

EZQMECEU.COM

“SPECIAL TESTS IN THE QME EXAMINATION”

Perry J. Carpenter DC, QME
Fellow, Academy of
Chiropractic Orthopedics



WWW.EZQMECEU.COM

- Welcome to Today's Program – “Special Tests” in the QME Examination. This Program is Approved by the Division of Worker's Compensation for 6 Hours of QME Home Study Continuing Education Credits.
- This is a narrated PowerPoint Presentation. It is presented just as if you were at a live lecture.
- Your Course Materials also contain copies of the PowerPoint slides with space provided for note taking. Grab those now to get ready.
- Sit back, relax, take notes, learn a lot, and enjoy the Program!

WWW.EZQMECEU.COM

- GET READY!!!!

PRESENTED BY:

Perry J. Carpenter DC QME

Diplomate, Academy of Chiropractic Orthopedists (DACO)

Board Eligible, Chiropractic Neurology

Board Eligible, Chiropractic Sports

Certified Chiropractic Sports Physician (CCSP)

Certified Chiropractic Extremity Practitioner (CCEP)

Certified Strength & Conditioning Specialist (CSCS*D)



WWW.EZQMECEU.COM

- WE HAVE A GROWING LIBRARY OF TOPICS RELATING TO DAY TO DAY PROCEDURES INVOLVED WITH PERFORMING QME EXAMINATIONS AND PREPARING REPORTS THAT ARE CREDIBLE AND THAT QUALIFY AS SUBSTANTIAL MEDICAL EVIDENCE.
- CHECK OUR WEBSITE OFTEN FOR NEW PROGRAM RELEASES
- IF THERE IS A TOPIC THAT INTERESTS YOU THAT YOU WOULD LIKE EXPANDED ON, LEAVE A SUGGESTION ON THE WEBSITE AND WE WILL DO IT!



Additional Programs
Available from
EZQMECEU.COM:

- **Medical-Legal Report Writing and Technique of the QME Examination (6 hours)**
- **Gait Disturbance & Assistive Devices (3 hours)**
- **The Non-Physiologic Examination (3 hours)**
- **The Deposition Matrix (6 hours)**
- **21 Secrets of the Most Persuasive QME's (6 hours)**
- **Upper Extremity Impairments – Entrapment Neuropathies (6 hours)**
- **Lower Extremity Impairments due to Peripheral Nerve Lesions (6 hours)**
- **The Importance of the Neurologic Examination (6 hours)**
- **Manual Muscle Testing and the AMA Guides 5th Edition (6 hours)**



WWW.EZQMECEU.COM

Medical-Legal
Report Writing
and Technique
of the QME
Examination (6
hours)

Topics Include:

- Section 1 - Medical Legal Report Writing
- Section 2 – The QME Panel Process
- Section 3 – Technique of the QME Examination



Gait Disturbance & Assistive Devices (3 hours):

Topics:

- AMA Guides - Descriptions of Gait Disturbances in AMA Guides Chapters 13 and Chapters 17
- Procedure for the Gait Analysis and Observation
- Description of the Phases of “Normal” Gait and “Pathologic” Gait
- Causes of Deviations from the Normal Gait
- Named Gait Signs
- Assistive Devices – canes, crutches, pick up frames, ankle foot orthosis, knee ankle foot orthosis
- Gait Conclusions



WWW.EZQMECEU.COM

The Non-Physiologic Examination (3 hours)

Topics Include:

- Practical Considerations for the Quantification of Pain
- Activities of Daily Living Assessments – a Practical Method
- Malingering – Waddell's Signs and DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) Criteria
- Medical Records, and Interview Findings of Inconsistency
- Physical Examination Findings of Inconsistency



WWW.EZQMECEU.COM

The “Deposition Matrix” (6 Hours):

Philosophy: Reasons why
Depositions are called –
Applicant Attorney vs.
Defense Attorney

- Rules for Deposition: Combination of tips and suggestions from 1) my own experience plus 2) communication tips from a Certified Court Reporter
- Case Examples:
 - Mechanism of Injury:
 - Clinical Course:
 - Permanent Impairment/Apportionment Opinions
- Deposition Questions and the responses



WWW.EZQMECEU.COM

UPPER
EXTREMITY
IMPAIRMENTS –
PERIPHERAL
NEUROPATHIES

Topics Include:

- Neurology 101
- Entrapment Neuropathies
- Exam Procedures
- Impairment Calculations
- Case Examples



WWW.EZQMECEU.COM

Lower
Extremity
Impairments
– Peripheral
Nerve
Lesions

Topics Include:

- Neurology 101
- Entrapment Neuropathies
- Exam Procedures
- Impairment Calculations
- Case Examples



The Importance of the Neurologic Examination (6 hours)

- Part 1
- AMA Guides references to “Neurology”
- Neurology 101:
 - Development of CNS & PNS
 - Spinal Cord, Spinal Nerves, and the Plexuses (4)
 - Named Peripheral Nerves of the Upper & Lower Extremities



Manual Muscle Testing (MMT) and the AMA Guides 5th Edition

PART 1&2

- AMA GUIDES REFERENCES TO MMT
- Myology 101 – Development of the Muscular System
- MMT General Principles and Procedures
- MMT OF NERVE ROOT INNERVATED MUSCLES (Focus on MMT of “Specific Muscles”)
- MMT OF PERIPHERAL NERVE INNERVATED MUSCLES (Focus on MMT of “Specific Motions”)



WWW.EZQMECEU.COM

21 Secrets of
the Most
Persuasive
QME's (6
Hours)

Topics:

- Preparatory Secrets (3)
- Interview/Exam Secrets (10)
- Report Writing Secrets (4)
- Deposition Secrets (4)



WWW.EZQMECEU.COM

- For a brief video introduction to each of the above Programs, click the link below:
- [Gait Disturbance & Assistive Devices](#)
- [The Non-Physiologic Examination](#)
- [The Deposition Matrix](#)
- [21 Secrets of the Most Persuasive QME's](#)
- [Upper Extremity Impairments – Entrapment Neuropathies](#)
- [Lower Extremity Impairments due to Peripheral Nerve Lesions](#)
- [The Importance of the Neurologic Examination](#)
- [Manual Muscle Testing & the AMA Guides](#)

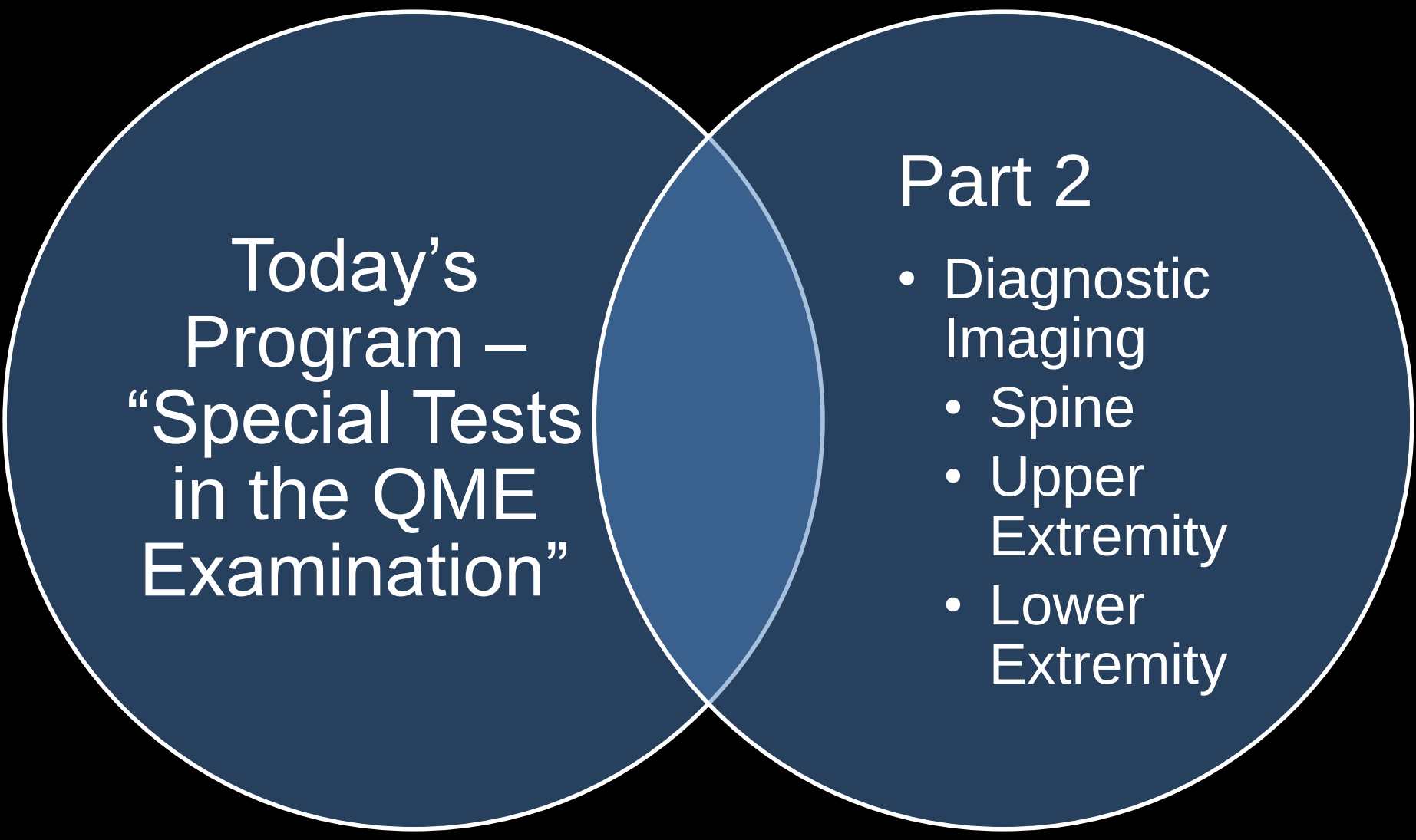


Today's
Program –
“Special Tests
in the QME
Examination”

Part 1:

- Physical Examination:
 - Spine
 - Upper Extremity
 - Lower Extremity





Today's
Program –
“Special Tests
in the QME
Examination”

Part 2

- Diagnostic Imaging
 - Spine
 - Upper Extremity
 - Lower Extremity



“SPECIAL TESTS” IN THE PHYSICAL EXAMINATION

- Chapter 15 – THE SPINE: Box 15-1 (page 382) of the Guides give us an idea of the Physical Examination findings that the Guides considers to be important in the determination of Permanent Impairment due to spinal injury:
 - Muscle Spasm
 - Muscle Guarding
 - Asymmetry of Spinal Motion
 - Non-verifiable radicular root pain
 - **Reflexes**
 - Weakness and loss of sensation
 - Atrophy
 - **Radiculopathy**
 - Electrodiagnostic verification of radiculopathy
 - **Alteration of Motion Segment Integrity**
 - Cauda Equina syndrome
 - Urodynamic Tests



Muscle Spasm

Muscle spasm is a sudden, involuntary contraction of a muscle or group of muscles. Paravertebral muscle spasm is common after acute spinal injury but is rare in chronic back pain. It is occasionally visible as a contracted paraspinal muscle but is more often diagnosed by palpation (a hard muscle). To differentiate true muscle spasm from voluntary muscle contraction, the individual should not be able to relax the contractions. The spasm should be present standing as well as in the supine position and frequently causes a scoliosis. The physician can sometimes differentiate spasm from voluntary contraction by asking the individual to place all his or her weight first on one foot and then the other while the physician gently palpates the paraspinal muscles. With this maneuver, the individual normally relaxes the paraspinal muscles on the weight-bearing side. If the examiner witnesses this relaxation, it usually means that true muscle spasm is not present.

Muscle Guarding

Guarding is a contraction of muscle to minimize motion or agitation of the injured or diseased tissue. It is not true muscle spasm because the contraction can be relaxed. In the lumbar spine, the contraction frequently results in loss of the normal lumbar lordosis, and it may be associated with reproducible loss of spinal motion.

Asymmetry of Spinal Motion

Asymmetric motion of the spine in one of the three principal planes is sometimes caused by **muscle spasm or guarding**. That is, if an individual attempts to flex the spine, he or she is unable to do so moving symmetrically; rather, the head or trunk leans to one side. To qualify as true asymmetric motion, the finding must be reproducible and consistent and the examiner must be convinced that the individual is cooperative and giving full effort.

Nonverifiable Radicular Root Pain

Nonverifiable pain is pain that is in the distribution of a nerve root but has no identifiable origin; ie, there are **no objective physical, imaging, or electromyographic findings**. For dermatomal distributions, see Figures 15-1 and 15-2.

Reflexes

Reflexes may be normal, increased, reduced, or absent. For reflex abnormalities to be considered valid, the involved and normal limb(s) should show marked asymmetry between arms or legs on repeated testing. **Once lost because of previous radiculopathy, a reflex rarely returns. Abnormal reflexes such as Babinski signs or clonus may be signs of corticospinal tract involvement.**

Weakness and Loss of Sensation

To be valid, the sensory findings must be in a strict anatomic distribution, ie, follow dermatomal patterns (see Figures 15-1 and 15-2). Motor findings should also be consistent with the affected nerve structure(s). **Significant, long-standing weakness is usually accompanied by atrophy.**

Atrophy

Atrophy is measured with a tape measure at identical levels on both limbs. For reasons of reproducibility, the difference in circumference should be 2 cm or greater in the thigh and 1 cm or greater in the arm, forearm, or leg. The evaluator can address asymmetry due to extremity dominance in the report.

Radiculopathy

Radiculopathy for the purposes of the *Guides* is defined as significant alteration in the function of a nerve root or nerve roots and is usually caused by pressure on one or several nerve roots. The diagnosis requires **a dermatomal distribution of pain, numbness, and/or paresthesias in a dermatomal distribution. A root tension sign is usually positive.** The diagnosis of herniated disk must be substantiated by an appropriate finding on an imaging study. **The presence of findings on an imaging study in and of itself does not make the diagnosis of radiculopathy.** There must also be clinical evidence as described above.

Electrodiagnostic Verification of Radiculopathy

Unequivocal electrodiagnostic evidence of acute nerve root pathology includes the presence of multiple positive sharp waves or fibrillation potentials in muscles innervated by one nerve root. However, the quality of the person performing and interpreting the study is critical. Electromyography should

be performed only by a licensed physician qualified by reason of education, training, and experience in these procedures. Electromyography does not detect all compressive radiculopathies and cannot determine the cause of the nerve root pathology. On the other hand, electromyography can detect noncompressive radiculopathies, which are not identified by imaging studies.

Alteration of Motion Segment Integrity

Motion segment alteration can be either loss of motion segment integrity (increased translational or angular motion) or decreased motion secondary to developmental fusion, fracture healing, healed infection, or surgical arthrodesis. An attempt at arthrodesis may not necessarily result in a solid fusion but may significantly limit motion at a motion segment. Motion of the individual spine segments cannot be determined by a physical examination but is evaluated with flexion and

extension roentgenograms. The loss of motion segment integrity is defined in Section 15.1b.

Cauda Equina Syndrome

Cauda equina syndrome is manifested by bowel or bladder dysfunction, saddle anesthesia, and variable loss of motor and sensory function in the lower extremities. Individuals with cauda equina syndrome usually have loss of sphincter tone on rectal examination and diminished or absent bladder, bowel, and lower limb reflexes.

Urodynamic Tests

Cystometrograms are useful in individuals where a cauda equina syndrome is possible but not certain. A normal cystometrogram makes the presence of a nerve-related bladder dysfunction unlikely. Occasionally, more extensive urodynamic testing is necessary.



“SPECIAL TESTS” IN THE PHYSICAL EXAMINATION – Chapter 15

- Cervical Spine:
 - Review of Reflex Testing
 - Corticospinal Tract/Upper Motor Neuron Lesion Signs:
 - Babinski Sign
 - Hoffman Sign
 - Lhermitte Sign
 - Hyperreflexia
 - Gait – Myelopathic Gait
- Radiculopathy Assessments:
 - Cervical Compression (Spurling Sign)
 - Foraminal Compression (Spurling Maneuver)
 - Shoulder Depressor Maneuver
 - Thoracic Outlet Maneuvers



“SPECIAL TESTS” IN THE PHYSICAL EXAMINATION – Chapter 15

- Chapter 15 – THE SPINE:
 - Thoracic Spine:
 - Reflexes -
 - Radiculopathy Assessment (Neurologic Exam for Non— Verifiable Radiculopathy)
 - Corticospinal Tract Signs (Spinal Cord Myelopathy)



“SPECIAL TESTS” IN THE PHYSICAL EXAMINATION – Chapter 15

- Lumbar Spine:
 - Gait Evaluation – AMA Guides provide for Permanent Impairment in Chapters 13 & 17
 - Heel/Toe Walk
 - Squatting
 - Neurologic:
 - Reflexes (review Hamstring Reflex)
- Sciatic Nerve Tension Signs:
 - Straight Leg Raising (supine/sitting)
 - Braggard's
 - Neri's Bowstring
 - Crossed straight leg raising
 - Associated Non-Physiologic Exam Findings
- Femoral Nerve Stretch Test



“SPECIAL TESTS” IN THE RADIOLOGIC EVALUATION – Chapter 15

- ANALYSIS OF MOTION SEGMENT INTEGRITY (Cervical/Thoracic/Lumbar)
- COMPRESSION FRACTURES (Cervical/Thoracic/Lumbar)



CERVICAL SPINE

- In the cervical spine, the focus of Physical Examination testing is on the identification and determination of neurologic conditions – specifically myelopathy (injury to corticospinal tracts), and/or radiculopathy (injury to spinal nerve roots).
- Myelopathy Presentation: Classic complaints include 1) difficulty with fine motor tasks involving the upper extremities, and 2) weakness involving the lower extremity.
- Fine Motor Tasks: Diffuse hand numbness that is not restricted to a specific dermatome is more likely to be myelopathic in origin. Examinees may report clumsiness with buttoning a shirt, deterioration of their handwriting, and other hand related tasks involved with normal activities of daily living.



CERVICAL SPINE

- LOWER EXTREMITIES: The recent use of walking aids, such as a cane or walker, is also suggestive of myelopathy.
- Urinary incontinence, urinary retention, and fecal incontinence are rare and when present, suggest advanced myelopathic involvement.
- Review ACTIVITIES of DAILY LIVING – page 4 AMA Guides to identify impairments in activities of daily living as a result of corticospinal tract involvement



ACTIVITIES of DAILY LIVING – page 4

- Self – care & Personal Hygiene:

- Urinating
- Defecating
- Brushing teeth
- Combing hair
- Bathing
- Dressing oneself
- Eating
- Other

- Communication Activities:

- Writing
- Typing
- Seeing
- Hearing
- Speaking
- Other



ACTIVITIES OF DAILY LIVING

- Physical Activity:

- Standing
- Sitting
- Reclining
- Walking
 - Assistive device
 - Elevations
 - Grades
 - Deep Chairs
 - Long Distances
 - Climbing Stairs

- Sensory Function:

- Hearing
- Seeing
- Tactile feeling
- Tasting
- Smelling
- Other



ACTIVITIES OF DAILY LIVING

- Non— Specialized Hand Activity:
 - Grasping
 - Lifting
 - Tactile Discrimination
 - Other
- Travel Activities:
 - Riding
 - Driving
 - Flying
 - Other



ACTIVITIES OF DAILY LIVING

- Sexual Function:

- Orgasm
- Lubrication
- Ejaculation
- Erection
- Pain

- Sleep:

- Restful Sleep
- Nocturnal Sleep Pattern
- Daytime Sleepiness
- Other



CERVICAL SPINE

- Radiculopathy Presentation: Manifests as sensory and motor symptoms related to a specific dermatome and myotome, respectively. Patients will describe a localized region of numbness, tingling, or paresthesias (sensation of tingling, tickling, prickling, pricking, or burning) in addition to neck, shoulder, and upper extremity pain. They may report improvement in symptoms when raising the affected arm overhead (Bakody's/abduction sign).
- Hallmark Physical Examination testing for myelopathy and radiculopathy include **objective** reflex testing:
 - In radiculopathy, we test for alterations of the "deep tendon **reflexes**."
 - In myelopathy, we test for "pathologic **reflexes**."



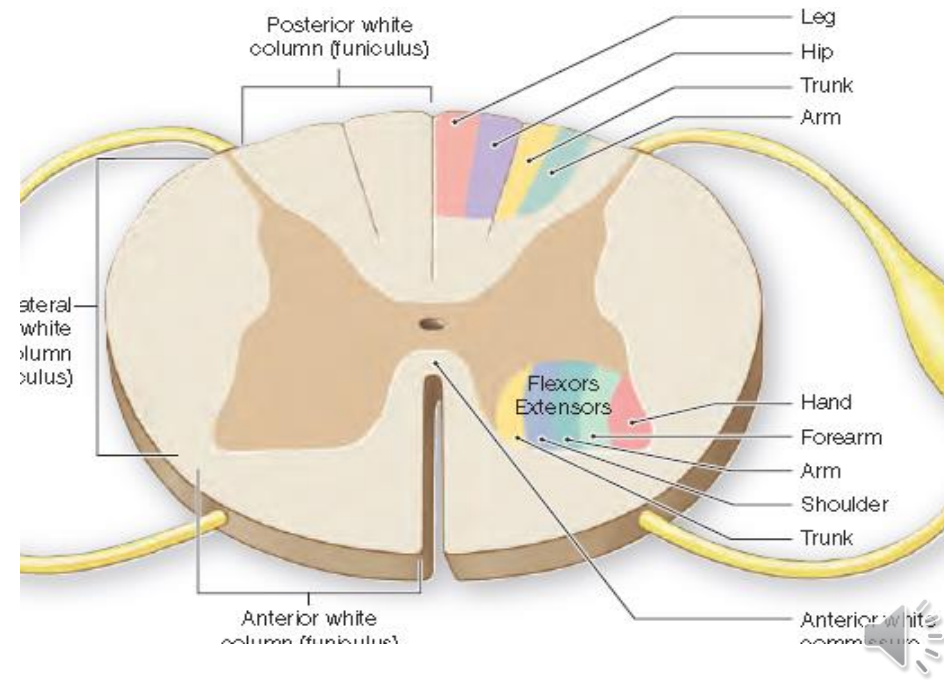
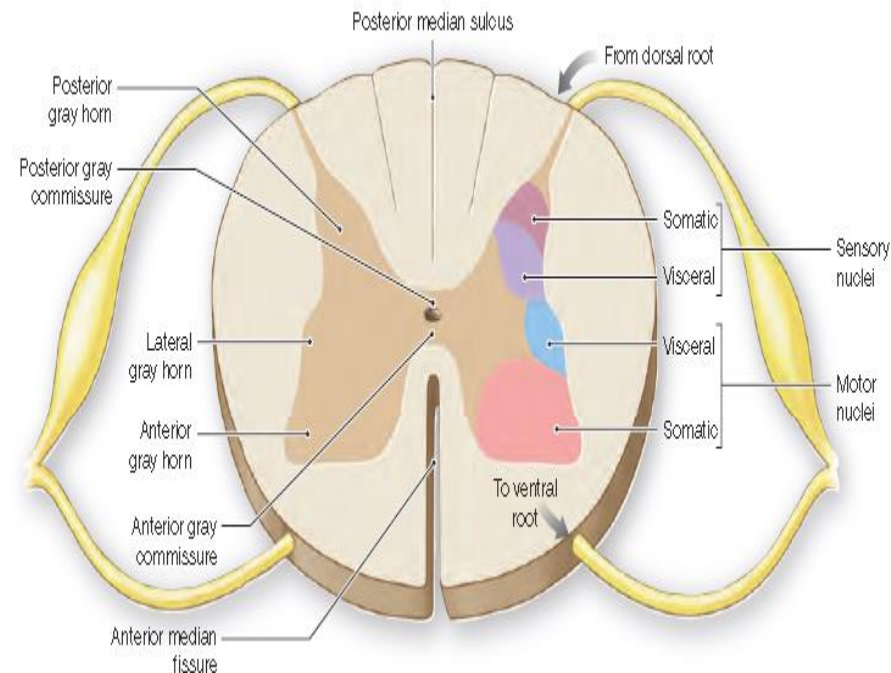
DEEP TENDON **REFLEX** TESTING

- Reflex - is an involuntary and nearly instantaneous movement in response to a stimulus¹
- 6 Components of a Deep Tendon Reflex Arc:
 - 1. Stimulus – rapid stretch of muscle/tendon
 - 2. Receptors – muscle spindle in muscle (specialized dendrite)
 - Detect stimulus



REFLEX TESTING

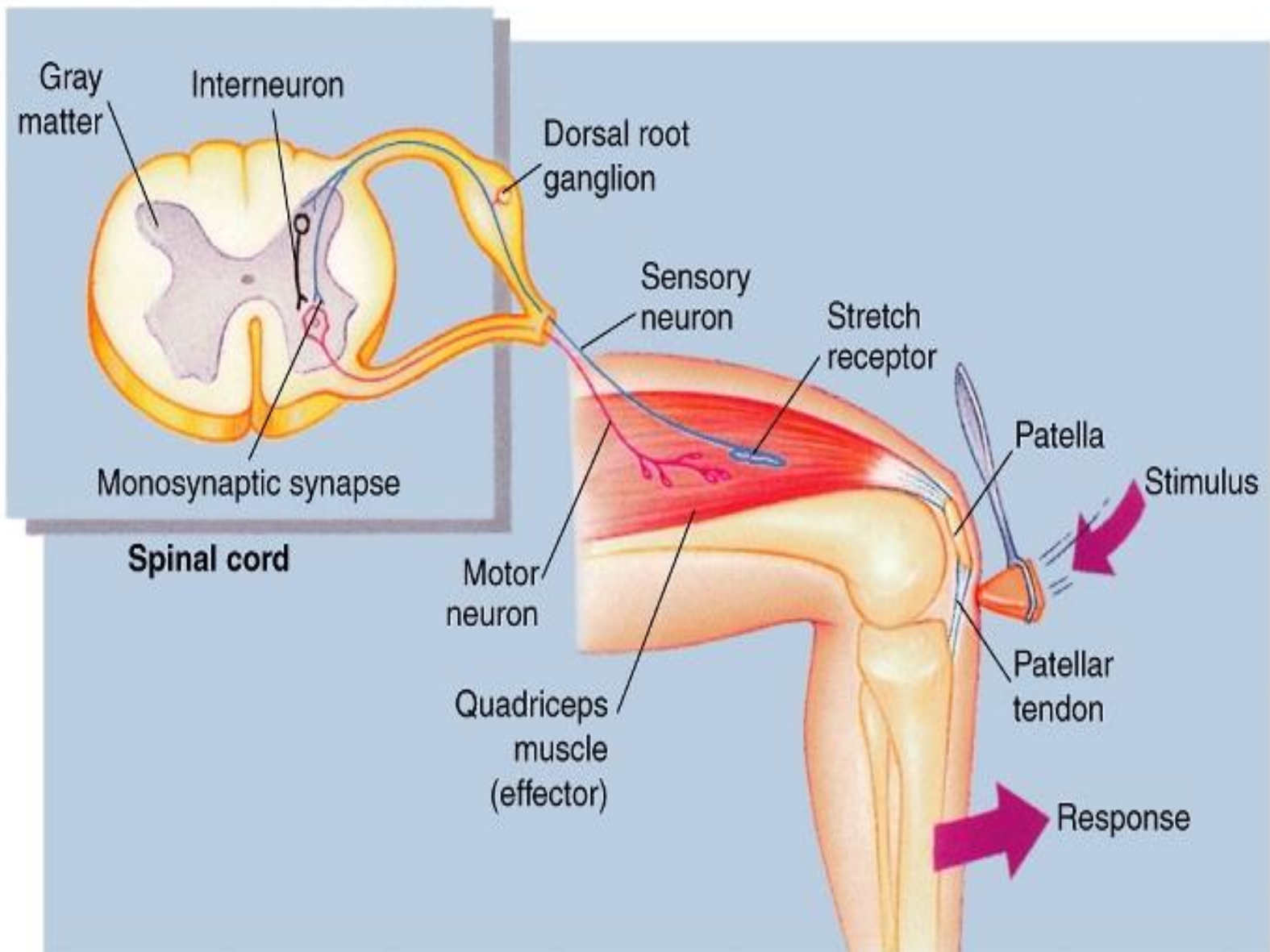
- 3. Sensory Nerve/Neuron – impulses travel up peripheral process/dendrite to the nerve cell body – located (???) – central process/axon ends in the spinal cord in the dorsal horn. Dorsal horn is somatotopically arranged.



REFLEX TESTING

- 4. Spinal Cord (Control center) - Decides the correct response
- 5. Motor Nerve/Neuron— carries impulse back to the “effector” (muscle). Motor neuron makes a synapse at the muscle (NMJ). Here neurotransmitter chemicals (ACh) released from NMJ.
- 6. Effector - A muscle or gland that carries out the response (in the case of the upper extremities we are talking about the biceps, brachioradialis, and the triceps muscles).





GRADING REFLEXES

- AMA Guides – Box 15-1: Reflexes may be “normal, increased, reduced, or absent.” With radiculopathy, reflexes will be reduced. With myelopathy, reflexes will be increased.

0	AREFLEXIA	Radiculopathy
1	HYPOREFLEXIA	Radiculopathy
2-3	NORMAL/AVERAGE	Normal
3+ - 4	HYPERREFLEXIA	Myelopathy 

CERVICAL SPINE

- Reflex Testing:
- Typical Reflexes tested in Cervical Spine Examination:
 - C5 (Musculocutaneous Nerve): Biceps reflex
 - C6 (Radial Nerve): Brachioradialis reflex
 - C7 (Radial Nerve): Triceps reflex



REPORTING YOUR FINDINGS

- The upper extremity reflexes were symmetric bilaterally. This indicates normal function of:
 - Musculocutaneous Nerve: Arises from the lateral cord of the brachial plexus (which is formed by the anterior divisions from the upper and middle trunks) - C5/C6/C7 (Review Anatomy of the Brachial Plexus)
 - Left and right biceps muscle spindles (stretch receptors)
 - Left and right C5 sensory nerve root function
 - Left and right musculocutaneous (C5, C6, and C7) nerve sensory function
 - C5 level of spinal cord function
 - Left and right C5 motor nerve root function
 - Left and right musculocutaneous (C5, C6, C7) nerve motor function
 - Left and right biceps muscle function
- The same findings would apply in the case of normal 1) brachioradialis, and 2) triceps reflexes. This indicates preserved and intact function of cervical spine nerve roots and upper extremity peripheral nerves.

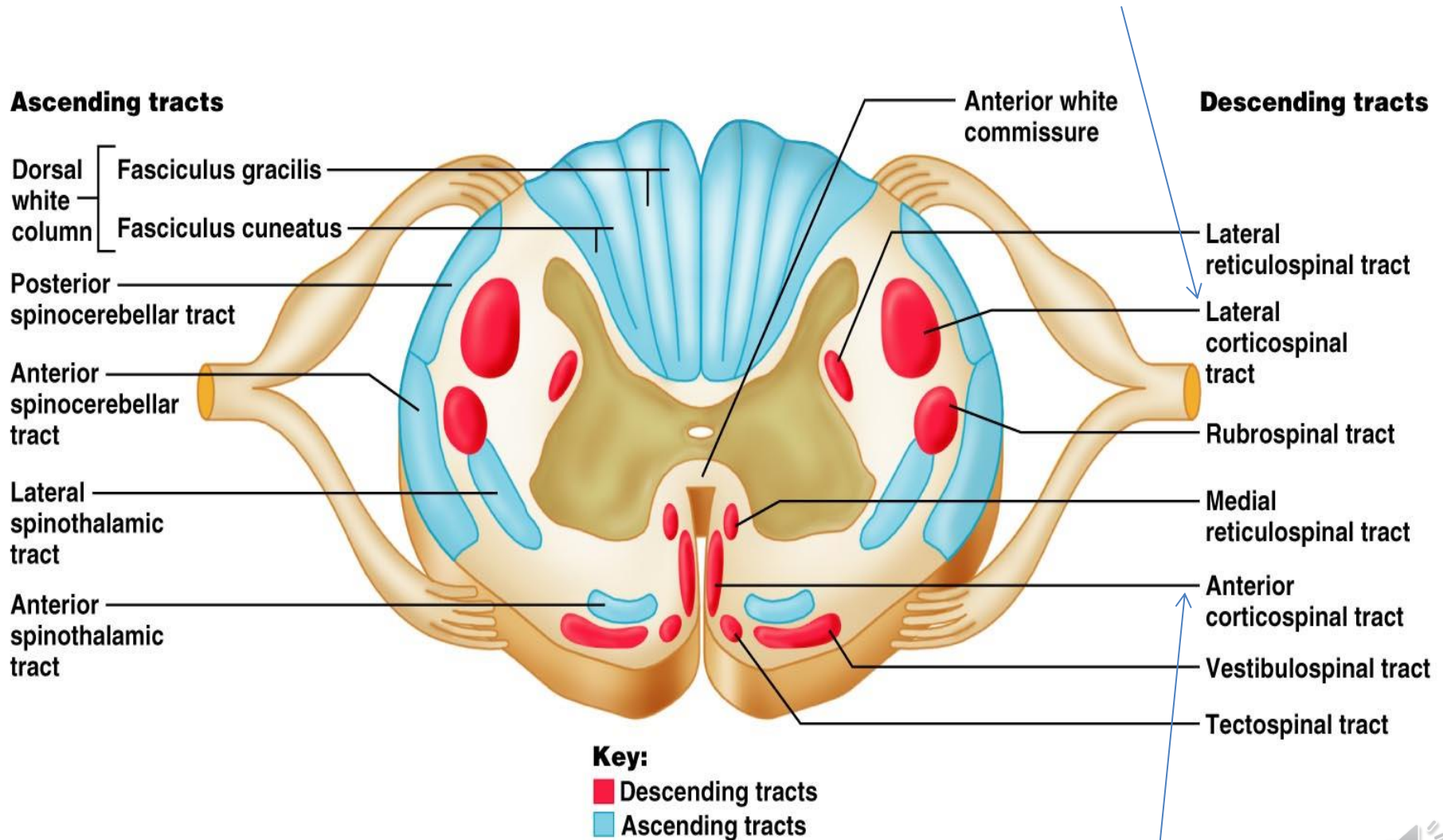


CORTICOSPINAL TRACT INJURY

- Upper Motor Neuron Lesion **Reflex** Signs:
 - Hyperreflexia
 - Babinski Reflex (aka “Plantar reflex”)
 - Hoffman Reflex
- Upper Motor Neuron Lesion Exam Findings:
 - Myelopathic Gait
 - Lhermitte Sign
 - Spurling Sign



CORTICOSPINAL TRACT INJURY



CORTICOSPINAL TRACTS

- Pyramidal Tracts:
 - Anterior Corticospinal Tract – involved with motor activity of the upper extremities down to about T6 – controls central axial and girdle muscles
 - Lateral Corticospinal Tract – fine movement of the limbs
- Extra – Pyramidal Tracts:
 - Reticulospinal Tract – involved with locomotion and postural control of trunk and proximal limbs
 - Tectospinal tract - coordinate head, neck, and eye movements, primarily in response to visual stimuli.
 - Rubrospinal tract - responsible for large muscle movement as well as fine motor control, terminating primarily in the cervical spinal cord, suggesting that it functions in upper limb
 - Vestibulospinal tract – involved with changing the position of the body and limbs to maintain posture of the body in alignment with the head



PATHOLOGIC REFLEXES

- Babinski Reflex – aka “PLANTAR REFLEX”
- Unlike deep tendon/muscle stretch reflexes, the plantar reflex is not a “deep reflex.” It is a skin/muscle – or “superficial” reflex.
- Examples of other “superficial reflexes” –
 - Corneal reflex
 - Gag reflex
 - Abdominal skin – muscle reflexes
 - Anal wink and bulbocavernosus reflexes
 - And... according to DeMeyer, author of Technique of the Neurologic Examination 5th Edition, “The most important of all reflexes – the plantar reflex”



PLANTAR REFLEX

- Examinee is supine with the limbs completely relaxed
- Examiner strokes the lateral side of the sole of the foot from the medial calcaneal tubercle to the head of the third metatarsal (do not stroke the toes!) – length, velocity, and pressure of the stroke are important
- Normal – large toe plantar flexes (“toe *downgoing*”)
- With corticospinal tract damage (UMN Lesion) – toe extends at the MTP joint – “+ Babinski sign”
- This should be repeatable!



PLANTAR REFLEX

- The reflexogenous zone for the plantar reflex is the S1 dermatome
- The afferent nerve is the tibial nerve
- Reflex is mediated by the L4, L5, S1, and S2 levels of the spinal cord
- Efferent: Motor response back through the L4, L5, S1, and S2 roots to the sciatic nerve to its bifurcation. Toe flexors are innervated by the tibial nerve. Toe extensors (extensor hallucis longus, extensor digitorum longus) are innervated by the deep peroneal nerve. Loss of normal adult descending pyramidal control of the reflex arc to suppress extensor withdrawal results in the upgoing toes in the plantar reflex – this is known as “Babinski's sign.”



PLANTAR REFLEX

- The extensor toe response is a sign of anatomic or pathophysiologic interruption of the pyramidal/corticospinal tract (UMN lesion)
- Other methods are just different stimuli within the S1 dermatome that result in an *extensor response* in the case of UMN lesion:
- Chaddock's - Stroking the lateral malleolus
- Schaeffer - Squeezing the Achilles tendon
- Oppenheim - Applying pressure to the medial side of the tibia
- Gordon - Squeezing the calf muscle
- Gonda - Flexing and suddenly releasing the 4th toe



CERVICAL SPINE

- Upper Motor Neuron Lesion Signs:
 - Hoffman Reflex - The examiner depresses the distal phalanx and allows it to flip up. The extension of the phalanx stretches the flexor muscles, causing the fingers and **thumb** to flex. This method is effective only with very brisk (+3) muscle stretch reflexes.



CERVICAL SPINE

- Upper Motor Neuron Lesion Signs:
 - Hyperreflexia - Has many causes:
 - Physiologic (upper range of normal)
 - Pathologic:

Structural/CNS lesion	Toxic/metabolic disorder
Malformation	Hypocalcemia/tetany
Birth injuries/cerebral palsy	Tetanus
Vascular	Strychnine
Traumatic	
Neoplastic	
Degenerative	



CERVICAL SPINE

- Clonus: (from the Greek for "violent, confused motion") is a series of involuntary, rhythmic, muscular contractions and relaxations. Clonus is a sign of certain neurologic conditions, particularly associated with UMN involving descending motor pathways, and in many cases is, accompanied by spasticity (another form of hyperexcitability). Clonus causes large motions that are usually initiated by a reflex. Studies have shown clonus beat frequency to range from 3–8 cycles per second on average, and may last a few seconds to several minutes depending on the patient's condition.



CLONUS

- Clonus at the ankle is tested by rapidly flexing the foot into dorsiflexion (upward), inducing a stretch to the gastrocnemius muscle. Sustain pressure on the sole of the foot to reinitiate the stretch once the contraction subsides. Subsequent beating of the foot will result, however only a sustained clonus (5 beats or more) is considered abnormal. Clonus can also be tested in the knees by rapidly pushing the patella (knee cap), towards the toes.
- [Video Demonstration of Ankle Clonus](#)



CERVICAL SPINE

- Upper Motor Neuron Lesion Signs:
 - Lhermitte Sign - Sharp flexion of the head causes an electric shock like sensation of pain or "pins and needles" in the body and extremities. Pain may extend to the feet. Coughing, sneezing, or straining may elicit the same sensation. Stretch of the neural tissue at the site of the lesion of the **cord** apparently causes the sensation.



CERVICAL SPINE

- Upper Motor Neuron Lesion Signs:
 - Gait – Myelopathic Gait – Ataxic, broad based, shuffling gait due to sensory changes in the lower extremities. (Ataxia = lack of muscular coordination – due to muscular weakness)



CERVICAL SPINE

- RADICULOPATHY “SPECIAL TESTS”
 - Cervical Compression (Spurling’s Maneuver):
 - Shoulder Depression Test:
 - Upper Limb Tension Test
 - Thoracic Outlet Tests:



CERVICAL SPINE

- Cervical Compression (Spurling's Maneuver):
 - Used in the assessment of disc protrusion or intervertebral foramen compromise, ligamentous lesions, and irritation of facet joint capsules.
 - The subject is seated, with the head and neck in a neutral position. The examiner, with fingers interlocked and placed on top of the subjects head, provides gentle downward force. Take care not to cause forward, backward, or sideways bending of the cervical spine. Variations on this tests include the addition of side bending, rotation, and backward bending of the cervical spine. Compression force directed through the cervical spine in a position of rotation is referred to as "Jackson's" test. The maximum cervical compression test is performed with the cervical spine laterally flexed, and rotated (to the same side) with the addition of extension, prior to application of axial pressure.



SPURLING'S MANEUVER

- Radiculopathy:
 - Spurling Sign – In the presence of a disc protrusion or compromised intervertebral foramen, compression of the spine tends to increase symptoms, while decreasing symptoms in ligamentous lesions or irritation of facet joint capsules. Compression test which involve rotation and side bending will refer symptoms toward the side of side bending and rotation.



SPURLING'S MANEUVER

- Radiculopathy: The test is positive when the pain arising in the neck **radiates** in the direction of the corresponding dermatome ipsilaterally. Symptoms on the contralateral side would be considered nonphysiologic.
- Localized neck pain is not a positive finding.



SHOULDER DEPRESSION TEST

- This test may be performed in suspected cases of nerve root or nerve compression, foraminal compromise, dural adhesions, or facet joint capsule irritation.
- The subject is positioned either supine or seated. The examiner depresses the shoulder of the side being tested while simultaneously side bending the neck away from that side.

Shoulder Depression Test



SHOULDER DEPRESSION TEST

- Reproduction of symptoms or exacerbation of already existing symptoms on the side being stretched indicates a positive test.
- Localized neck pain is not a positive shoulder depression test finding.
- Symptoms on the contralateral side would be considered non-physiologic.

Shoulder
Depression
Test



SHOULDER DEPRESSION TEST

- Validity Test: If symptoms are reproduced with shoulder depression with simultaneous cervical contralateral flexion – due to irritation of cervical spine nerve roots, then symptoms should be relieved by maneuvers that decrease tension on the nerve roots.
- Shoulder Abduction Relief Sign: (Spine 1981 Sep-Oct;6(5):441-6):
- “This shoulder abduction relief sign has not been commonly elicited in the past, and the authors wish to bring attention to its value as an indicator of significant cervical extradural radicular compressive disease.”



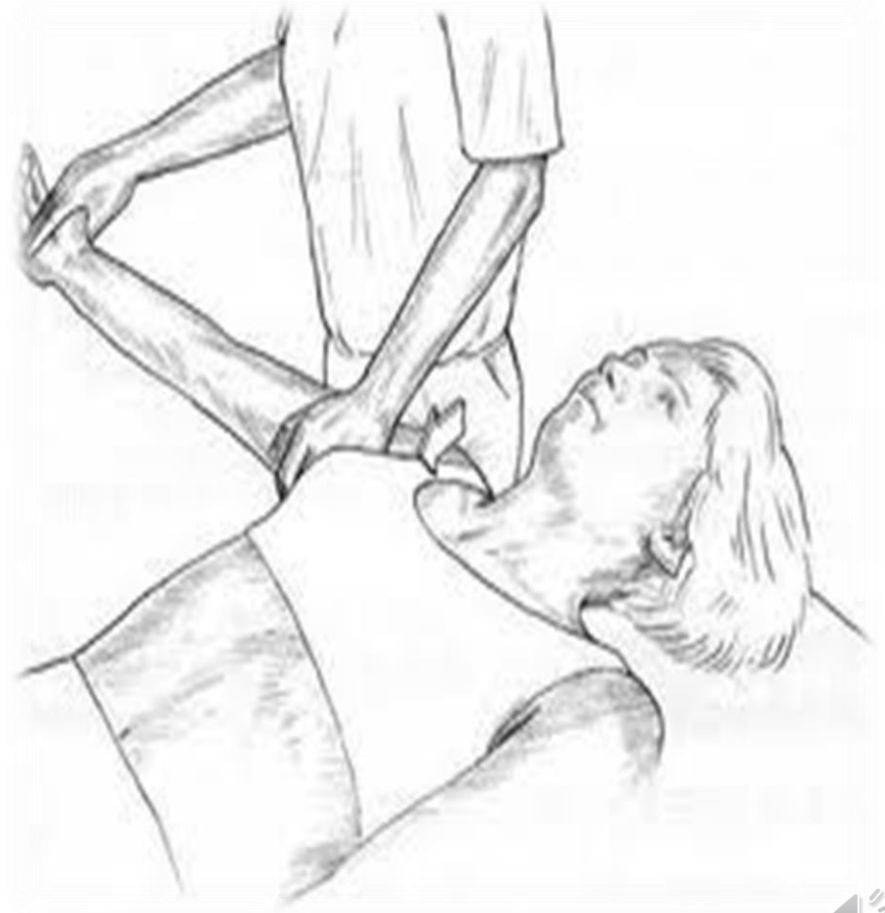
SHOULDER DEPRESSION TEST

- Validity Test:
- Abduction
Relief/Bakody's Sign:
- A positive, objective
Physical Examination
Finding



UPPER LIMB TENSION TEST

- The upper limb tension test is designed to stress 1) the cervical spine nerve roots, 2) the brachial plexus, and 3) the dura of the cervical spine.
- The subject lies supine while the examiner applies movements to the upper limb and neck that progressively stretch the neural tissues.



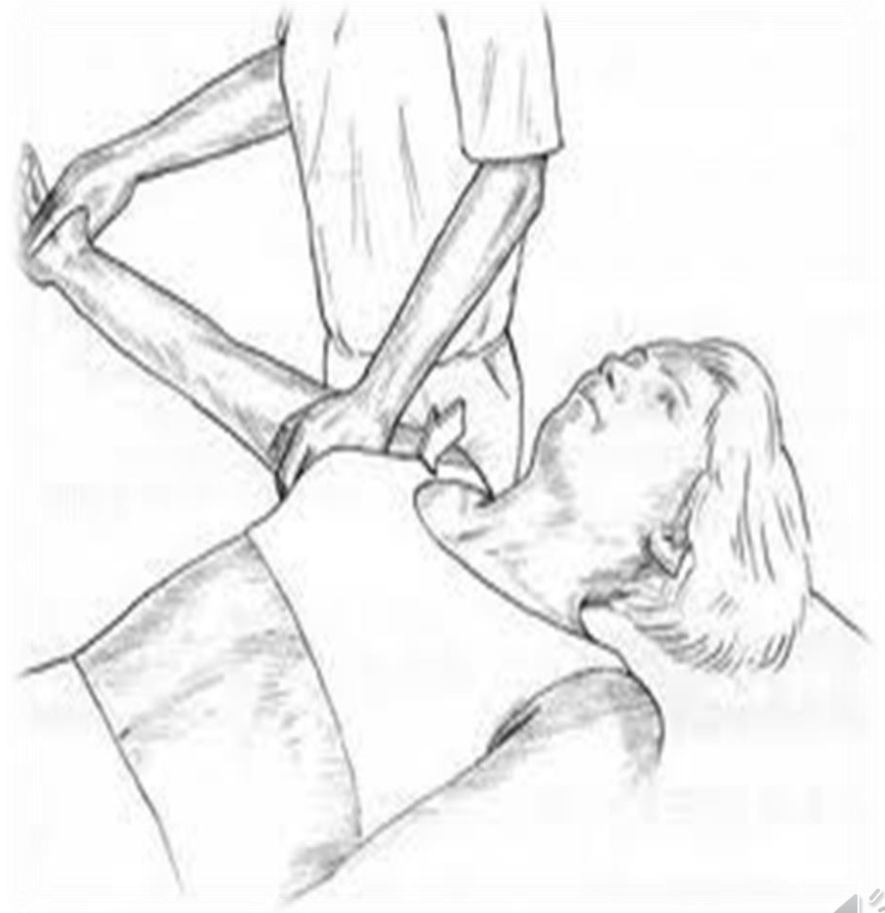
UPPER LIMB TENSION TEST

- Initially, the examiner abducts and externally rotates the shoulder posterior to the frontal plane, which stabilizes the shoulder girdle in depression. Next, the elbow is passively extended, the forearm is supinated, the wrist extended, and the fingers are placed into extension. Finally, if tolerated the subject can side bend the head to the contralateral side.



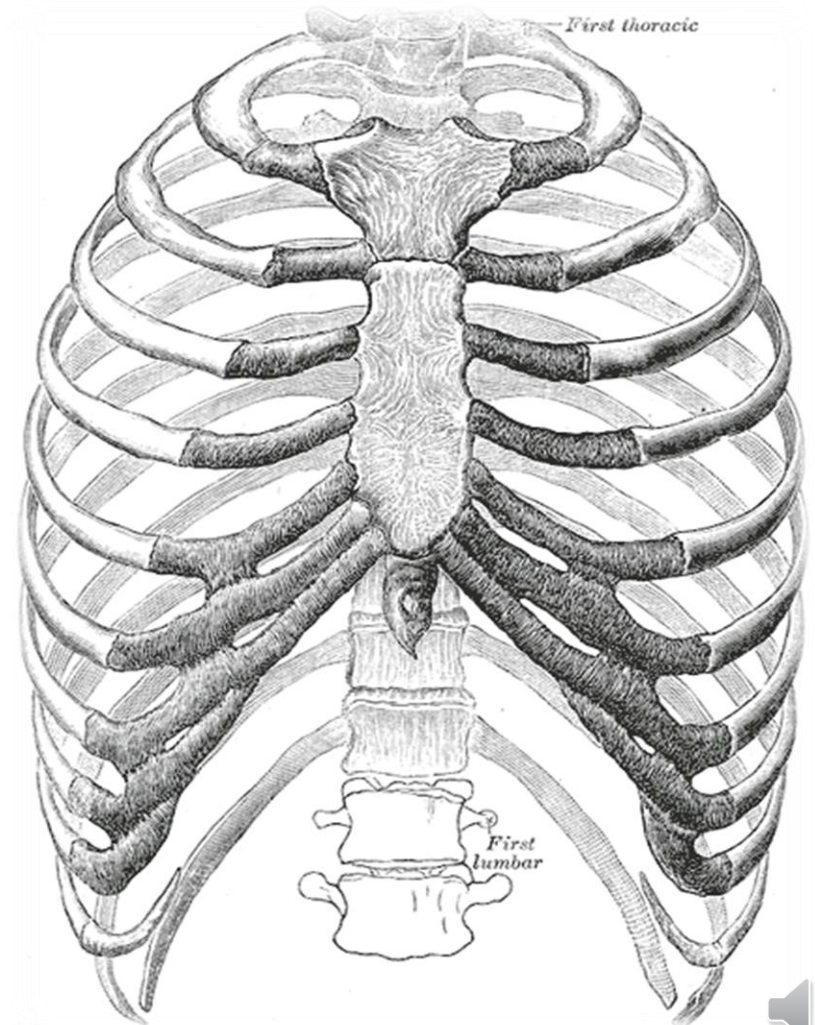
UPPER LIMB TENSION TEST

- As the progressive stretch is performed, the subject may experience reproduction of symptoms, including pain, paresthesias, or numbness in the upper limb. An indication as to the severity of the problem is evident in the amount of elbow extension tolerated by the subject as compared to the uninvolved side.



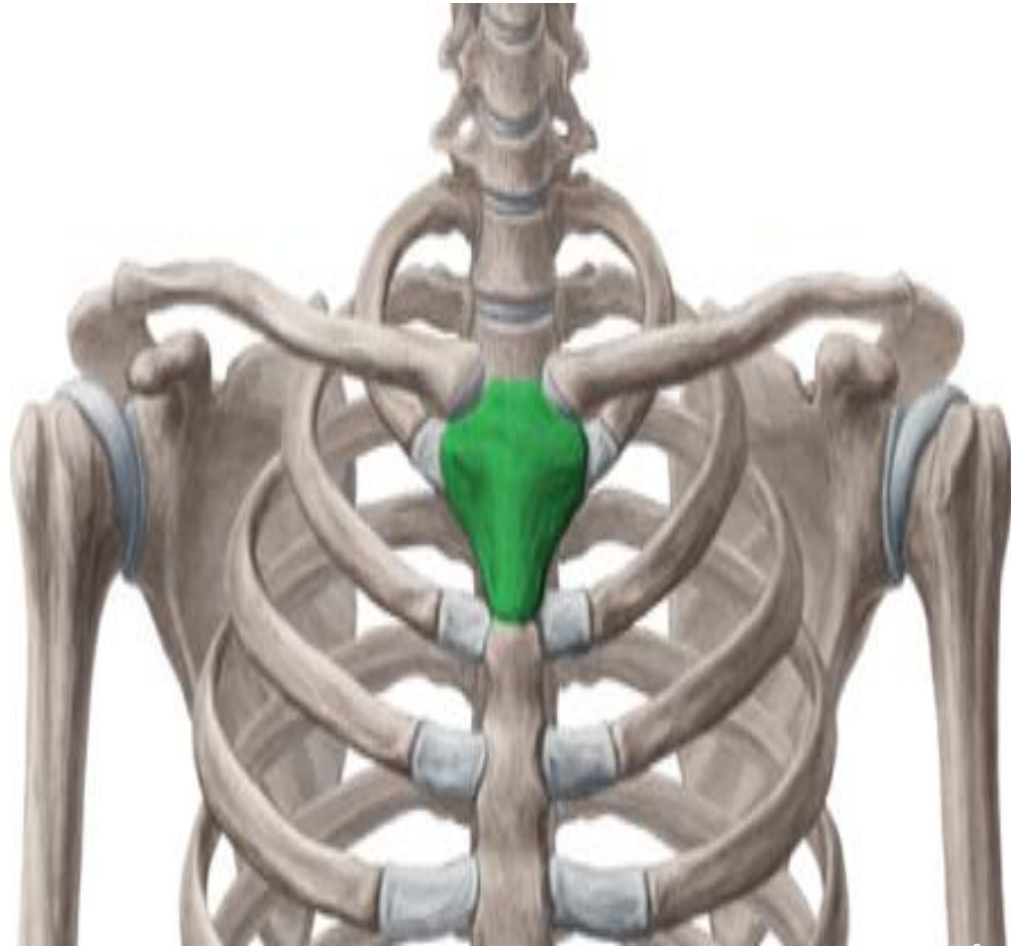
THORACIC OUTLET MANEUVERS

- Thoracic Outlet: aka “Superior Thoracic Aperature”
- Borders:
 - Posteriorly by first thoracic vertebra
 - Laterally by the 1st rib
 - Anteriorly by the costal cartilage of the first rib and the superior border of the manubrium.



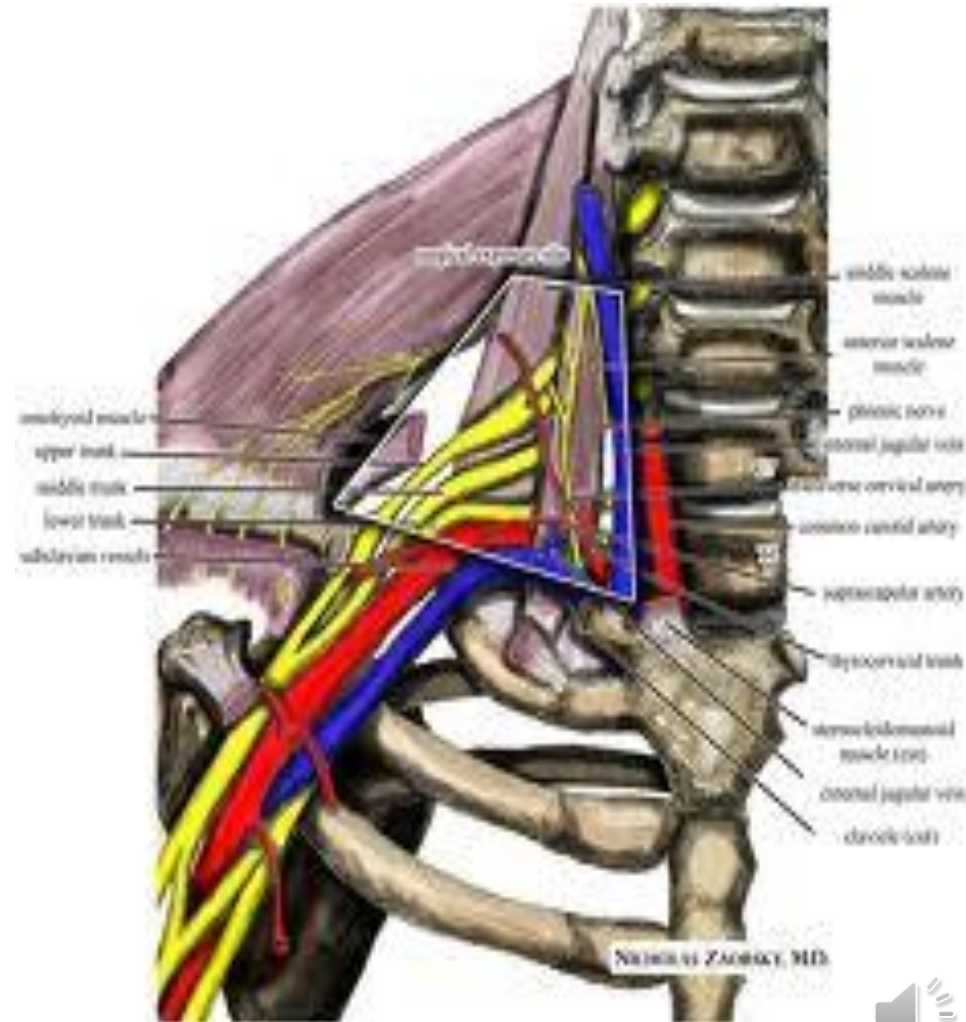
THORACIC OUTLET MANEUVERS

- The clavicle articulates with the manubrium to form the anterior border of the thoracic outlet.
- Clavicle attaches to the clavicular notch , while the first rib attaches slightly inferiorly.



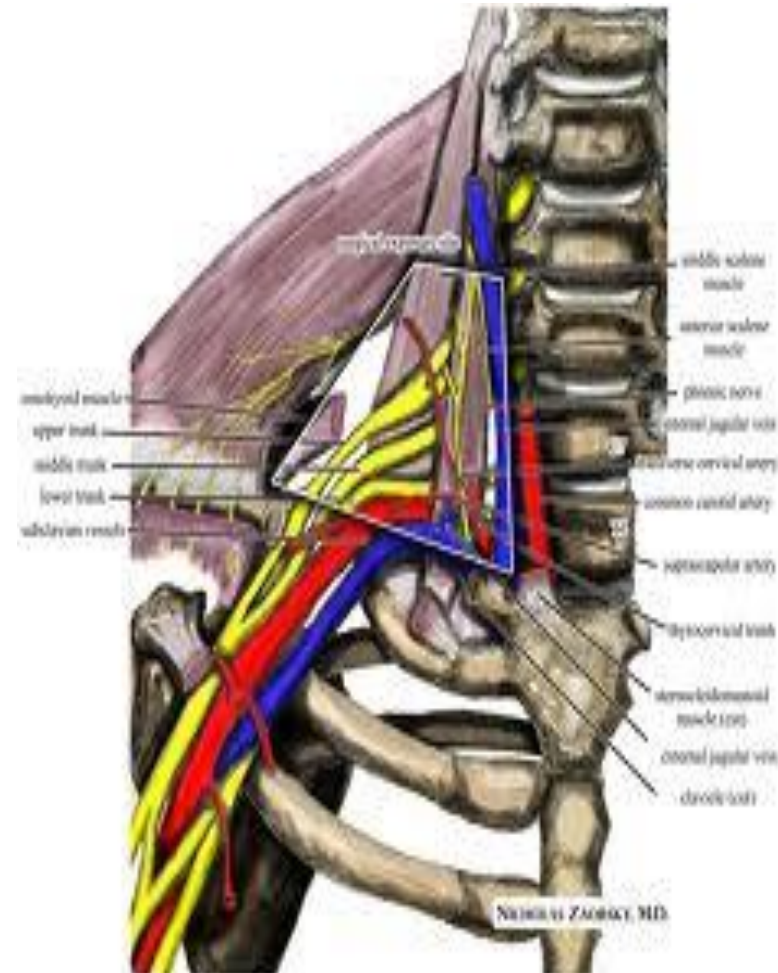
THORACIC OUTLET MANEUVERS

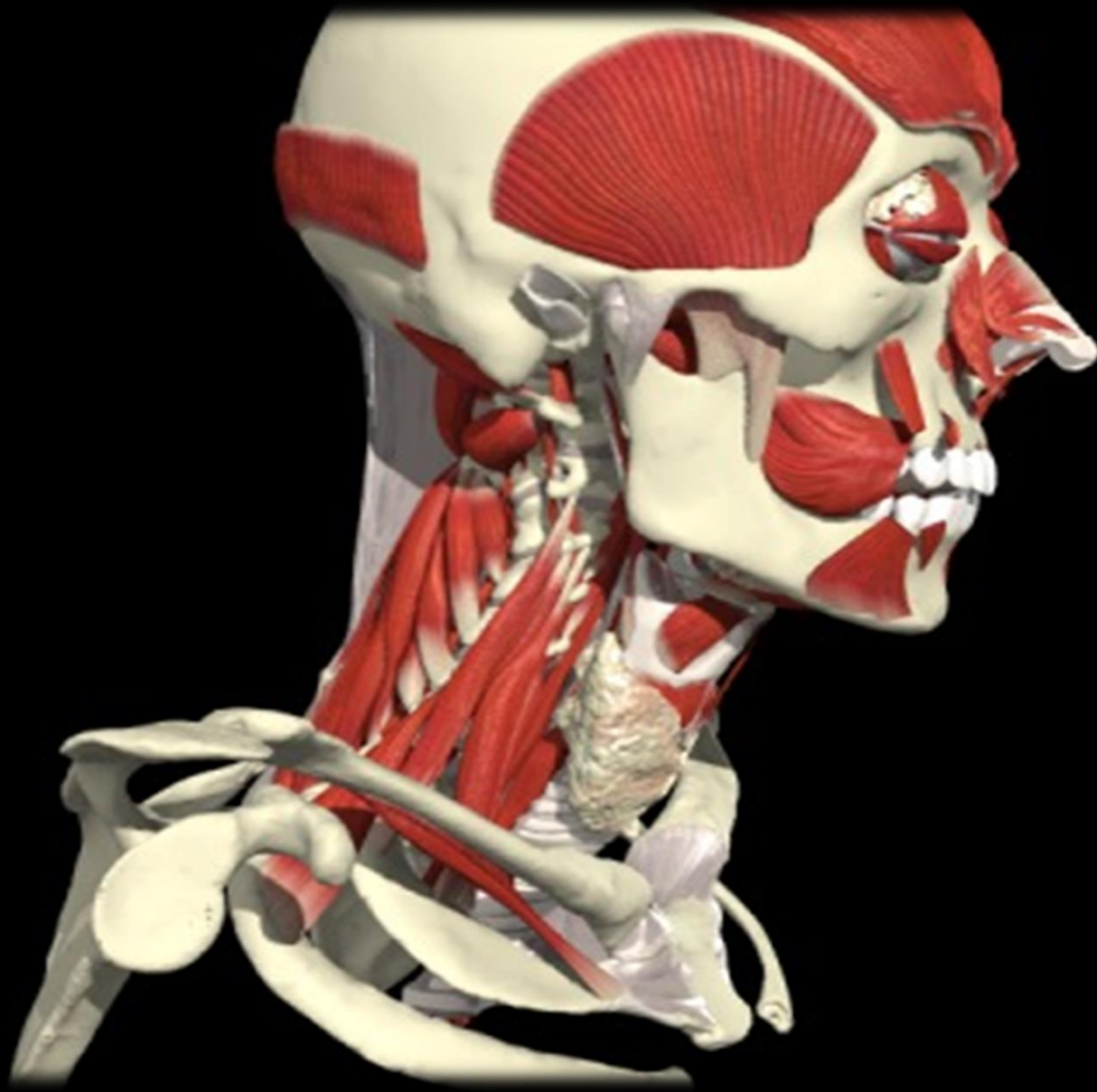
- The brachial plexus is located superolaterally.
Palpate this.
- The brachial plexus emerges between the anterior and middle scalene muscles, and superior to the first rib. It then passes obliquely and inferiorly, underneath the clavicle, into the axilla and then into the arm.



THORACIC OUTLET MANEUVERS

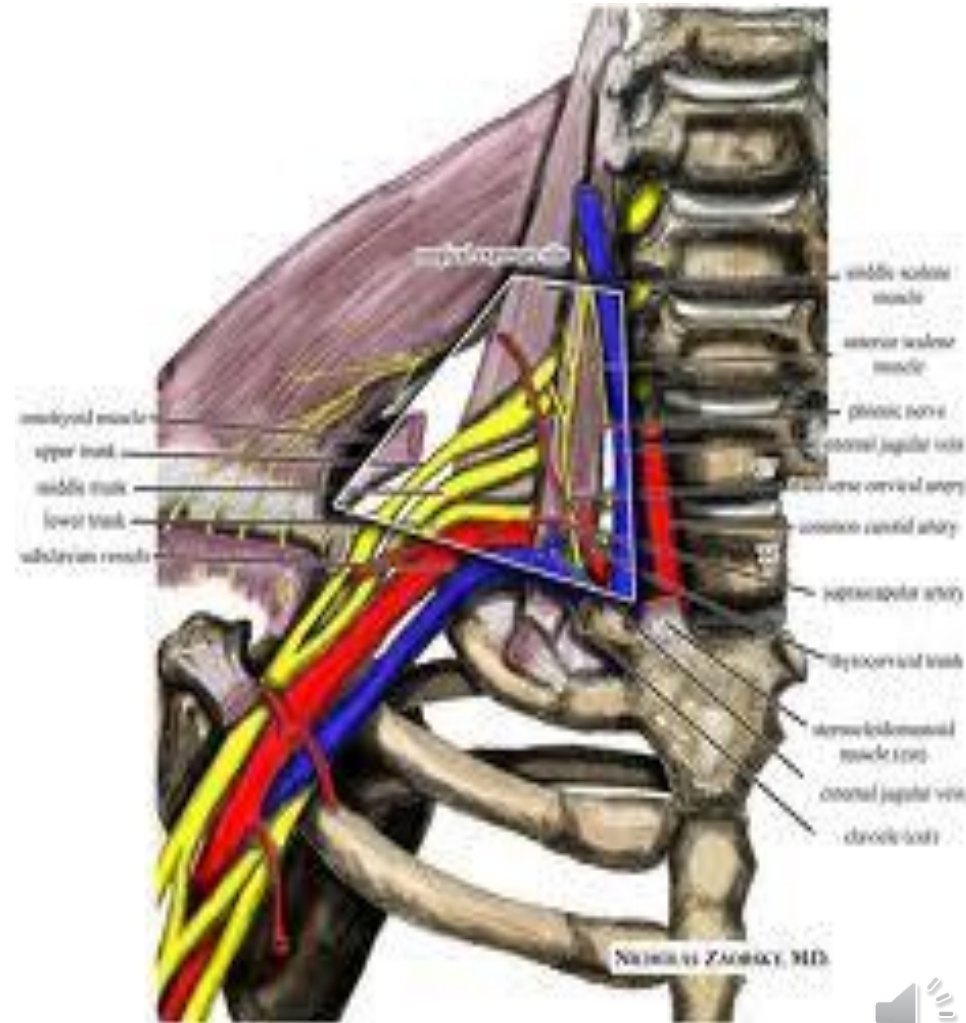
- Anterior Scalene:
 - Origin: Anterior tubercles of transverse processes of third through sixth cervical vertebrae.
 - Insertion: Scalene tubercle and cranial crest of first rib
 - Action:
 - Elevate first rib and laterally flex head to same side
 - Acting bilaterally: Flexion.
 - Acting unilaterally: Rotation toward opposite side
- Middle Scalene:
 - Origin: Posterior tubercles of transverse processes of second through seventh cervical vertebrae
 - Insertion: First rib, cranial surface between tubercle and subclavian groove
 - Action:
 - Elevate first rib and laterally flex head to same side
 - Acting bilaterally: Lateral flexion
 - Acting unilaterally: Rotation toward opposite side





THORACIC OUTLET MANEUVERS

- Impingement of the brachial plexus in the region of the scalene muscles, first rib, the clavicle, and even more distally (in the case of the pectoralis minor muscle) is responsible for “thoracic outlet syndrome.”

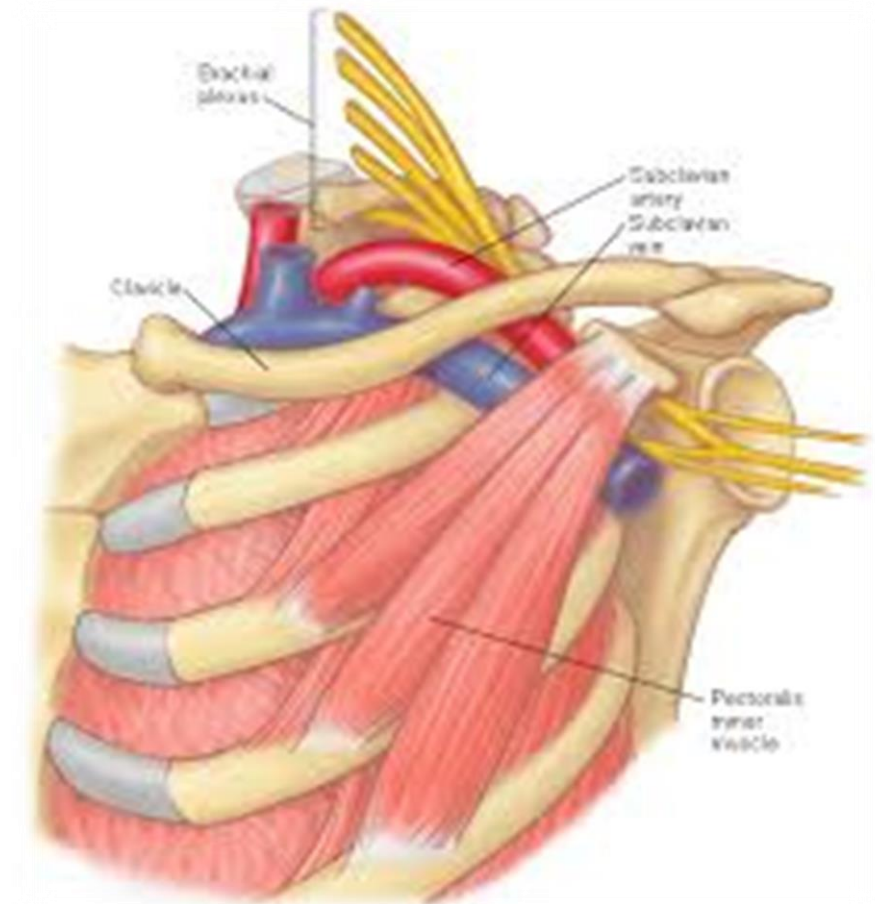


- TOS: It can affect one or more of the nerves (brachial plexus) and/or blood vessels that supply the upper limb as they pass between the chest and upper extremity. Blood vessels include the subclavian artery and subclavian vein. Involvement of the subclavian vein is rare because it does not normally pass through the scalene hiatus.
- TOS may result from a *positional* cause, for example, by abnormal compression from the clavicle and shoulder girdle with arm movements.
- There are also several *static* forms, caused by 1) abnormalities, enlargement, or spasm of the various muscles surrounding the blood vessels, and/or brachial plexus, 2) a fixation of a first rib, or 3) a cervical rib and/or enlargement of the transverse processes of the C7 vertebra.
- The most common causes of TOS include 1) physical trauma from a car accident, 2) repetitive stress injury from a job such as frequent nonergonomic use of a keyboard, 3) sports-related activities, and 4) anatomical defects such as having an extra rib. In pregnancy, if a narrow superior thoracic outlet exists previously, the patient can have symptoms for the first time because joints loosen during pregnancy, making it easier to develop bad posture.



THORACIC OUTLET MANEUVERS

- Thoracic Outlet Maneuvers:
- 1) Adson's test
- 2) Halstead's Test
- 3) Costoclavicular maneuver
- 4) Hyperabduction maneuver
- 5) "Hands-Up" test, Elevated Arm Stress Test, Roos Test.



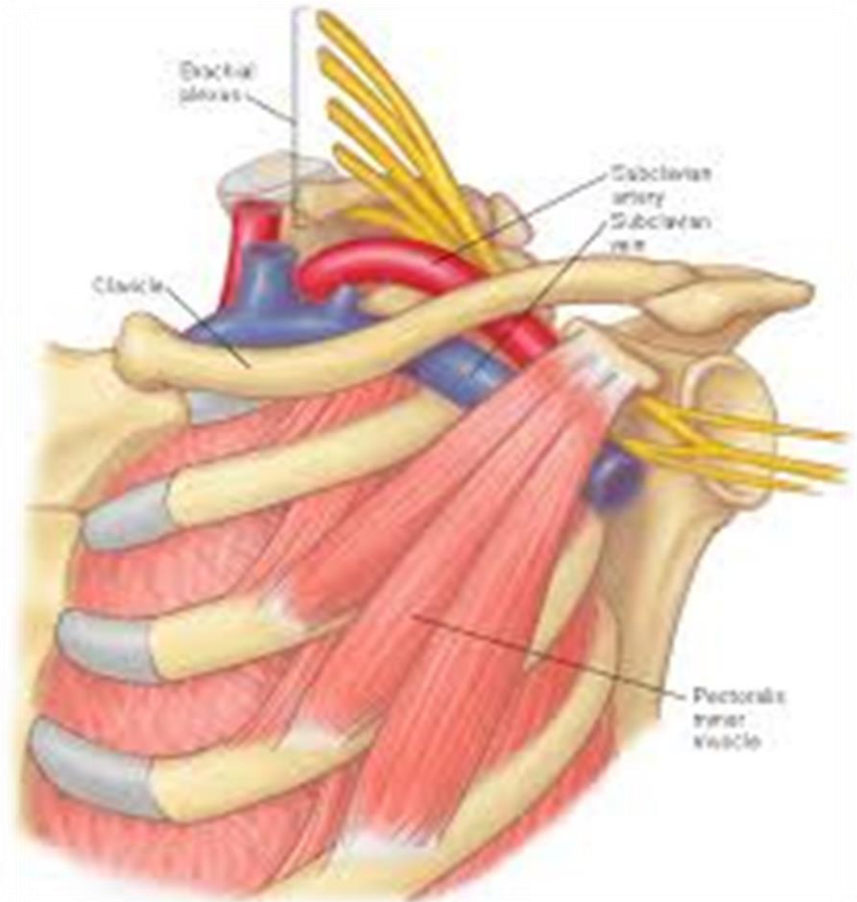
THORACIC OUTLET MANEUVERS

- Adson's Test: Is used to assess for compression of the neurovascular bundle secondary to a cervical rib, or abnormalities of scalene musculature.
- The Examiner palpates the radial pulse while extending and externally rotating the shoulder. The subject is instructed to take a deep breath and hold it for a count of 10. The subject's head is extended and rotated toward the side being tested while the examiner continues to palpate the pulse.
- A diminution or disappearance of the radial pulse, and/or a reproduction of the patient's symptoms is a positive result for thoracic outlet syndrome
- Malanga GA, Landes P, Nadler SF (April 2003). ["Provocative tests in cervical spine examination: historical basis and scientific analyses"](#). *Pain physician* **6** (2): 199–205
- "Not even tentative statements can be made with regard to interexaminer reliability, sensitivity, and specificity, based on the existing literature."



THORACIC OUTLET MANEUVERS

- Halstead's Test: This test is performed similar to Adson's test, although the examinee is asked to rotate their head opposite the affected side. A diminution or disappearance of the radial pulse, and/or a reproduction of the patient's symptoms is a positive result for thoracic outlet syndrome (neurovascular compression).



THORACIC OUTLET MANEUVERS

- Costoclavicular Test (a.k.a. “At Attention” Test):
- This test is performed by having the examinee seated with their arms at their sides with the palms forward. Both shoulders are pulled down and back by the examiner – in the positions that would occur if they were standing at attention or carrying a backpack. Then, hyperextend the neck and head.
- This narrows the costoclavicular interval and can reproduce potential compression there – versus at the scalene muscles. Any change in blanching of the hands, decrease of radial pulse, or an increase in symptoms is a positive finding.



THORACIC OUTLET MANEUVERS

- **Hyperabduction Maneuver** – This maneuver is performed in cases of suspected thoracic outlet syndrome due to entrapment of the neurovascular bundle near the tendon of the pectoralis minor at the coracoid process of scapula.
- 3 muscles attach to the coracoid process of scapula....
- The upper limb being tested is placed and maintained in a position of shoulder hyperabduction and external rotation as the examiner palpates the radial pulse. Any change in blanching of the hands, decrease of radial pulse, or an increase in symptoms is a positive finding.



THORACIC OUTLET MANEUVERS

- "Hands-Up" test, Elevated Arm Stress Test, Roos Test
- The subject sits/stands with both shoulders abducted to 90° and externally rotated with the elbows flexed to 90° . The subject slowly opens and closes the hands for a three minute period.
- A positive test for thoracic outlet syndrome is indicated by the inability to maintain the upper limb position, ischemic pain, numbness or paresthesia of the limb, or heaviness of the arm.



TAKE A BREAK!!!!

- WOW!! THAT'S A LOT! TAKE A MOMENT TO DIGEST THAT INFORMATION AND COME BACK WHEN YOU ARE READY TO GET STARTED ON THE

THORACIC & LUMBAR SPINES



THORACIC SPINE

- Neurologic Exam (Non— Verifiable Radiculopathy)
- Spinal Cord Myelopathy – all same Physical Examination Findings as for cervical spine w/ exception that upper extremities would be spared.
- What is the Neurologic Exam of the Thoracic Spine?:
 - AMA Guides do not describe “radicular syndromes” of the thoracic spine
 - AMA Guides are stingy on description of thoracic dermatomes – mentioning only the dermatomes of T1-T4, and T10-T12



Table 15-2 Common Radicular Syndromes

Disk Level	Nerve Root	Motor Deficit	Sensory Deficit	Reflex Compromise
Lumbar				
L3-4	L4	Quadriceps	Anterolateral thigh Anterior knee Medial leg and foot	Knee
L4-5	L5	Extensor hallucis longus	Lateral thigh Anterolateral leg Middorsal foot	Medial hamstrings
L5-S1	S1	Ankle plantar flexors	Posterior leg Lateral foot	Ankle
Cervical				
C4-5	C5	Deltoid Biceps	Anterolateral shoulder and arm	Biceps
C5-6	C6	Wrist extensors Biceps	Lateral forearm and hand Thumb	Brachioradialis Pronator teres
C6-7	C7	Wrist flexors Triceps Finger extensors	Middle finger	Triceps
C7-T1	C8	Finger flexors Hand intrinsic	Medial forearm and hand, ring and little fingers	None
T1-T2	T1	Hand intrinsic	Medial forearm	None



Figure 15-2 Skin Area Innervated by the Cervical and Thoracic Nerve Roots Showing Autonomous Zones

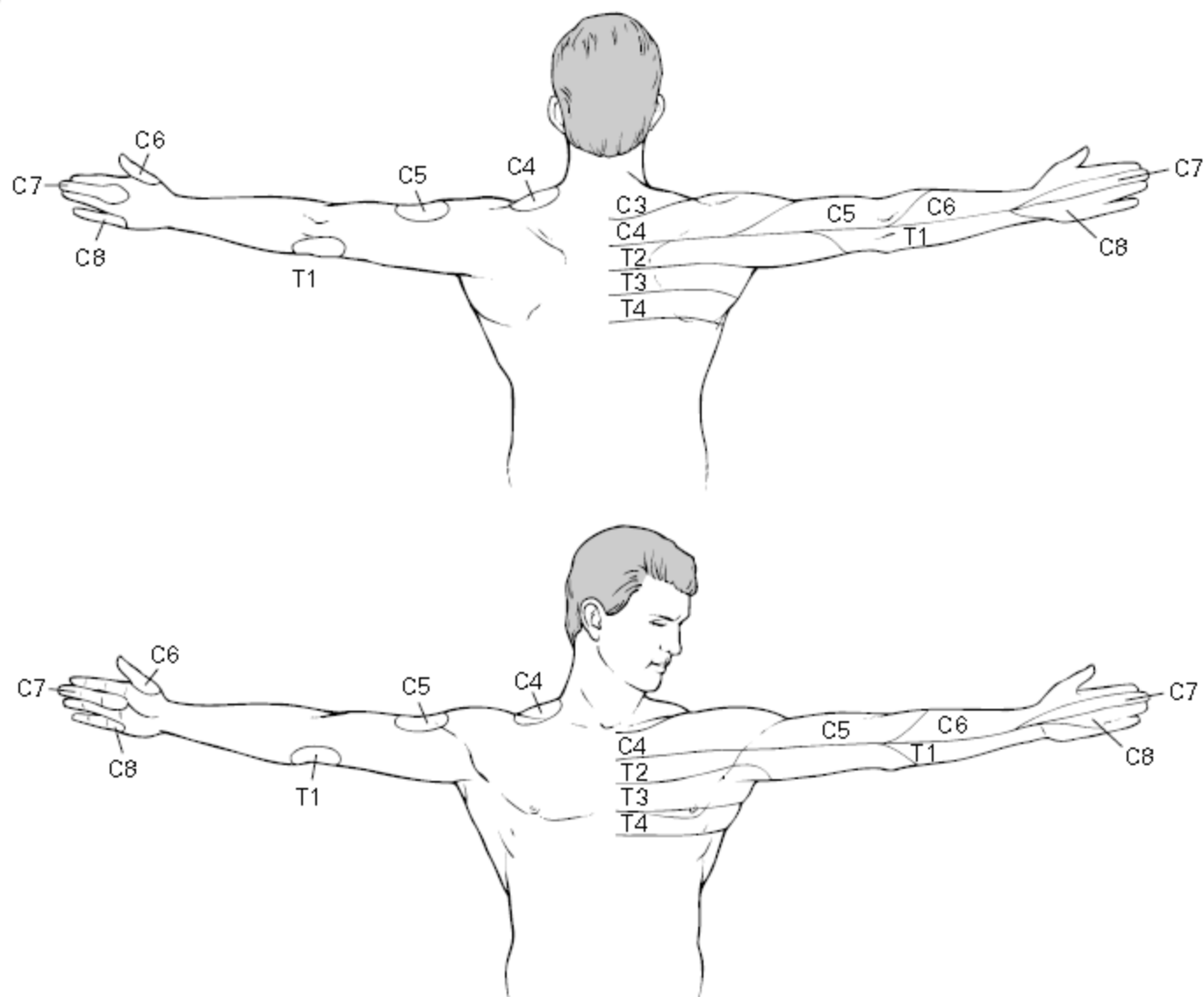
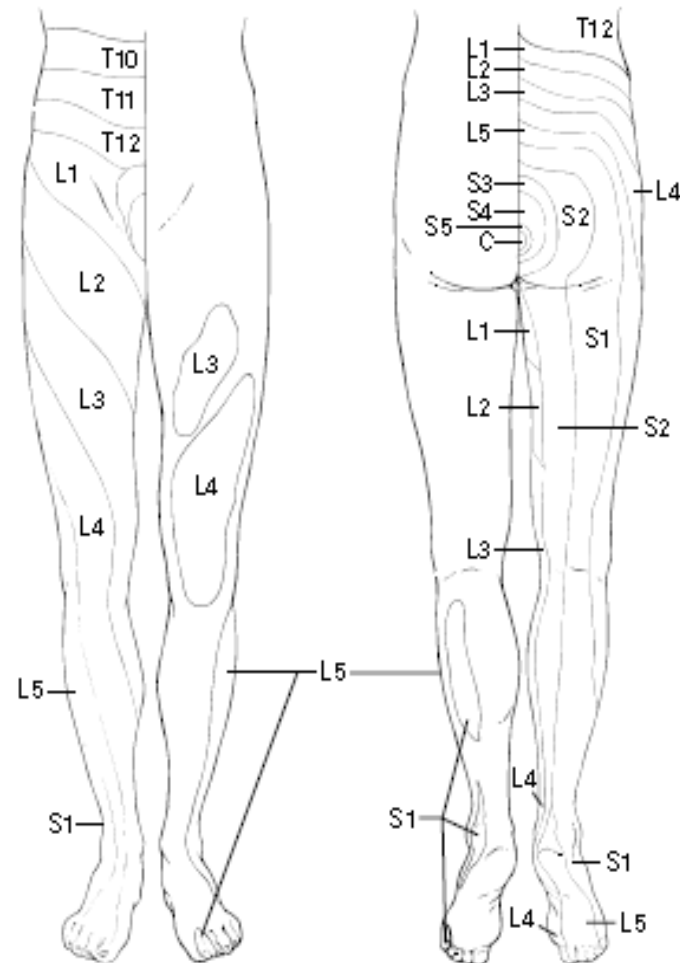


Figure 15-1 Skin Areas Innervated by the Thoracic and Lumbosacral Nerve Roots and Showing Autonomous Zones



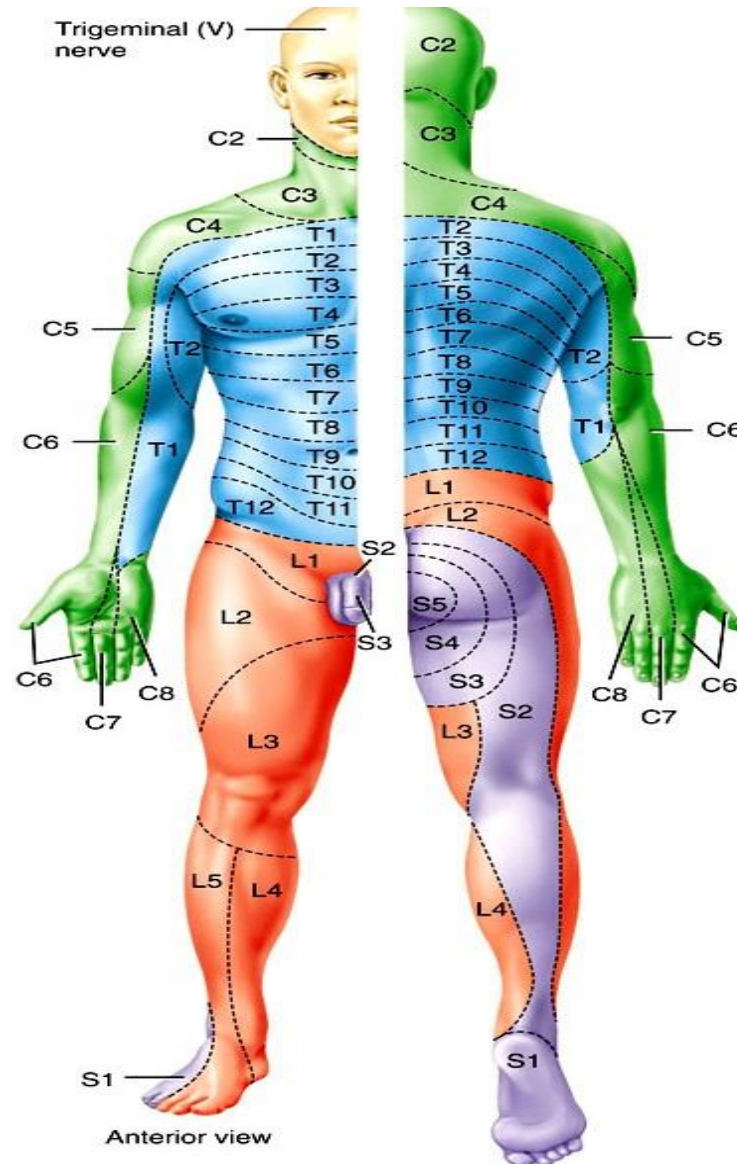
THORACIC SPINE

- Neurologic Examination:
 - Sensory Examination of thoracic spine dermatomes:
 - Motor Exam: N/A
 - Reflex Exam: N/A
 - Girth Measurements: N/A



THORACIC SPINE DERMATOMES

- Landmarks:
- T4 crosses the nipple line
- T7 crosses the xiphoid process
- T10 crosses the umbilicus
- T12 crosses the groin



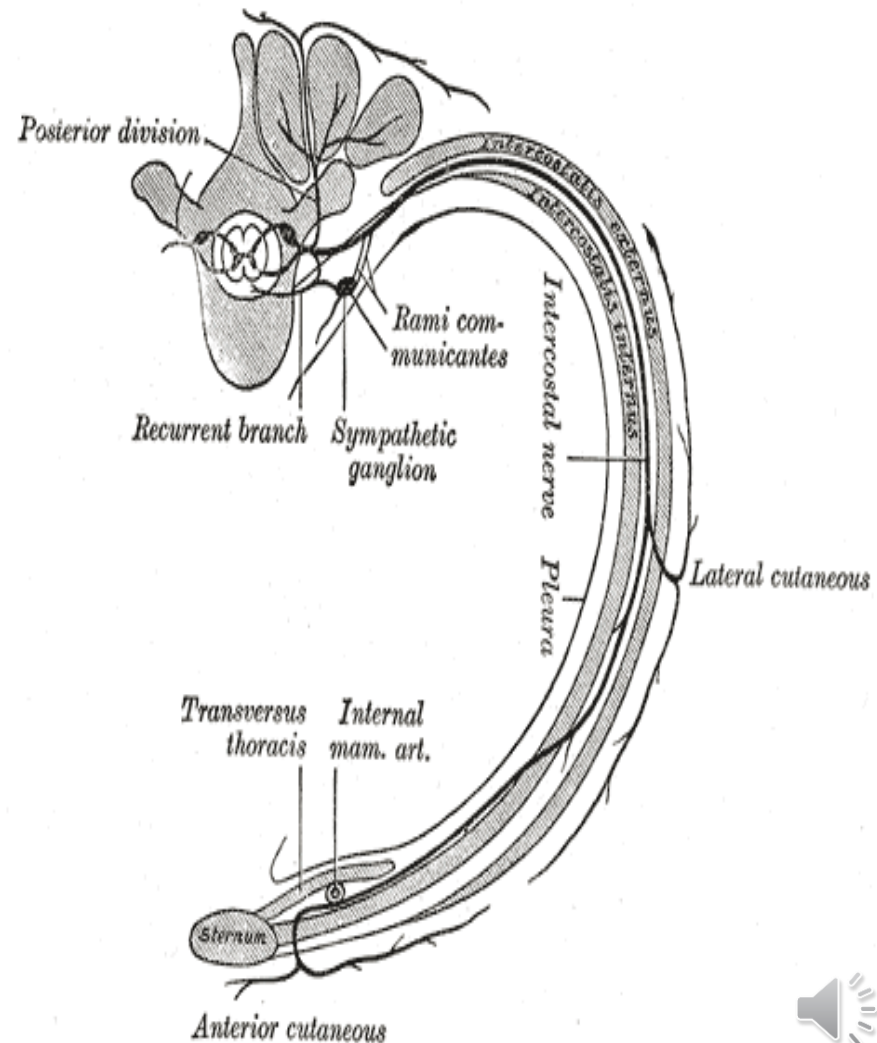
THORACIC SPINE DERMATOMES

- The Sensory Examination consisted of procedures to test the sensory modalities of light touch and pain.
-
- Superficial Tactile Sensibility (Light Touch) – This Sensory Exam was performed using a Semmes Weinstein monofilament (2.83 gauge).
 - There was intact light touch sensation to 2.83 Semmes-Weinstein monofilament testing in the bilateral T1-T12 dermatomes. I concluded that function of the cutaneous branches of the intercostal nerves was intact.



THORACIC SPINE MYOTOMES

- Motor Exam:
 - Intercostal muscles – each are innervated by the local segmental motor nerve root. Individual muscles are difficult to isolate and examine. However, on a global scale, we can assess generalize motor function with abdominal muscle testing – thoracoabdominal nerves:
 - Upper Abdominals – T5/T7-T10
 - Lower Abdominals – T10 – L1



THORACIC SPINE MYOTOMES

- Motor Exam:
 - Upper Abdominals – T5-T10
 - The upper portion of the rectus abdominis muscle is tested for flexion of the upper trunk in the sagittal plane, through a range such that the inferior angles of the scapulae clear the table. The subject should curl up slowly.
 - For a grading of 5 (or normal): – the hands are on top of the head with the shoulder horizontally abducted, inferior angles of scapulae clear the table.



THORACIC SPINE MYOTOMES

- Motor Exam:
 - Lower Abdominals – T10 – L1
 - The lower portion of the rectus abdominis muscle is tested during the motion of flexion of the lower trunk until the sacrum clears the treatment table.
 - For a muscle test grade of 5 (or normal) – examinee lifts sacrum through full range of motion 10 times.
- Reflexes:
 - No known reflexes:



LUMBAR SPINE

- The Examination maneuvers of importance for the lumbar spine examination are focused on the presence or absence of **radiculopathy**.
- According to the AMA Guides, page 382 – Radiculopathy for the purpose of the Guides is defined as "significant alteration in the function of a nerve root or nerve roots and is usually caused by pressure on one or several nerve roots.
- The diagnosis requires a dermatomal distribution of pain, numbness, and/or paresthesias in a dermatomal distribution. **A root tension sign is usually positive.** The diagnosis of herniated disc must be substantiated by an appropriate finding on an imaging study. The presence of findings on an imaging study in and of itself does not make the diagnosis of radiculopathy. There must also be clinical evidence as described above."



LUMBAR SPINE

- So, for our purposes here, the “**Special Tests**” that we will be concerned with regarding the lumbar spine involve those tests instrumental for a determination of **radiculopathy** – including:
 - Heel/Toe Walk
 - Squatting
 - Root Tension Signs:
 - L4, L5, S1: Straight Leg Raising (supine/sitting)
 - L4, L5, S1: Braggard’s Maneuver
 - L4, L5, S1: Slump Test
 - L4, L5, S1: Neri’s Bowstring Sign
 - L4, L5, S1: Crossed Straight Leg Raising
 - L2, L3, L4: Femoral Nerve Stretch Test
 - Reflexes:
 - Hamstring Reflex (L5)
 - Gait Evaluation



HEEL/TOE WALK MANEUVER

- Heel Walking – requires dorsiflexion of the toes (extensor digitorum), and the ankle (tibialis anterior) – and is a reflection of function of the L5 nerve root.
- Toe Walking – requires plantar flexion of the toes (flexor digitorum longus) and ankle (plantaris/gastrocnemius/soleus) – and is a reflection of function of the S1 nerve root.
- Have the patient do extended duration contractions of these muscles to demonstrate full function.

Table 15-1 Physical Examination

Lumbar Spine

Individual Position	Examination
Standing	Posture Scoliosis Lordosis Kyphosis
	Palpation Muscles Tenderness
	Gait
	Range of motion
	Muscle strength screening Heel-toe walk Squatting



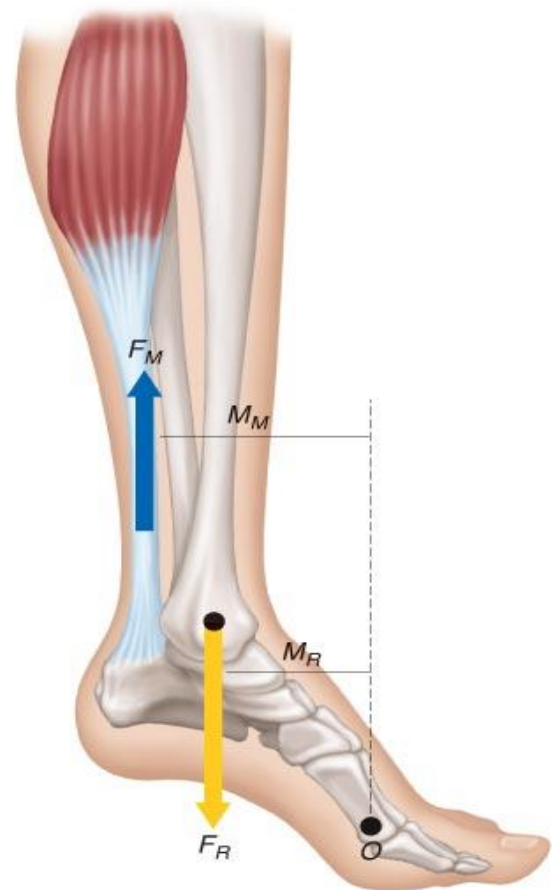
SECOND CLASS LEVER

- A lever for which the muscle force (M_{af}) and resistive force (R_{af}) act on the same side of the fulcrum, with the muscle force acting through a moment arm longer than that through which the resistive force acts. Due to its mechanical advantage (>1.0), the muscle force required to lift the given load is smaller than the resistive force (wheelbarrow).



A Second-Class Lever (the Foot)

- Resisted ankle plantarflexion against resistance (e.g., toe walk maneuver or standing heel raise exercise).
 - F_M = muscle force; F_R = resistive force; M_M = moment arm of the muscle force; M_R = moment arm of the resistive force.
 - When the body is raised, the point about which the foot rotates (fulcrum), is the ball of the foot(O).
 - Because M_M is greater than M_R , F_M is less than F_R .
 - MMT Implications???



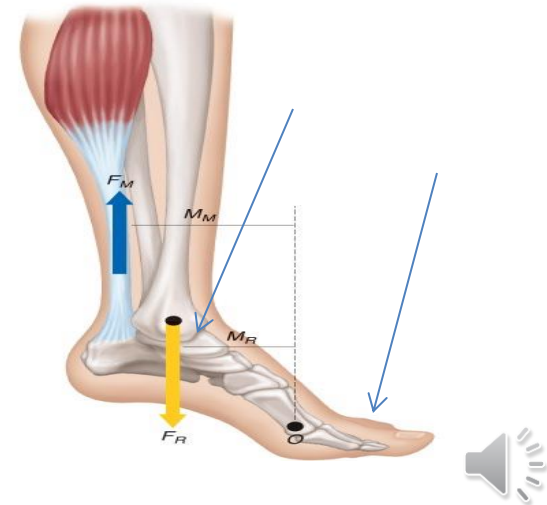
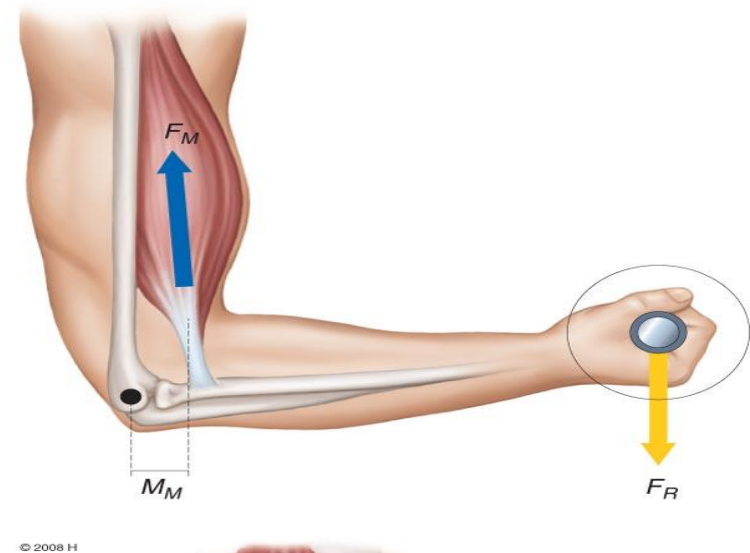
THIRD CLASS LEVER

- A lever for which the muscle force (M_{af}) and resistive force (R_{af}) act on the same side of the fulcrum, with the muscle force acting through a moment arm shorter than that through which the resistive force acts. The mechanical advantage is thus less than 1.0, so the muscle force has to be greater than the resistive force in order to overcome the torque produced by the resistive force.



A Third-Class Lever (the Forearm)

- I.E. - Elbow flexion against resistance (e.g., MMT of the biceps to evaluate C6 nerve root).
- F_M = muscle force; F_R = resistive force; M_M = moment arm of the muscle force; M_R = moment arm of the resistive force.
- Because M_M is much smaller than M_R , F_M must be much greater than F_R .
- Tibialis ant. – inserts on to medial cuneiform and base of 1st MT
- EHL/EDL- insert on to middle and distal phalanges



HEEL/TOE WALK MANEUVER

- A positive report of lower back pain is considered a non-physiologic exam finding.
- Consistency Findings ???



REPETITIVE SQUAT MANEUVER

Table 15-1 Physical Examination

Lumbar Spine

Individual Position	Examination
Standing	Posture Scoliosis Lordosis Kyphosis
	Palpation Muscles Tenderness
	Gait
	Range of motion
	Muscle strength screening Heel-toe walk Squatting



REPETITIVE SQUAT MANEUVER

- Have examinee squat down and repeat for 5 (or more) repetitions.
- Successful performance of this indicates preserved neurologic function of the lumbar spine and lower extremities.



ROOT TENSION SIGNS

- Caveats: These tests were designed and interpreted as tests of involvement of irritability of the lumbar spine nerve roots by assessing reproduction of symptoms when the nerve roots are tensed. The examiner must remember that the spinal nerve roots are not the only structures provoked by these tests. In addition to the spinal nerve root, vertebral facets, sacroiliac and hip joint structures, hamstring muscles, and fascial elements are also put under stress. The examiner must be aware that one of these other structures may be the source of symptoms, or at least influence symptoms. All of these structures must be properly assessed before it is possible to conclude which structure is responsible for production of pain.



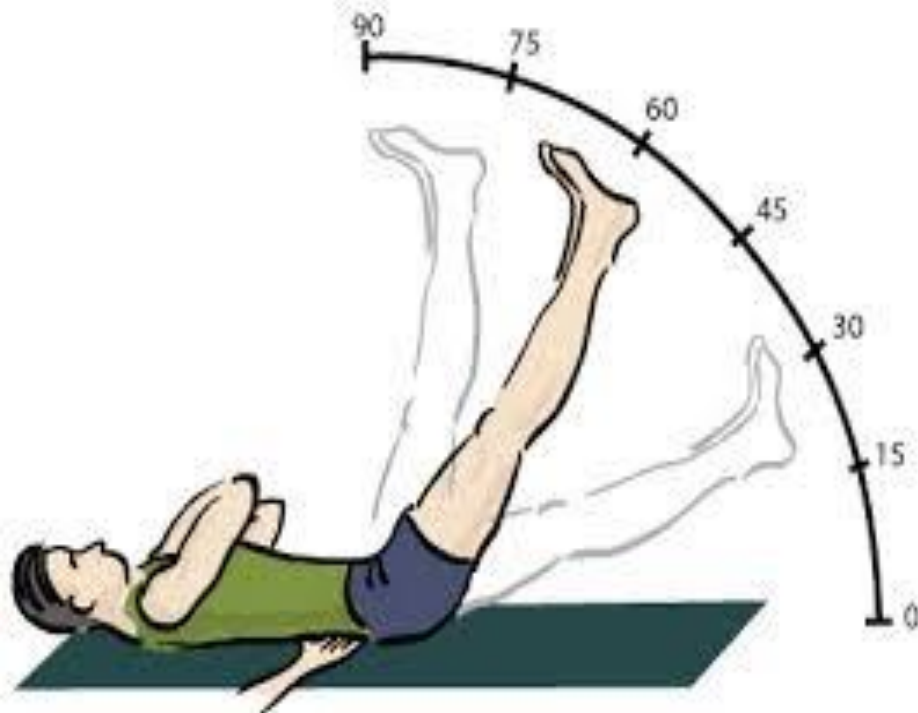
ROOT TENSION SIGNS

- Straight Leg Raising (supine/sitting):
- The subject lies supine with the non-test limb positioned in extension and resting on the table. The examiner passively raises the test lower limb, keeping the hips slightly abducted and internally rotated and the knee fully extended. The angle of the hip, measured between the elevated lower limb and the table, is recorded.
- Reproduction of symptoms in the back or along the distribution of the sciatic nerve indicates a positive test. The sciatic nerve is on full stretch at approximately 70° of hip flexion, therefore a positive test for sciatic nerve involvement will occur prior to that amount of hip flexion.



ROOT TENSION SIGNS

- Straight Leg Raising/SLR/Lasegue's Test - (supine/sitting):
- Straight leg raising, by itself, can produce pain from a variety of sources, including myogenic pain, ischial bursitis, annular tear, and hamstring tightness, as well as herniated disc causing radiculopathy.
- In order to sort these possible contributors out.....



ROOT TENSION SIGNS

- AMA GUIDES – PAGE 376....

Research indicates that the maximum movement of nerve roots occurs when the leg is at an angle of 20° to 70° relative to the trunk. However, this may vary depending on the individual's anatomy. Further, the L4, L5, and S1 nerve roots are those that primarily change their length when straight leg raising is performed. Thus, pathology at higher levels of the lumbar spine is often associated with a negative SLR.



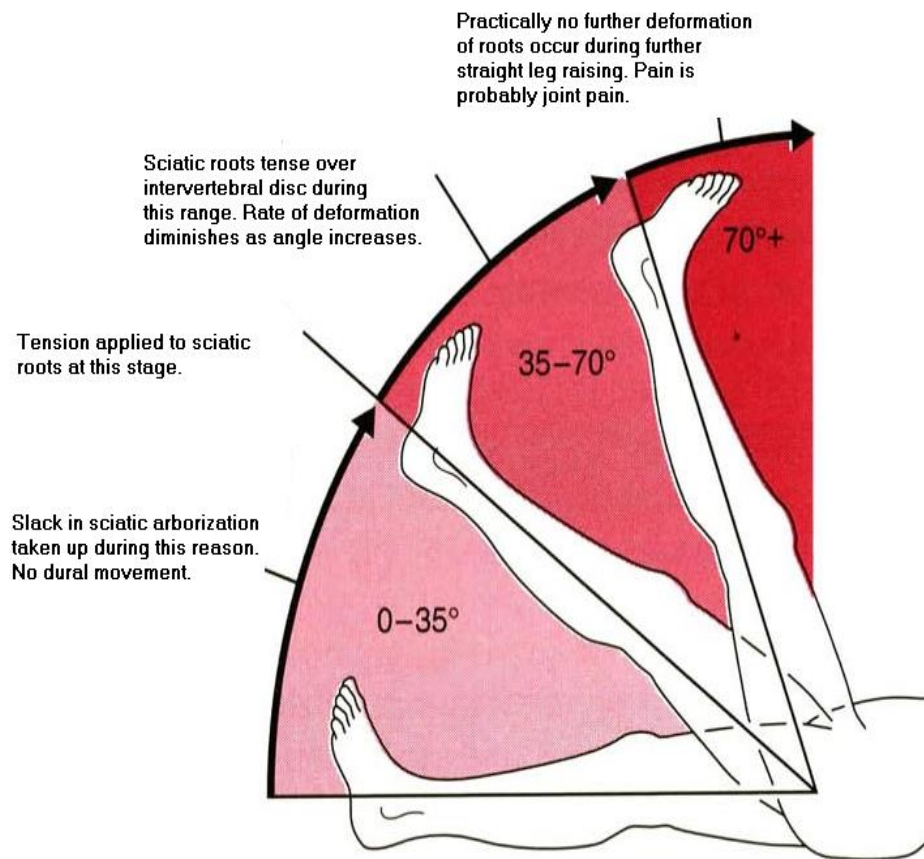
ROOT TENSION SIGNS

- Popliteal Compression Test:
- Lower the involved leg a few degrees below the point at which the examinee reports symptoms
- Applying compression to the popliteal fossa helps to tether the sciatic nerve and should provoke symptoms with a lesser degree of a SLR (removing hamstring irritation as a potential cause of symptoms)



ROOT TENSION SIGNS

- Braggard's Maneuver (AKA "Sciatic Stretch" Test)
- The subject lies supine. The examiner raises the involved lower limb to the point just short of where radiculopathy symptoms begin. The ankle is then dorsi flexed by the examiner.



BRAGGARD'S MANEUVER

- The result is positive if symptoms are reproduced in the lower back or the involved extremity. A variation of this test would be to raise the involved limb to the point of symptom reproduction and then slightly lower the limb to a point of no symptoms. The examiner then dorsiflexes the ankle, which would again reproduce the symptoms.
- **Validity** of this maneuver can be assessed by then plantar flexing the ankle. A positive report of lower back or lower extremity pain would constitute a nonphysiologic exam finding suggestive of symptom magnification.



ROOT TENSION SIGNS

- Crossed Straight Leg Raising –
- The subject lies supine while the examiner passively performs a straight leg raise of the uninvolved lower limb.
- The result is positive if pain is reproduced in the back or in the involved limb. A positive test is usually representative of some space occupying lesion, such as a central disc herniation.



ROOT TENSION SIGNS

- Slump Test:
- The subject is seated with the upper limbs clasped at the hands behind the back. The subject is asked to "slump" forward at the trunk. The examiner, using one arm, next applies an overpressure through the shoulders to the slumped trunk – stretching the dura. The examiner then directs the subject to forward bend the neck, after which the examiner again applies an overpressure. With this overpressure being maintained by the examiner at the head, neck, and trunk, the subject then extends the knee – the ankle is then dorsiflexed by the examiner.



SLUMP TEST



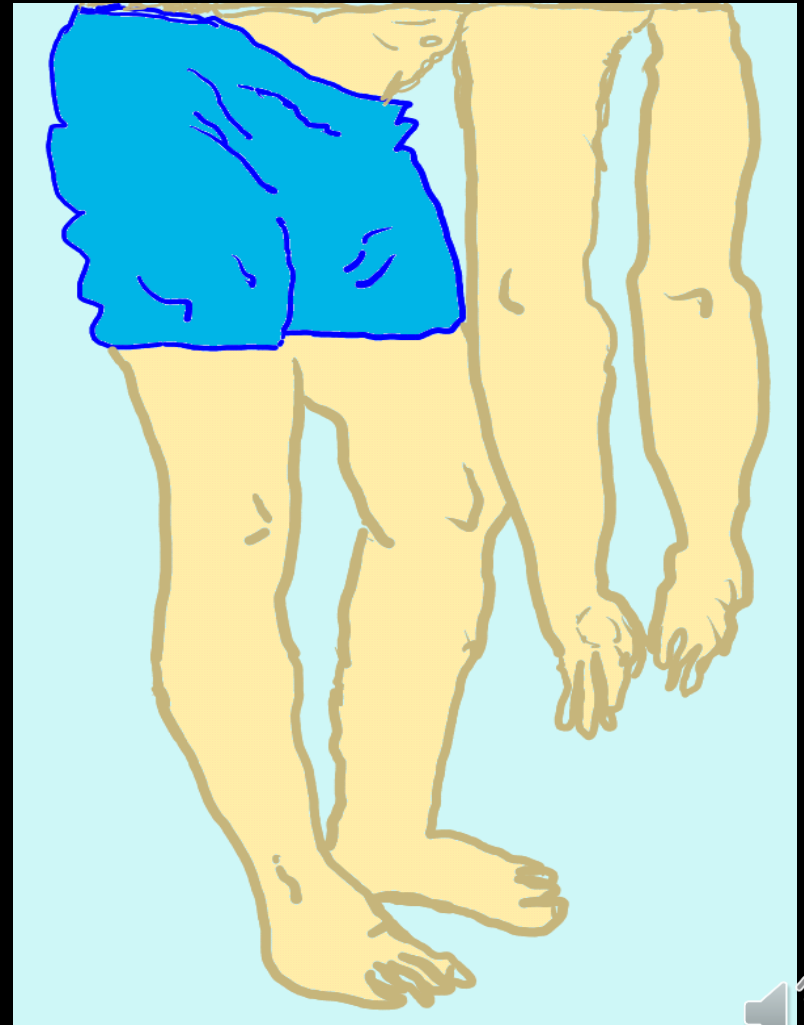
ROOT TENSION SIGNS

- Neri's Bowstring Sign
- This is an observation of flexion of the knee on the involved side as the hip flexion angle increases (with examinee either standing or supine) and root tension increases. Many times this is involuntary in an effort to relieve tension on the root. Often, this can be detected as an inability to perform the heel walk maneuver due to root tension. Absence of a reflexive "bowstring sign" with claimed radiculopathy symptoms may be considered a non-physiologic exam finding.



NERI'S BOWSTRING SIGN

- In cases of bona fide radiculopathy, some degree of reflex flexion of the knee should be observed. Thus, the bowstring sign should accompany all sciatic nerve tension tests in the case of positive report of pain.



ROOT TENSION SIGNS

- **Femoral Nerve Stretch Test:**
- This test is used to determine whether there is any irritation of the femoral nerve or nerve roots L2/L3/L4.
- The subject is prone. The examiner flexes the subject's knee while supporting the thigh just proximal to the knee. The examiner stabilizes the pelvis while extending the hip to provide a further stretch of the femoral nerve.
- Pain reproduced or exacerbated in the subject's back or throughout the femoral nerve distribution indicates a positive result for femoral nerve or nerve root irritation.
- What type of objective finding would accompany a + report of pain?



REFLEXES

Table 15-2 Common Radicular Syndromes

Disk Level	Nerve Root	Motor Deficit	Sensory Deficit	Reflex Compromise
Lumbar				
L3-4	L4	Quadriceps	Anterolateral thigh Anterior knee Medial leg and foot	Knee
L4-5	L5	Extensor hallucis longus	Lateral thigh Anterolateral leg Middorsal foot	Medial hamstrings
L5-S1	S1	Ankle plantar flexors	Posterior leg Lateral foot	Ankle



HAMSTRING REFLEX

- The HAMSTRING REFLEXes (medial and lateral hamstring) are mediated by the L5 nerve root. It is elicited by tapping the hamstring tendon at the musculotendinous junction near the back of the medial/lateral knee. The medial hamstring reflex is mediated by the L5 nerve root carried in the tibial nerve, while the lateral hamstring reflex is mediated by the L5 nerve root carried in the common peroneal nerve. Thus, the presence/absence of this reflex may also be clinically relevant in the case of peripheral nerve injury.



“SPECIAL TESTS” - CONTINUED

- Gait Evaluation:
- According to DeMeyer in “Technique of the Neurologic Examination” – “Watching the patient walk is the single most important part of the entire neurologic examination.”
- AMA Guides require an evaluation of gait in Chapters 13 (The Nervous System), Chapter 15 (The Spine), and Chapter 17 (Lower Extremity), however, there is no mention as to how to perform the Gait Analysis.
- Refer to QME Continuing Education Program - “[Gait Disturbances & Assistive Devices](#)”
-



GAIT DISTURBANCES AND ASSISTIVE DEVICES

- What is “Gait?”
- Webster’s Dictionary: “manner of walking or moving on foot, a sequence of foot movements (as a walk, trot, pace, or canter) by which a horse or a dog moves forward, a manner or rate of movement or progress.”
- Take a look at these videos and ask yourself “Is the manner of walking or moving “normal” or “abnormal?”
- [Gait Disturbance Compendium](#)



GAIT DISTURBANCES AND ASSISTIVE DEVICES

- Therefore:
- A “Normal” gait would be:
 - A *smooth* manner of walking or moving on foot.
 - A *balanced* sequence of foot movements.
 - An *unlabored* manner or rate of movement or progress.
- An “Abnormal” gait would be:
 - A *disrupted* manner of walking or moving on foot.
 - An *unbalanced* sequence of foot movements.
 - A *labored or difficult* manner or rate of movement or progress.



GAIT DISTURBANCES AND ASSISTIVE DEVICES

- AMA Guides – Chapter 13 (Table 13-15) – Impairment due to “loss of balance and unsteady gait due to central and peripheral nervous system disorders:
 - Rises to standing position, walks, but has difficulty with elevations, grades, stairs, deep chairs, and long distances – this is a Class 1 Impairment.
 - Rises to standing position, walks some distance with difficulty and without assistance, but is limited to level surfaces – this is a Class 2 Impairment.
 - Rises and maintains standing position with difficulty, **cannot walk** without assistance – this is a Class 3 Impairment.
 - **Cannot stand** without help, mechanical support, and/or an assistive device – this is a Class 4 Impairment.



AMA Guides 5th Edition

Table 13-15 (page 336)

Class 1 Impairment

1-9% Whole Person

Class 2 Impairment

10-19% Whole Person

Class 3 Impairment

20-39% Whole Person

Class 4 Impairment

40-60% Whole Person



GAIT DISTURBANCES AND ASSISTIVE DEVICES

- Chapter 17 (Table 17-5) – Impairment due to limp and use of assistive devices due to lower extremity injury
- Mild Impairments:
- Antalgic limp with shortened stance phase and documented moderate to advanced arthritic changes of hip, knee, or ankle.
- Positive Trendelenburg sign and moderate to advanced osteoarthritis of hip.
- Same as #1 or #2 above but individual requires part time use of a **cane or crutch** for distance walking but not usually at home or in the workplace.
- Requires routine use of short leg brace (ankle foot orthosis).
- [Medical Necessity of a Cane](#)



ESTABLISHING THE MEDICAL NECESSITY OF A CANE



Chapter 17 (Table 17-5 cont.)

- Moderate Impairments:
- Requires routine use of a cane, crutch, or long leg brace (knee ankle foot orthosis).
- Requires routine use of a cane or crutch and a short leg brace (ankle foot orthosis).
- Requires routine use of two canes or two crutches.



Chapter 17 (Table 17-5 cont.)

- Severe Impairments:
- Requires routine use of two canes or two crutches and a short leg brace (ankle foot orthosis).
- Requires routine use of two canes or two crutches and a long leg brace (knee ankle foot orthosis)
- Requires routine use of two canes or two crutches and two lower extremity braces (ankle foot orthoses or knee, ankle, foot, orthoses).
- Wheelchair dependent



AMA Guides 5 th Edition	Table 17-5
Mild Impairment	7-15% Whole Person
Moderate Impairment	20-40% Whole Person
Severe Impairment	50-80% Whole Person



The Gait Analysis – Practical Applications

- The Gait Analysis begins even before meeting the injured worker.
- For a spine or lower extremity injury (and even in the case of an upper extremity injury) – be prepared *in advance* to do a gait analysis



The Gait Analysis – cont.

- Steps to the Gait Analysis:
 1. Observe
 2. Interrogate
 3. Define
 4. Videotape
 5. Review for Consistency



The Gait Analysis – cont.

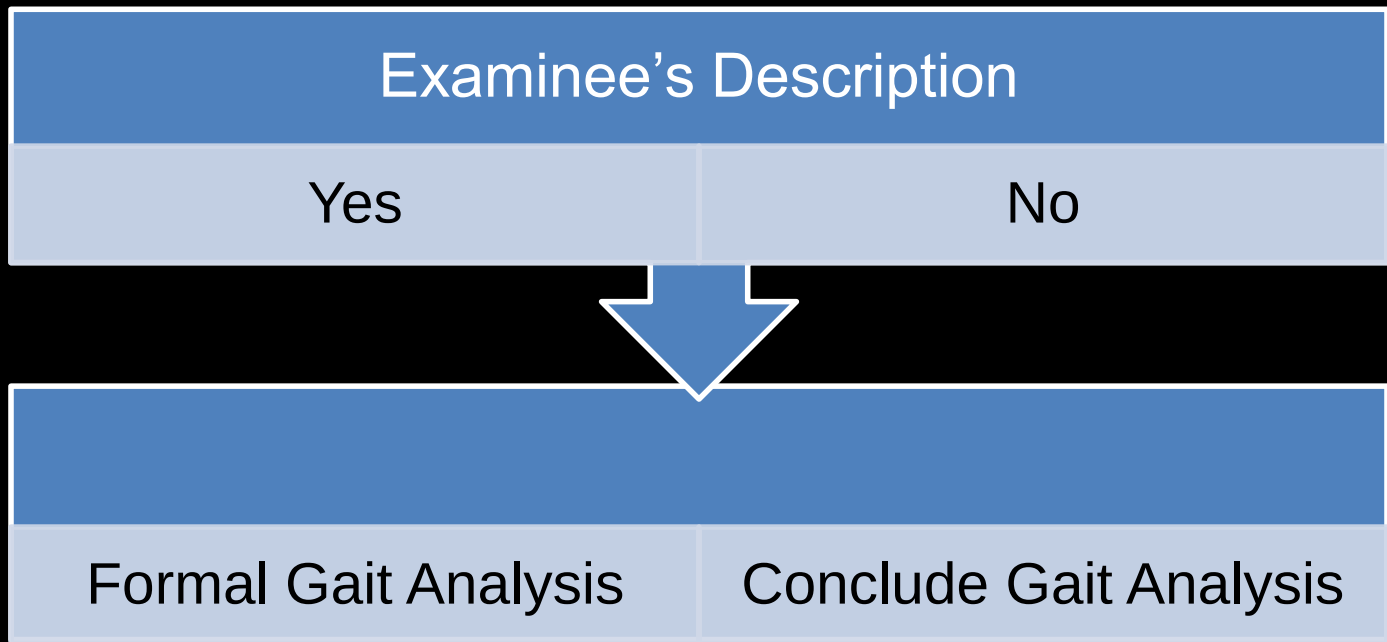
- Observe –
 1. Presence or absence of assistive devices
 2. Rising from waiting room chair (+/- Minor's sign?)
 3. Movement from waiting room to examination room



The Gait Analysis – cont.

- Interrogate –

1. Ask the injured worker about their gait. Ask “Can you walk okay? Do you have any kind of a limp or pain with walking?”



The Gait Analysis – cont.

- The Formal Gait Analysis –
 1. Observe the gait from at least 3 positions
 - Front/Back/Involved side
 2. Define/Characterize – ask the examinee to help you to define the nature of the disturbance. Confirm this through repetition.
 3. Videotape – again from 3 positions:
 - Front/Back/Involved side
- Review for Consistency



Gait Analysis

Interrogate

- Ask the examinee if they believe that they have any kind of gait disturbance, limp, or other type of compensation.

Observe and Define

- Watch from the front, back, and side and characterize the disturbance. Ask the Examinee for their help in defining the disturbance.

Videotape

- Videotape from the front, from the back, and from the side of the affected lower extremity.

Review

- Review videotaping and observe for consistency with Physical Examination Findings



- For More Information about the QME Continuing Education Home Study Program “Gait Disturbances & Assistive Devices” – click below:
- YouTube Gait Video – [click here](#)
- Product Page on www.ezqmeceu.com
- Gait Impairment Videos on www.ezqmeceu.com



DIAGNOSTIC STUDIES IN THE QME EXAM

- Next Section of this Program is excerpted from the “21 Secrets” Program and relates to the importance of:
 - Ordering the necessary Diagnostic Studies
 - Performing an Analysis of Motion Segment Integrity

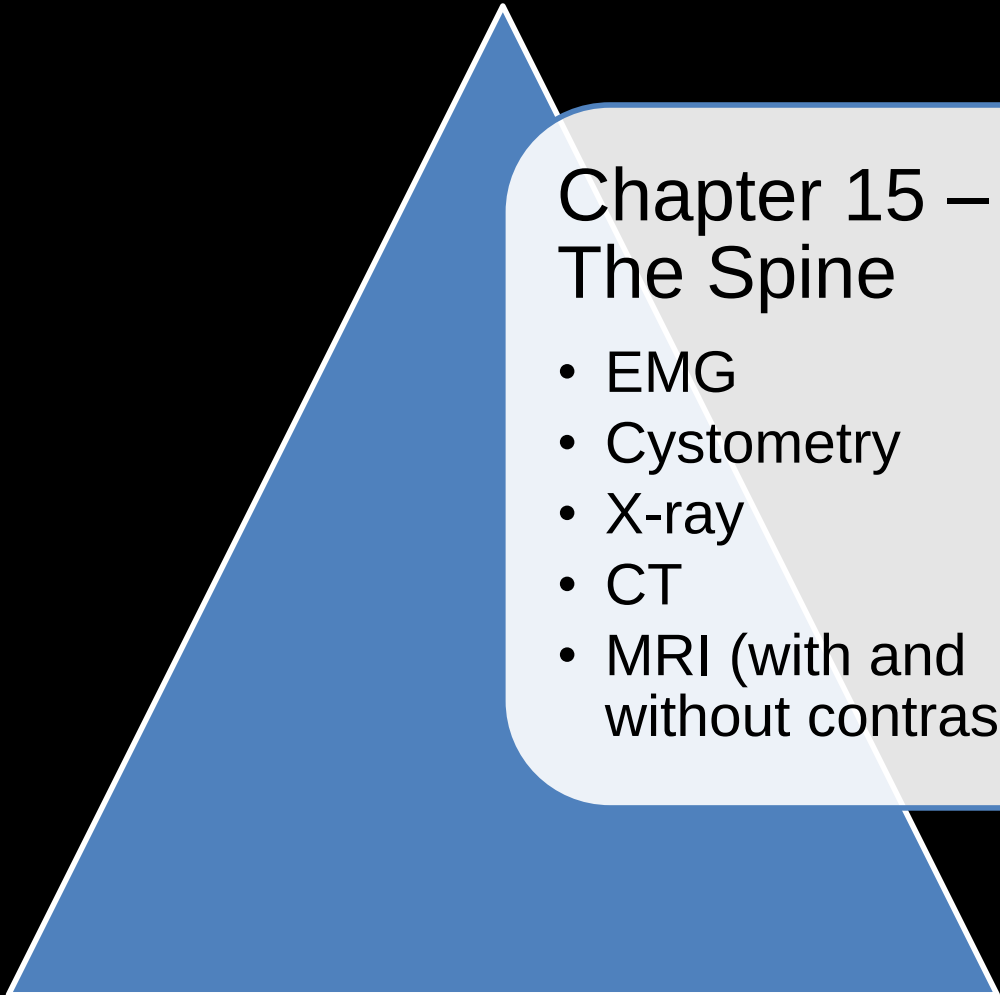


DIAGNOSTIC STUDIES in the QME EXAM

- What Diagnostic Studies are required by the AMA Guides?



DIAGNOSTIC STUDIES DESCRIBED IN THE AMA GUIDES

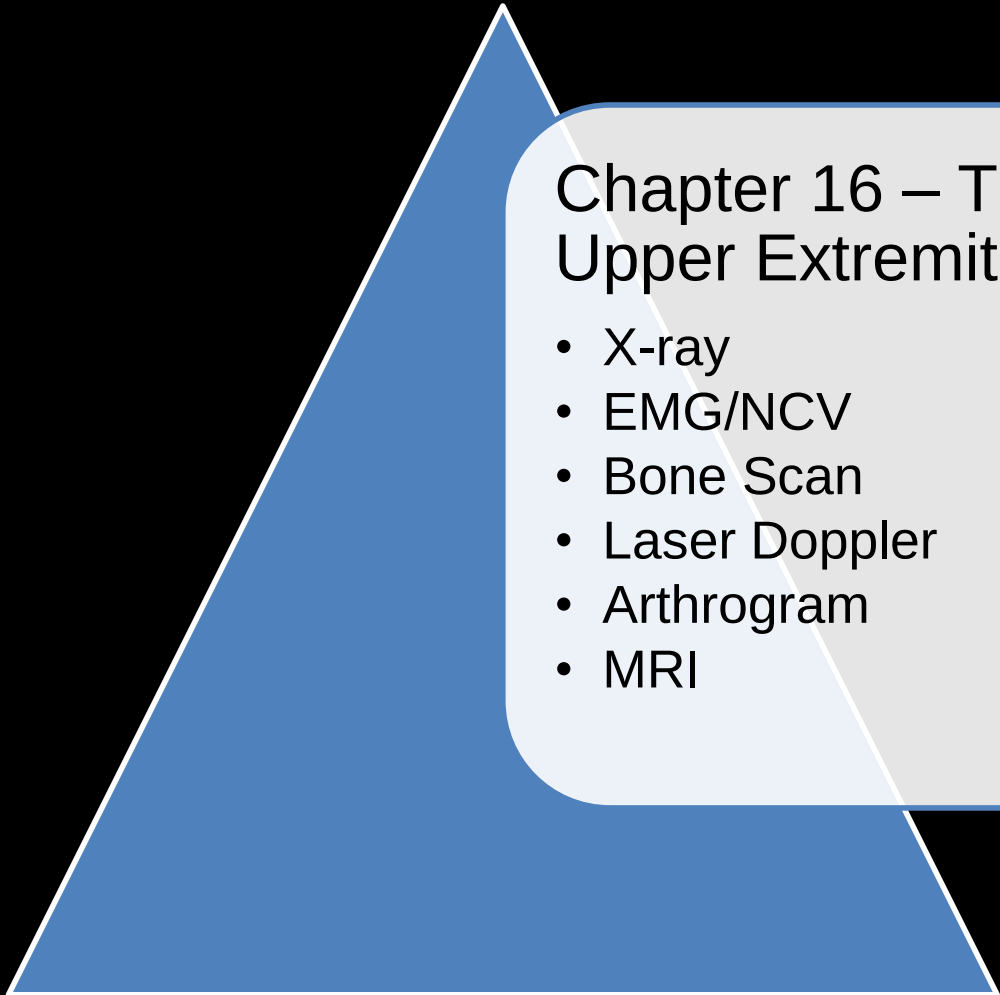


Chapter 15 – The Spine

- EMG
- Cystometry
- X-ray
- CT
- MRI (with and without contrast)



DIAGNOSTIC STUDIES DESCRIBED IN THE AMA GUIDES

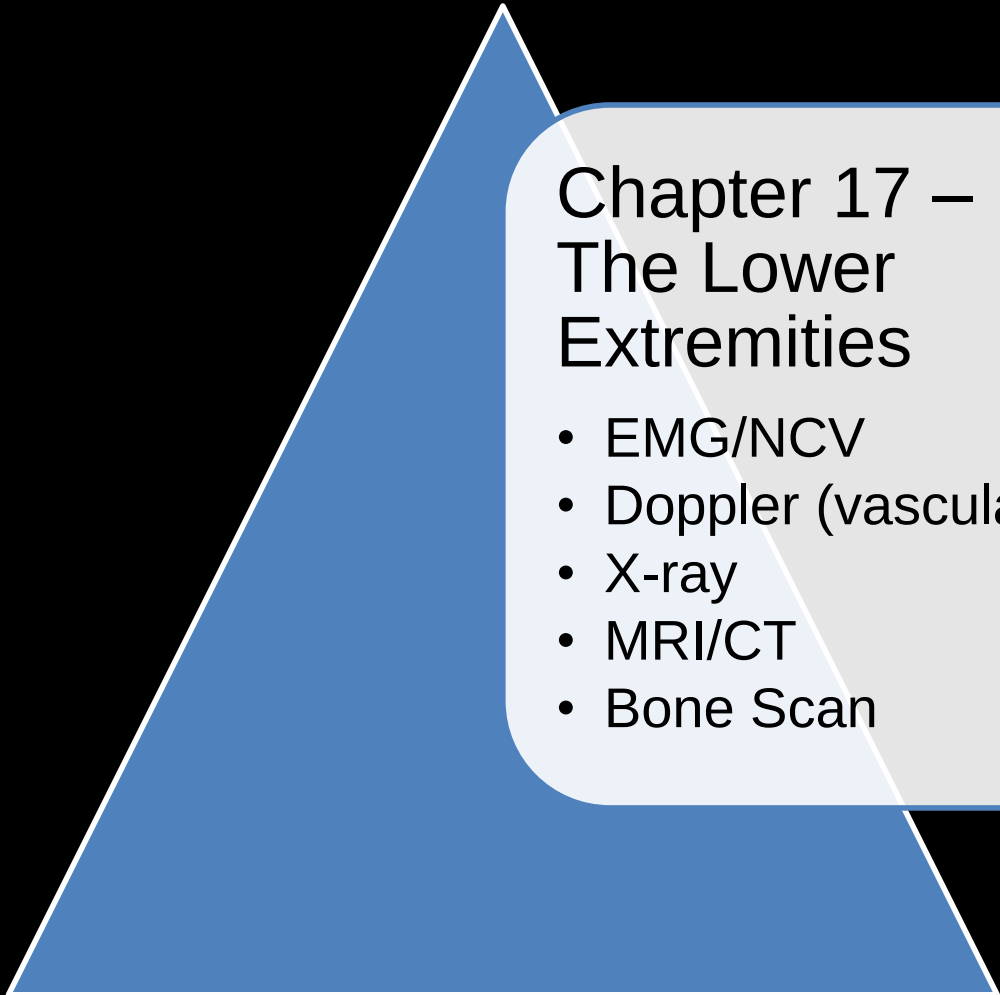


Chapter 16 – The Upper Extremities

- X-ray
- EMG/NCV
- Bone Scan
- Laser Doppler
- Arthrogram
- MRI



DIAGNOSTIC STUDIES DESCRIBED IN THE AMA GUIDES

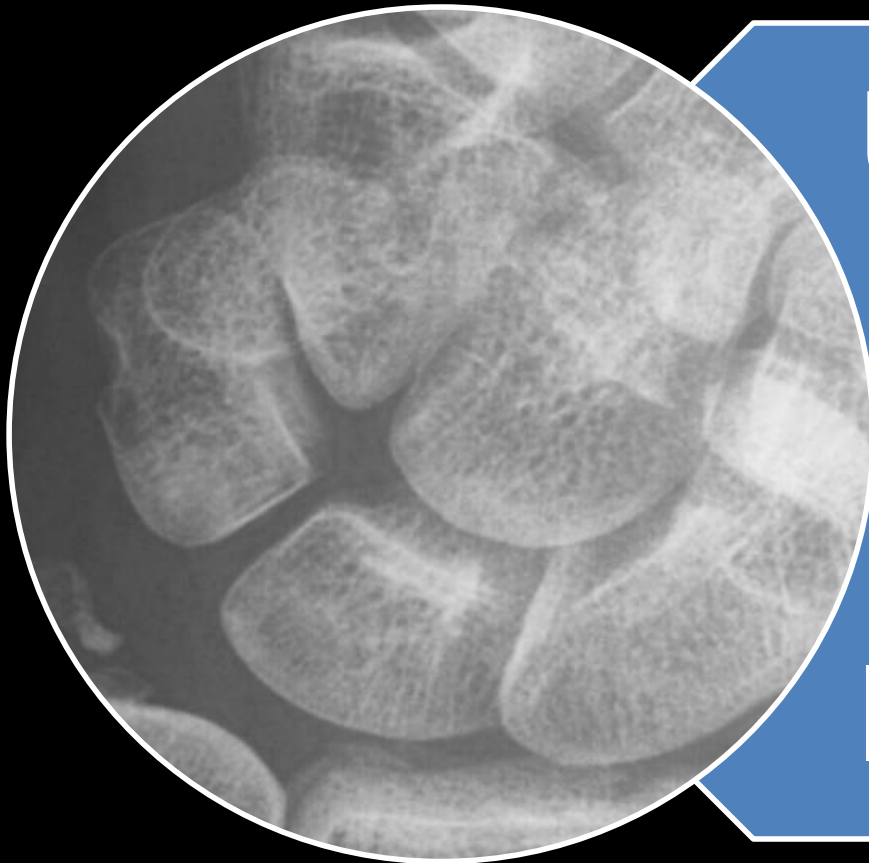


Chapter 17 – The Lower Extremities

- EMG/NCV
- Doppler (vascular)
- X-ray
- MRI/CT
- Bone Scan



DIAGNOSTIC STUDIES DESCRIBED IN THE AMA GUIDES



Uses of X-ray
in the
evaluation of
Permanent
Impairment??



DIAGNOSTIC STUDIES DESCRIBED IN THE AMA GUIDES

Spinal Impairments

- Loss of Motion Segment Integrity
- Assessment of acute or late effect of fracture
- Impairment due to “Compression Fracture”
- Pre-existing conditions/anomalies/etc.

Upper Extremity Impairments

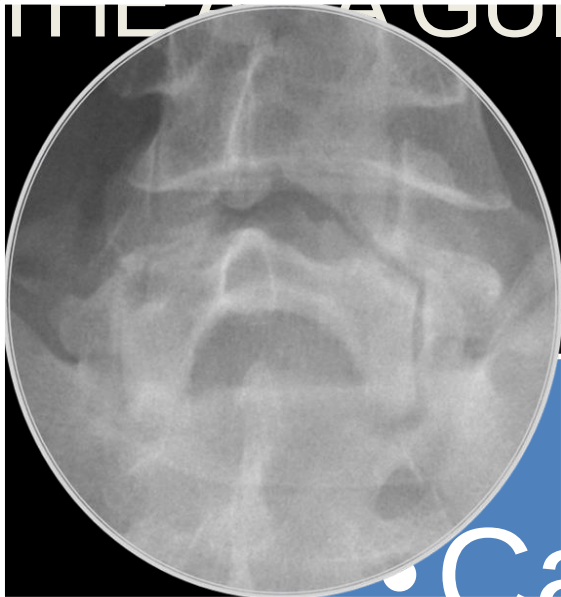
- Carpal Instability
- Trophic changes of bone (page 495/496)
- Ankylosis

Lower Extremity Impairments

- Arthritis (Loss of cartilage interval)
- Limb length discrepancy
- Confirm impairment due to gait disturbance
- Ankylosis
- Fractures
- CRPS/Causalgia



DIAGNOSTIC STUDIES DESCRIBED IN THE AMA GUIDES



Other
Considerations

- Causation
- Apportionment
- Examples??



ANALYSIS OF MOTION SEGMENT INTEGRITY

- Chapter 15 – THE SPINE:
 - Cervical Spine:
 - Thoracic Spine:
 - Lumbar Spine:



ANALYSIS OF MOTION SEGMENT INTEGRITY – Page 378

Motion Segment Integrity

A motion segment of the spine is defined as two adjacent vertebrae, the intervertebral disk, the apophyseal or facet joints, and ligamentous structures between the vertebrae. The range of motion from segment to segment varies. In the upper cervical spine (occiput to C2), there is little flexion-extension, while the lower cervical spine permits increasing flexion-extension movements from about 10° at C2 to C3 to about 20° at C5 to C6 and C6 to C7. Flexion-extension movements are about 4° in the upper thoracic spine, 6° in the midthoracic spine, and 12° in the lower thoracic spine segments. In the lumbar spine there is a gradual increase from about 12° at L1 to L2 to 20° at the L5 to S1 level.¹³

Lateral bending is 5° to 6° in the lower cervical spine and about 6° in the upper thoracic spine.

In the lumbar spine, lateral bending is greatest at L3 to L4, where it is about 8° to 9° . Axial rotation is 30° to 40° in each direction in the upper cervical spine, 5° to 6° in the lower cervical and upper thoracic spine, and minimal in the lumbar spine.



ANALYSIS OF MOTION SEGMENT INTEGRITY – Page 378

Motion of the individual spine segments cannot be determined by a physical examination but is evaluated with flexion and extension roentgenograms (see Figures 15-3a through 15-3c).^{13,14} Loss of motion segment integrity is defined as an anteroposterior motion of one vertebra over another that is greater than 3.5 mm in the cervical spine, greater than 2.5 mm in the thoracic spine, and greater than 4.5 mm in the lumbar spine (Figure 15-3a). Loss of motion segment integrity is also defined as a difference in the angular motion of two adjacent motion segments greater than 15° at L1-2, L2-3, and L3-4 and greater than 20° at L4 to L5. Loss of integrity of the lumbosacral joint is defined as angular motion between **L5 and S1 that is greater than 25°** . In the cervical spine, loss of motion segment integrity is defined as motion at the level in question that is more than 11° greater than at either adjacent level.



ANALYSIS OF MOTION SEGMENT INTEGRITY

- Page 378 - “Alteration of motion segment integrity can be either 1) loss of motion segment integrity (increased translational or angular motion), or 2) decreased motion resulting mainly from developmental changes, fusion, fracture healing, healed infection, or surgical arthrodesis. An attempt at arthrodesis may not necessarily result in a solid fusion, but it may significantly limit motion at a motion segment and qualify for “alteration of motion segment integrity.”
- What is the procedure for measuring and analyzing intersegmental motion?
- [21 Secrets of the Most Persuasive QME's](#)



ANALYSIS OF MOTION SEGMENT INTEGRITY



Analyze for “Loss of Motion Segment Integrity”

AMA Guides
pages 378-379

2 Methods:

- Translation
- Angular Motion



ANALYSIS OF MOTION SEGMENT INTEGRITY

Example: Lumbar Spine Angular Motion

Get x-rays done and recorded digitally

Provide instructions to technician to stabilize pelvis during flexion and extension to minimize hip motion



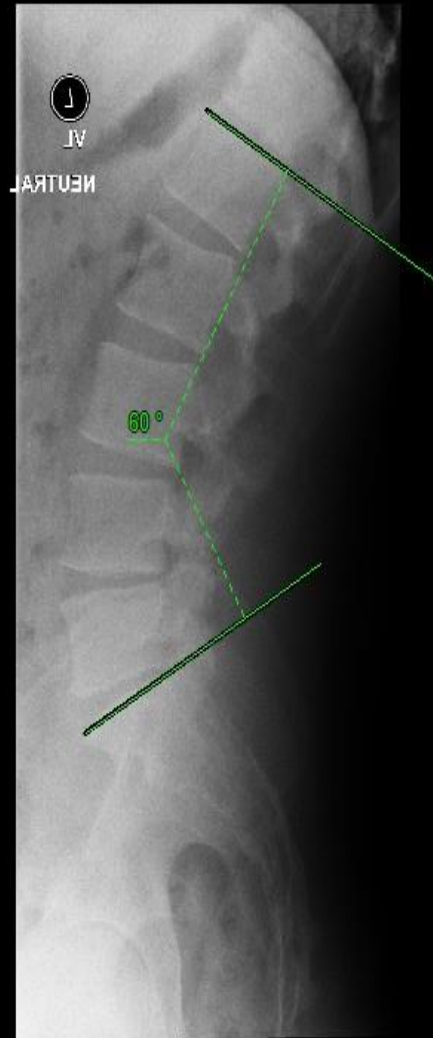
ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure:

1. Measure lumbar lordosis on lateral view – record at bottom of Table



1



LATERAL
09:40

Zoom:0.2

W:4096
C: 2048



Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2							
L2-L3							
L3-L4							
L4-L5							
L5-S1							
Totals	-60 degrees						

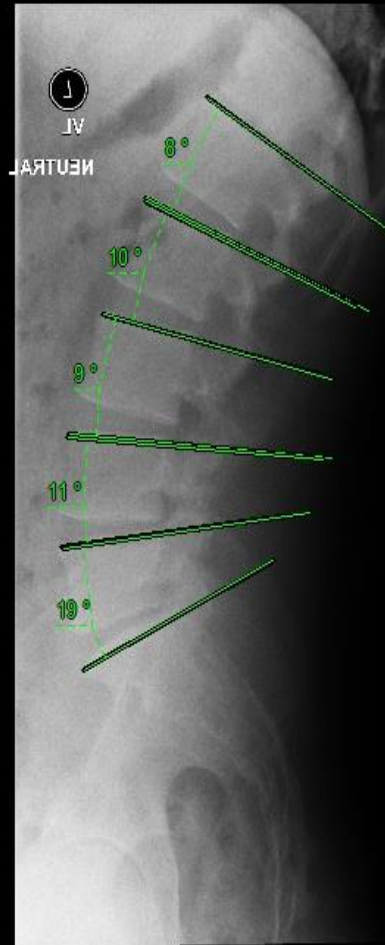


ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure:
2. Measure
intersegmental
angles from L1-L2 to
L5/S1 – record in
Table.



1



LATERAL
09:40

Zoom:0.2

W:4096
C: 2048



Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2	-8 degrees						
L2-L3	-10 degrees						
L3-L4	-11 degrees						
L4-L5	-14 degrees						
L5-S1	-18 degrees						
Totals	-60 degrees						



ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure (continued):

3. Measure lumbar lordosis on flexion view – record at bottom of Table

4. Measure intersegmental angles from L1-L2 to L5-S1 – record in Table







Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2	-8 degrees	+1 degrees					
L2-L3	-10 degrees	+2 degrees					
L3-L4	-11 degrees	+4 degrees					
L4-L5	-14 degrees	-6 degrees					
L5-S1	-18 degrees	-10 degrees					
Totals	-60 degrees	-10 degrees					

ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure (continued):

5. Calculate *delta* F – the change in a) lumbar lordosis angle and b) the change in each of the intersegmental angles in moving from neutral to flexion – record in Table. Make a mental note of the figures and assess for loss of motion segment integrity (too much/too little)



Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2	-8 degrees	+1 degrees	Delta 9				
L2-L3	-10 degrees	+2 degrees	Delta 12				
L3-L4	-11 degrees	+4 degrees	Delta 15				
L4-L5	-14 degrees	-6 degrees	Delta 8				
L5-S1	-18 degrees	-10 degrees	Delta 8				
Totals	-60 degrees	-10 degrees	Delta 50/52 degrees				



ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure (continued):

6. Measure lumbar lordosis on extension – record at bottom of Table

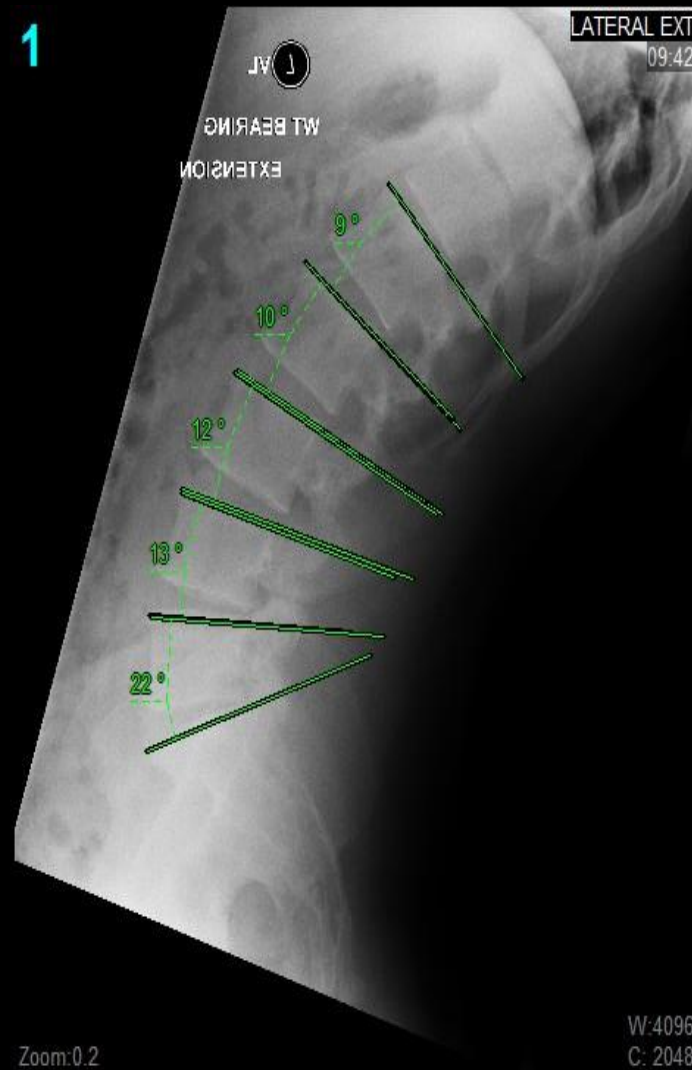
7. Measure intersegmental angles from L1-L2 to L5-S1 – record in Table



1



1



Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2	-8 degrees	+1 degrees	Delta 9	-9 degrees			
L2-L3	-10 degrees	+2 degrees	Delta 12	-10 degrees			
L3-L4	-11 degrees	+4 degrees	Delta 15	-12 degrees			
L4-L5	-14 degrees	-6 degrees	Delta 8	-13 degrees			
L5-S1	-18 degrees	-10 degrees	Delta 8	-22 degrees			
Totals	-60 degrees	-10 degrees	Delta 50/52 degrees	- 66 degrees			



ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure (continued):

8. Calculate *delta F* – the change in a) lumbar lordosis angle and b) the change in each of the intersegmental angles – record in Table. Make a mental note of the figures and assess for loss of motion segment integrity (too much/too little)



Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2	-8 degrees	+1 degrees	Delta 9	-9 degrees	Delta 1		
L2-L3	-10 degrees	+2 degrees	Delta 12	-10 degrees	Delta 0		
L3-L4	-11 degrees	+4 degrees	Delta 15	-12 degrees	Delta 1		
L4-L5	-14 degrees	-6 degrees	Delta 8	-13 degrees	Delta 1		
L5-S1	-18 degrees	-10 degrees	Delta 8	-22 degrees	Delta 4		
Totals	-60 degrees	-10 degrees	Delta 50/52 degrees	- 66 degrees	Delta 6/7 degrees		



ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure (continued):

9. Calculate Total Angular Motion. Make note of the equation and be aware of “+” and “-” angles. Most lordosis angles will be negative.

10. Make an assessment of motion segment integrity.



Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2	-8 degrees	+1 degrees	Delta 9	-9 degrees	Delta 1	1 - (- 9) = 10 degrees	
L2-L3	-10 degrees	+2 degrees	Delta 12	-10 degrees	Delta 0	2 - (- 10) = 12 degrees	
L3-L4	-11 degrees	+4 degrees	Delta 15	-12 degrees	Delta 1	4 - (- 12) = 16 degrees	
L4-L5	-14 degrees	-6 degrees	Delta 8	-13 degrees	Delta 1	-6 - (- 13) = 7 degrees	
L5-S1	-18 degrees	-10 degrees	Delta 8	-22 degrees	Delta 4	-10 - (- 22) = 12 degrees	
Totals	-60 degrees	-10 degrees	Delta 52 degrees	- 66 degrees	Delta 7 degrees	-10 – (-66) = 56 degrees (should be roughly equivalent to the flexion+extension inclinometric	



ANALYSIS OF MOTION SEGMENT INTEGRITY

Procedure
(continued):

10. Make an
assessment of
motion segment
integrity.



INTERSEGMENTAL MOTION

* AMA Guides (page 378-379): In the lumbar spine there is a gradual increase in flexion - extension movement from about 12° at L1 to L2 to 20° at the L5 to S1 level. In the lumbar spine, angular motion of more than 15 degrees (compared to the adjacent segments above and below) at L1-L2, L2-L3, and L3-L4, greater than 20 degrees at L4-L5, and greater than 25 degrees at L5-S1 = “loss of motion segment integrity.” Apply also the “rule of twos.”

Yochum & Rowe (page 41): “Rule of twos” (interspinous spaces, interpediculate distances, vertical interpediculate distances, facet joint spaces, and vertebral wedging should not vary more than 2 mm. in adjacent segments)



Motion Segment	Neutral (Intersegmental) Lumbar Lordosis Angles	Flexion Angular Motion (degrees)	Delta Flexion (Neutral – Flexion Angles)	Extension Angular Motion (degrees)	Delta Extension (Neutral – Extension Angles)	Total Angular Motion Flexion – (-Extension) = Degrees	Alteration of Motion Segment Integrity
L1-L2	-8 degrees	+1 degrees	Delta 9	-9 degrees	Delta 1	1 - (- 9) = 10 degrees	Normal
L2-L3	-10 degrees	+2 degrees	Delta 12	-10 degrees	Delta 0	2 - (- 10) = 12 degrees	Normal
L3-L4	-11 degrees	+4 degrees	Delta 15	-12 degrees	Delta 1	4 - (- 12) = 16 degrees	Normal
L4-L5	-14 degrees	-6 degrees	Delta 8	-13 degrees	Delta 1	-6 - (- 13) = 7 degrees	Decreased
L5-S1	-18 degrees	-10 degrees	Delta 8	-22 degrees	Delta 4	-10 - (- 22) = 12 degrees	Decreased
Totals	-60 degrees	-10 degrees	Delta 52 degrees	- 66 degrees	Delta 7 degrees	-10 – (-66) = 56 degrees (should be roughly equivalent to the flexion+extension inclinometric	

OUT OF TIME

- FUTURE PROGRAMS:
 - COMPRESSION FRACTURES
 - SPECIAL TESTS IN THE QME EXAMINATION OF THE UPPER AND LOWER EXTREMITIES



CONCLUSION

- This is Dr. Perry Carpenter. Thank you.
- 800-676-8127
- admin@ezqmeceu.com
- Reminder: When you are done with your Course Examination, fax (530-295-9196) or email (admin@ezqmeceu.com) your Examination and your credit for the course will be immediately processed.
- Reminder: Remember to visit www.ezqmeceu.com for products designed to make your QME Reports more powerful and more persuasive.



THANK YOU!!!

- YOU MAKE THESE PROGRAMS POSSIBLE. IF YOU HAVE A TOPIC THAT YOU WOULD LIKE TO HAVE ME RESEARCH AND EXPLORE, PLEASE LEAVE A COMMENT ON THE WEBSITE (WWW.EZQMECEU.COM), OR FEEL FREE TO CALL 800 676-8127.
- BEST OF LUCK TO YOU – YOU DESERVE TO SUCCEED AND THESE PROGRAMS WILL HELP YOU IN YOUR DESIRE TO BE A BETTER QUALIFIED MEDICAL EVALUATOR.
- IF THERE IS ANYTHING I CAN DO TO HELP YOU, JUST LET ME KNOW. IT WILL BE MY PLEASURE!

WWW.EZQMECEU.COM

PRODUCED AND NARRATED BY:

PERRY J. CARPENTER DC QME
2014

"DREAM BIG DREAMS!"