Concordance of Upper Limb Neurodynamic Tests With Medical Examination and Magnetic Resonance Imaging in Patients With Cervical Radiculopathy: A Diagnostic Cohort Study

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Abstract

Objective: The purpose of this study was to investigate the concordance of the upper limb neurodynamic tests (ULNTs) with a chosen reference standard, consisting of medical examination and magnetic resonance imaging (MRI), in patients with cervical radiculopathy.

Methods: This diagnostic cohort study included 51 consecutive patients referred to a center for spinal surgery for clinical investigation of cervical and/or arm pain in Sweden during the period of November 2007 to February 2008. The patients were exposed to the 4 different tests of ULNT. One diagnosis based on each of the tests separately and one based on the tests combined were compared with a chosen reference standard consisting of MRI, anamnestic features, and clinical examination.

Results: The ULNT (1-3 used combined) had a sensitivity of 0.97 and a specificity of 0.69. The results of ULNT (1-3 used combined) corresponded in 88.2% with the reference standard. Individually, the ULNT 1 (median) showed the highest validity, and ULNT 2b (radial), the lowest.

Conclusion: Upper limb neurodynamic test (combined) showed a substantial agreement with findings from medical examination including MRI. These results indicate the importance of ULNT (combined) to complement the clinical examination of patients with radiculopathy. (J Manipulative Physiol Ther 2013;36:626-632)

Key Indexing Terms: *Magnetic Resonance Imaging; Cervical Radiculopathy; Brachial Plexus; Neurological Examination*

Radiculopathy is commonly defined as radiating pain experienced in a dermatome, myotome, or sclerotome due to compression or inflammation of a spinal nerve or nerve root.[1] Cervical radiculopathy is a condition with a yearly incidence of 0.1% caused by disk hernia, foraminal stenosis, or other space-occupying lesions.[2]

In most cervical radiculopathies, the nerve roots of the lower cervical spine are affected, where the most common cervical spinal root lesion is C7 followed by C6, C5, C4, and C8.[3]

Patients with a cervical radiculopathy will often experience neck and arm pain, loss of sensibility, and motor weakness. To evaluate the symptoms and set a diagnosis, the clinicians make use of a variety of investigations such as magnetic resonance imaging (MRI), computerized imaging (computed tomographic scans), clinical examination, and electrophysiological testing.[4]

Magnetic resonance imaging of neural structures has become the most common method to diagnose significant pathology in the cervical spine.[5] For most clinicians, this method is accessible but with waiting time for the patients and high costs for society. However, MRI may produce a substantial amount of false-positive answers when asymptomatic radiological abnormalities are common in radiological imaging of the cervical spine.[6] The correlation between MRI and clinical findings is often weak as the evaluation of false-positive and false-negative findings can

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Table 1. *ULNT procedure*

Order of movements	ULNT1 (median)	ULNT2a (median)	ULNT2b (radial)	ULNT3 (ulnar)
1	Shoulder depression	Shoulder depression	Shoulder depression	Shoulder depression
2	Shoulder abduction, 110°	Elbow extension	Elbow extension	Shoulder abduction, 100°
3	Wrist and finger extension	Lateral rotation of the arm	Medial rotation arm	Lateral rotation arm
4	Forearm supination	Wrist and finger extension	Wrist and finger flexion	Forearm pronation
5	Shoulder lateral rotation	Shoulder abduction, 10°	Shoulder abduction	Elbow flexion
6	Elbow extension	Contralateral lateral flexion of the cervical spine	Contralateral lateral flexion of the cervical spine	Wrist and finger extension
7	Contralateral lateral flexion of the cervical spine			Contralateral lateral flexion of the cervical spine

ULNT, upper limb neurodynamic test.

be influenced by the experience of both the radiologist and the clinician.[7] Therefore, a combination of clinical and radiological examinations would be an appropriate standard reference in the diagnosis of significant root compressions.

Clinical provocative tests are used to reproduce the patient's symptoms and thereby confirm the diagnosis.[8] Five different provocative tests have been reported useful in the diagnosis of cervical radiculopathy—Spurling's test, the shoulder abduction test, Valsalva maneuver, neck distraction, and upper limb neurodynamic test (ULNT) 1 (median)—where ULNT 1 (median) is the single best test to exclude a cervical radiculopathy.[9]

Clinical provocative tests have been used since the beginning of the 20th century. Bragard[10] described a nerve tension test for the ulnar nerve in 1929. In 1988, Kenneally et al described specific tests for the 3 major nerves in the arm, the upper limb tension tests.[11,12] The upper limb tension tests have subsequently been modified and renamed "upper limb neuro-dynamic tests," ULNT by Butler[13] and Shacklock.[14] Upper limb neurodynamic test consists of 4 different neurodynamic tests used in the diagnosis of neurogenic conditions in the upper extremities with or without neck pain as the testing leads to mechanical stress of the brachial plexus and/or the spinal nerve and/or nerve root.[15] These 4 tests are ULNT 1 (median), ULNT 2a (median), ULNT 2b (radial), and ULNT 3 (ulnar). A neurodynamic test is considered positive if the following 3 criteria are fulfilled: the patient's symptoms are reproducible, there are side differences, and the symptoms are increased by the use of structural differentiation.[16] If there are similar radiating symptoms from both sides, the test is considered negative. However, this implies that a bilateral cause of radiculopathy has to be considered and MRI findings scrutinized.

Structural differentiation refers to movements used to confirm or exclude a disorder in the nervous system, for example, dorsiflexion of the ankle in the straight leg raise[17] or contralateral lateral flexion of the cervical spine in ULNT.[18]

A test's diagnostic accuracy depends on its specificity and sensitivity, which illustrate if the test is positive in the presence of pathology and negative in the absence of pathology. According to previous research, the ULNTs, besides the ULNT1 (median),[19] have proven high sensitivity and lower specificity in the diagnosis of a radiculopathy.[9] The high sensitivity and lower specificity of ULNT indicate that the tests can be positive, although there is an absence of pathology. There are no published studies that have evaluated the validity of the 4 ULNTs as an encapsulated test and compared the results to a reference standard when diagnosing cervical radiculopathy. This circumstance makes it difficult to compare results between studies.[8]

Table 2. *Diagnosis of the 16 patients without cervical radiculopathy according to reference standard*

Diagnosis	n
Cervical degeneration	7
Disk hernia without radiculopathy	1
Stenosis without radiculopathy	2
Carpal tunnel syndrome	1
Unspecified diagnosis	4
Supraspinatus tendinitis	1

The purpose of this study was to investigate the concordance of the ULNT (1, 2a, 2b, 3) with a chosen reference standard, consisting of MRI, medical history, and clinical examination, in patients with cervical radiculopathy.

Methods

This diagnostic cohort study included 58 consecutive patients, who were referred to a neurosurgeon by a general practitioner, during the period of November 2007 to February 2008. All patients meeting the neurosurgeon had undergone an MRI within the last 6 months. When arriving at the center for spinal surgery, the patients were informed about the study and gave their consent to participate. Inclusion criteria were cervical pain with experiences of arm pain. Patients with a history of multitrauma involving the spinal column, malignant engagement of the spinal column, system disease with possible neuropathy, or patients whose general condition (physically or/and