve, and more global deficits. In addition to light touch and pain, vibration can also be tested to help evaluate posterior column function and potentially superimposed peripheral neuropathy. When tapping the brachioradialis tendon, hypoactive wrist extension along with hyperactive finger flexion has been described as an inverted radial reflex, which goes along with spinal cord and ipsilateral C5 nerve root compression [30] (Table 2).

Special signs and tests for the upper extremity that have been described for the assessment of cervical myelopathy include wasting of the shoulder girdle, possibly with associated fasciculations, and the myelopathic hand, with atrophy of the intrinsic muscles of the hand [32,33], which can result from anterior horn cell necrosis at the C5–C6 and C8–T1 levels respectively. The finger escape sign occurs when the hand is held out with fingers extended and adducted for 30 to 60 seconds, during which time the ring and little fingers drift into abduction and flexion. The grip and release test is positive when the patient is unable to smoothly open and then close the hand into a fist at least 20 times in 10 seconds.

In addition to an unsteady gait with heel-to-toe walking compared with normal subjects, the gait pattern in patients with severe myelopathy is characterized by hyperextension of the knee in the stance phase, decreased plantar flexion in the swing phase, reduced walking speed and step length, prolonged stance phase duration and decreased

Table 1
Clinical signs of cervical radiculopathy and myelopathy

+ Pathologic −Normal	Cervical radiculopathy	Myelopathy
Muscle wasting	+ Unilateral	+ Bilateral
Sensory deficit radicular	+	−
Vibratory sense diminished	−	+ Lower extremities
Muscle stretch reflexes	+ Weak	+ Hyper
Abdominal reflexes	−	+ Absent
Spurling	+	−
Babinski sign	−	+
Hypertonicity	−	+
Gait	−	+