CERVICAL ORTHOPEDIC TESTS

Adopted 5/05
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Contents

Cervical Orthopedic Tests

This protocol contains descriptions of various orthopedic tests applied to the cervical region. The following tests are included:

- *Arm Squeeze Test*
- *Bakody's Sign*
- *Brachial Plexus Compression*
- *Brachial Plexus Tension Test*
- *Cervical Flexion (including Brudzinski's Sign, Lhermitte's sign, Lindner's sign)*
- *Cervical Flexion Rotation Test*
- *Cervical Compression, Jackson's Compression, Maximum Foraminal Compression(Spurling's)*
- *Cervical Distraction*
- *Cervical Resisted Muscle Tests and Passive Range of Motion (O'Donoghue maneuver)*
- *Rust's Sign*
- *Shoulder Abduction Test*
- *Shoulder Depression*
- *Soto-Hall Test*
- *Tinel Sign*

In addition, there are four appendices offering an overview of tests that can be performed as "packages" based on the suspected type of condition and an appendix with advice for charting.

- Appendix A: Summary of exam procedures to perform for suspected cervical radiculopathy
- Appendix B: Summary of exam procedures to perform for suspected cord lesions
- Appendix C: Summary of exam procedures to perform for suspected brachial plexus, neurovascular, or other nerve entrapment syndromes
- Appendix D: Summary of exam procedures to perform for suspected lumbosacral radiculopathy
- Appendix E: Charting the results of pain provocation tests

Test Clusters for Diagnosis of Radicular Syndromes

One study of mild to moderate C6-C7 radicular syndromes (based on EMG and nerve conduction studies) has suggested that the following cluster of findings may be of diagnostic value:

1. symptom reproduction with cervical compression with the neck in lateral flexion to the side of pain
2. symptom reduction with cervical distraction
3. symptom reproduction with an upper limb tension test
4. cervical rotation reduced to less than 60 degrees toward the side of pain.

If 3 out of 4 of the above tests were positive, the likelihood of cervical radiculopathy increased from 23% to 65% (LR+ 6.1); when all four were positive, the probability rose to 90% (LR+ 30.3). (Wainner 2003)

A more recent systematic review suggested that a combination of a positive Spurling's test, axial traction (cervical distraction) test, and Arm Squeeze test may be used to increase the likelihood

of a cervical radiculopathy, whereas a negative outcome of combined Upper Limb Neural Tension tests (ULNTs) and Arm Squeeze test may be used to decrease the likelihood. (Thoomes 2018)

ARM SQUEEZE TEST

Indications for Testing

This test maybe useful in differentiating whether pain in the shoulder region is due to a nerve root lesion or a lesion of the shoulder girdle.

Procedure

With the patient seated and the examiner standing behind the patient, the examiner places their hand on the middle third of the patient's arm (fingers over biceps and thumb over triceps) and applies a firm squeeze with approximately 6 to 8 kg of force. For comparison, digital pressure of the same amount of force is also carried out on the acromioclavicular and anterolateral-subacromial area. The patient is asked to rate their pain with each of the squeezes.

Mechanism

The anatomic rationale of the test is that in the middle third of the arm, the musculocutaneous nerve (C5 to C7), the radial nerve (C5 to T1), the ulnar nerve (C7 to T1) and the median nerve (C5 to T1) are relatively superficial and therefore squeezing the arm with moderate compression will create tension in these nerves and cause pain if any of the included nerve roots are irritated. Pressure in the region would not typically be painful with lesions of the shoulder.

Interpretation

Squeezing the middle third of the upper arm is more likely to elicit a reaction of local pain in patients with cervical nerve root irritation from C5 to T1, not when the pain arises from the shoulder. If this squeeze is more painful than the comparative squeezes, it is more likely that the patient's shoulder pain is due to a nerve root lesion. The test is considered positive when the patient rates the pain at least 3 points higher with the arm squeeze than with the squeezes at the acromioclavicular and anterolateral-subacromial areas.

Charting

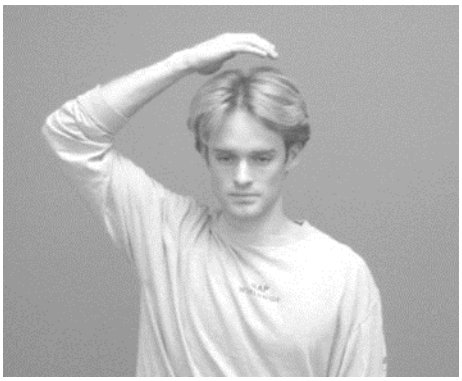
The location of the squeezes should be noted as well as the patient's reported pain intensity with each.

Reliability and Validity

A study by Gumina (2013) found a specificity of 96% with a +LR of 24 and a sensitivity of 95% with a -LR of 0.05. Interexaminer reliability was reported as k= .81 and intraexaminer reliability as k = .87.

BAKODY'S SIGN

Indications for Testing



Mechanism

This is not a test but is simply observed in the patient with neck and/or arm symptoms.

Procedure

Patients may present in this posture, which should be immediately recognized as a red flag. The hand may or may not be resting on the head since axial compression can provoke even more discomfort.

Nervous tissue. Raising the arm overhead tends to reduce neurological tension in the nerve roots, spinal nerves, and the brachial plexus, and may also decrease intraforaminal pressure.

Interpretation

The sign, when it reduces **peripheral symptoms** in the upper extremity, is suggestive of cervical radiculopathy. The presence of this sign also suggests that abduction of the arm may be helpful during cervical joint palpation and manipulation. (See UWS care pathway, Neck Pain and Arm Symptom.)

Charting

Sample language for use in charting: "Patient presented holding the symptomatic arm above their head for pain relief (Bakody's sign)."

Reliability and Validity

See Shoulder Abduction Test

BRACHIAL PLEXUS COMPRESSION

Indications for Testing

This test can be performed as part of a series of tests to confirm neurological involvement in a patient with neck pain and arm symptoms.

Procedure

The practitioner creates firm compression over the plexus with the thumb or fingers (just above the clavicle and posterior to the SCM).

Mechanism

Pressure in the area potentially tractions the spinal nerves and brachial plexus.

Procedural Errors

Not pressing with sufficient pressure may lead to a false negative finding.

Interpretation

Pain radiating between the shoulder blades or into the arm suggests cervical neurological involvement which may include cervical cord lesions. Local pain produced at the site of compression is a normal finding and not considered a positive finding.

Charting

Document side tested and the location of symptom production. Optionally, document the intensity of pain produced and how the patient described the symptoms.

Reliability and Validity

The test had a sensitivity of 74% in patients with mechanical lesions around the nerve root and 69% in patients with lesions of the cervical cord. It has better reported sensitivity than cervical compression. Specificity ranged between 79% and 83%. (Uchihara 1994)

BRACHIAL PLEXUS TENSION TEST

Indications for Testing

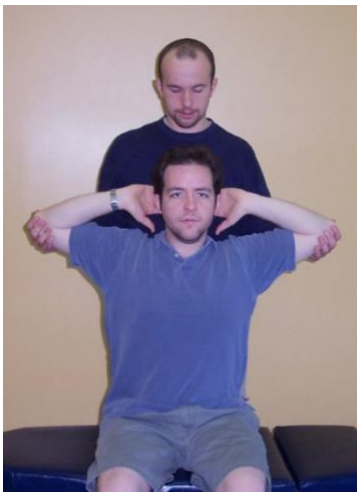
The brachial plexus tension test is used to confirm or rule out the possibility of neurodynamic tension in cases of suspected ulnar, C8, T1 nerve adhesion or impingement; e.g., neurologic signs such as numbness in the medial hand and 4th and 5th fingers or weakness in the muscles of opposition of 1st and 5th fingers or hypothenar eminence.

Procedure

A seated patient is instructed to abduct the arms with elbows extended until the onset of arm symptoms. The patient then repositions the arms just short of symptoms and laterally rotates the arms while being supported in this position by the examiner. Next, with examiner support under the elbows, the patient flexes the elbows such that the hands are positioned behind the head.

Mechanism

The postures and positions utilized in these tests have been shown cadaverically to produce elongation or stretching of the brachial plexus and the ulnar nerve in particular.



Procedural Errors

Arm abduction needs to be in the frontal plane, midline. If the arms are allowed to flex forward, nerves and nerve roots will be shortened creating a situation in which false negative findings are likely.

Interpretation

Reproduction of arm symptoms with elbow flexion is considered a positive test suggesting an ulnar nerve lesion or C8 or T1 radiculopathy.

Charting

As with other pain provocative tests, documentation of patient position, location, quality, quantity, radiation of pain and recreation of chief complaint pain provides useful outcome measures.

Reliability and Validity

Interexaminer reliability regarding the documentation of nerve tension has been shown to be quite good. Cadaveric studies have confirmed that the positions utilized do, in fact, increase tension along the course of the nerve. Nerve tension tests have been shown to result in many false positive tests, so interpretation of findings must be conservative.

Follow-up Testing

Suspicion of upper limb radiculopathy or nerve root adhesion should be confirmed with the appropriate upper limb tension test.

CERVICAL COMPRESSION, JACKSON'S COMPRESSION, MAXIMUM FORAMINAL COMPRESSION

Indications for Testing

This is part of a standard examination of the neck and is particularly helpful when neck pain is accompanied by arm symptoms (e.g., pain, paresthesia).

Procedure

The examiner stands behind, placing hands on top of the seated patient's head. Gradually increasing pressure is applied axially down through the neck. If arm symptoms are not aggravated, the test may be repeated with the neck in a variety of positions.

Lateral flexion (Jackson's Compression). The next option is to laterally flex the neck to the side of pain and again apply an axial load.

Maximum (Spurling's Test). If necessary, lateral flexion can be combined with extension (both of these variations have at times been referred to as *Spurling's test*). Rotation to the symptomatic side can be added to the extension and lateral flexion in order to further close down the IVF *(maximum foraminal compression*). Other variations include holding the compression for 30-60 seconds (Evans 2001), axial compression combined with rotation to the symptomatic side but without lateral flexion or extension (also called *Jackson's compression*) or adding a quick vertical blow to the top of the head (considered part of *Spurling's test*).

Mechanism

Nervous tissue. Axial compression reduces the size of the intervertebral foramen, compressing vessels and nerves. The IVF is further compressed with rotation, lateral flexion and extension all to the same side. In cadaver studies, ipsilateral rotation and extension are the most root compromising movements. (Yoos 1992, Farmer 1994).

Joints and ligaments. Facet joints and intervertebral discs are also significantly loaded. The load on the facet is further increased when lateral flexion, extension, and rotation are all combined to the same side (also known as the "quadrant position").

Procedural Errors

Insufficient downward force will not compress the IVFs of the lower cervical vertebrae. Cervical flexion may also result in false negative tests. The testing procedure should be performed slowly and steadily to avoid rebound pain.

Interpretation
Creation or reproduction of upper extremity pain, paresthesia or numbness is suggestive of a radicular syndrome.

Aggravation of local neck pain only, suggests cervical disc derangement, facet syndrome, or intersegmental dysfunction.

Charting
Describe neck position, symptoms produced, which arm is affected, and the referral pattern (at least indicating the most distal territory of referral). For example: “Maximum cervical compression to the right is positive for sharp pain into the right fourth and fifth digit.” Other options include the length of time compression is held before arm symptoms are reproduced. In the case of local pain, the patient can also be asked to grade the pain on a 1-10 scale. For other options, see Appendix E: Charting the results of pain provocation tests.

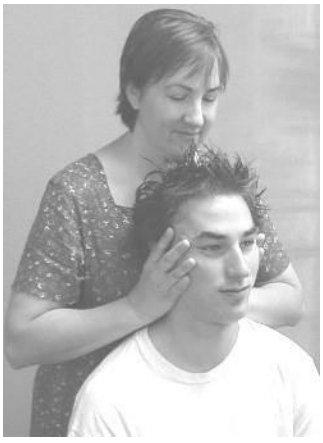
Reliability and Validity
The several studies on reliability of the various versions of cervical compression have found interexaminaer reliability to be moderate to fair. (Cleland 2011)

Various studies have evaluated the diagnostic accuracy of cervical compression, but all performed slightly different movements before adding downward axial compression to the cervical spine. Regardless of head position, cervical compression appears to have a high specificity and moderate sensitivity for diagnosing radicular syndromes. (Thoomes 2018)

Although provocation of local pain suggests the presence of a cervical joint lesion, test validity for specific cervical diagnoses has not been established.

Follow-up Testing
To confirm suspicion of radiculopathy, see Appendix A: Summary of exam procedures to perform for suspected radiculopathy. For facet or segmental dysfunction syndrome, correlate with palpation findings.

CERVICAL DISTRACTION



Indications for Testing
Usually part of a basic orthopedic examination of the neck. It is most useful in patients with possible radicular syndromes. It may be useful to help document cervical sprain or facet capsular sprain.

Procedure
The patient is seated in a neutral posture. The examiner places thumbs under the patient’s occiput, thenar eminences under mastoid processes. The examiner gradually adds force superiorly up to about 5 to **30** pounds of lifting pressure. As an option the distraction can be held for up to 30-60 seconds.

Mechanism

Nervous tissue. Distraction opens the IVF, potentially relieving pressure on the nerve roots.

Joints and ligaments. Distraction opens the IVF, unloads the disc (and may relieve disc pressure on a nerve root), and unloads the zygapophyseal joints, but may create stretching of the facet capsule and other ligaments.

Muscles. Some muscles are placed under increased tension. Occasionally, a muscle strain may be aggravated, but this is equivocal and not a major clue to the diagnosis.

Procedural Errors

The examiner must use caution to avoid lifting the jaw **and** compressing the TMJ. If the distractive force is insufficient to adequately unload the lower cervical spine, false negatives may occur. The test should be performed in a slow, steady manner. Sudden lifting may cause needless discomfort; too rapid a release may trigger a “rebound” pain.

Interpretation

A <u>decrease</u> in arm symptoms suggests IVF encroachment. Further, it also suggests that traction therapy may be beneficial for this patient. An <u>increase</u> in local pain with distraction may suggest a ligamentous sprain, facet capsular sprain, or may be aggravating a muscular strain.

Charting

Document the location of pain production, the reduction or centralization of peripheral symptoms, and which arm was affected by the test. See Appendix E: Charting the results of pain provocation tests.

Reliability and Validity

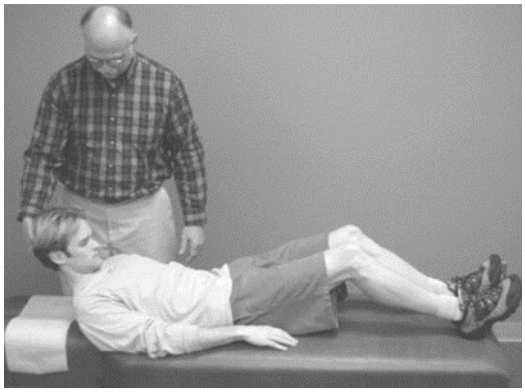
A positive test is good evidence to support a radicular syndrome diagnosis, especially if caused by a soft disc or hard encroachment such as from osteophytes. In such cases, specificity has been reported as high as 100% (Viikari-Juntura, 1987, 1989), although independent analysis of the data from these studies appears insufficient to support such a strong claim. ***A negative test has poor power in ruling out radicular syndromes*** (sensitivity ranged from 26-43%) (Viikari-Juntura 1989). These findings were repeated in another preliminary study of patients with mild to moderate radicular syndromes confirmed by EMG findings. A positive test (any relief of symptoms with up to 14 kg of traction) was very useful in supporting a C6-C7 radicular diagnosis (90% specificity and LR+ 4.4), but useless in ruling out the condition (44% sensitivity). **(Wainner 2003)**

Validity relative to sprains, strains or facet irritation is unknown.

Follow-up Testing

In cases where arm symptoms are relieved, see Appendix A: Summary of exam procedures to perform for suspected cervical radiculopathy. In cases where a facet syndrome is suggested, correlate with cervical compression test, and static and motion palpation of the cervical joints and muscles.

CERVICAL FLEXION (includes Brudzinski's sign, Lhermitte's sign, Lindner's sign)



Indications for Testing

Cervical flexion can be used as a neurodynamic test for lesions of the meninges, spinal cord or nerve roots. It is indicated in suspected cases of

1. *meningitis* (Cipriano 2010)
2. *spinal cord lesions, including multiple sclerosis, cervical spondylitis, and other forms of spinal cord compression* (e.g., patients with neck or back pain who also complain of lower extremity symptoms, hand clumsiness, changes in bladder function)
3. *cervical or lumbar disc herniation or radiculopathy*. Because this maneuver results in nerve root traction, it can be used to confirm a positive straight leg raise test or be incorporated as part of the maximum straight leg raise test for patients with leg pain.

Procedure

Depending on the circumstances, the patient can be seated or supine. The practitioner supports the patient's head and moves the neck though the entire range of flexion to patient tolerance. Performing cervical flexion with the patient in long leg sitting (i.e., sitting with the legs straight out on an adjusting table), rather than the normal sitting position, creates more tension and may further sensitize the test similar to the Slump Test.

Mechanism

With neck flexion, the dural sac, meninges, spinal cord, and nerve roots are elongated under a tensile load. The medulla oblongata may elevate 4 mm. (Orient 2000) Stretching of an inflamed dural sac or injured spinal cord will cause pain at the level of irritation. Flexing the hips and knees reduces tension on the meninges (knee flexion decreasing tension on the sciatic nerve and hip flexion decreasing tension on the femoral nerve). (McGee 2014) In the presence of sclerotic lesions or other scarring in the cord or dura, the patient will experience "nerve pain," described typically as shock-like or electrical**,** radiating down the spine and into the extremities. The lumbar nerve roots are also placed under increased tension as the spinal cord moves about 1 cm in the lumbar region, potentially reproducing any radicular symptoms.

Procedural Errors

During passive neck flexion, the chin should not be allowed to protrude. In cases of meningeal irritation, getting the patient to lie supine with knees extended to begin the test can prove

problematic. When the procedure is performed with the patient sitting, the examiner must be certain that the patient's cervical spine is not already flexed.

Interpretation

In a suspected meningitis case, the patient can be tested in a supine position. Reactive flexion of the patient's knees and hips is considered ***Brudzinski's sign***. Although classically associated with meningitis, it may also be the result of non-infectious meningeal irritation or arachnoiditis following myelopathy. (Evans 2010) Other possible causes include cord tumors or cord inflammation, multiple sclerosis, sphenoid sinusitis, tetanus, subarachnoid hemorrhage, spina bifida, and a tumor in the posterior fossa (Orient 2000).

Whether passive neck flexion is performed with the patient seated or supine, sharp, shooting pain down the spine and into the extremities is ***Lhermitte's sign*** and suggests the presence of a cord tumor, posterior column disease, meningeal adhesions, multiple sclerosis, or cervical spondylotic myelopathy. This sign may take on other forms, such as increasing spastic rigidity in the lower extremity.

A positive test that recreates symptoms along the nerve distribution in the lower extremity is ***Lindner's sign***, suggesting radiculopathy. The patient can be tested either seated or supine. Another method of eliciting Lindner's sign in the supine patient is to brace the patient's head with both hands, lifting the neck into flexion, and continuing to flex the patient's torso including his/her thoracic and lumbar spine into a C-shape.

Charting

Describe the patient's position (e.g., sitting, long leg sitting, supine), quality of pain if noteworthy (e.g., "electrical shooting"), and radiation pattern. See Appendix E: Charting the results of pain provocation tests.

Reliability and Validity

Based on pooling patients with Brudzinski and/or Kernig's sign, the sensitivity for meningitis has been reported to be around 61%. Specificity is not known. (McGee 2014) Lhermitte's sign has been reported to be present in as many as 25% of patients with cervical spondylotic myelopathy. (An 1998) The accuracy of Lindner's sign is not reported.

Follow-up Testing

Bacterial meningitis must be considered in any adult where signs/symptoms include some combination of the following: sudden rapid progression of headache or neck pain (within a day or two), stiff neck, rash, severe headache, change in mental status, temperature above 101º F, Brudzinski or Kernig's signs or appearing severely ill.

For suspected cord lesions, see Appendix B: Summary of exam procedures to perform for suspected cord lesions. For suspected lumbar radiculopathy, see Appendix D: Summary of exam procedures to perform for suspected lumbosacral radiculopathy.

CERVICAL FLEXION ROTATION TEST

Indications for Testing
This test is commonly used in cases of suspected cervicogenic headache or upper cervical joint dysfunction.

Procedure
With the patient supine, the examiner sits or stands at the head of the patient and fully flexes the patient's cervical spine. While holding the flexed position, the examiner then rotates the patient's head to end range of both left and right rotation.

Mechanism
In cases where cervical rotation range of motion appears to be decreased, maintaining the flexed position of the cervical spine is more likely to isolate the rotation to C1-C2. Observed hypomobility can then be more likely attributed to the upper cervical segments.

Procedural Errors
Failure to maintain the cervical spine in full flexion will decrease the likelihood of isolating C1-C2 movement.

Interpretation
Decreased rotational range of motion may indicate hypomobility of the C1-C2 segment. In patients presenting with headache, loss of ≥ 10° of motion or recreation of the patient's headache pattern increases the likelihood that the headache is cervicogenic.

Charting
It should be documented whether the test produced symptoms and whether the examiner perceived a decrease in range of motion.

Reliability and Validity

Two small studies have assessed the validity of this test for diagnosing cervicogenic headache. One found a specificity of 100 and sensitivity of 86 (Hall 2004). The other found a specificity of 90 with +LR of .91 and a sensitivity of 91 with a -LR of 0.1(Ogince 2007)

One study on the inter-examiner reliability of this test showed *K*= .50 (Hall 2010).

CERVICAL RESISTED MUSCLE TESTS (includes O'Donoghue maneuver)

Indications for Testing
Resisted muscle tests of the cervical spine are used to assess a possible muscle strain, particularly following trauma.

Procedure
The tests are performed to induce isometric contractions. In an acute setting, muscle testing is best performed with the cervical spine in neutral. In non-acute settings, a common option is to test the neck in mid-range. The muscle tests can also be done at end-range. Testing the muscles in a neutral posture can provide useful information prior to end-range assessment.

Appropriate muscle testing requires an adequate amount of force. The force can be initiated either by the patient ("push into my hand") or by the practitioner ("resist me"). Each of the cardinal planes is evaluated. (McGee 2014)

Once the maximum force is achieved, the contraction should be sustained for one to two seconds. In cases where the suspicion of a muscle strain is high but the muscles test strong and do not elicit pain, the practitioner may choose to increase the challenge by extending the duration of each contraction to 5 seconds or by repeating a one- to two-second contraction, ten times.

Mechanism
The isometric load imposed by the tests may cause pain due to an injured muscle (e.g. muscle strain or occasionally with acute muscle spasm). It may also reveal weakness because of a tear in the muscle fibers. Although an isometric contraction does not result in appreciable movement of the cervical joints, compression of the joints does occur and may be painful, especially during the initial phase of the contraction.

O'Donoghue maneuver
When muscle testing is followed by passive range of motion into each of the cardinal directions, this combination of procedures has been referred to as the O'Donoghue maneuver and is performed to distinguish between cervical muscle strain and ligament sprain. The passive tests place end range tensile loads on the cervical ligaments and discs. Such tests also load the muscle at end range, without eliciting an active contraction of that muscle.

Procedural Errors
Common errors include inducing too weak of a contraction to adequately load the tissue or, alternately, using too much force and overpowering the patient (especially while testing flexion). Special care must be taken in cases of recent trauma.

Interpretation

In acute trauma cases: Local pain in the muscles being tested suggests a grade 1 strain. Pain and muscle weakness (+4/5) suggest a possible grade 2 strain. +3/5 weakness with or without pain suggests a possible grade 3 strain. Full passive range of motion in combination with one weak and/or painful resisted movement suggests a muscle lesion (e.g., a strain).
Note: Weakness may result from the pain the patient is experiencing with the contraction and may not be due to significant fiber damage. The patient may be able to clarify the reason that they cannot create a stronger contraction. It may be necessary to test during another visit after the acute phase in order to identify a more serious tear.

Non-traumatic cases: In cases without a clear indication of trauma (e.g., repetitive microtrauma, posture loads), interpretation is broader. If the pain with contraction is greater than the pain with passive range of motion, then the muscle tested may be the pain generator. Weakness in a non-traumatic context may simply be due to pain with contraction as opposed to true weakness. The patient may be able to give some guidance. If pain increases just with the initiation of the contraction, then the pain may be arthrogenic.

Weakness without pain suggests a possible neurological lesion and should be correlated with other neurological tests. Grade 4 weakness may also be associated with muscle imbalance—either hypertonic ("tight" weakness) or hypotonic and lengthened ("stretch weakness"). Other proposed causes of inhibition include a short tight antagonist (reciprocal inhibition), joint dysfunction, and myofascial trigger points residing in the muscle being tested. The weakness may also result as a reflex inhibition from a more distant muscle harboring trigger points.

Charting

Muscle strength must be graded (graded 1-5 as a fraction of 5) and location of pain noted. (*See CSPE protocol "Muscle Testing.* If muscle tests are sustained, the time it took to produce pain or weakness should be recorded over a baseline of 5 seconds. In the case of multiple repetitions, the number of the repetitions over a baseline of 10 should be recorded (e.g., "grade 3 weakness at 7/10 reps"). For additional charting options, see Appendix E: Charting the results of pain provocation tests.

Reliability and Validity

Reliability and validity have not been established.

DEEP NECK FLEXOR ENDURANCE TEST and JULL'S TEST

Indications for Testing

This test is indicated in patients presenting with neck or upper back symptoms in which lack of strength endurance or neuromuscular control in the deep cervical flexors is suspected.

Procedure

In the supine position, the patient is directed to maximally retract the chin and, while maintaining the retraction, lift the head about one inch off the table. The examiner places a hand on the table under the patient's head and observes for the skin folds in the neck created by chin retraction. The test is terminated when the patient's head touches the examiners hand or separation of the skin folds occurs.

Jull's Test is commonly described as the examiner placing their hands under the head of a supine patient who is instructed to retract the chin. The examiner then passively raises their head about an inch. They then instruct the patient to maintain the position of the head while the examiner slowly removes their hands.

Interpretation

If the patient is unable to maintain the beginning position or the examiner observes a loss of the skin folds created by chin retraction, chin jutting, or shaking, this would be considered a failed test. The examiner may also place their hand under the patient's head to be able to feel when the patient's head lowers. Under normal circumstances the patient should be able to hold the position for about 39 seconds. (Magee 2014)
A failed test would indicate a potential need for exercises that focus on improving strength and endurance of the involved muscles.

Reliability and Validity

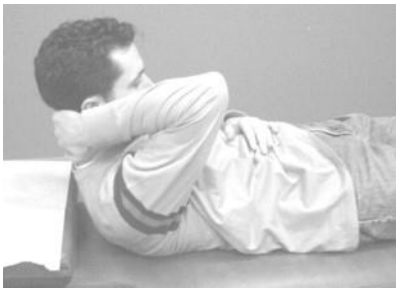
Various studies have shown this test to have moderate to high inter-examiner reliability (Cleland 2011)
Validity is unknown

RUST'S SIGN

Indications for Testing
Rust's sign is an observation (rather than a test) indicative of cervical instability that may be associated with upper cervical fracture, rheumatoid arthritis, severe sprain or subluxation.

Procedure
Patients support the neck with their hands due to pain and/or to provide stability following trauma. The sign may be observed in a patient who is sitting or standing or may be observed when a recumbent patient attempts to arise**.**

Mechanism
Significant trauma to the head and neck (e.g., motor vehicle accident, diving injury, falls) may result in odontoid fracture or transverse ligament sprain or rupture. Atlantoaxial instability is also associated with rheumatoid arthritis and other inflammatory arthritis (e.g., ankylosing arthritis, psoriatic arthritis, Reiter's syndrome). This instability, especially when traumatic, may result in rigidity or painful torticollis, requiring extra support which the patient attempts to supply with his/her hands.



Interpretation
The sign suggests cervical instability, so caution in patient handling and careful history taking are necessary to prevent further injury. In cases of trauma or suspected inflammatory arthritis, manipulation is contraindicated until appropriate radiographs are taken.

Charting
Sample language that may be used in a narrative report: "The patient was observed holding their neck for support (Rust's sign)."

Reliability and Validity
Unknown.

Follow-up Testing
Neurological examination including cranial nerves, sensory, reflex and motor examination will provide useful documentation for comparison to clinical progress and outcome. Imaging studies including plain film, CT and MRI will be necessary for a specific diagnosis. For safe transportation to the orthopedic or neurological surgeon, the patient's neck may require external support (e.g., a rigid cervical collar, backboard and ambulance).

SHOULDER ABDUCTION TEST

Indications for Testing
This test is used when evaluating a patient suffering from neck and arm symptoms, especially if a radicular syndrome is suspected (e.g., dermatomal pain, paresthesia, subjective weakness or numbness).

Procedure
The patient is asked to actively raise (abduct) the symptomatic arm until it is near the head and to report if there are any changes in arm symptoms.

Mechanism
Nervous tissue. Alleviation of arm pain or paresthesia with shoulder abduction over the head may occur due to a reduction in nerve root tension, mainly C6-C8 (Fast 1989), or intraforaminal pressure (Farmer 1994).

Procedural Errors
If the arm is not raised high enough, there may be a false negative. Monitoring neck symptoms rather than arm symptoms may lead to a false positive.

Interpretation
If shoulder abduction relieves the patient's arm pain, this suggests there is a radicular syndrome of the lower nerve roots. Patients may present in this posture to relieve radicular arm pain (Bakody's sign). It also suggests that abduction of the arm during cervical joint palpation and manipulation may be helpful.

An increase in symptoms may suggest that pressure is increasing in the scalene triangle. (Evans 2009)

Charting
The most important feature to record is whether the arm symptoms are relieved or aggravated.

Reliability and Validity
One study evaluated the diagnostic accuracy in 13 patients. The authors defined a positive test when radicular symptoms decreased or disappeared when the patient lifted the affected hand above the head. The study showed a moderate sensitivity and high specificity of this test (Viikari-Juntura 1989).

Follow-up Testing
See Appendix A: Summary of exam procedures to perform for suspected cervical radiculopathy.

SHOULDER DEPRESSION

Indications for Testing

Used to indicate possible nerve root or brachial plexus irritation/inflammation in patients with neck and arm symptoms.

Procedure

Patient may be seated or supine. Examiner first instructs patient to laterally bend the neck away from the side to be tested. Then examiner maintains the head in that amount of lateral flexion attained by the patient and places the other hand on top of the patient's shoulder. With gradually increasing pressure, the examiner depresses the affected shoulder. Radicular pain produced on the side being stretched constitutes a positive test. Confirmation of the positive test may be appreciated by reducing downward pressure on the shoulder until symptoms just abate and then have the patient rotate the head away from the affected shoulder. Exacerbation of radicular symptoms confirms a positive test.

Mechanism

Nervous tissue. Nerve root and brachial plexus tension is increased both by cervical lateral flexion away from the shoulder and by depression of the shoulder away from the cervical spine. Rotation of the head away from the affected shoulder also increases tension on the brachial plexus. In addition, the IVF is closed down on the concave side and may irritate an already compressed nerve root on that side. ***Joints and ligaments***. The facets and cervical discs are compressed on the concave side of the neck and ligaments are stretched on the convex side. ***Muscles.*** The lateral neck flexors as a group can be length tested for tightness.

Procedural Errors

Examiner forcing the neck into lateral flexion may well irritate symptoms beyond that which the shoulder depression test is designed to document. Patients with serious neck immobility may not be able to position themselves for adequate stretch of the brachial plexus resulting in false negative tests. If performing the test primarily for muscle tightness, the movement should be slow and steady, applying pressure through the shoulder. The patient must be relaxed and offer no resistance. Jerky or accelerating movements may be needlessly uncomfortable.

Interpretation

Test Result	Interpretation
Reproduction or exacerbation of radicular symptoms on the side tested	Irritation/inflammation of the nerve root, spinal nerve or brachial plexus due to tractioning forces during the test
Reproduction or exacerbation of radicular symptoms on the opposite side that is tested	Irritation/inflammation of the nerve root, spinal nerve or brachial plexus due to compressive forces during the test
Reproduction of arm symptoms	May be myofascial pain referral from stretching (e.g., anterior scaleni)

Local pain on the concave side of the neck	Joint irritation (joint dysfunction, facet, disc derangement)
Local pain on the convex side of the neck	Ligamentous sprain, capsular stretching, or a painful muscle such as the scaleni or upper trapezius
Reduced passive ROM and altered end feel	Short, tight lateral flexors (primarily upper traps, levator scapula, and/or scaleni).

Charting

Document side tested and the location of symptom production. Optionally, document the intensity of pain produced.

Reliability and Validity Unknown.

Follow-up Testing

See Appendix A: Summary of exam procedures to perform for suspected cervical radiculopathy.

SOTO-HALL TEST

Indications for Testing
This test may be useful when suspecting a fracture or lesion of the lower cervical or upper thoracic joints. (Evans 2009)

Procedure
With the patient supine, one hand is placed on the patient's sternum to prevent lumbar and thoracic regions from flexing; the other hand is under the patient's occiput. The neck is then passively flexed towards the chest while maintaining gentle pressure on the sternum. (Evans 2009, Kleinfield 1993, Cipriano 2010)

Mechanism
This test places traction on the posterior elements of the cervical and upper thoracic spine and compresses the anterior bodies and discs. It also causes traction of the nervous system (see Cervical Flexion). In the case of vertebral fracture, when the supraspinous ligament pulls on the spinous process of the fractured element, acute local pain will result.

Procedural Errors
Common errors include placing too much pressure on the sternum resulting in needless discomfort to the patient or placing too little pressure and allowing the thorax to rise off of the table.

Interpretation
Localized pain suggests a possible joint or bone injury or pathology (but not lower than the T7 level). This test may also produce Brudzinki's, Lindner's, or Lhermitte's signs (see Cervical Flexion).

Charting
Document the nature of the test and patient response. See Appendix E: Charting the results of pain provocation tests.

Reliability and Validity
The test is nonspecific and has limited use to localized conditions of the cervical and upper thoracic spine. (Evan 2009, Cipriano 2010) Test reliability and validity is unknown.

Follow-up Testing
Perform other active and passive loading tests to the area of injury (e.g., palpation, Valsalva maneuver, spinal percussion, cervical compression, etc).

TINEL'S SIGN

Indications
It is most useful in trauma cases that suggest the potential for brachial plexus injuries vs. nerve root injury.

Procedure
Tap over the posterior triangle, just posterior to the SCM, along the nerve trunks as the patient laterally bends his/her neck away.

Tinel's sign suggesting nerve root
No response suggests that, if there is neurological injury, it is in the root rather than elsewhere in the cervical or brachial plexus.
A pure tingling sensation (no pain) in the distribution of the nerve trunk suggests damage in the brachial plexus or root. Roots C5 and C6 are the most superficial and are most likely to respond.

Tinel's sign suggesting cervical or brachial plexus
Pure local pain suggests an underlying cervical plexus injury which is recovering.
Pain in the distribution of the nerve trunk suggests more severe disruption of the whole trunk.

Reliability and Validity
Unknown

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APPENDIX A: SUMMARY OF EXAM PROCEDURES TO PERFORM FOR SUSPECTED CERVICAL RADICULOPATHY

Orthopedic and palpatory procedures indicating nerve root irritation – may be due to compressive pathologies, such as a disc herniation, or tractional forces resulting in neurapraxis injury.

- Cervical compression (neutral, lateral, maximal, other variations)
- Cervical distraction
- Upper limb tension test (median nerve)
- Shoulder abduction (or observe Bakody's sign)
- Valsalva maneuver
- Arm Squeeze Test
- Provocation of neurological tissue: brachial compression, Tinel's test/palpation posterior to the SCM.

Neurological exam procedures to screen for loss of nerve root function – due to compressive or tractional forces.

Procedures should be compared bilaterally.

- Deep tendon reflexes (biceps, triceps, brachioradialis)
- Muscle tests in the upper extremity (performed repetitively or sustained if necessary)
- Dynamometer (optional)
- Sensory tests (light touch, sharp-dull discrimination)
- Measure girth of arm and forearm checking for atrophy.

If a radicular syndrome is suspected:

1. Perform additional physical exam procedures to rule out cord compression. (*See Appendix B: Summary of exam procedures to perform for suspected cord lesion.*)
2. Consider plain films – 3 views minimally, but 5-view series (including obliques) is recommended by the WSCC Radiology department.
3. Consider an immediate MRI (preferred) or CT if there are signs of cord compression, profound muscle weakness, or suspicion of a serious disease process.
4. On rare occasions, nerve conduction, EMG or sensory evoked potential may be helpful. Nerve conduction/EMG studies are less likely to yield useful results if performed earlier than 3 months after the injury or longer than 6 months.

If a radicular syndrome is ruled out, but neurological involvement is still suspected, go to *Appendix C: Summary of exam procedures to perform for suspected brachial plexus, neurovascular, or other nerve entrapment syndromes.*

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APPENDIX B: SUMMARY OF EXAM PROCEDURES TO PERFORM FOR SUSPECTED CORD LESIONS

Orthopedic exam procedures

- Cervical flexion for Lhermitte's sign

Neurological exam procedures indicating loss of function of the posterior column

Procedures should be compared bilaterally.

- Vibration (middle finger and toe)
- Romberg and/or position sense (middle finger and toe)
- 2 point discrimination (optional)

Neurological exam procedures indicating loss of function of the spinothalamic tract

Procedures should be compared bilaterally.

- Sharp-dull discrimination (upper and lower extremity)
- Hot vs. cold (optional)

Neurological exam procedures indicating UMNL (upper motor neuron lesion)

Procedures should be compared bilaterally.

- Deep tendon reflexes (biceps, triceps, Achilles and patellar)
- Babinski's reflex
- Hoffman's reflex (or dynamic Hoffman's if stenosis is suspected)
- Clonus (performed at ankle and wrist)
- Muscle testing of upper and lower extremity muscles (to include proximal muscle groups such as the deltoid and hip flexors, sustained/repetitive if necessary)
- Superficial abdominal reflex (optional)

Optional neurological procedures for suspected cervical cord compression

Procedures should be compared bilaterally.

- Rapid opening and closing of the hands
- Finger escape sign
- Scapulohumeral reflex

If spinal cord signs are present:

- Perform a cranial nerve exam (to rule out more extensive disease or lesions rostral to the cord).
- Consider plain films (3 views minimally), add flexion-extension if instability is suspected.
- Order an MRI (preferred) or CT or refer for neurological consultation.

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APPENDIX C: SUMMARY OF EXAM PROCEDURES TO PERFORM FOR SUSPECTED BRACHIAL PLEXUS, NEUROVASCULAR, OR OTHER NERVE ENTRAPMENT SYNDROMES

Orthopedic and palpatory procedures indicating tension/irritation in the spinal nerves, brachial plexus, or peripheral nerves

Procedures should be compared bilaterally.

- Upper limb tension test I for the median nerve
- Upper limb tension test II the median nerve
- Upper limb tension test III for the radial nerve
- Upper limb tension test IV for the ulnar nerve
- Provocation of neurological tissue: brachial plexus compression, Tinel's test at various locations (e.g., palpation posterior to the SCM, medial elbow, pronator teres, carpal tunnel)

Orthopedic/palpation procedures indicating compression of the brachial plexus, TOS or other neurovascular conditions

Procedures should be compared bilaterally.

- Roos' test
- Hyperabduction (Wright's test)
- Costoclavicular test (Eden's)
- Adson's and Halstead's
- Allen's test
- Palpate/compress forearm (e.g., pronator teres) and wrist (e.g., Phalen's test, reverse Phalen's, etc.)
- Length test scalenes and pectoral muscles for hypertonicity

Neurological exam procedures to screen for loss of function

- Deep tendon reflexes (biceps, triceps, brachioradialis)
- Muscle tests in the upper extremity (if necessary, performed repetitively or sustained)
- Dynamometer (optional)
- Sensory tests (light touch, sharp-dull discrimination) to include *pure patches for peripheral nerves*
- Measure girth of arm and forearm, inspect for atrophy (e.g., intrinsic muscles of the hand intrinsic, thenar eminence)

If peripheral nerve damage is suspected:

On rare occasions, nerve conduction, EMG or sensory evoked potential may be helpful. Nerve conduction/EMG studies are less likely to yield useful results if performed earlier than 3 months after the injury or longer than 6 months.

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APPENDIX D: CHARTING THE RESULTS OF PAIN PROVOCATION TESTS

Recording positive results

When recording the results of orthopedic pain provocation tests, there are a few basic principles that should always be followed and a number of optional notations that can also be made. *A test should NEVER be simply noted as being positive!*

Basic principles

- Record pain location including any radiation pattern.
- If the procedure reproduces the symptoms exactly, this should be recorded. You may mark this as “CC” for chief complaint. However, there will be situations when it is important to note more specifically which chief complaint or which part of the chief complaint has been aggravated (e.g., if the patient has both headache and neck pain, which portion of the chief complaint was affected?).
- If a procedure is designed to be sustained for a certain length of time (e.g., Roos test), note when the symptoms were reproduced/aggravated.

Optional

- Record the quality of the pain if it is noteworthy (e.g., sharp, burning, electrical).
- Record the intensity of the symptoms (any verbal scale is acceptable as long as the denominator is recorded, e.g., 3/5 or 6/10).
- Record whether the symptoms were aggravated at end range only.

Recording negative results

Sometimes the test is technically negative for what it is primarily designed to test, but yields other useful information. For example, a SLR may be negative as a nerve tension test but may reveal that the hamstrings are tight at 70 degrees. On WSCC exam forms, circle the item and describe the finding. In narrative formats, likewise, describe the finding. For example, “SLR on the right was negative for nerve involvement but aggravated the patient’s back pain.”

All negative tests must be recorded. Do not leave them off an exam form or out of a SOAP note just because they are negative. The fact that the test was performed must be part of the chart.

Record inability to perform a test

Cases in which an attempt is made to perform a pain provocation test, but the patient cannot tolerate it, record "not performed due to pain." This can be abbreviated "NP d/t P." Sometimes procedures are not performed for other reasons. In these cases, line out the procedure on the exam form and write NA (not applicable) or NP (not performed).

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