

Evaluation and Treatment of Tunnel/Entrapment Syndromes



Kevin P. McNamee, D.C., L.Ac.

Significance of Tunnel Syndromes

- Nerves in the body risk
 - Entrapment
 - Compression
 - Damage
 - Impairment
- Passing through tunnels created by
 - Bony
 - Fibrous
 - Osteofibrosis
 - fibromuscular

There are three types of nerves in the body

- sensory,
 - motor and
 - autonomic.
-
- Each has afferent and efferent impulses carried by cells.
-
- Patient's signs and symptoms
 - usually associated with the motor and sensory portion

Terms

- Common interchangeable terms used to describe the damage to neurovascular structures :
 - Canalicular
 - Canal
 - Channel
 - Tunnel

Categories

- designated by its originating source
 - Compressed Nerve: i.e. ilioinguinal syndrome
 - Anatomical Area Affected: i.e. metatarsalgia
 - Anatomical Tunnel: i.e. carpal tunnel syndrome
 - Motion Producing the Compression: i.e. hyperabduction syndrome
 - Named after the Author Describing the Syndrome: i.e. Kiloh-Nevin's Syndrome
- All syndromes originate from a lesion to the neurovascular bundle in a narrow anatomical space.

Causes

1. Tumor
2. Trauma
3. Infection
4. Metabolic
5. Toxic
6. Iatrogenic
7. Idiopathic
8. Vascular
9. Muscular Compression
10. Anatomical Variation

To determine the cause

- Patient presenting with a
 - Chief complaint,
 - History
 - Examination
 - Diagnostic scans, studies or tests may be ordered.

Differential Diagnosis

- Symptoms and signs depend on the type of nerve compressed
 - sensory, motor or mixed.
 - symptoms of tunnel syndromes may be similar to other conditions
 - differentiation of the cause is essential for correct treatment.
- Radicular pain may be
 - Tunnel syndrome vs. herniated disc or tumor
 - ex: Piriformis muscle syndrome vs. Herniated nucleus pulposus herniation vs. Ependymoma
- Raynaud's phenomenon may be
 - Carpal tunnel vs. autonomic dysfunction secondary to autonomic nerve compression
- Vascular disease may be
 - isolated nerve ischemia vs. thoracic outlet syndrome,
 - carpal tunnel and Guyon's tunnel canal syndrome

Differential Diagnosis

- History and Examination
- Indicated imaging and tests
- Differentiate the cause
- Determine treatment
- For example:
 - carpal tunnel syndrome
 - cervical spine or brachial plexus disease
 - because the sensory and motor nerves overlap.

Etiology and Pathogenesis

- Most common cause of tunnel syndromes –
 - narrowing of the neurovascular tunnel made of
 - osteofibrous
 - or
 - fibromuscular

Etiology and Pathogenesis

- Changes include:
 - tumors
 - cysts
 - inflammatory process (rheumatic, tubercular)
 - trauma (blunt-hematoma formation, sharp fractures)
 - anatomic variations.

How much is needed

- Altered nerve function does not require a major compromise in the tunnel.
 - 6 mm Hg pressure changing nerve function.

Etiology and Pathogenesis

- Inflammatory changes
 - causing slight connective tissue thickening of the nerve sheaths.
- Ischemic events
 - affect sensory nerve fibers.
 - Sensory affected first followed by motor fiber damage.
- Edema
 - secondary to hormonal changes associated
 - pregnancy, birth control pills, menopause, hypothyroidism.
- Traction or compression
 - during dynamic activity which may cause slight anatomical variations.

Clinical Symptoms and Signs

- range from
 - vague diffuse numbness or
 - pain to specific muscle weakness or sensory changes.
- most common symptom presentation
 - pain (sharp, burning pain)
 - If limited to a specific dermatome
 - may have sensation changes
 - hyperesthesia, hyperesthesia, hypalgesia, hyperalgesia, loss of two-point discrimination, or loss of vibratory sense

Clinical Symptoms and Signs

- motor nerves are compressed
 - diffuse deep pain or
 - weakness
 - specific to a muscle group

Clinical Symptoms and Signs

- Usually, sensory symptoms and signs
 - appear first before the motor signs
 - do not base the diagnosis and treatment upon the motor signs
 - sensory nerve may be the actual cause of the tunnel syndrome.

Clinical Symptoms and Signs

- Sensory testing of
 - dermatomes and vibration;
 - motor function through muscle strength testing;
 - reflexes
- help provide the cause of the tunnel syndrome and indicate the need of diagnostic testing.

Taking a Patient's History (OPQRST and FAOMASH)

- Identification
 - Age
 - Race
 - Gender
- Onset/Occurrence
- Palliative/Provocative
- Quality/Quantity
- Radiation
- Site
- Time

Taking a Patient's History

Questions to Ask: Onset/Occurrence

- When did it happen?
- How did it happen?
- How often is it present?
- How long does it last when it is present?
- This may give you information about the mechanism of injury and what impact it has on the patient.
- Length of time since the onset may provide clues as to the prognosis for the chief complaint.

Taking a Patient's History

Questions to Ask: Palliative/Provocative

- What makes it better?
- What makes it worse?
- Is there a change in position, lying, sitting or standing?
- Have you tried heat, cold, massage, stretches or exercises or medications?
- What helps or doesn't help provides key information as to the stage of healing, what therapies may or may not help.
- Gives direction for the treatment plan design.

Taking a Patient's History

Questions to Ask: **Quality/Quantity**

- What is the sensation like?
- Sharp, Dull, Throbbing, Achy, Numbness, Tingling, Electrical, etc.?
- On a zero to 10 scale, zero being no pain, 10 being the worst imaginable, what does it feel like in general?
- Does it restrict or stop your activities?
- The type of sensation will give clues about the body systems affected, nerve fibers involved, duration of the condition – recent vs. chronic.

Taking a Patient's History

Questions to Ask: **Radiation**

- Does the pain travel?
- If so, from where to where?
- How often is the radiation present and how long does it last?

Taking a Patient's History

Questions to Ask: **Site**

- Does the pain change with patient's location (work, home, car, etc.)?

Taking a Patient's History

Questions to Ask: **Time**

- Is there a change related to any time of day: morning, late morning, afternoon, early afternoon, evening or night time?

Patient's Past Medical History Questions to Ask: **Family History**

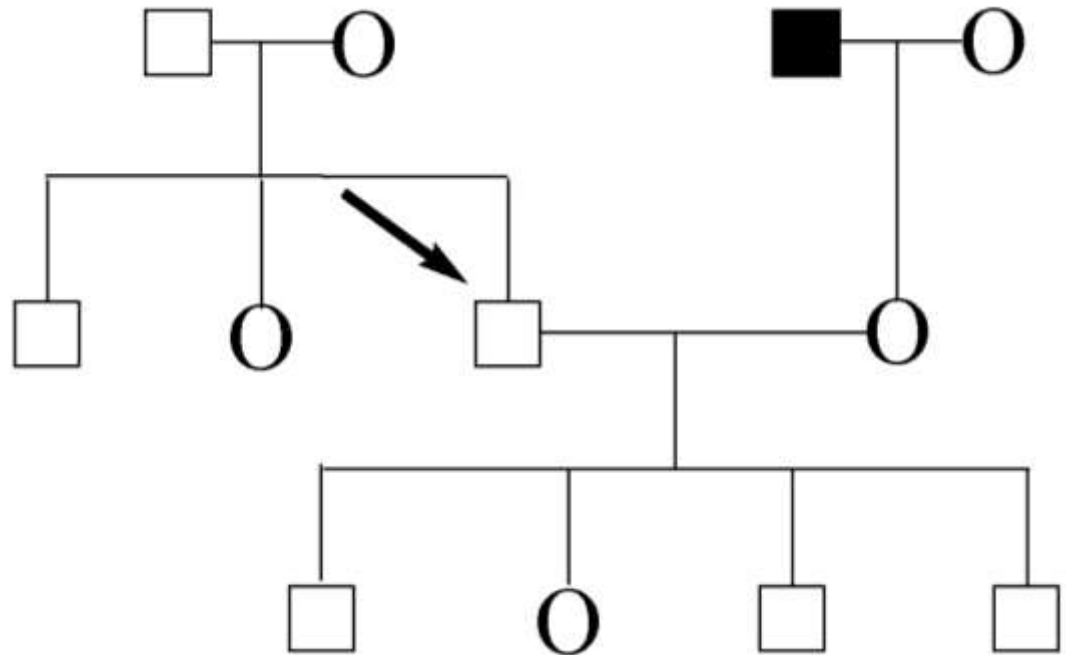
- **Immediate Family History**
 - How is the age and health of your Sisters, Brothers, Mother and Father?
- **Complete Past** includes grandparents, aunts and uncles and/or cousins, great aunts and great uncles?
- Include a genogram (with at least three generations).

Sample Family History

Shorthand method to record the family history of major health or genetic disorders (hypertension, cancer, cardiac, respiratory, kidney, strokes, or thyroid disorders; asthma or other allergic manifestations, spontaneous abortions and stillbirths, etc.).

KEY

Deceased	■	●
Male	□	
Female	○	
Patient		↘



Insert the Age and Pertinent Health History of Each

Patient's Past Medical History Questions to Ask: **Accidents**

- Any past
 - motor vehicle accidents,
 - severe falls,
 - major injuries like fractures or dislocations?
- If so, when did they happen, what treatments were you given, and relate the residuals to the current condition subjective and objectives.

Patient's Past Medical History Questions to Ask: **Other Doctors**

- Who have you seen for this condition and what have they done for it?

Patient's Past Medical History Questions to Ask: **Medications/Vitamins/Herbs**

- Are you taking any medications, vitamins or herbs?
- What conditions are you taking them for?
- Who prescribed them for you?

Patient's Past Medical History Questions to Ask: **Allergies**

- Do you have any allergies?
- Are you allergic to any medications? (Use the abbreviation for **No Known Drug Allergies -- NKDA**)

Patient's Past Medical History Questions to Ask: **Surgeries**

- Have you had any surgeries?
- Give examples if the patient does not recall. Tonsils, appendix, gall bladder, hernia, uterus, ovaries?

Patient's Past Medical History Questions to Ask: Hospitalization

- Have you ever been hospitalized?
- When and what for?

Patient's Past Medical History Questions to Ask: **Usual Childhood Diseases**

- Have you had measles, mumps, chicken pox or other childhood diseases?
- The abbreviation is **UCHD**

Patient's Past Medical History Questions to Ask: **Social History**

- Married or single?
- Any children?
- Your present and past employer?
- Any exposure to environmental agents?
- Your religion?
- Any hobbies?
- What is your living condition?
- Where do you get your water supply?
- Do you smoke, drink, use IV drugs, any blood transfusions or have multiple sex partners?
- For veterans, include military service history question.
- For pediatric patients, include sleep, play habits and pets.

Systems Review

- Do you have any problems with....

History Form Available

- To obtain a history form to use until you become proficient with these questions, go to
- www.TheSupplyCenter.com
 - Your Practice
 - Forms and Tools
 - Patient History Form

Examination (IPPIRONEL)

- (I) Inspection
- (P) Palpation
- (P) Percussion
- (I) Instrumentation
- (R) Range of Motion
- (O) Orthopedic
- (N) Neurological
- (E) X-ray and Diagnostic Imaging
- (L) Laboratory

Diagnostic Testing

- Depends on the history and examination
- Electro-diagnostic tests are
 - based on its ability to stimulate specific nerves
 - nerve failure to respond in a timely and appropriate fashion is defined as pathologic.
 - can indicate or confirm the diagnosis
 - reliability and accuracy depends on the tester and the nerve tested.

Diagnostic Testing

- **Electromyography (EMG)**
 - records the **MUSCLE** response to various neural stimuli
 - muscle response is judged from its resting state to a maximally stimulated state
- muscle is in the resting state
 - few if any fasciculation
 - a nerve is stimulated
 - more motor units are recruited which appears in waves and become superimposed during maximal stimulation

Diagnostic Testing

- **Nerve Conduction Velocity (NCV)**
 - maximal stimulation to assess
 - **TIME** between stimulus and motor response
 - Identify the lesion site varying the stimulated point in the nerve's course
- each nerve has a characteristic
 - conduction time and configuration.
- normal or borderline normal electro-diagnostic study
 - does not exclude the existence of a tunnel syndrome.
 - Do not rely exclusively on these tests

Initial History and Exam

cc: Chief Complaint

Chief complaint leads to the type of history

(H) History

(OPQRST and FAOMASH)

This leads you into the type examination

Examination

- (I) Inspection
- (P) Palpation
- (P) Percussion
- (I) Instrumentation
- (R) Range of Motion
- (O) Orthopedic
- (N) Neurological

Diagnostic imaging and Laboratory Tests Depending on the history and exam, lab and/or diagnostic imaging maybe ordered

- (E) X-ray and Diagnostic Imaging
- (L) Laboratory

Daily Progress Notes (SOAP)

Subjective, Objective, Assessment and Plan

Subjective

(Comes from the History)

Objective

(Comes from IPPIRONEL)

Assessment (Diagnosis)

Treatment Plan

Discharge

(Re-evaluate)

(Re-evaluate)

Symptoms Associated with Compression of Different Nerve Type

1. Sensory
 - Loss of discrimination, sharp burning, vibratory sense, paresthesia, hyperesthesia, hypaplegisia, hyperesthesia, hyperalgesia, pain
2. Motor
 - Vague pain, blunt pain on appropriate muscle group pressure and night pain.
3. Mixed
 - Combined and varying effects
4. Weakness
 - Muscle atrophy
5. Automatic
 - Vegetative disturbances, autonomic sweating/decreased

Palpation

- Palpation is the examining with the hands and fingers
- Provides clues as to the possible origin of the condition.
- Muscle in spasm or hypertonicity have three possible sensations
 - Tickle, pain, (tickle pain combination) or pressure
 - Tickle sensation indicates the spasm has been there a while longer than a muscle with a pain sensation.
 - Pressure sensation is found in a normal, healthy muscle

Palpation

- Examine all muscles of the region
 - Both superficial and deep,
 - Feel for the presence of
 - edema,
 - heat or cold,
 - muscle contraction,
 - sensation to the patient,
 - reproduction or radiation of pain,
 - nodules, masses, etc

Palpation

- Muscle tenderness is graded and documented with the following scale

Tenderness: (List Location and Grade)

Grading Scale: (segmental level)

- (+1) = Patient states that the area is **mildly tender - annoying**.
- (+2) = Patient states that the area is **moderately tender**.
- (+3) = Patient complains of **considerable tenderness** and **withdraws momentarily** in response to the test pressure.
- (+4) = Patient complains of **severe tenderness**, withdraws immediately in response to test pressure, and is **unable to bear sustained pressure**.

Pulses

- Pulses are found in many parts of the body.
- Decreased arterial blood flow may result in pain and other symptomatology.
- Depending on the chief complaint, specific pulses may be evaluated for abnormalities.

Pulses

- **Pulse Rate**

- Steadiness of the heart rhythm should be regular.
- If irregular, determine whether there is a consistent pattern.
- An irregular rhythm that occurs in a repeated pattern may indicate sinus arrhythmia which is dependent on inspiration and expiration.
- A pattern less, unpredictable, irregular rate may indicate heart disease or conduction system impairment.
- Lack of symmetry between the left and right extremities suggests impaired circulation.
- Compare the amplitude of the upper extremity pulses with those of the lower extremities and the left with the right.
- Ordinarily, the femoral is as strong as or stronger than the radial pulse.
- If this is reversed or if the femoral pulsation is absent, coarctation of the aorta must be suspected.

Locations of Palpable Pulses

- Carotid,
- Brachial,
- Radial,
- Femoral,
- Popliteal,
- Dorsal and posterior tibial.
- Pulse rate may be palpated in several different areas.

The amplitude of the pulse is described on a scale of 0 to 4

4	Bounding
3	Full, increased
2	Expected
1	Diminished, barely palpable
0	Absent, not palpable

Neurological Evaluation

- Mental Status (Cerebral Function)
- Cerebellar Testing (Cerebellum Function)
- Cranial Nerves (I to XII)
- Girth Measurements of the Upper Extremities
- Sensory Perception
 - Dermatomes
 - Sharp/Dull
 - Light Touch
 - Temperature
 - Two point Discrimination
 - Vibration Sense
- Muscle Strength
 - Muscle strength
 - Mensuration of Body Parts
 - Grip Strength
- Reflexes

purpose of neurological tests

- find lesions to the nervous system.
 - testing includes
 - deep tendon reflexes,
 - superficial reflexes, and
 - pathologic reflexes,
 - testing cranial nerves,
 - measuring body parts,
 - grading muscular strength and
 - gross sensory modalities.

screening examination for neurological conditions

- when no known neurologic problem is apparent, include
 - Cranial Nerves (II through XII);
 - Proprioception and
 - Cerebellar Function
 - One test for
 - rapid rhythmic alternating movements,
 - accuracy of movements,
 - balance (Rhomberg test),
 - gait and
 - heel-toe walking;
 - Sensory Function,
 - Superficial pain and touch
 - Vibration and
 - Position senses
 - assessed by testing the great toe;
 - Deep Tendon Reflexes

Sensory Perception

- Sharp/Dull
- Light Touch
- Vibration
- Temperature and
- Two Point Discrimination
- Each nerve root corresponds to specific areas of the body.

- Dermatome location
 - usually consistent from patient to patient,
 - various text books will have subtle variations.

descriptive terms associated with each dermatome

- Anesthesia is Complete loss of sensation
- Hypoesthesia Diminished sensation
- Hyperesthesia Increased tactile sensibility
- Analgesia Complete loss of pain sensation
- Hyperalgesia Increased sensibility to pain (tenderness)
- Astereognosis Inability to recognize familiar objects by the sense of touch (anesthesia not being present). It usually indicates a lesion in the parietal cerebral cortex

If loss of sensation or impairment is found

- map the boundaries
 - by the distribution of major peripheral
 - nerves or
 - Dermatomes
 - Loss of sensation can indicate spinal tract, brainstem or cerebral lesions
- During the evaluation
 - the patient is to have eyes closed
 - focus concentration on the area tested and avoid inaccurate responses.

Light Touch

- Touch the skin with a cotton wisp or with your fingertip, using light strokes.
- Do not depress the skin, and avoid stroking areas with hair.
- Compare one side of the body to the opposite, corresponding side.
- Ask the patient to indicate if there is an
 - increase,
 - decrease or
 - equal sensation
 - comparing one side to the other.
- Note any changes in sensation and map out the area.



Sharp/Dull (Superficial Pain)

- Alternating the sharp and smooth edges of a broken tongue blade or the point and hub of a sterile needle, touch the patient's skin in an unpredictable pattern.
- Allow two seconds between each stimulus to avoid a summative effect.
- Ask the patient to identify each sensation as sharp or dull and where it is felt.
- It is possible to combine evaluation of superficial pain and touch.
- Alternate the use of the tongue blade or sterile needle with strokes of your fingertip to determine whether the patient can identify the change in sensation.



Temperature and Deep Pressure

- Only when superficial pain sensation is not intact are temperature and deep pressure sensation tests performed.
- Roll test tubes of hot and cold water alternately against the skin, again in an unpredictable pattern, to evaluate temperature sensation.
- Ask the patient to indicate which temperature is perceived and where it is felt.
- Deep pressure sensation is tested by squeezing the trapezius, calf or biceps muscle. The patient should experience discomfort.

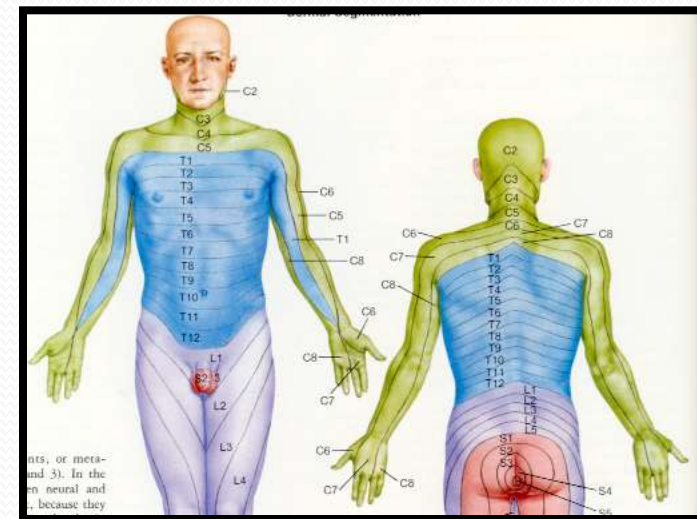
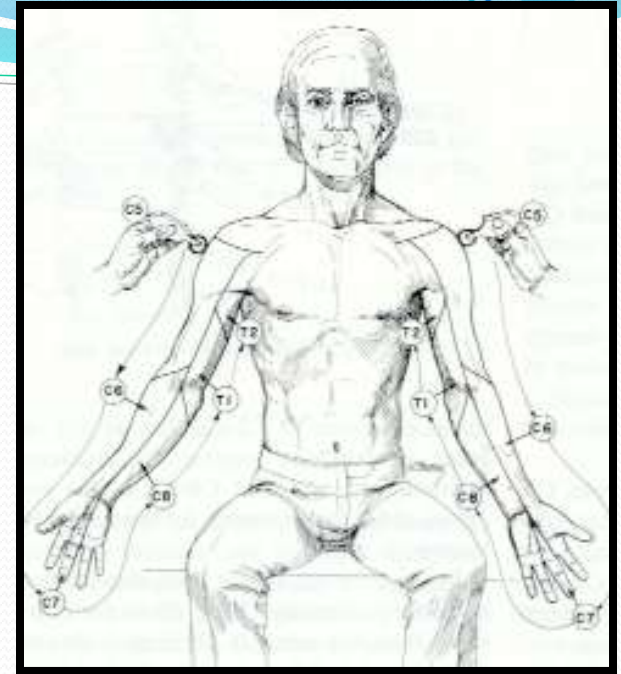
Vibration

- Place the stem of a vibrating tuning fork (the tuning fork with lower Hz has slower reduction of vibration) against several bony prominences, beginning at the most distal joints.
- Sternum, shoulder, elbow, wrist, finger, joints, shin, ankle, and toes may all be tested.
- Buzzing or tingling sensation should be felt.
- Ask the patient to tell you when and where the vibration is felt. Occasionally dampen the tines before application to see if the patient distinguishes a difference.



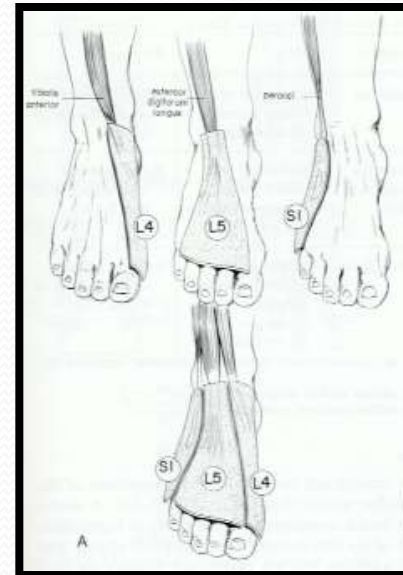
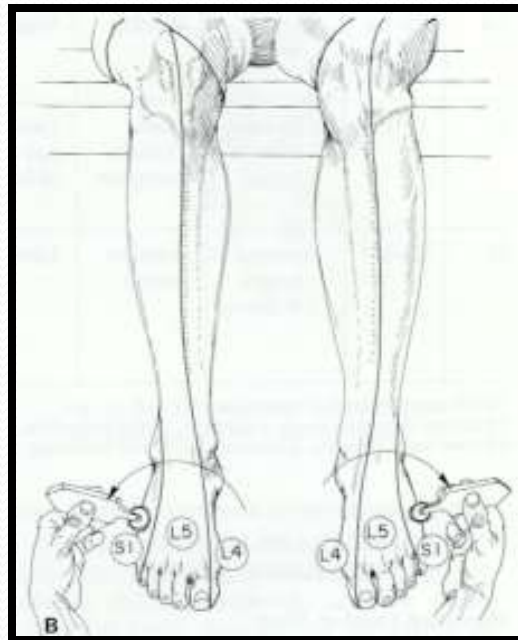
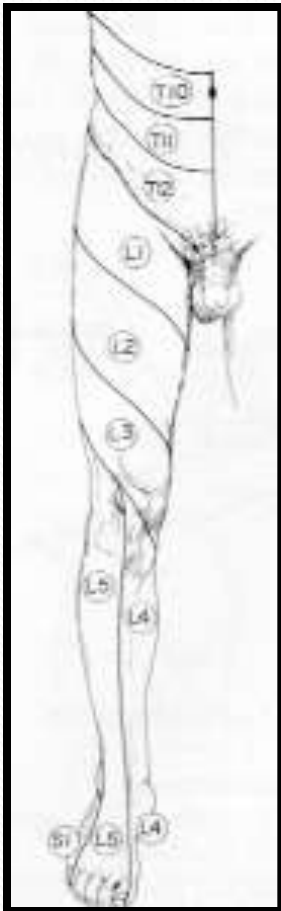
Dermatome Distribution

- Each nerve root corresponds to specific areas of the body.
- Location of the dermatomes are usually consistent from patient to patient, however, in various text books the nervous system will have subtle variations.



Dermatomes of the Lower Extremity

- Using Hoppenfield's Dermatome Diagram



Mensuration of Body Parts (Girth Measurements)

- Used to determine atrophy and functional and anatomic abnormalities. Common areas of mensuration are:
- **Upper Extremity Circumference of the brachium and ante brachium** as measured in the non-contracted state. Indicate which side is injured and which is the major extremity.
- **Measuring the Arm Girth:** With the extremity hanging relaxed at the side, place the tape around the arm at the mid-biceps just approximating the skin without tension. Measure opposite arm at same level. Report injured over uninjured side.
- **Measuring the Forearm Girth:** With the upper extremity hanging relaxed at side, apply tape at maximum circumference of forearm. Apply tape so that it just approximates the skin without tension and report as injured over uninjured side.



Mensuration of Body Parts (Girth Measurements)

- Used to determine atrophy and functional and anatomic abnormalities. Common areas of mensuration are:
- **Lower Extremity Circumferences** (thigh and calf) as measured in the non-contracted state. Girth measurements of the lower extremities are to be made with the patient supine in the anatomical position.
- **Measuring Thigh Girth:** Measure the girth of the thigh at a point one-third of the distance from the upper pole of the patella to the umbilicus. The tape should just approximate the skin without tension and with muscles relaxed.
- **Measuring Calf Girth:** Measure the circumference of the calf at the largest diameter of calf muscles. Record the distance from the lower pole of the patella to the location of the girth measurement.



Muscle Strength Grading

- Note muscle strength by graded scale.
- 5 (Normal) Complete range of motion against gravity with full resistance.
- 4 (Good) Complete range of motion against gravity with some resistance.
- 3 (Fair) Complete range of motion with gravity.
- 2 (Poor) Complete range of motion with gravity eliminated.
- 1 (Trace) Evidence of slight contractility. No joint motion.
- 0 (Zero) No evidence of contractility.
- The results are recorded by the descriptive word, Good, Trace, etc., or numerically listing the finding over the normal: 4/5.

Muscle Strength Testing Upper Extremities



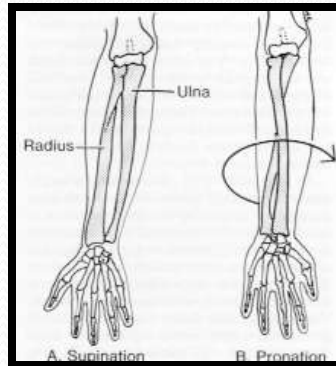
Elbow Flexion and
Extension



Wrist Extension



Wrist Flexion



Supination and Pronation of the Forearm



Finger Adduction Abduction



Finger Flexion

Measuring Hand and Grip Strength

- Dynamometer is a device to measure hand grip and finger muscle strength.
- Measures in pounds or kilograms of force.
- Measurement is made three times alternating between sides allowing for a rest between samples.
- Patient is sitting with elbow at 90 degrees when gripping the dynamometer.
- Patient instructed to make one full effort to reach maximum strength.



Muscle Strength Testing

Lower Extremities

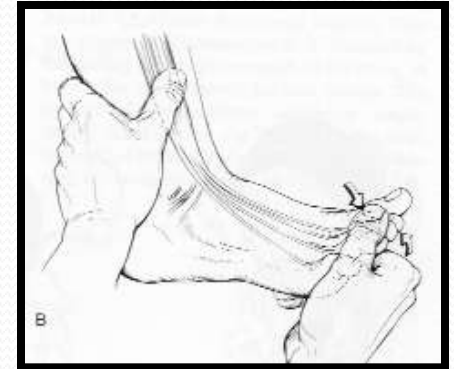


Squat and Rise testing gross muscle strength and joint range of motion.

Heel and Toe walking

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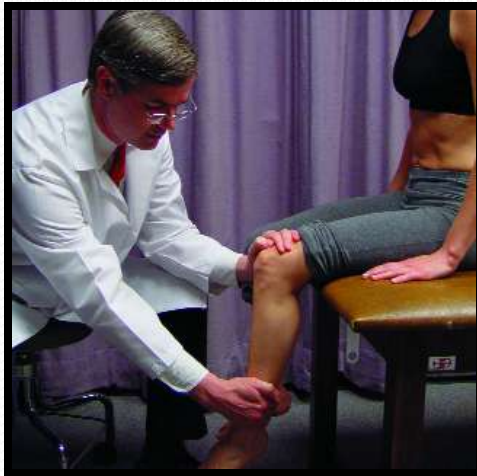
Muscle Strength Testing Lower Extremities



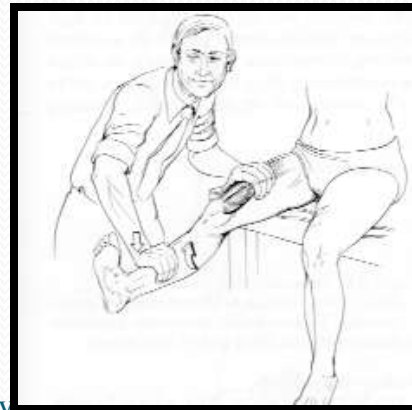
Muscle strength and active range of motion of the foot and ankle

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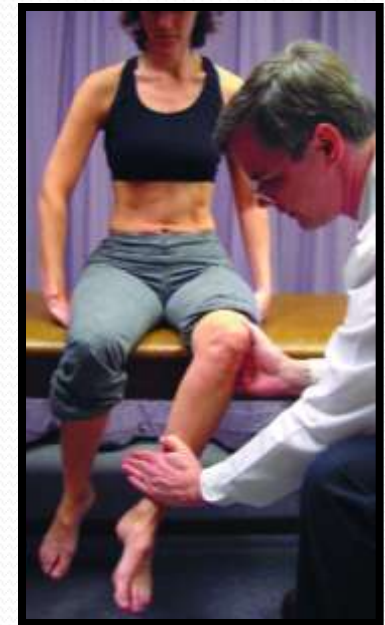
Muscle Strength Testing Lower Extremities



Muscle strength and active range of motion of the knee



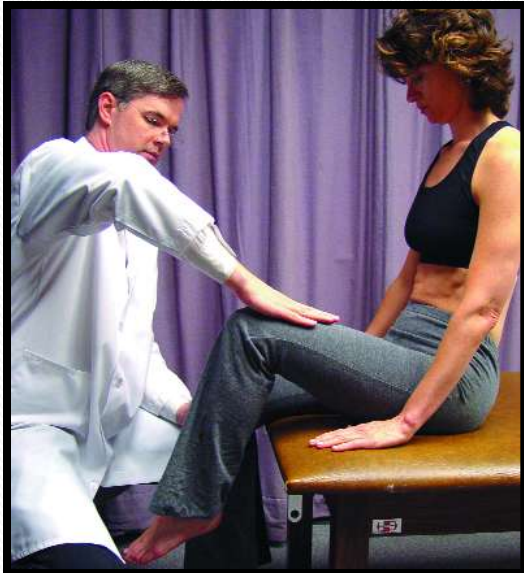
Muscle Strength Testing Lower Extremities



Muscle strength and active range of motion of the hip in abduction, adduction, internal and external rotation.

Muscle Strength Testing

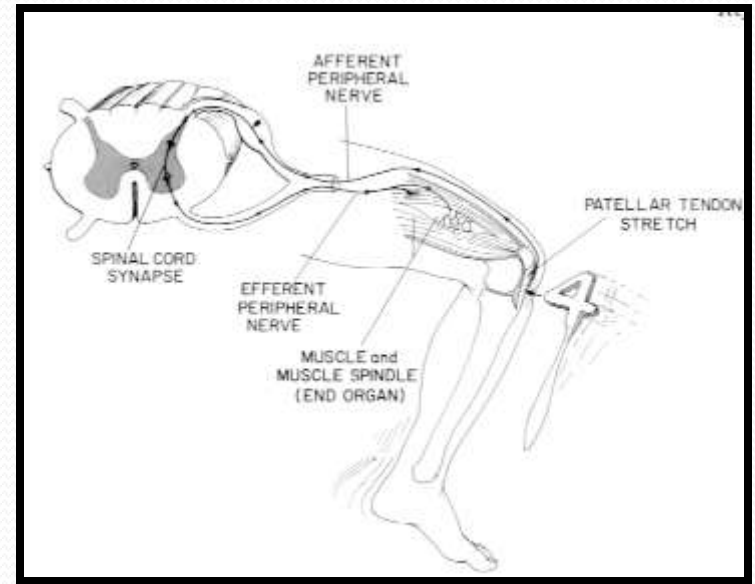
Lower Extremities



Muscle strength and active range of motion of the hip flexion and extension

Reflexes

- The stretch reflex arc is composed of an organ capable of responding to stretch (muscle spindle), a peripheral nerve (axon), the spinal cord synapse, and muscle fibers.
- Impulses descend from the brain along long (upper motor neuron) tracts (lateral and anterior corticospinal) to modulate the reflex.
- As a general rule, an interruption in the basic reflex arc results in the loss of reflex,
- while pressures on the nerve root itself may decrease its intensity (hyporeflexia).
- Interruption of the upper motor neuron's regulatory control over the reflex will ultimately cause it to become hyperactive (hyperreflexia).



Reflexes

- Reflexes are reported as
 - absent
 - decreased
 - normal,
 - increased
- Evaluation requires that one side be compared with the other.
- Bilateral comparison provides a direct, immediately accessible way to detect any alteration in reflexes and is essential for an accurate diagnosis of pathology since the degree of reflex activity varies from person to person.

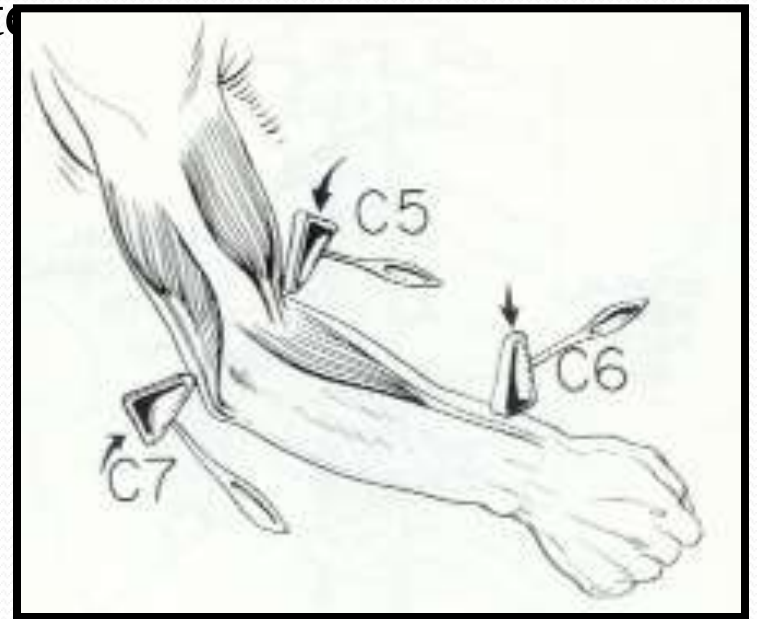
Reflexes

- **Grading of deep tendon reflexes**
 - 0 No response
 - 1+ Hypo-reflexia
 - 2+ Normal
 - 3+ Hyper-reflexia
 - 4+ Hyper-reflexia with transient clonus
 - 5+ Hyper-reflexia with intermittent or sustained clonus

Reflexes

Deep Tendon Reflexes

- Deep tendon reflexes help locate the lower motor neuron lesion and differentiate it from an upper motor neuron lesion.



Reflexes

Biceps Reflex

- Flex the patient's arm to 45 degrees at the elbow.
- Palpate the biceps tendon in the antecubital fossa.
- Place your thumb over the tendon directly, with the reflex hammer.
- Contraction of the biceps muscle causes visible or palpable flexion of the elbow.



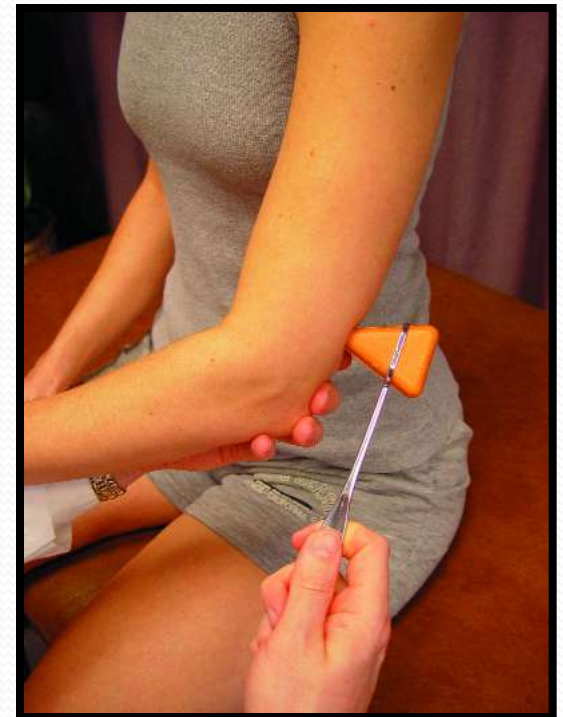
Reflexes

- **Brachioradial Reflex**
 - Flex the patient's arm to 45 degrees and rest his or her forearm on your arm with the hand slightly pronated.
 - Strike the brachioradial tendon (about 1 to 2 inches above the wrist) directly with the reflex hammer.
 - Pronation of the forearm and flexion of the elbow should occur.



Reflexes

- **Triceps Reflex**
- Flex the patient's arm at the elbow up to 90 degrees and rest the patient's hand against the side of the body.
- Palpate the triceps tendon and strike it directly with the reflex hammer, just above the elbow.
- Contraction of the triceps muscle causes visible or palpable extension of the elbow.



Reflexes

- Patellar Reflex
- Flex the patient's knee to 90 degrees, allowing the lower leg to hang loosely. Support the upper leg with your hand, not allowing it to rest against the edge of the examining table. Strike the patellar tendon just below the patella. Contraction of the quadriceps muscle causes extension of the lower leg.



Patellar Reflex. On right with Jendrasic Maneuver. Testing L4.

Reflexes

- Achilles Reflex
- With the patient sitting, flex the knee to 90 degrees and keep the ankle in neutral position, holding the heel of the foot in your hand. (Alternatively, the patient may kneel on the chair with the toes pointing toward the floor.) Strike the Achilles tendon at the level of the ankle malleoli. Contraction of the gastrocnemius muscle causes plantar flexion of the foot.



- **Dermatomes**

- Areas of sensation on the skin supplied by a single spinal segment.

- **Myotomes**

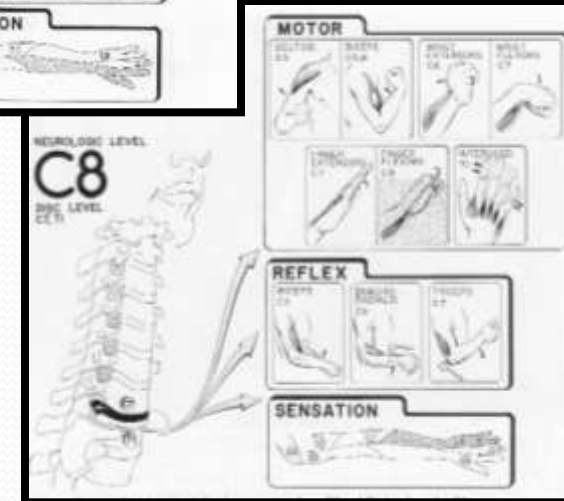
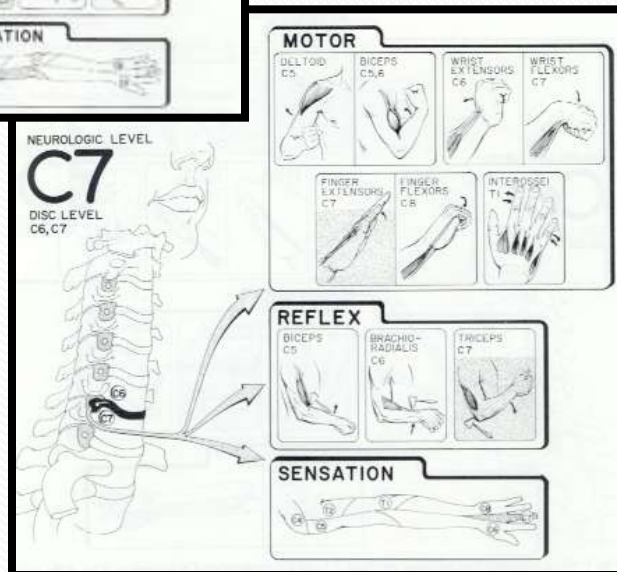
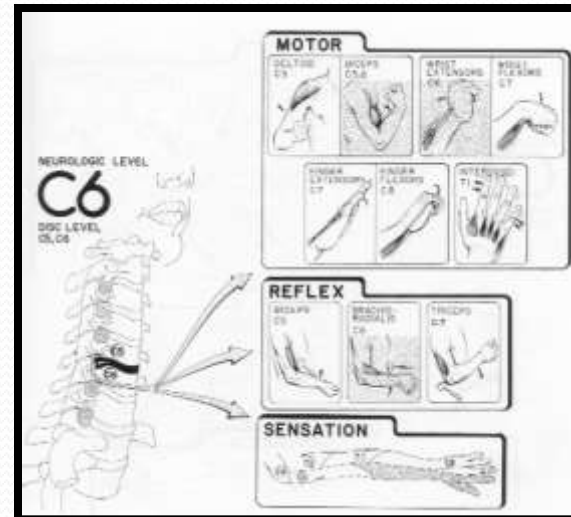
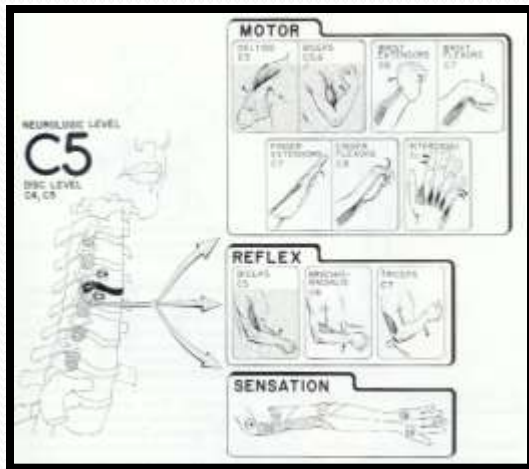
- Groups of muscles innervated by a single spinal segment.

- **Reflexes**

- Tests the pathway from the muscle to the spine and back to the muscle.

- The dermatomes, myotomes and reflexes provide information as to the level of involvement.

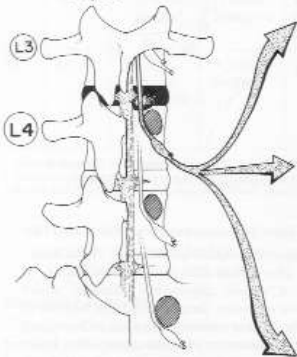
Dermatome, Myotomes and Reflexes



NEUROLOGIC LEVEL

L4

DISC LEVEL
L3, L4



MOTOR

TIBIALIS ANTERIOR
L4



EXTENSOR DIGITORUM LONGUS
L5



PERONEUS LONGUS
S1



REFLEX

PATELLAR TENDON
L4



ACHILLES TENDON
S1



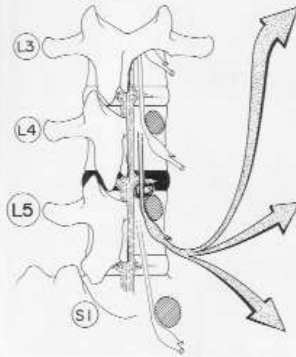
SENSATION



NEUROLOGIC LEVEL

L5

DISC LEVEL
L4, L5



MOTOR

TIBIALIS ANTERIOR
L4



EXTENSOR DIGITORUM LONGUS
L5



PERONEUS LONGUS
S1



REFLEX

PATELLAR TENDON
L4



ACHILLES TENDON
S1



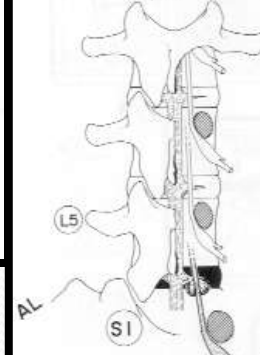
SENSATION



NEUROLOGIC LEVEL

S1

DISC LEVEL
L5, S1



MOTOR

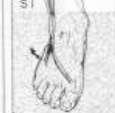
TIBIALIS ANTERIOR
L4



EXTENSOR DIGITORUM LONGUS
L5



PERONEUS LONGUS
S1



REFLEX

PATELLAR TENDON
L4



ACHILLES TENDON
S1



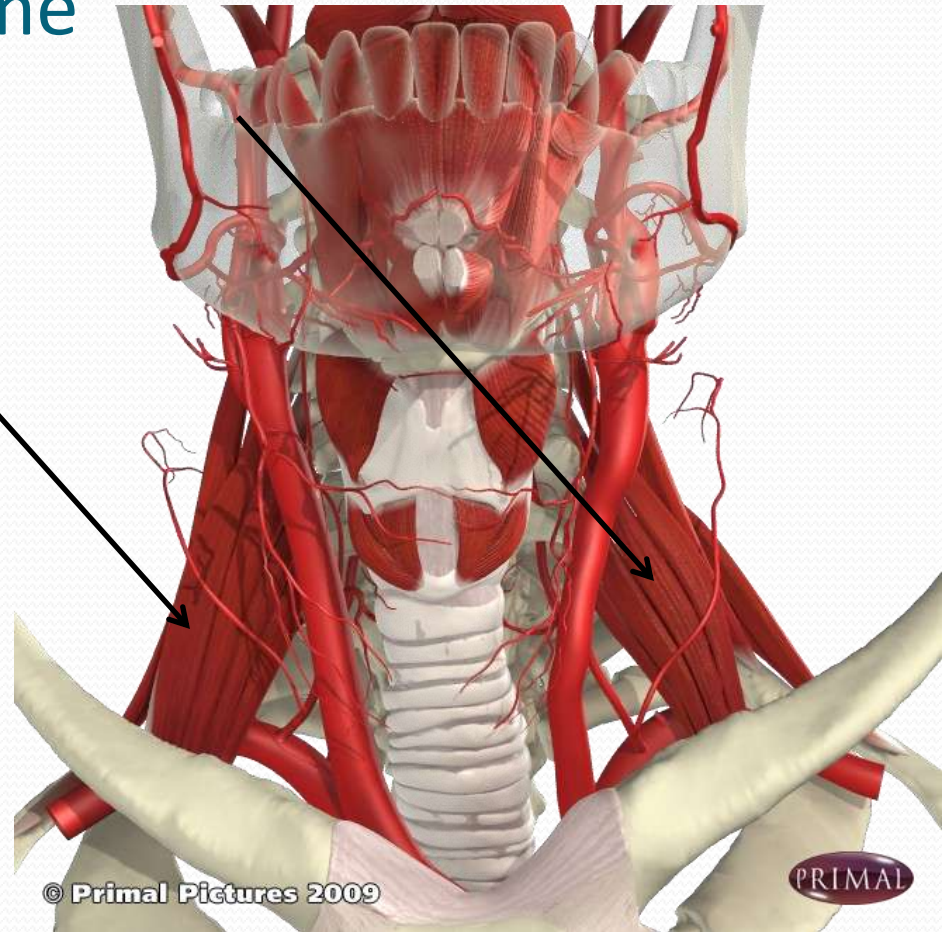
SENSATION



Upper Extremity Entrapment / Tunnel Syndromes

Anterior Scalene Syndrome

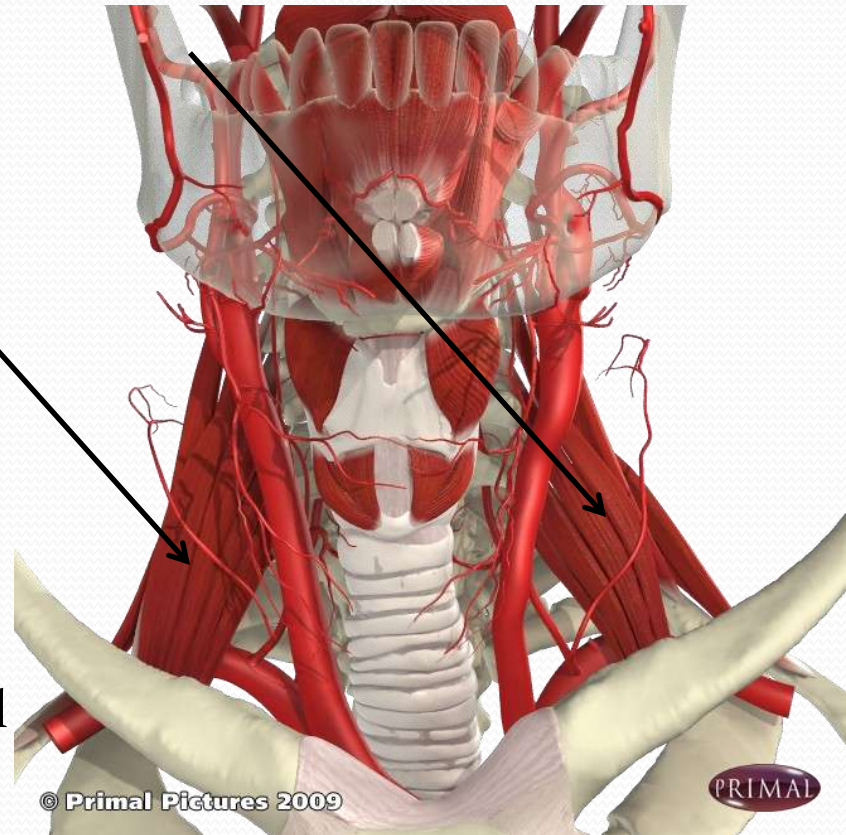
- Etiology
 - Poor posture, prolonged work above head, wearing of knapsack, advanced age produces lowered or anteriorly placed shoulder, increasing distance the nerves and vessels have to travel
 - Women have lower shoulder position
 - Carrying heavy objects and increased respiratory excursion tension over scalene foramen
 - Cervical rib raises floor of foramen/ narrows
 - Scalenus hypertrophy, fibrous bands, insertions narrows sulcus



Upper Extremity Entrapment / Tunnel Syndromes

Anterior Scalene

- Clinical Signs and Symptoms
 - Pain in fingers, hand, forearm, arm, shoulder, with paresthesias and hyperesthesias especially in cervical spine and 1st thoracic nerve root dermatomes
 - Numbness in fingers, hand and forearm
 - Severe gangrene and ulcerations
 - Ischemic pain, weakened grip, impaired finger function
 - Distal to site of compression can lie aneurysm, thrombi, obliterate terminal finger arteries and severe pain
 - Adson's sign



Upper Extremity Entrapment / Tunnel Syndromes

Anterior Scalene

- **Adson's Test**
- aka Scalene Maneuver, Scalenus Anticus Test
- **Procedure:** This is probably the most common test for thoracic outlet syndrome. The patient is seated and the head is rotated to face the tested shoulder. The patient then extends the head while the examiner externally rotates and extends the shoulder. The examiner locates the radial pulse and the patient is instructed to take a deep breath and hold it. If the maneuver is negative, repeat it by having the patient turn the head to the Contra lateral side.
- **Positive Finding:** A disappearance of the pulse indicates a positive test. The test is significant for identifying neurovascular compression of the subclavian artery and brachial plexus of the ipsilateral side, which are commonly caused by scalenus anticus or cervical rib thoracic outlet syndromes.



Upper Extremity Entrapment / Tunnel Syndromes

Anterior Scalene

- Treatment
 - Remove underlying biomechanical cause
 - PT- increase tone in shoulder to decrease tone in C/S musculature, massage to anterior scalene.
 - Stretch anterior scalene musculature
 - Immobilization
 - Ice, US, Muscle Stimulation to fatigue musculature
 - Exercises to remodel the cervical lordotic curve
 - Manipulation of the cervical spine
 - Corticosteroid injections
 - Surgical decompression

Types of Treatment

Stretching Using Contract Relax

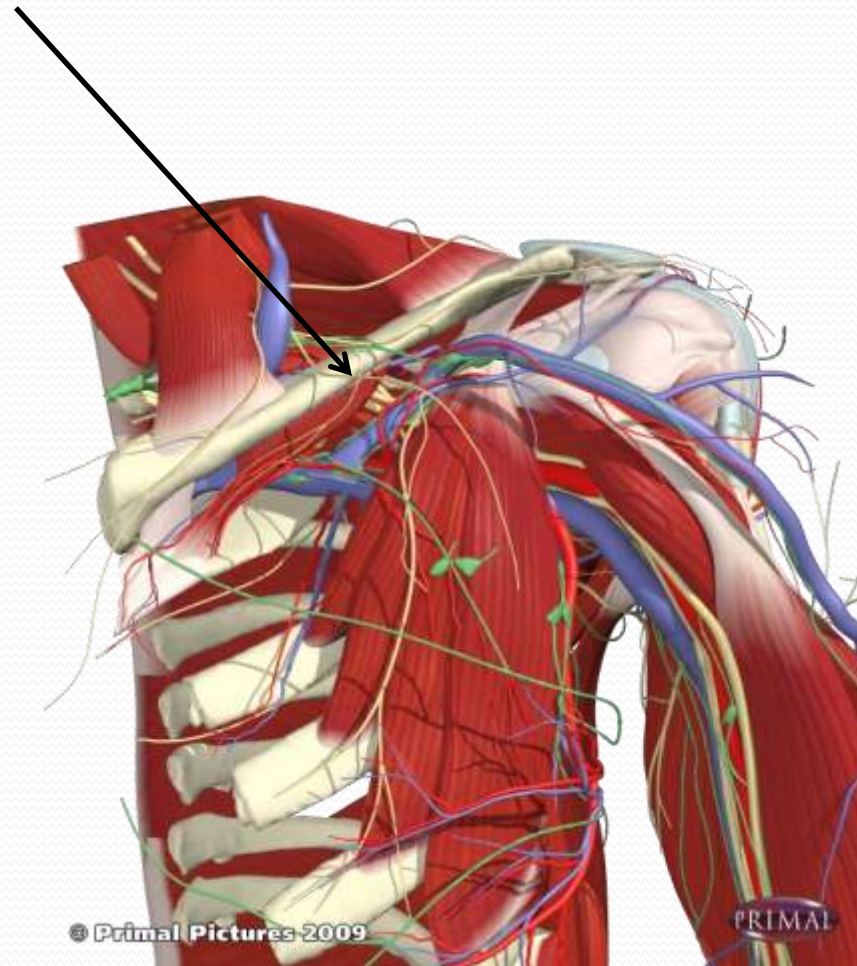


Stretches of the cervical spine musculature

Upper Extremity Entrapment / Tunnel Syndromes

Costoclavicular Syndrome

- Etiology
 - Congenital anomalies
 - Raising arm rotates clavicle posteriorly into costoclavicular space
 - Displacing shoulder posteriorly and inferiorly rotates clavicle post.
 - Inhaling deeply
- Clinical Signs and Symptoms
 - Similar to ant. Scalene syndrome
 - Vascular symptoms dominate
 - Radial pulse evaluation



Upper Extremity Entrapment / Tunnel Syndromes

Costoclavicular Syndrome

- **Costoclavicular Maneuver**
- **Procedure:** The patient is seated and the examiner palpates the radial pulse while drawing the patient's shoulder down and into extension. The patient flexes the cervical spine (chin to chest).
- An alternative method is to have the patient actively abduct the shoulders and flex the elbows to 90 degrees. The examiner palpates the radial pulse of the affected arm and externally rotates the arm. Disappearance of the pulse indicates that thoracic outlet syndrome may occur. Before the arm is externally rotated in this position, a subtle sign of thoracic outlet syndrome may occur. This sign involves blanching of the hand of the affected arm. The examiner should use the unaffected side as a control.
- **Positive Finding:** A positive test suggests thoracic outlet syndrome. A positive result is more pronounced in patients who complain of symptoms wearing a backpack or a heavy coat.



Upper Extremity Entrapment / Tunnel Syndromes

Costoclavicular Syndrome

- Treatment
 - Remove underlying biomechanical cause (lighter back pack, or use pull cart instead of a back pack, etc.)
 - PT- increase tone in upper trapezius muscle.
 - Stretch cervical spine muscles, and Pectoralis Minor muscles
 - Immobilization
 - Ice, US, Muscle Stimulation to fatigue musculature
 - Exercises to remodel the cervical lordotic curve
 - Manipulation of the cervical spine
 - Massage to anterior chest and cervical muscles

Types of Treatment

Stretching Using Contract Relax



Stretches of the cervical spine musculature

Stretches for Pectoralis Minor



Position of elbows are below, even and above the shoulders with each position stretch.

Massage



Pectoralis Minor and Subclavius Muscle Stretching with Deep Stroking Massage

Exercises / Strengthening

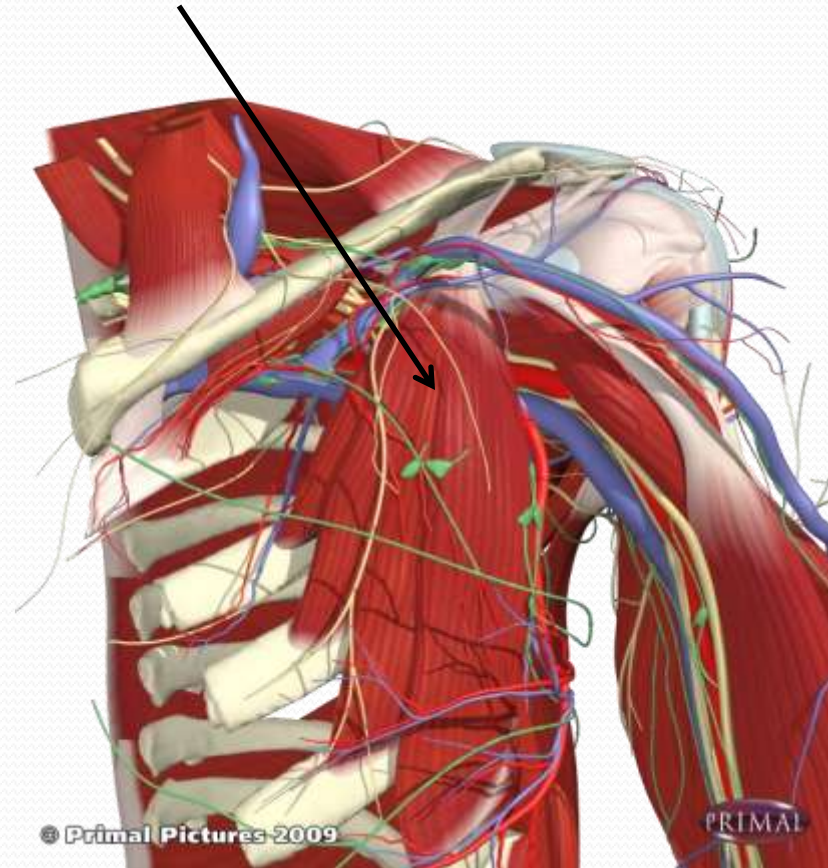


Strengthen Rhomboid Muscles

Upper Extremity Entrapment / Tunnel Syndromes

Hyperabduction Syndrome

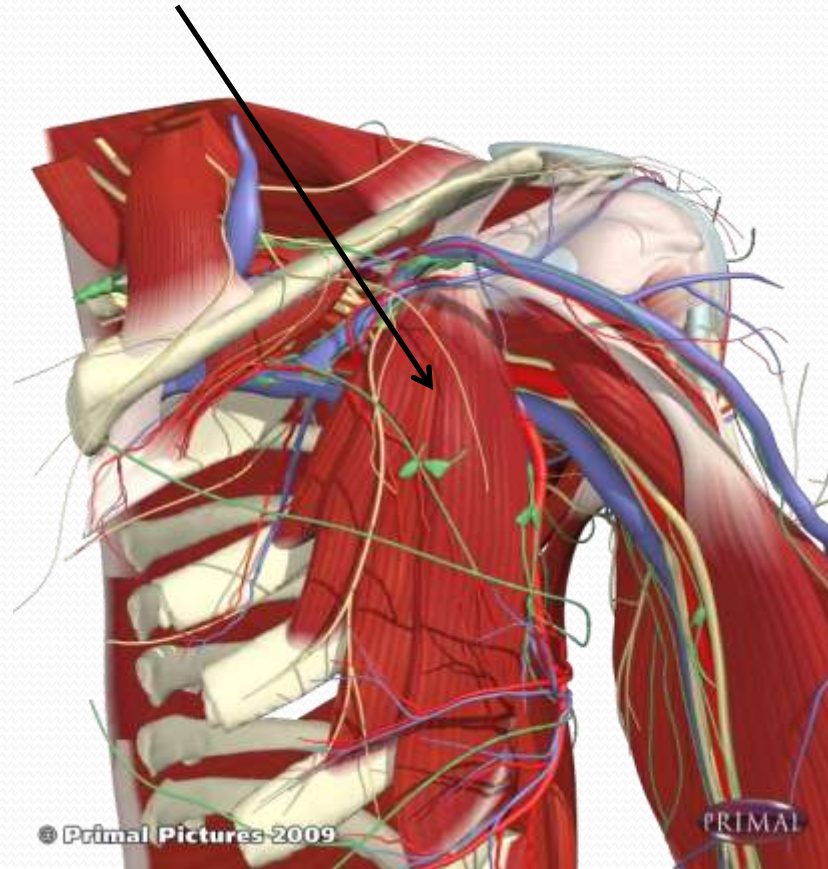
- Etiology
 - Compression while passing through costoclavicular tunnel
 - Compression while passing under pectoral minor tendon at insertion
 - Compression by pectoralis minor muscle and humeral head
 - Characteristic position is 180° abduction & elbow flex.
 - Commonly occurs during sleep or in professionals such as electricians, painters, bricklayers, or masons



Upper Extremity Entrapment / Tunnel Syndromes

Hyperabduction Syndrome

- Clinical Signs and Symptoms
 - Pain , paresthesia, numbness first in fingers and later in hand
 - May resemble Raynauds's neurological symptoms usually absent b/c patients correct arm position as paresthesia and pain develop so nerve compression lasts for a short time



Upper Extremity Entrapment / Tunnel Syndromes

Hyperabduction Syndrome

- Treatment
 - Remove underlying biomechanical cause
 - Exercise to increase tone in mid back muscles.
 - Stretch the Pectoralis Minor Muscles
 - Ice inflamed Pectoralis Minor Muscle
 - Deep stroking massage to Pectoralis Minor Muscle
 - Manipulation of the shoulder, neck and clavicle
 - Avoiding hyperabduction
 - Change in work habits

Stretches for Pectoralis Minor



Position of elbows are below, even and above the shoulders with each position stretch.

Massage



Pectoralis Minor Muscle Stretching with Deep Stroking Massage

Exercises / Strengthening

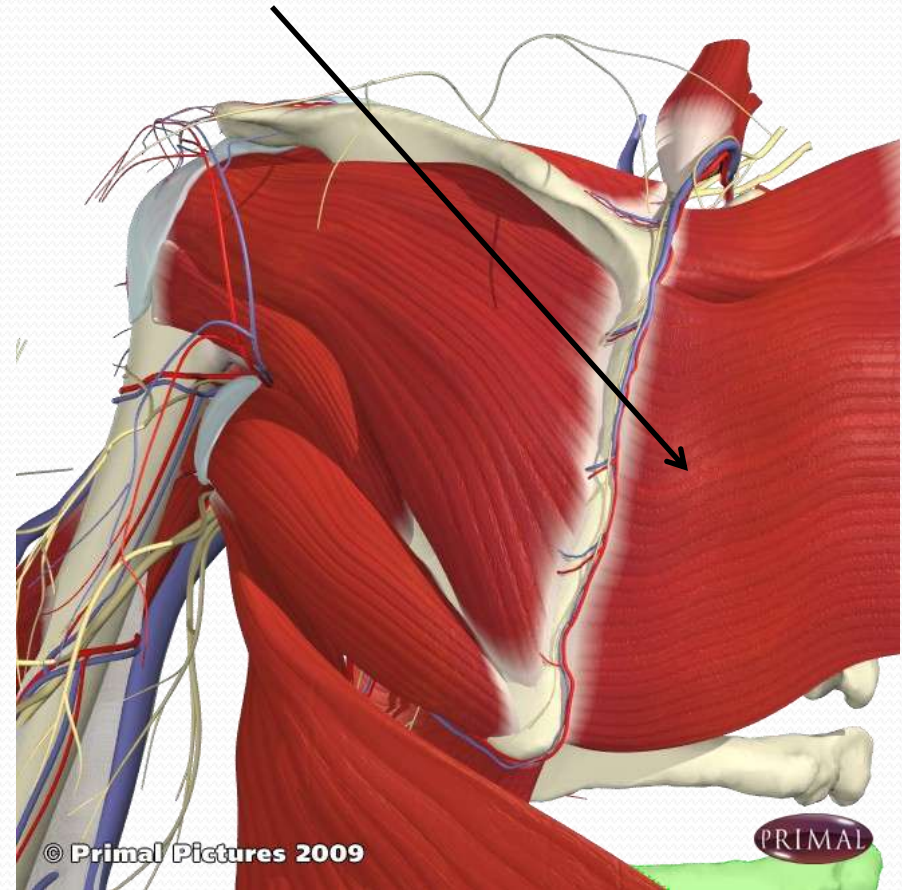


Strengthen Rhomboid Muscles

Upper Extremity Entrapment / Tunnel Syndromes

Scapulocostal Syndrome

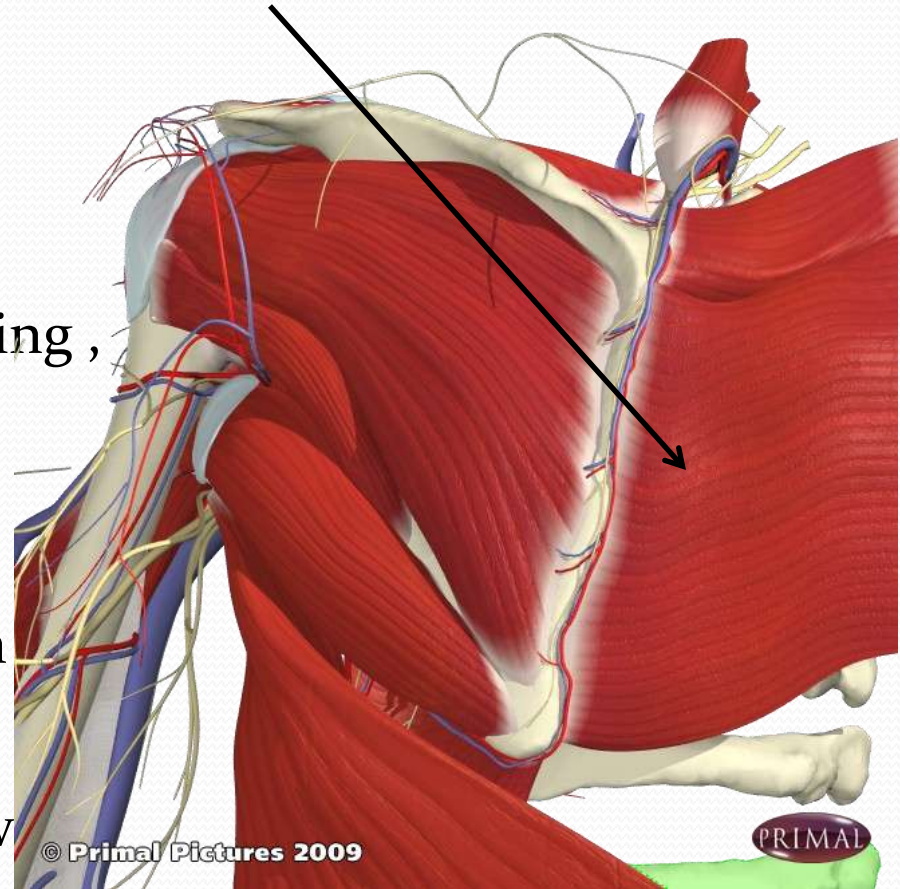
- Etiology (Exact cause unknown)
 - Poor posture – idiopathic, anatomical or functional deformity secondary to neck or shoulder injury, static anatomic predilection
 - Secondary to trauma or prolonged immobilization weakens muscle girdle
 - Shoulder subluxation, humeral fractures, rotator cuff injuries



Upper Extremity Entrapment / Tunnel Syndromes

Scapulocostal Syndrome

- Clinical Signs and Symptoms
 - Pain in neck, upper arm, and chest
 - Shoulder-girdle spasm
 - Pain culminates toward evening , but not aggravated by arm or shoulder motion
 - No sensory deficit nor motor paralysis or atrophy
 - May reveal localized point on med. Scapular border where pressure reproduces pain
 - Scapular elevation off chest with a forward stretch



Upper Extremity Entrapment / Tunnel Syndromes

Scapulocostal Syndrome

- Treatment
 - Remove underlying biomechanical cause
 - Stretch cervical spine muscles, and Pectoralis Minor Muscles
 - Increase tone in mid back muscles after anterior chest muscles are elongated (stretched).
 - Immobilization
 - Ice or US depending on the phase of care.
 - Muscle Stimulation to fatigue musculature
 - Lift the scapula from the thoracic region to stretch the musculature
 - Manipulation of the Thoracic Spine, Scapula and Shoulder
 - Postural modification
 - Cooling trigger zones



Fatigue and elongate the mid back musculature using a deep tissue stroke.



Stretch the anterior chest region

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Exercises / Strengthening



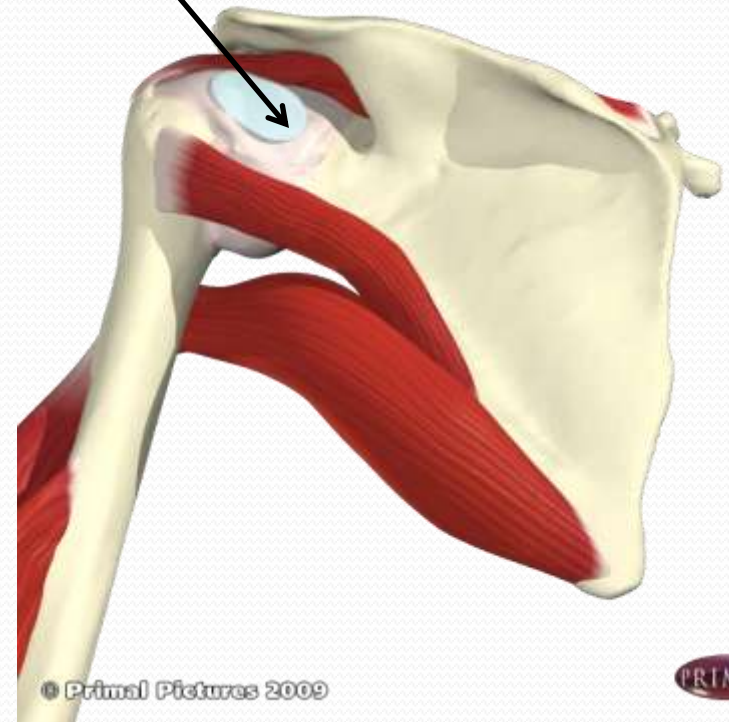
Strengthen Rhomboid Muscles

After the anterior chest muscles are elongated

Upper Extremity Entrapment / Tunnel Syndromes

Suprascapular nerve syndrome

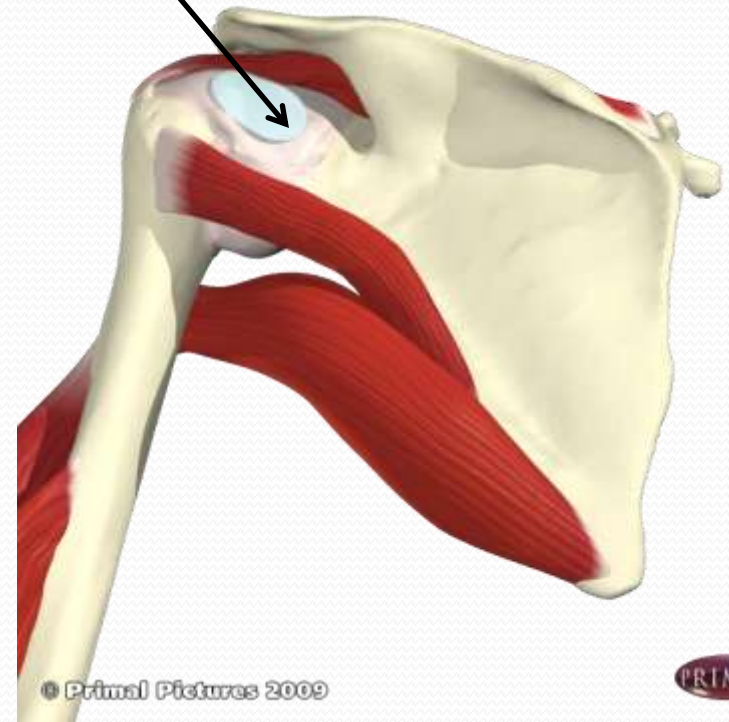
- Etiology
 - Scapular fracture, bony or soft tissue injuries in shoulder
 - Chronic mechanical irritation due to repetitive nerve compression from stretch
 - Sleeping with arms above head, painters, electricians, volleyball and tennis players, weight lifters, and boxers



Upper Extremity Entrapment / Tunnel Syndromes

Suprascapular nerve syndrome

- Clinical Signs and Symptoms
 - Pain doesn't localize
 - Pain ranges from deep and blunt to sharp with radiation down radial nerve distribution (suprascapular and radial nerve have common root origin)
 - Pain is most common over posterior portion of shoulder along border of traps with pain worsening at night
 - AROM and PROM reproduces pain
 - Painful spot along lateral third of upper border of traps over scapular notch
 - Motor symptoms such as supra/infraspinatus hypotrophy compensation teres minor hypertrophy
 - Pain in AC joint and reduced sensitivity to vibration



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Upper Extremity Entrapment / Tunnel Syndromes

Suprascapular nerve syndrome

- Treatment
 - Avoid all activities that stretch nerve
 - Ice to reduce inflammation
 - Manipulation of the Thoracic Spine, Shoulder and Scapula
 - Deep tissue strokes to elongate the musculature in the region.
 - Infiltration of scapular notch with anesthetics and corticosteroids using fluoroscopic guidance
 - Surgical release of transverse scapular ligament, opening of scapular foramen, neurolysis



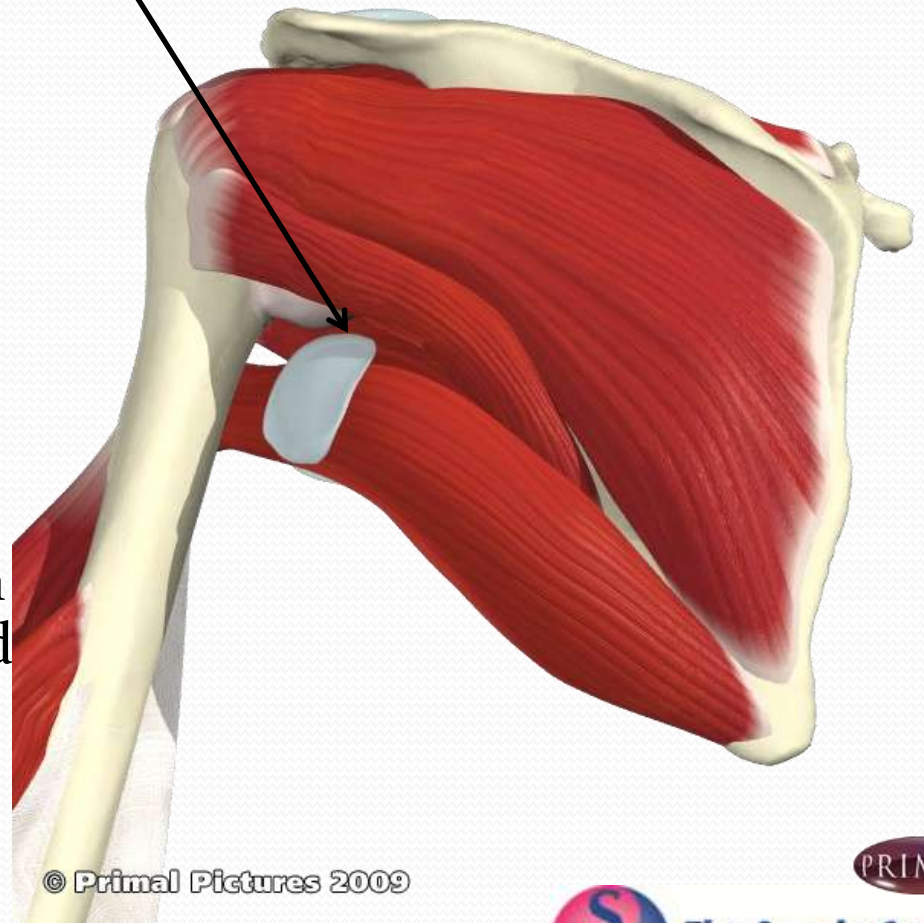
Terres Major and Minor

Deep stroking massage to the region to fatigue the muscles.

Upper Extremity Entrapment / Tunnel Syndromes

Lateral Auxiliary Hiatus syndrome

- Etiology
 - Fracture of humerus and scapula, shoulder dislocation
 - Local tumors, organizing hematomas, simple fracture callus narrows auxiliary hiatus
 - Sleeping with shoulder in abduction, the medial and lateral auxiliary hiatuses decrease in size
 - Teres hypertrophy

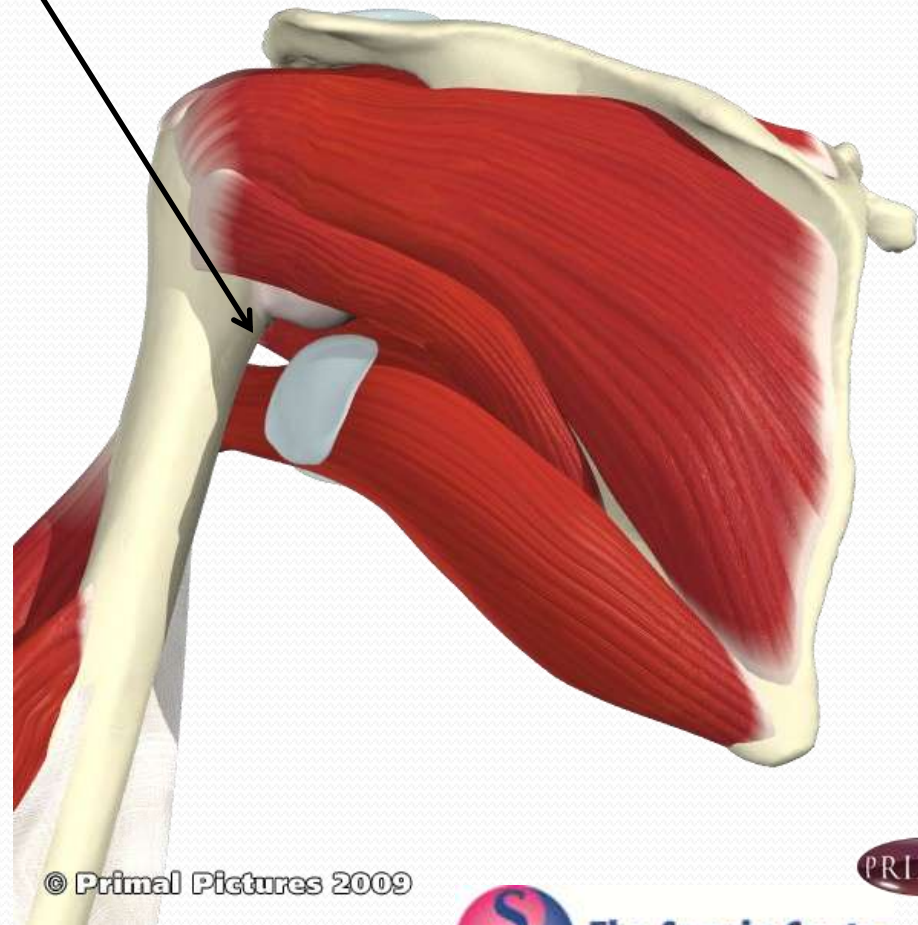


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Upper Extremity Entrapment / Tunnel Syndromes

Lateral Auxiliary Hiatus syndrome

- Clinical Signs and Symptoms
 - Paresthesias and hypesthesias around shoulder and upper arm
 - Deltoid atrophy
 - EMG studies may indicate peripheral nerve lesions proximal to deltoid muscle, degree of entrapment and reinnervation following removal of compressive lesion
 - Angiography may show blockage of posterior circumflex artery with arm in 60° abduction



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Upper Extremity Entrapment / Tunnel Syndromes

Lateral Auxiliary Hiatus syndrome

- Treatment
 - Immobilization (not in abduction)
 - Change underlying biomechanical causes of shoulder abduction
 - Manipulation of the Thoracic Spine, Scapula, and Shoulder
 - Ice or heat depending on the phase of healing
 - Deep tissue massage strokes to elongate the musculature
 - Failure to improve in 6 mo. Indicates need for surgical decompression

Upper Extremity Entrapment / Tunnel Syndromes

Lateral Auxiliary Hiatus syndrome



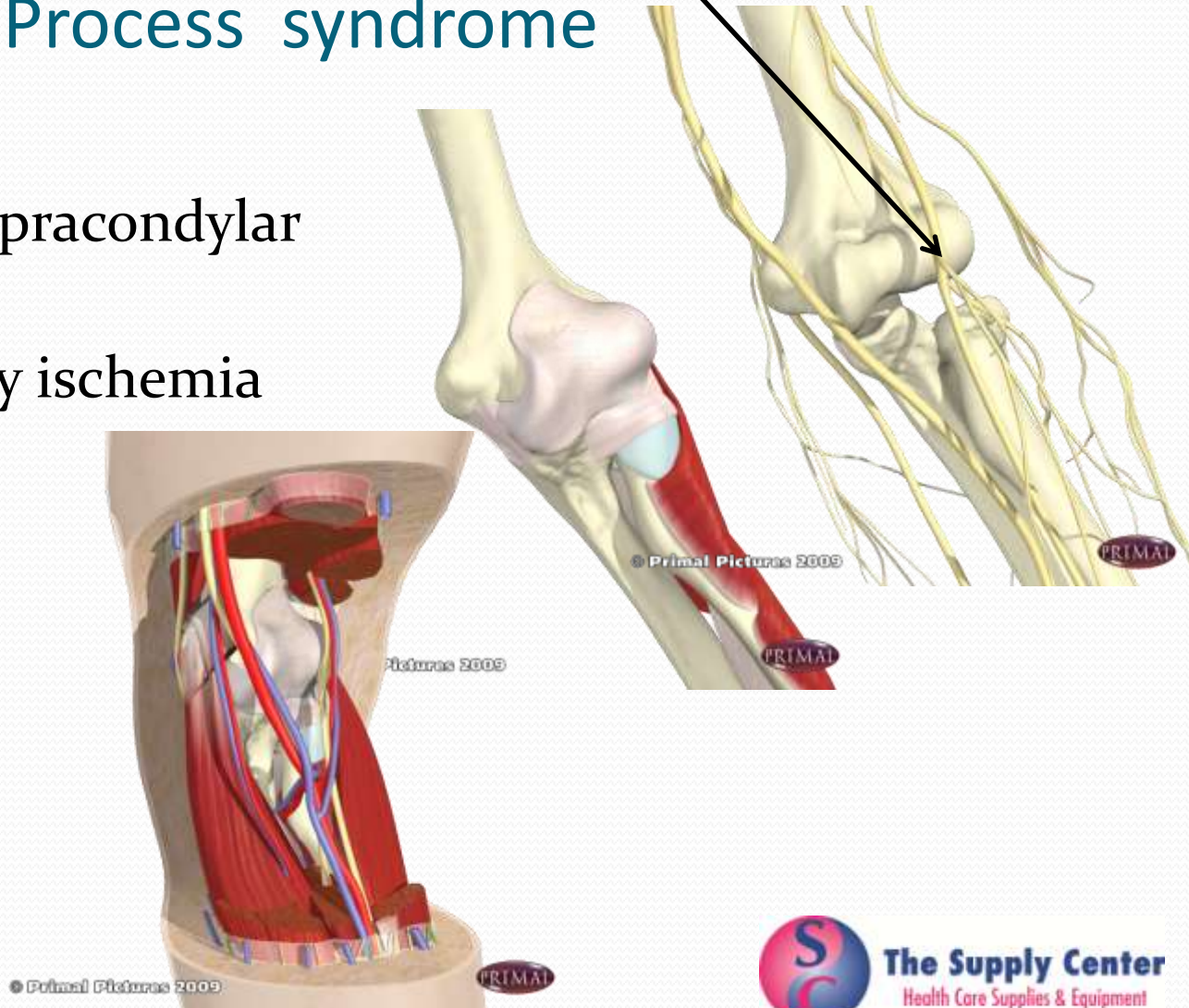
Terres Major and Minor

Deep stroking massage to the region to fatigue the muscles.

Upper Extremity Entrapment / Tunnel Syndromes

Supracondylar Process syndrome

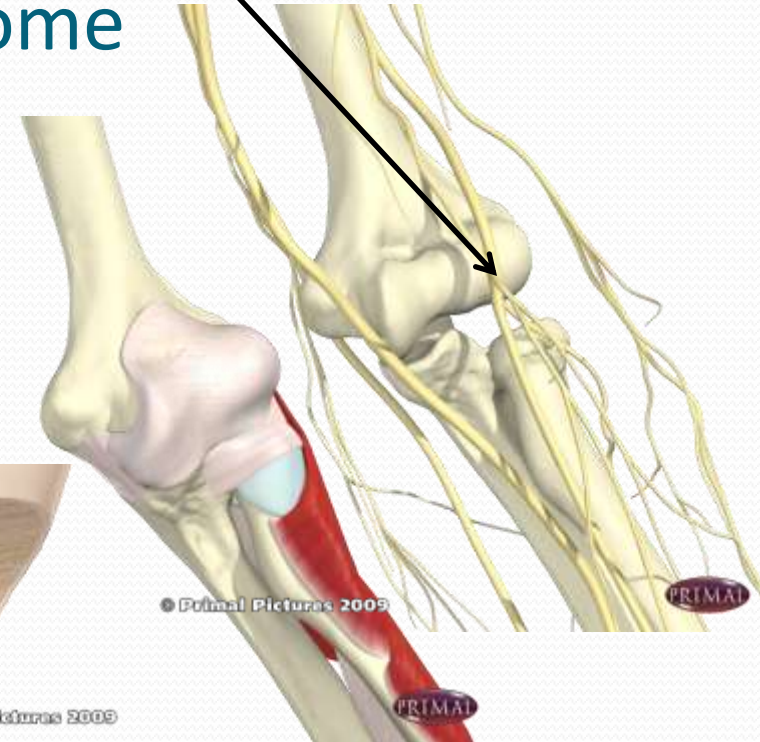
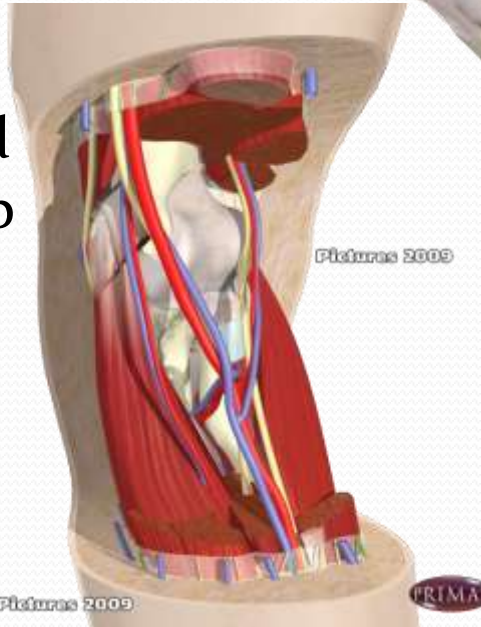
- Etiology
 - Fracture of supracondylar process
 - Brachial artery ischemia
 - Idiopathic



Upper Extremity Entrapment / Tunnel Syndromes

Supracondylar Process syndrome

- Clinical Signs and Symptoms
 - Pain and paresthesias in median nerve dermatomes, w/ deep blunt pain in area of compression
 - Pain increases at night and radiates to forearm, thumb and first three fingers
 - Decreased thumb opposition, flexion of first three fingers



Upper Extremity Entrapment / Tunnel Syndromes

Supracondylar Process syndrome

- Treatment
 - Stretch the forearm musculature
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation
 - Manipulation of the elbow
 - Immobilization of the forearm in pronation with elbow in 40° flexion
 - Surgery to remove supracondylar process

Types of Treatment

Stretching of the Forearms



Stretches for the forearm



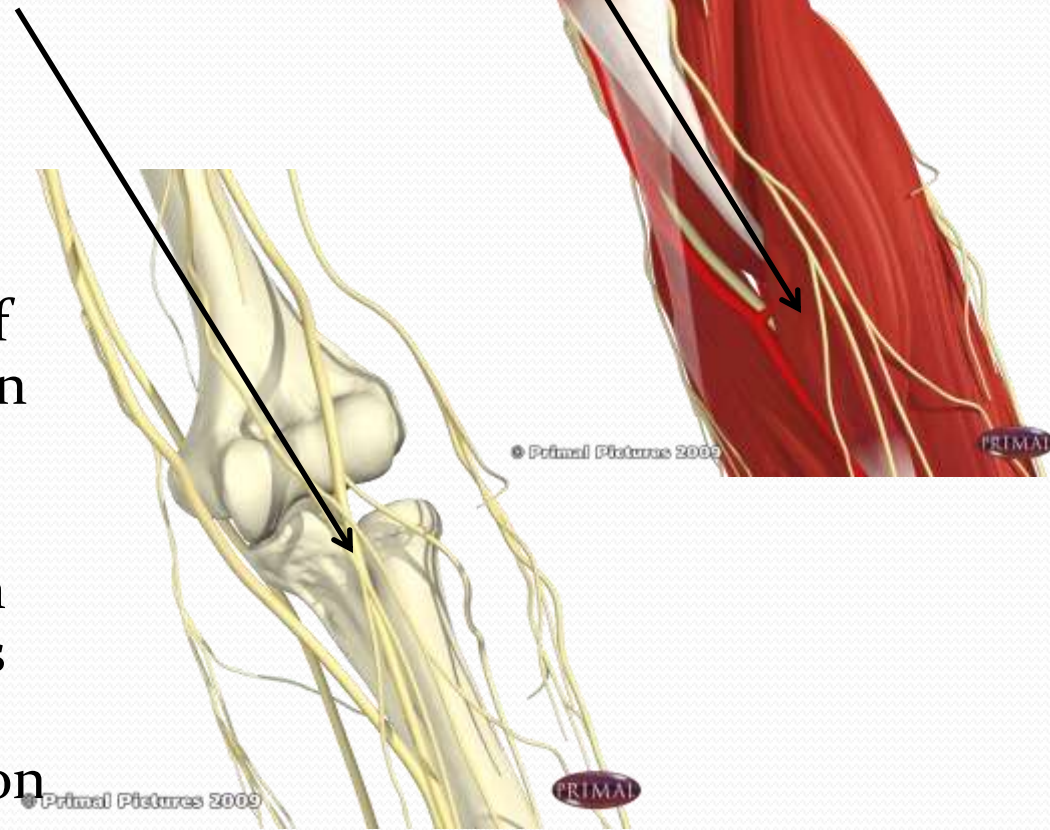
Forearm Flexor and Extensor Muscle Deep Stroking Massage with Stretches

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Upper Extremity Entrapment / Tunnel Syndromes

Pronator teres muscle syndrome

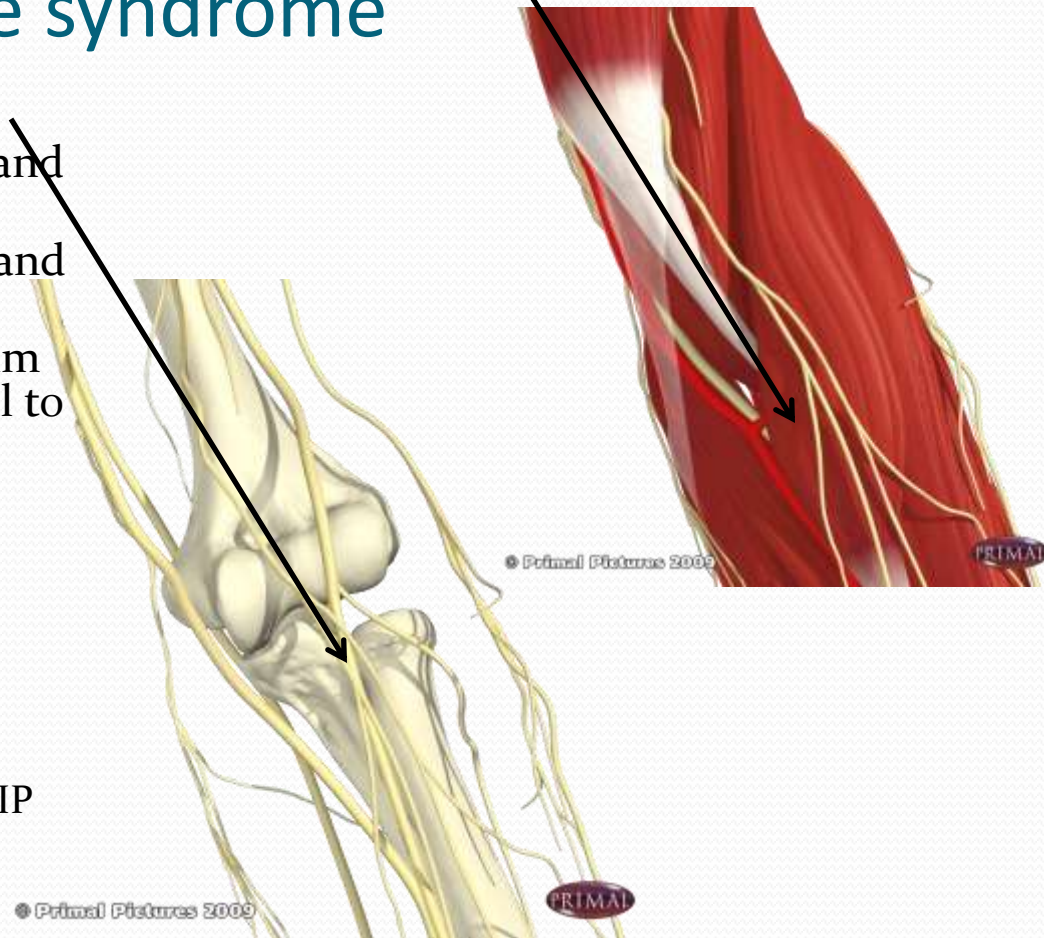
- Etiology
 - Myositis
 - Fibrous band
 - Forearm trauma
 - Dynamic relationship of the nerve and muscles in the forearm
 - Pushing cars with extending arms, sudden heavy lifting, doing jobs that require repetitive pronation and supination



Upper Extremity Entrapment / Tunnel Syndromes

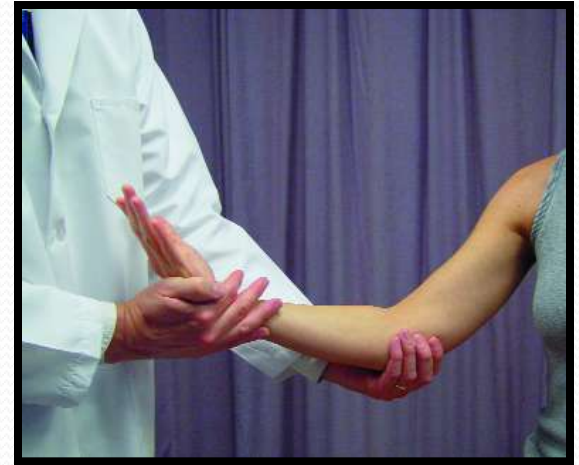
Pronator teres muscle syndrome

- Clinical Signs and Symptoms
 - Involves thenar muscles, wrist and finger flexors
 - Impaired thumb, index finger, and middle finger flexion
 - Sensory disturbances in the palm indicates compression proximal to the carpal tunnel
- Muscle tests
 - Resisted pronation w/ elbow extension indicates heads of pronator teres
 - Above with resisted flexion and supination indicates lacertus fibrosus
 - Above with resisted flexion of PIP of middle finger arch of Flexor Digitorum Superficialis muscle belly



Orthopedic Tests Elbow

- **Golfer's Elbow Test**
- Procedure: The patient is seated and the examiner flexes the patient's elbow slightly and supinates the hand against resistance.
- Positive Finding: Pain over the medial epicondyle suggests **medial epicondylitis**.



Upper Extremity Entrapment / Tunnel Syndromes

Pronator teres muscle syndrome

- Treatment
 - Reduction in physical activity
 - Forearm immobilization in neutral between supination and pronation
 - Corticosteroid injection
 - Stretch the forearm musculature
 - Manipulation of the elbow
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation.

Types of Treatment

Stretching of the Forearms



Stretches of the forearm



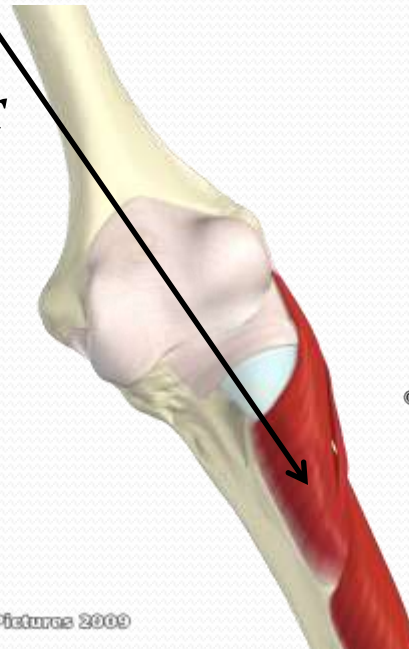
Forearm Flexor and Extensor Muscle Deep Tissue Massage with Stretching

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Upper Extremity Entrapment / Tunnel Syndromes

Supinator muscle syndrome

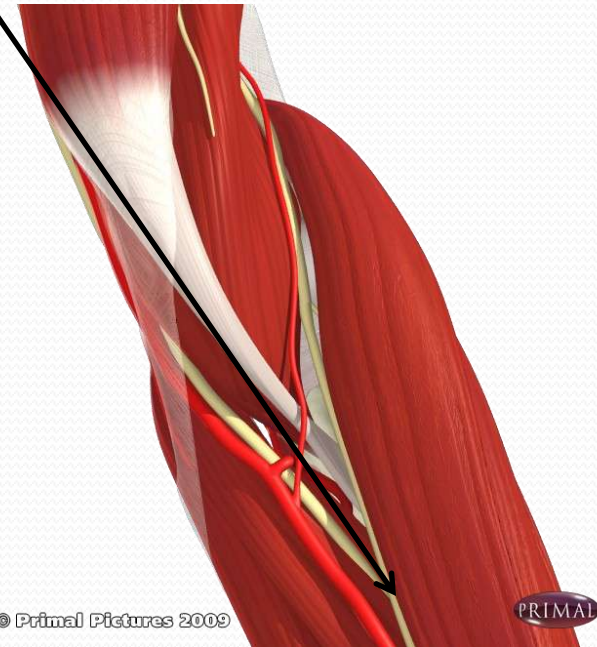
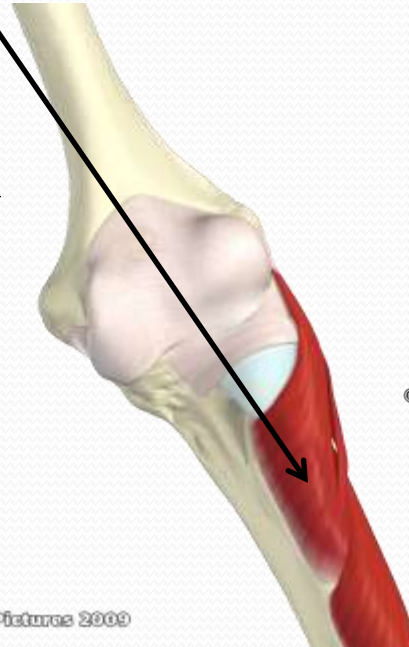
- Etiology
 - Compression and stretching of nerve over Froshe's arcade occurs with repeated pronation, forearm extension and simultaneous wrist flexion
 - ECRB compression



Upper Extremity Entrapment / Tunnel Syndromes

Supinator muscle syndrome

- Clinical Signs and Symptoms
 - Deep pain in the posterior or dorsum of the forearm followed by gradual fist weakness and local pain on compression distal to lateral humeral epicondyle
 - Finger weakness, thumb being last digit affected
 - No sensory deficits
 - Elbow and wrist motion remain unaffected
 - Often mistaken for tennis elbow



Upper Extremity Entrapment / Tunnel Syndromes

Supinator muscle syndrome

- Treatment
 - Avoid repetitive trauma to nerve in tunnel
 - Stretch the forearm musculature
 - Manipulation of the elbow
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation.
 - Surgical treatment should not be postponed too long since irreversible nerve damage may occur

Types of Treatment

Stretching of the Forearms



Stretches of the forearm

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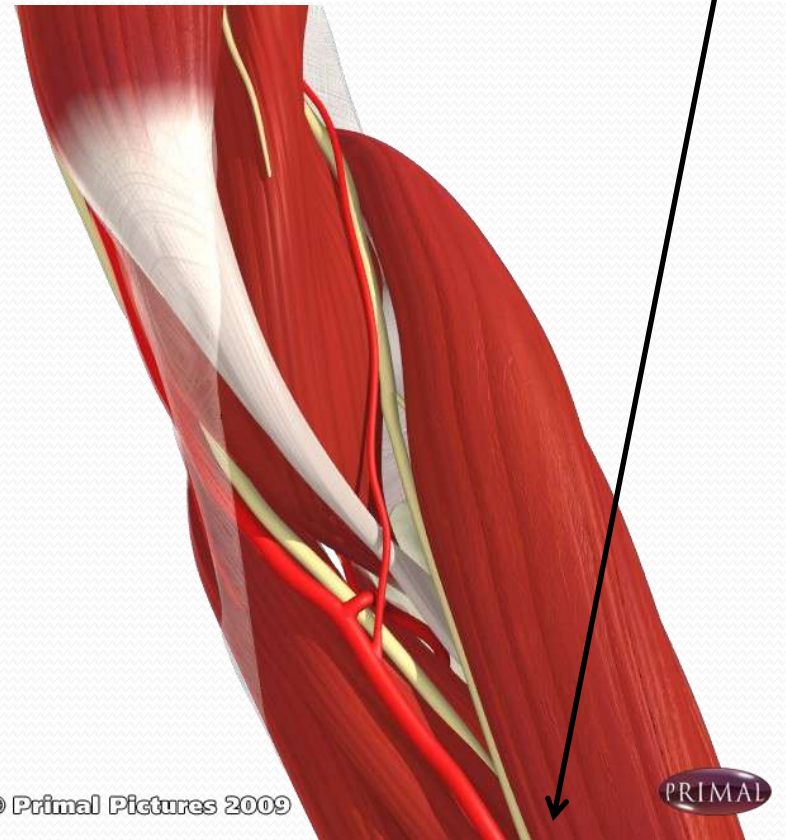
Forearm Flexor and Extensor Muscle Stretches with Deep Tissue Massage

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Upper Extremity Entrapment / Tunnel Syndromes

Supinator anterior interosseous muscle syndrome

- Etiology
 - Median nerve tumors, fibrous anomalies of FPL and FDS
 - Compression within the main trunk of the median nerve proximal to the elbow



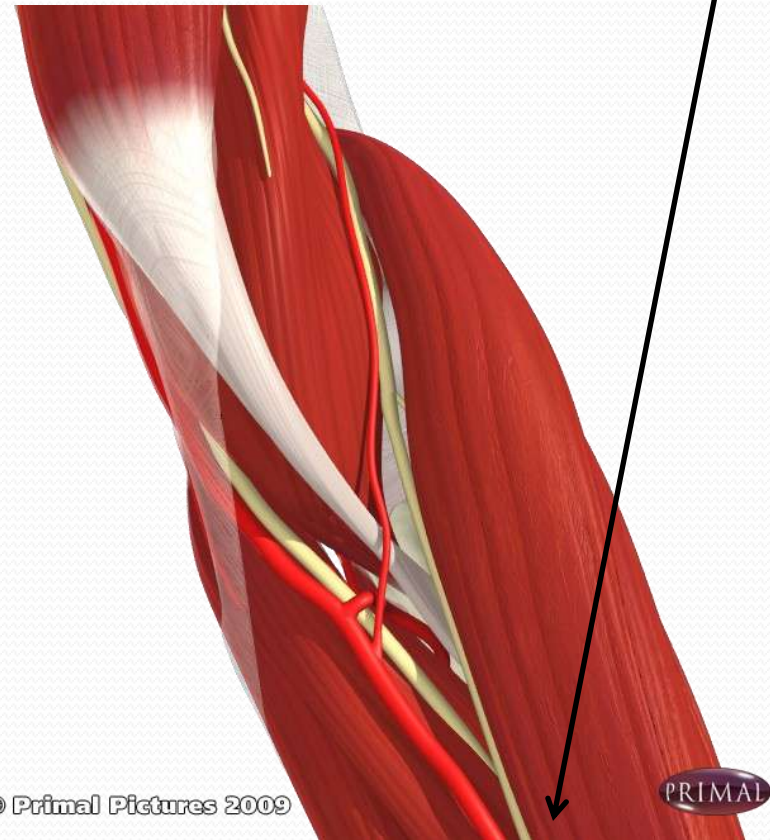
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Upper Extremity Entrapment / Tunnel Syndromes

Supinator Anterior interosseous muscle syndrome

- Clinical Signs and Symptoms
 - Inability to pinch between thumb and index finger pinch sign
 - Opposition of thumb and finger flexion of 3rd, 4th , and 5th digits remain intact
 - Ability to write is usually lost
 - Patient can't clench fist
 - Occasional weakness of pronator quadratus
 - Dull pain into prox. third of forearm that is aggravated by radial pressure at the level of the tendinous arch of the FDS
 - No sensory loss



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Upper Extremity Entrapment / Tunnel Syndromes

Supinator Anterior interosseous muscle syndrome

- Treatment
 - Stretch the forearm musculature
 - Manipulation of the elbow
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation.
 - Conservative treatment- maximum 6 mo. after onset

Types of Treatment

Stretching of the Forearms



Stretches of the Forearm

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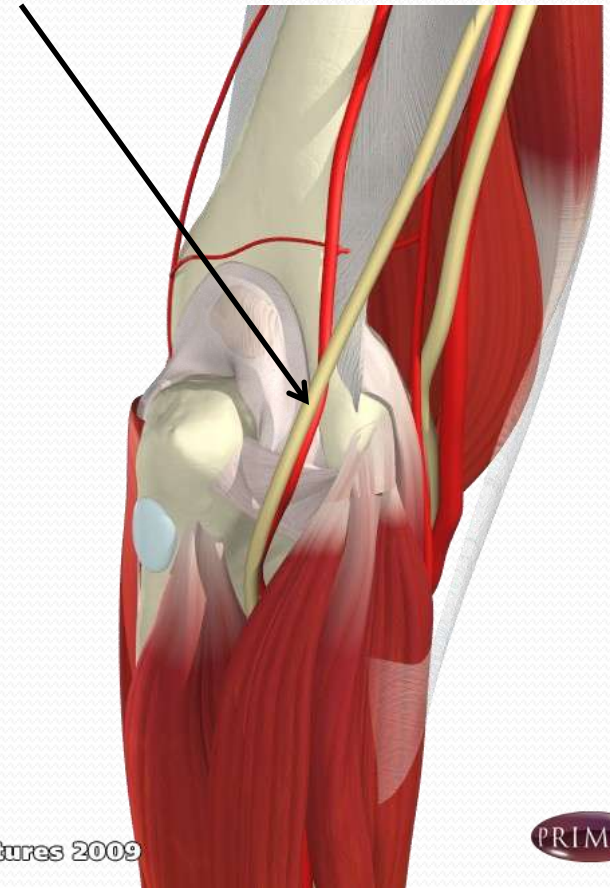
Forearm Flexor and Extensor Muscle Stretching with Deep Tissue Massage

800-549-5993 www.TheSupplyCenter.com

Upper Extremity Entrapment / Tunnel Syndromes

Sulcus ulnaris muscle syndrome

- Etiology
 - Trauma
 - Rheumatic changes
 - Peaks between 20-30 yrs with trauma as predominating cause
 - Peak between 50-60 years with rheumatic and DJD predominating
 - Cubitus valgus
 - Leaning on elbows
 - Microtrauma or repetitive nerve stretches (baseball, construction, boxing, javelin throwing)



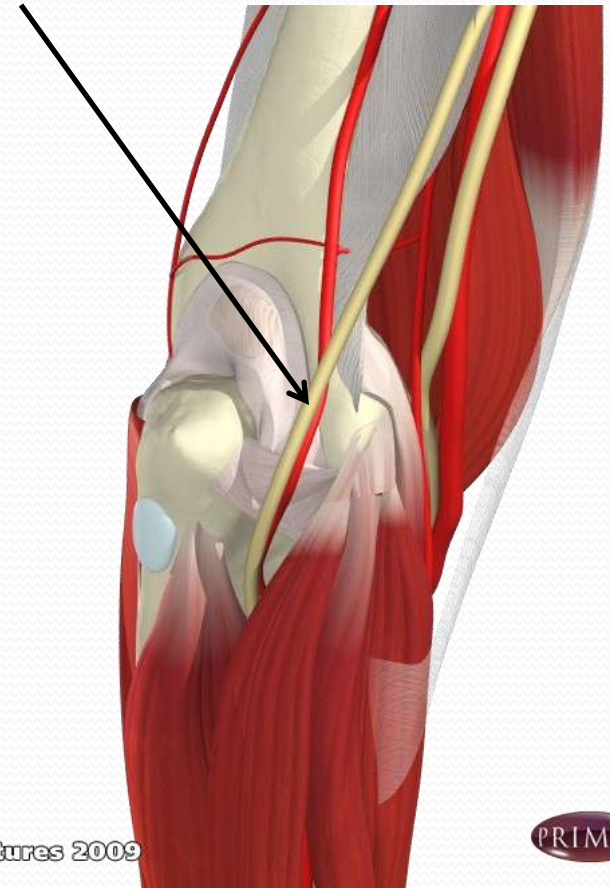
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Upper Extremity Entrapment / Tunnel Syndromes

Sulcus ulnaris muscle syndrome

- Clinical Signs and Symptoms
 - Paresthesias, hyperesthesia, hypesthesia and pain in sensory dermatome of ulnar nerve, and possibly near proximal shoulder with progression
 - Tinel's may not be positive
 - Muscle wasting first in web space followed by interossei and hypothenar
 - Claw- hand appearance

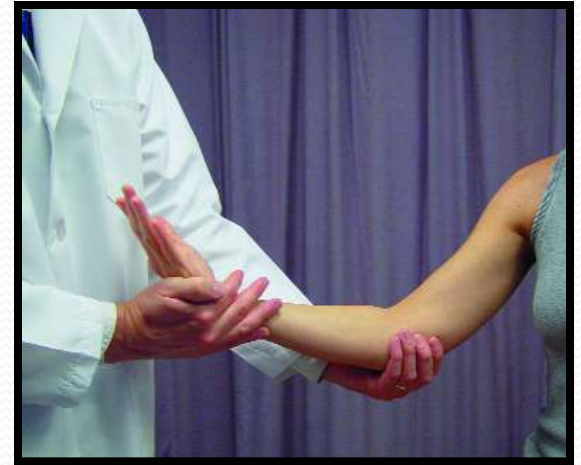


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Orthopedic Tests Elbow

- **Golfer's Elbow Test**
- Procedure: The patient is seated and the examiner flexes the patient's elbow slightly and supinates the hand against resistance.
- Positive Finding: Pain over the medial epicondyle suggests **medial epicondylitis**.



Upper Extremity Entrapment / Tunnel Syndromes

Sulcus ulnaris muscle syndrome

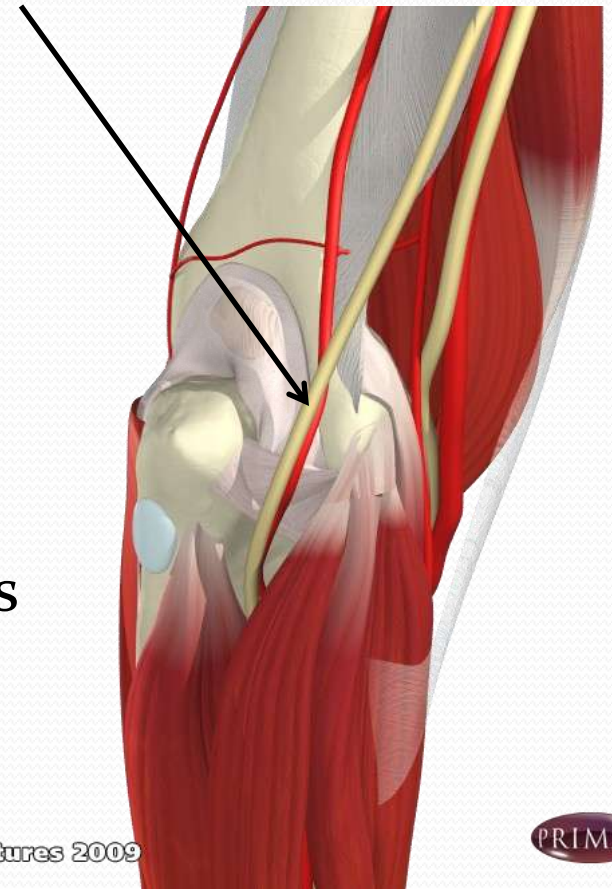
- Treatment
 - Rest,
 - Removal of causative agent
 - Corticosteroid injection
 - Stretch the forearm musculature
 - Manipulation of the elbow
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation.

Upper Extremity Entrapment / Tunnel Syndromes

Flexor carpi ulnaris muscle syndrome

a.k.a. cubital tunnel

- Etiology
 - Elbow flexion
 - Deep aponeurosis of Flexor Carpi Ulnaris potential site for nerve compression
 - Arthritis of the elbow
 - Loose bodies, other synovial changes



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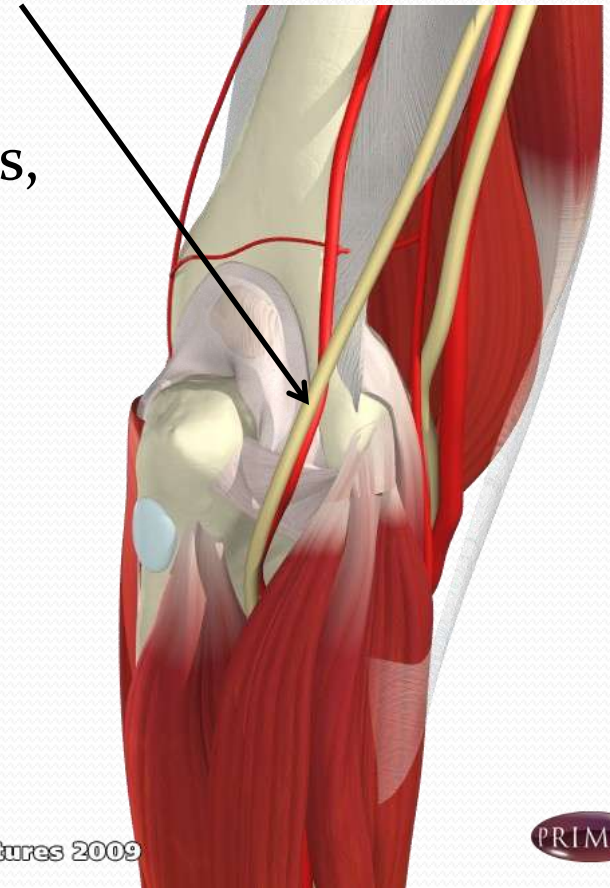
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Upper Extremity Entrapment / Tunnel Syndromes

Flexor carpi ulnaris muscle syndrome

a.k.a. cubital tunnel

- Clinical Signs and Symptoms
 - Gradual development of paresthesias, pain, and muscle weakness
 - End stage positive Froment's sign
 - Tinel's sign more distally

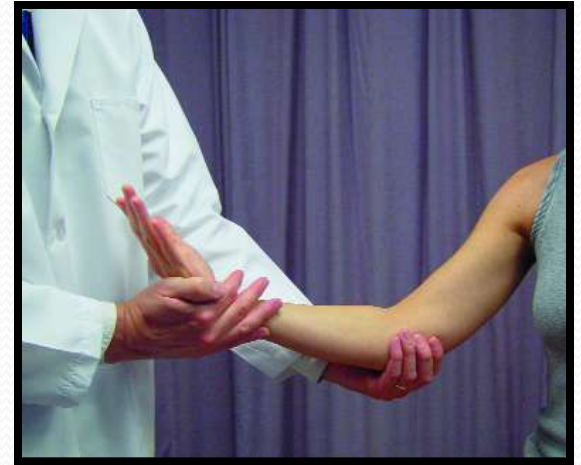


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Orthopedic Tests Elbow

- **Golfer's Elbow Test**
- Procedure: The patient is seated and the examiner flexes the patient's elbow slightly and supinates the hand against resistance.
- Positive Finding: Pain over the medial epicondyle suggests **medial epicondylitis**.



Orthopedic Tests Elbow

- **Tinel's Sign at the Elbow**
- aka Formication Sign, Distal Tingling on Percussion (DTP) Sign, Hoffman-Tinel Sign
- **Procedure:** The patient is seated with the elbow flexed to 90 degrees. The examiner taps the groove between the olecranon process and the lateral epicondyle with a neurologic reflex hammer. The same is repeated for the groove between the olecranon process and the medial epicondyle.
- **Positive Finding:** Hypersensitivity indicates **neuritis** or **neuroma** of the respective nerve. Tinel's sign present in the **medial** epicondylar groove suggests **ulnar** neuropathy. Tinel's sign present in the **lateral** epicondylar groove suggests involvement of the **superficial radial nerve**.



Upper Extremity Entrapment / Tunnel Syndromes

Flexor carpi ulnaris muscle syndrome

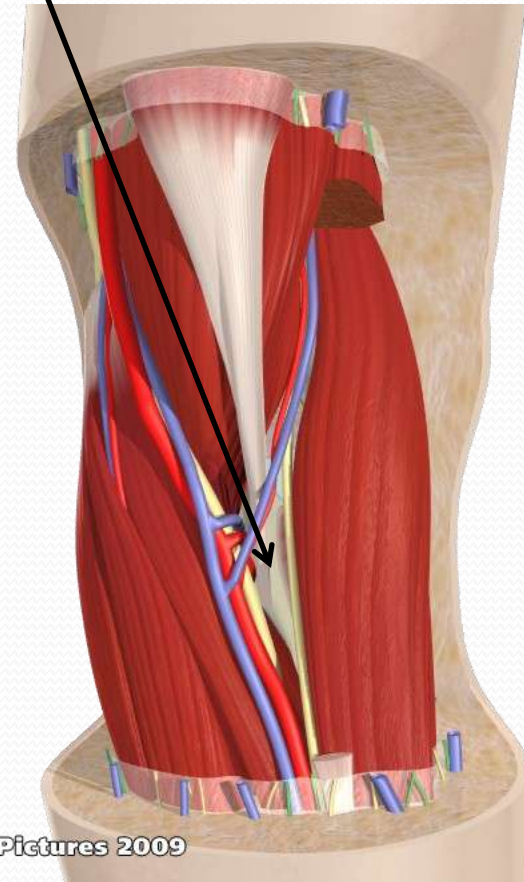
a.k.a. cubital tunnel

- Treatment
 - Short-term immobilization
 - Stretch the forearm musculature
 - Manipulation of the elbow
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation
 - Local corticosteroid injection

Upper Extremity Entrapment / Tunnel Syndromes

Musculotendinous nerve at elbow syndrome

- Etiology
 - The lateral free margin of the bicep aponeurosis compresses nerve against brachial fascia w/ elbow extension
 - When nerve passes below tendon of biceps before piercing brachial fascia
 - Hypertrophied coracobrachialis
 - Repeated pronation and supination of hand



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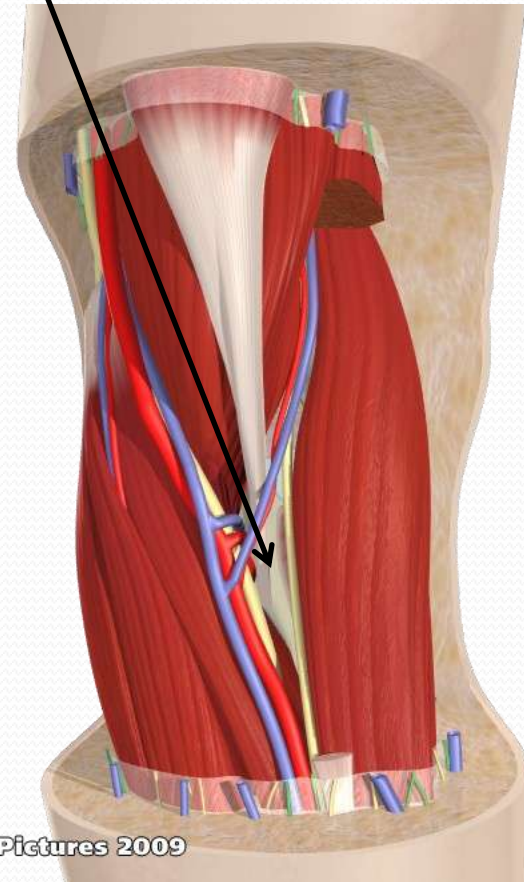
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Upper Extremity Entrapment / Tunnel Syndromes

Musculotendinous nerve at elbow syndrome

- Clinical Signs and Symptoms

- Pain always present and usually located in the anterolateral portion of the elbow
- Acute, burning pain
- Pts. Avoid full elbow extension with forearm pronation
- Supination may relieve pain
- Tender over the musculocutaneous nerve in region under biceps where it pierces the brachial fascia
- Subacute/Chronic pain with pronation and elbow extension



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Upper Extremity Entrapment / Tunnel Syndromes

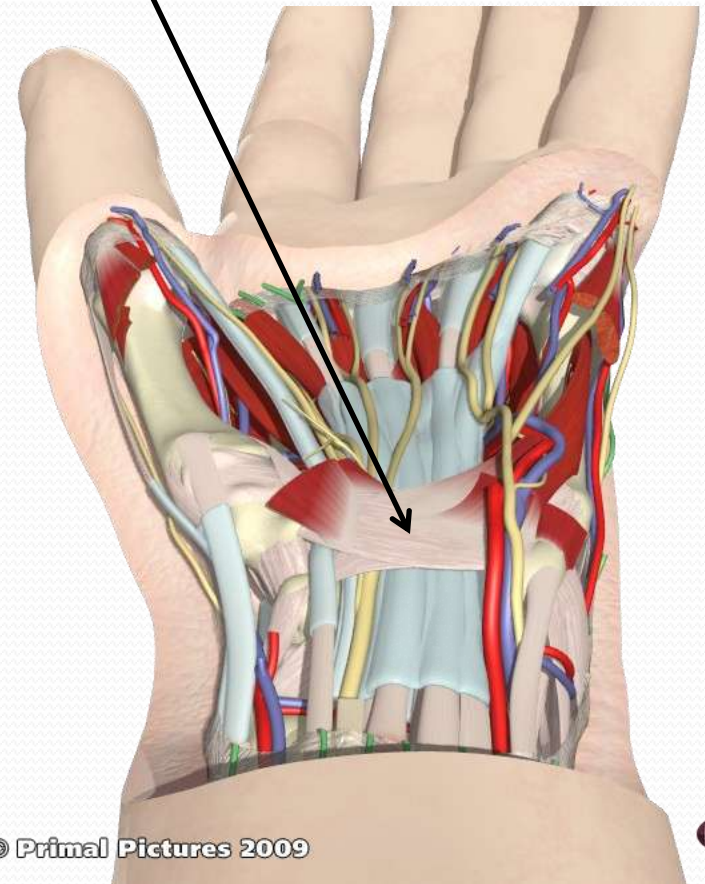
Musculotendinous nerve at elbow syndrome

- Treatment
 - Stretch the forearm musculature
 - Manipulation of the elbow
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation.
 - Rest
 - Avoidance of motions provoking pain
 - Splinting
 - Corticosteroid injection

Upper Extremity Entrapment / Tunnel Syndromes

Carpal tunnel syndrome

- Etiology
 - More freq. in women, peaks at 30-50
 - Extension develops biggest pressure on tunnel
 - Repetitive occupational tasks
 - Ischemia + compression



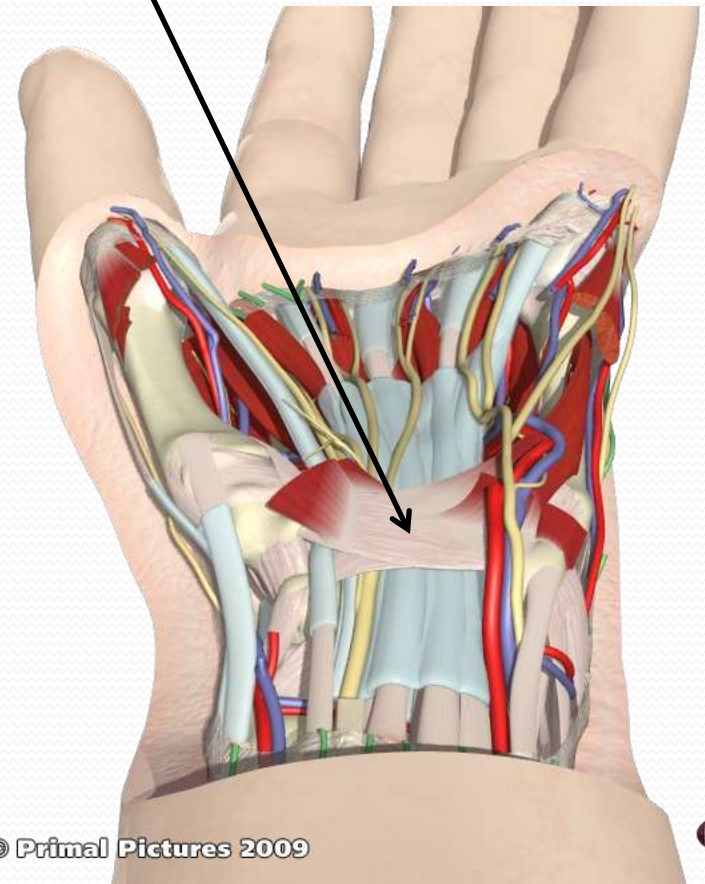
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Upper Extremity Entrapment / Tunnel Syndromes

Carpal tunnel syndrome

- Clinical Signs and Symptoms
 - Sensory complaints: night pain that wakens pt., numbness and tingling in sensory dermatomes of med. Nerve
 - Sensory fibers more pressure sensitive than motor
 - Acute- severe pain, wrist/hand swelling, cold hand, decreased finger motion
 - Chronic- either predominating sensory dysfunction or motor loss with trophic changes
 - Tinel's, Phalen's



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Orthopedic Tests Hand / Wrist

- **Tinel's Sign at the Wrist**

aka Formication Sign, Distal Tingling on Percussion (DTP) Sign, Hoffman-Tinel Sign

- **Procedure:** The patient's elbow is flexed and the forearm supinated. The wrist and hand are slightly dorsiflexed by the examiner. The examiner taps over the carpal tunnel at the wrist.
- **Positive Finding:** A positive result causes tingling in the thumb, index finger, forefinger, and the middle and lateral half of the ring finger (**median nerve distribution**). The tingling and paresthesia must be felt distal to the point of pressure for a positive test. The test is an indication of the rate of regeneration of the sensory fibers by the median nerve. The most distal point at which the abnormal sensation is felt represents the limit of nerve regeneration.



Orthopedic Tests Hand / Wrist

- **Phalen's Sign** aka Phelan's Sign, Prayer Sign
- **Procedure:** The patient flexes both wrists maximally and maintains this position for 60 seconds by pushing both the wrists together. The elbows can be dropped slightly to increase the wrist flexion angle.
- **Positive Finding:** A positive test is indicated by a tingling sensation that radiates into the thumb, the index finger, and the middle and lateral half of the ring finger due to neural ischemia. The presence of this sensation indicates **carpal tunnel syndrome** caused by pressure on the median nerve.



Upper Extremity Entrapment / Tunnel Syndromes

Carpal tunnel syndrome

- Treatment
 - Stretch the forearm musculature if Pronator Teres Muscle is involved
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation
 - Manipulation of the wrist carpal bones
 - Avoidance of trauma or repetitive actions
 - Immobilization with slight extension with dorsal splint for 3-6 weeks
 - Corticosteroid injections



Forearm Flexor and Extensor Muscles

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Types of Treatment

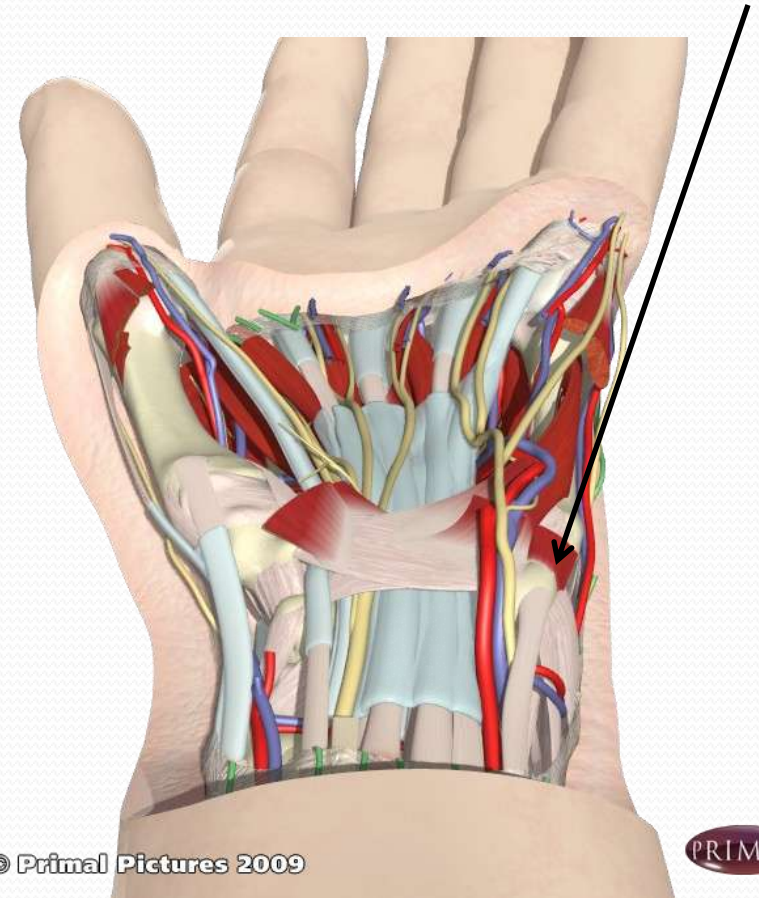
Stretching of the Forearms



Upper Extremity Entrapment / Tunnel Syndromes

Ulnar tunnel a.k.a. Guyon's Canal

- Etiology
 - “Upper form”- compression prox. and prevents any ulnar nerve innervations Mumenthaler's sign positive
 - “Middle form”- Compression prior to hypothenar muscle branches, produces only motor dysfunction, only deep branch is compromised
 - “Lower form”- deep-branch compression distal to hypothenar muscle branches, sparing it
 - Third form- superficial branch is compromised, predominantly sensory symptoms
 - Fracture of hook of hamate, riding bicycles
 - Occupationally related external compression, vascular disturbances, arthritis, bursitis near pisiform, edema, hypertrophy of Flexor Carpi Ulnaris



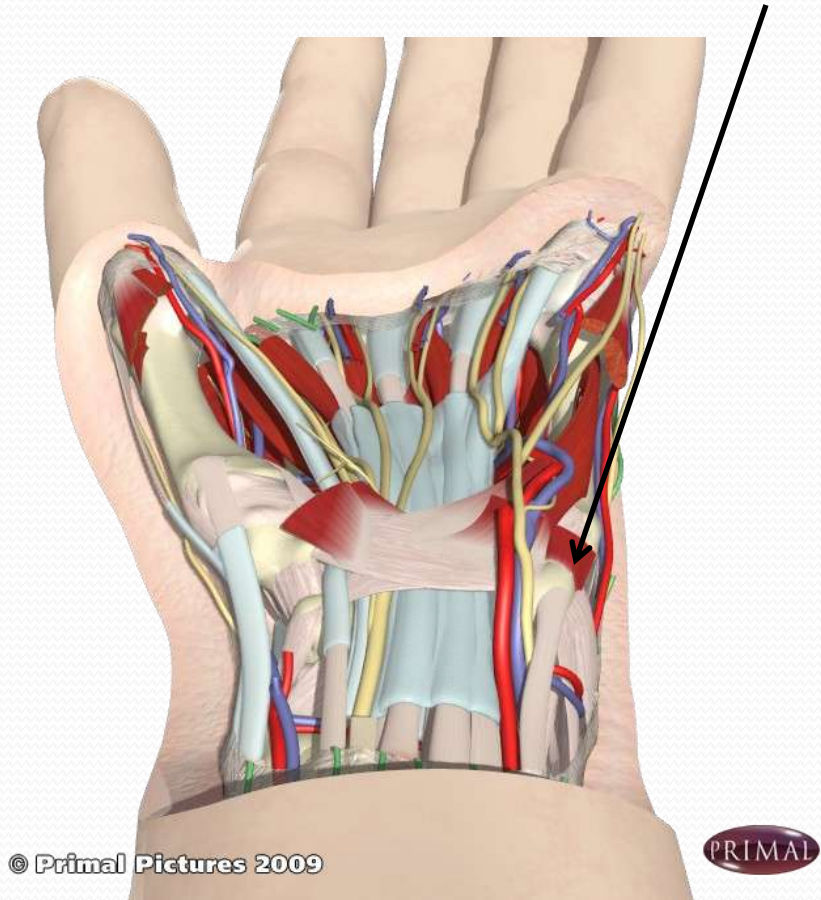
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Upper Extremity Entrapment / Tunnel Syndromes

Ulnar tunnel a.k.a. Guyon's Canal

- Clinical Signs and Symptoms
 - Worse at night involving 3rd, 4th, and 5th fingers
 - Phalens' causes paresthesias in 4th/5th fingers
 - Adduction of 5th finger and abd./add. Of thumb and other fingers not impaired
 - Late signs- hypotrophy and atrophy leading to cramps and grasp weakness
 - Carpal tunnel tests may be used to evaluate ulnar tunnel syndrome



Orthopedic Tests Hand / Wrist

- **Tinel's Sign at the Wrist** aka Formication Sign, Distal Tingling on Percussion (DTP) Sign, Hoffman-Tinel Sign
- **Procedure:** The patient's elbow is flexed and the forearm supinated. The wrist and hand are slightly dorsiflexed by the examiner. The examiner taps over the carpal tunnel at the wrist.
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Orthopedic Tests Hand / Wrist

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- **Positive Finding:** A positive test is indicated by a tingling sensation that radiates into the thumb, the index finger, and the middle and lateral half of the ring finger due to neural ischemia. The presence of this sensation indicates **carpal tunnel syndrome** caused by pressure on the median nerve.



Upper Extremity Entrapment / Tunnel Syndromes

Ulnar tunnel a.k.a. Guyon's Canal

- Treatment
 - Avoidance of trauma or repetitive actions
 - Immobilization with slight extension with dorsal splint for 3-6 weeks
 - Corticosteroid injections
 - Stretch the forearm musculature if Pronator Teres Muscle is involved
 - Manipulation of the wrist and carpal bones
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation.



Forearm Flexor and Extensor Muscles

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Types of Treatment

Stretching of the Forearms

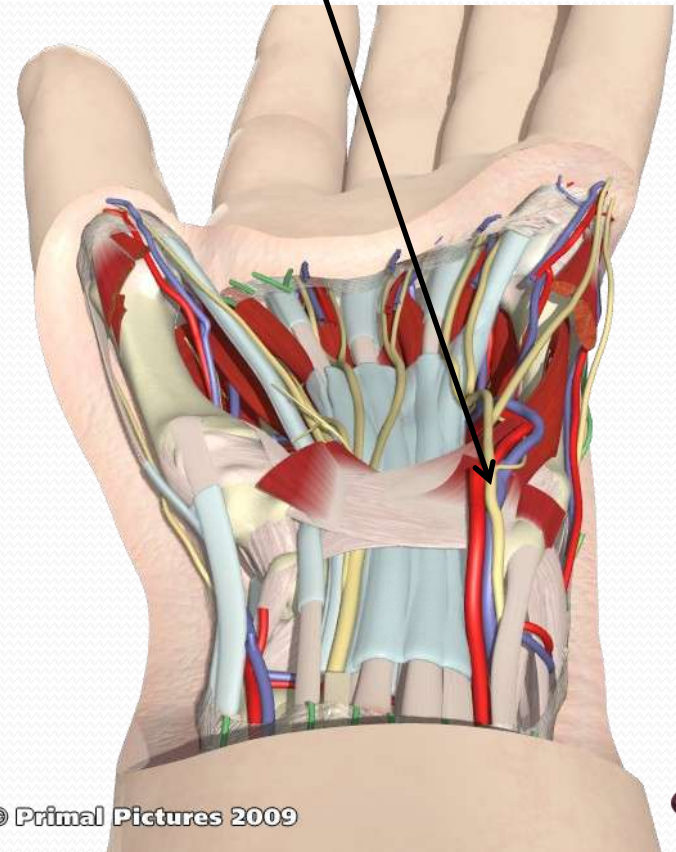


Stretches of the forearm muscles

Upper Extremity Entrapment / Tunnel Syndromes

Deep branch of ulnar nerve a.k.a. PISO-Hamate Hiatus syndrome

- Etiology
 - Occurs most frequently with ganglion cysts
 - Anomalous muscles, intraneural cysts, carpal bone fractures, ulnar artery anomalies and diseases, chronic wrist trauma



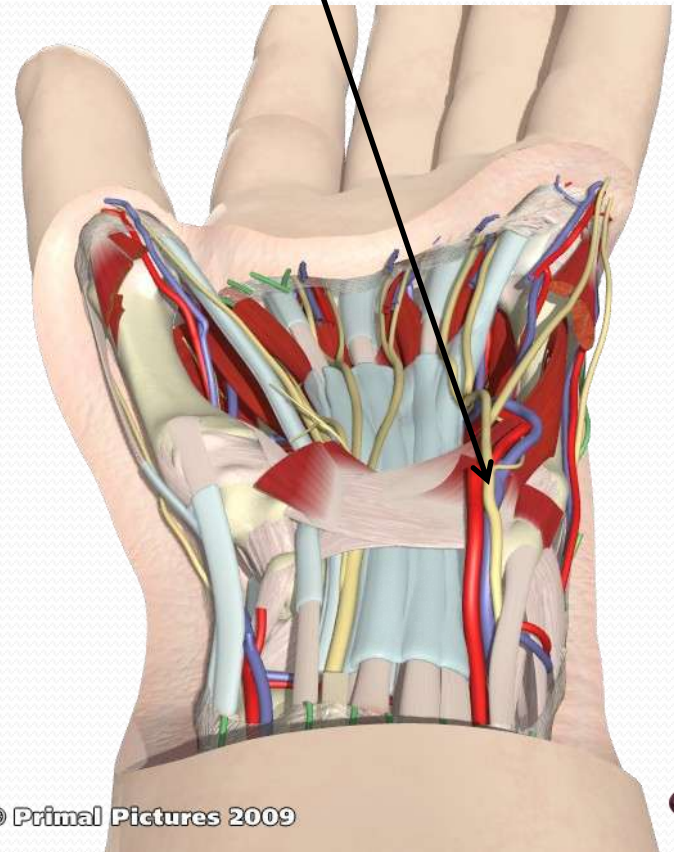
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Upper Extremity Entrapment / Tunnel Syndromes

Deep branch of ulnar nerve a.k.a. Piso-Hamate Hiatus syndrome

- Clinical Signs and Symptoms
 - Poorly localized pain in the innervations field of the deep branch of the ulnar nerve
 - No paresthesias or hypesthesias
 - Palmaris brevis and abductor digiti minimi still function in contrast to ulnar tunnel syndrome
 - Differential diagnosis with 2nd type of ulnar tunnel syndrome, progressive spinal muscle atrophy, and lateral amyotrophic sclerosis



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Upper Extremity Entrapment / Tunnel Syndromes

Deep branch of ulnar nerve a.k.a. PISO-Hamate Hiatus syndrome

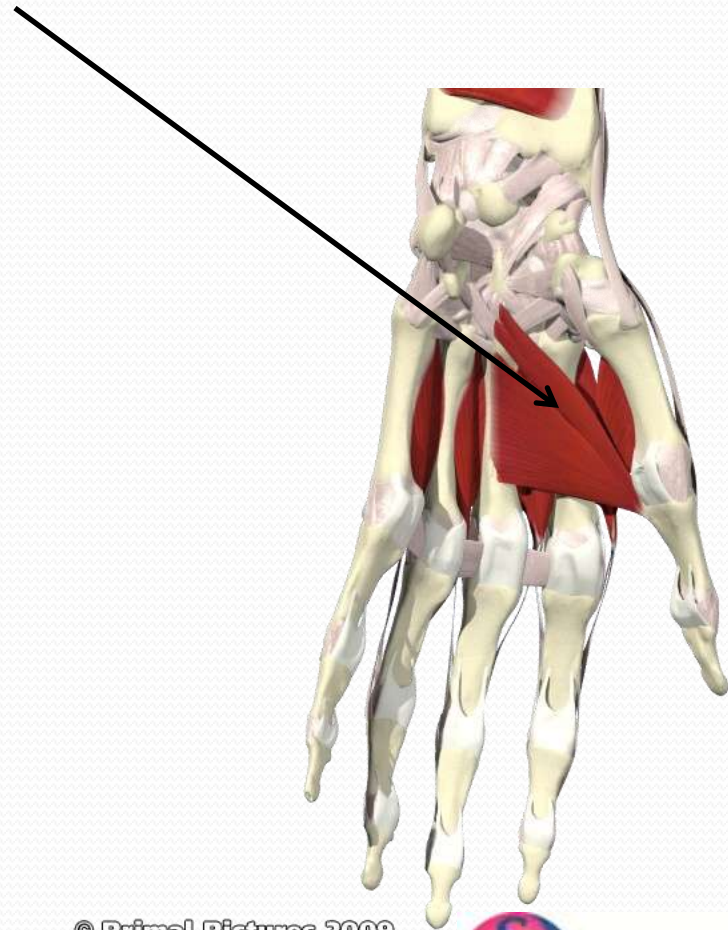
- Treatment
 - Avoidance of trauma or repetitive actions
 - Immobilization with slight extension with dorsal splint for 3-6 weeks
 - Corticosteroid injections
 - Stretch the forearm musculature if Pronator Teres Muscles is involved
 - Manipulation of the wrist and carpal bones
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation.

Upper Extremity Entrapment / Tunnel Syndromes

Tendinous arch of the adductor pollicis muscle

(Syndrome of the terminal part of the deep branch of the ulnar nerve)

- Etiology
 - Repetitive trauma to the midpalm
 - Professions that require prolonged gripping activities and in sports like cycling
 - Anything that affects the 3rd metacarpal bone

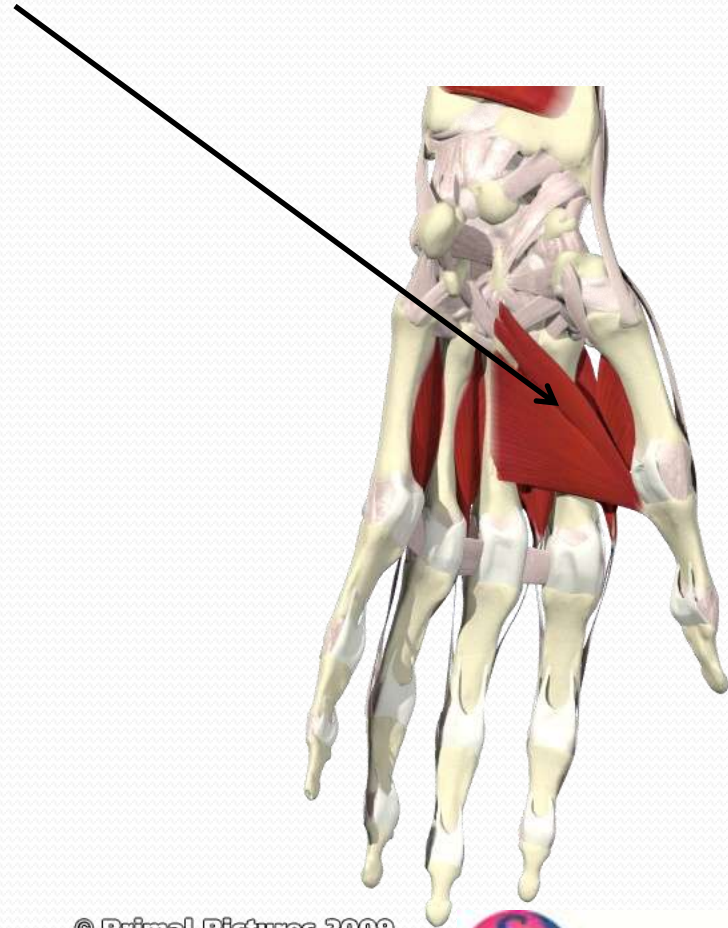


Upper Extremity Entrapment / Tunnel Syndromes

Tendinous arch of the adductor pollicis muscle

(Syndrome of the terminal part of the deep branch of the ulnar nerve)

- Clinical Signs and Symptoms
 - Blunt midpalmar pain without paresthesias , isolated weakness and atrophy of the adductor pollicis muscle



Upper Extremity Entrapment / Tunnel Syndromes

Tendinous arch of the adductor pollicis muscle

(Syndrome of the terminal part of the deep branch of the ulnar nerve)

- Treatment

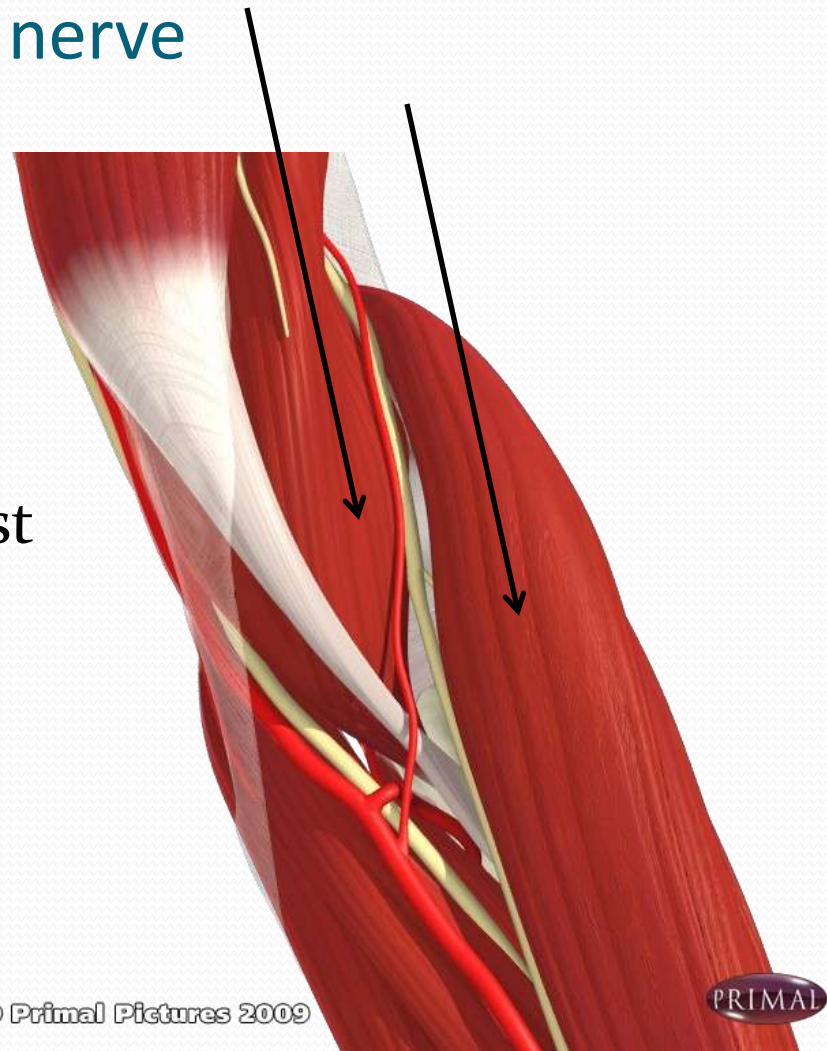
- Avoidance of trauma or repetitive actions
- Immobilization with slight extension with dorsal splint for 3-6 weeks
- Corticosteroid injections
- Stretch the thenar musculature combined with deep stroking
- Manipulation of the wrist, carpal bones and PIP
- Ice or heat depending on the phase of rehabilitation

Upper Extremity Entrapment / Tunnel Syndromes

Superficial branch of the radial nerve

a.k.a. Cheiralgia Paresthetica

- Etiology
 - Trauma to the radius
 - Surgical trauma
 - Osteoarthritic changes in wrist
 - Chronic irritation from tight cuffs or watch straps



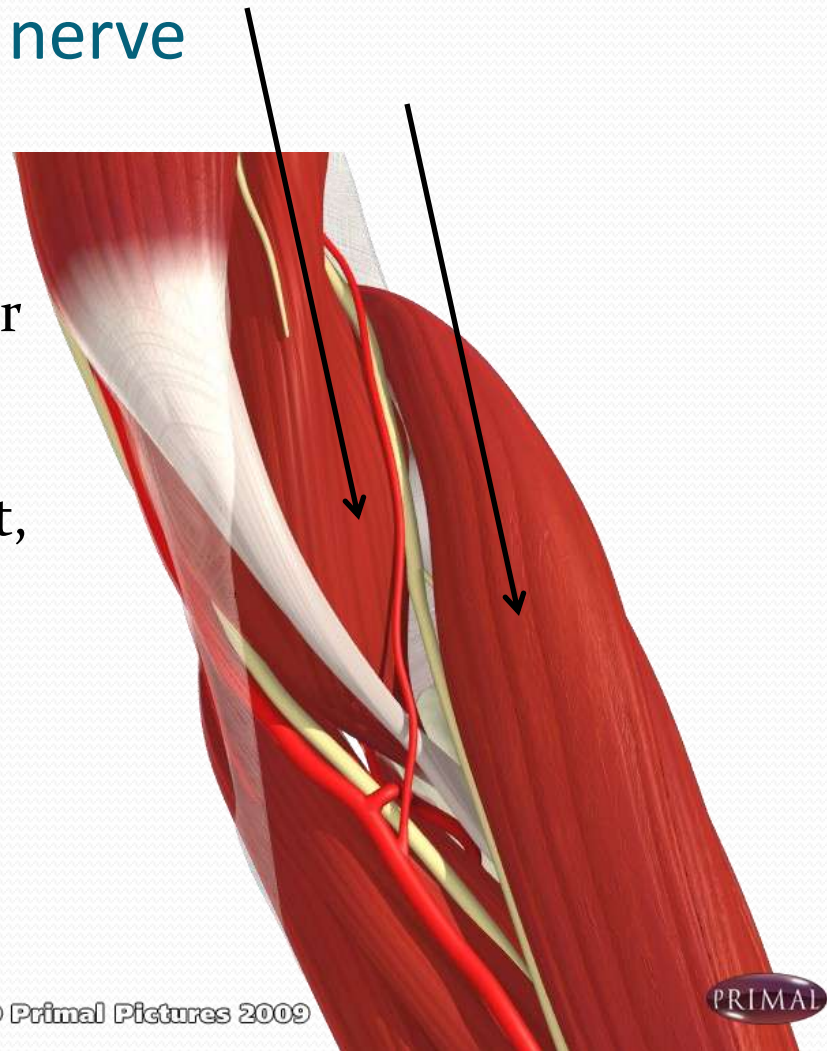
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Upper Extremity Entrapment / Tunnel Syndromes

Superficial branch of the radial nerve a.k.a. Cheiralgia Paresthetica

- Clinical Signs and Symptoms
 - Paresthesias without weakness or atrophy
 - Burning pain, sensory changes, and night pain along dorsal wrist, thumb and web space
 - Positive Tinel's test at elbow
 - Chronic- trophic skin changes, shiny surface and lack of hair
 - No motor signs or any affect on other areas of radicular involvement



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Orthopedic Tests Elbow

- **Cozen's Test**
- **Procedure:** The patient is seated and is instructed to clench the fist tightly, dorsiflex it, and maintain a pronated position. The examiner applies steady pressure against the dorsum of the patient's hand in an attempt to flex it while patient resists the movement.
- **Positive Finding:** The test is positive if lancinating pain is felt in the region of the lateral epicondyle. A positive test suggests **epicondylitis or radiohumeral bursitis**.



Upper Extremity Entrapment / Tunnel Syndromes

Superficial branch of the radial nerve

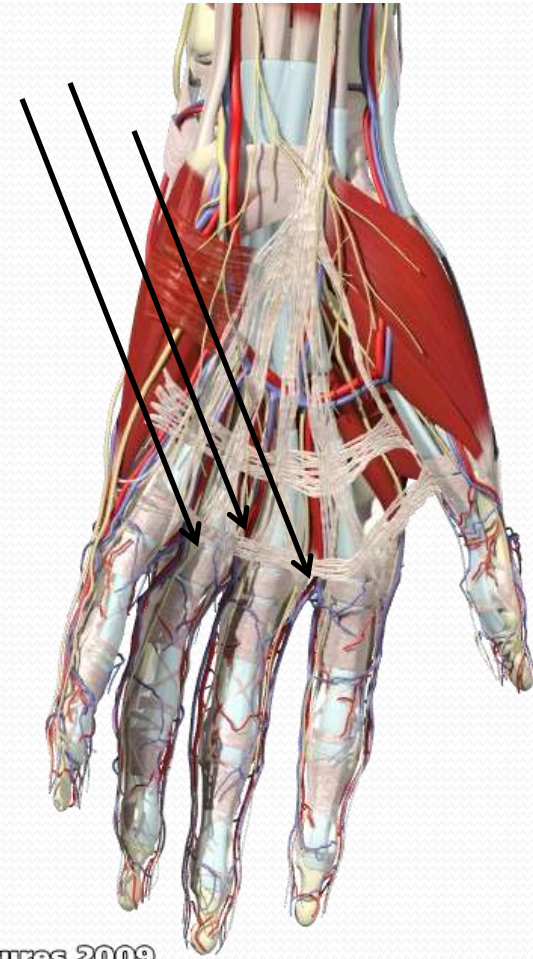
a.k.a. Cheiralgia Paresthetica

- Treatment
 - Avoidance of trauma or repetitive actions
 - Immobilization w/ slight extension w/ dorsal splint for 3-6 weeks
 - Corticosteroid injections
 - Stretch the forearm musculature
 - Manipulation of the elbow
 - Deep stroking with stretching the forearm muscles
 - Ice or heat depending on the phase of rehabilitation

Upper Extremity Entrapment / Tunnel Syndromes

Collateral digital nerve

- Etiology
 - Inflammation of tendon sheaths, especially in RAMC
 - Trauma to hyperextended finger
 - Occupations using vibrating devices
 - Neoplasms and digital nerve aneurysms



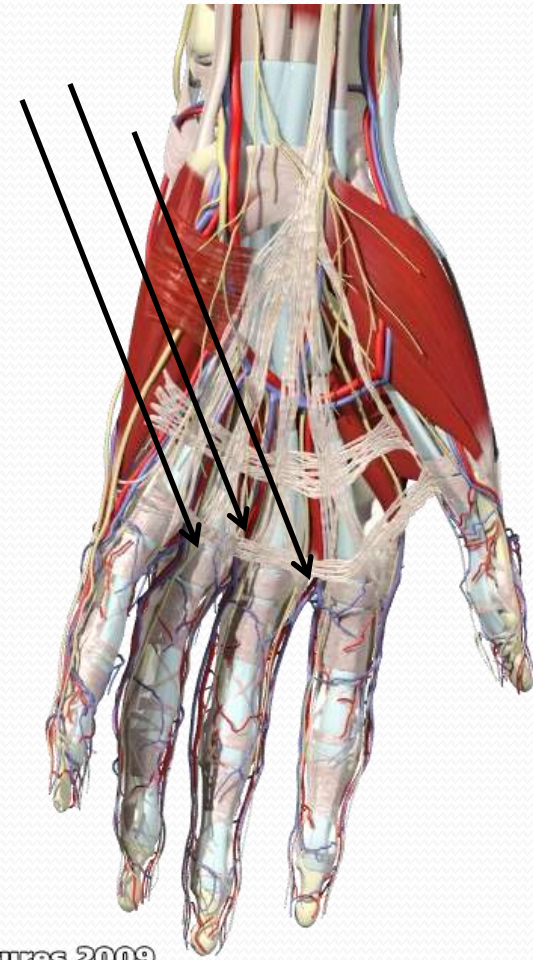
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Upper Extremity Entrapment / Tunnel Syndromes

Collateral digital nerve

- Clinical Signs and Symptoms
 - Varies from sharp burning pain, hypersthesia, or paresthesias in 2 neighboring fingers or similar symptoms on one side of a finger
 - Pressure between metacarpal heads, finger hyperextension, or finger adduction may cause pain



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Upper Extremity Entrapment / Tunnel Syndromes

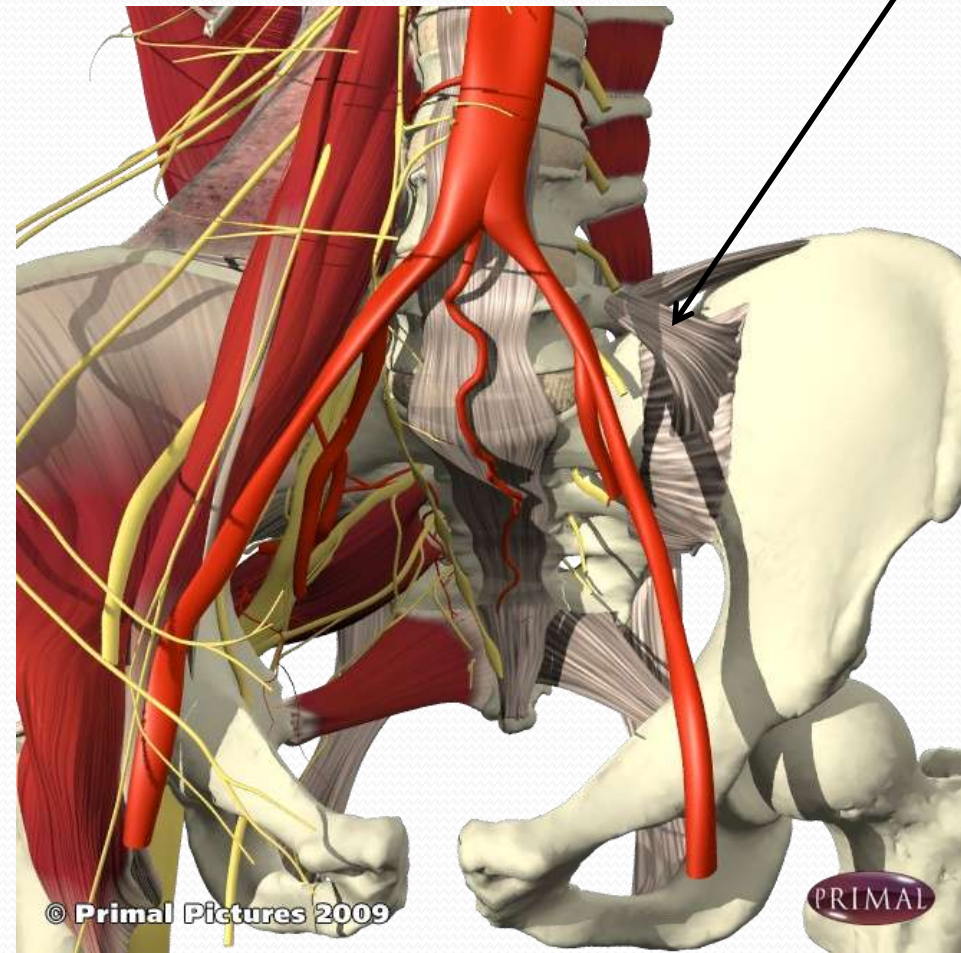
Collateral digital nerve

- Treatment
 - Reducing perineural inflammation
 - Avoidance of trauma or repetitive actions
 - Immobilization with slight extension with dorsal splint for 3-6 weeks
 - Corticosteroid injections
 - Deep stroking with stretching the interossei muscles
 - Manipulation of the finger joints
 - Ice or heat depending on the phase of rehabilitation.

Lower Extremity Entrapment / Tunnel Syndromes

Lumbosacral Tunnel

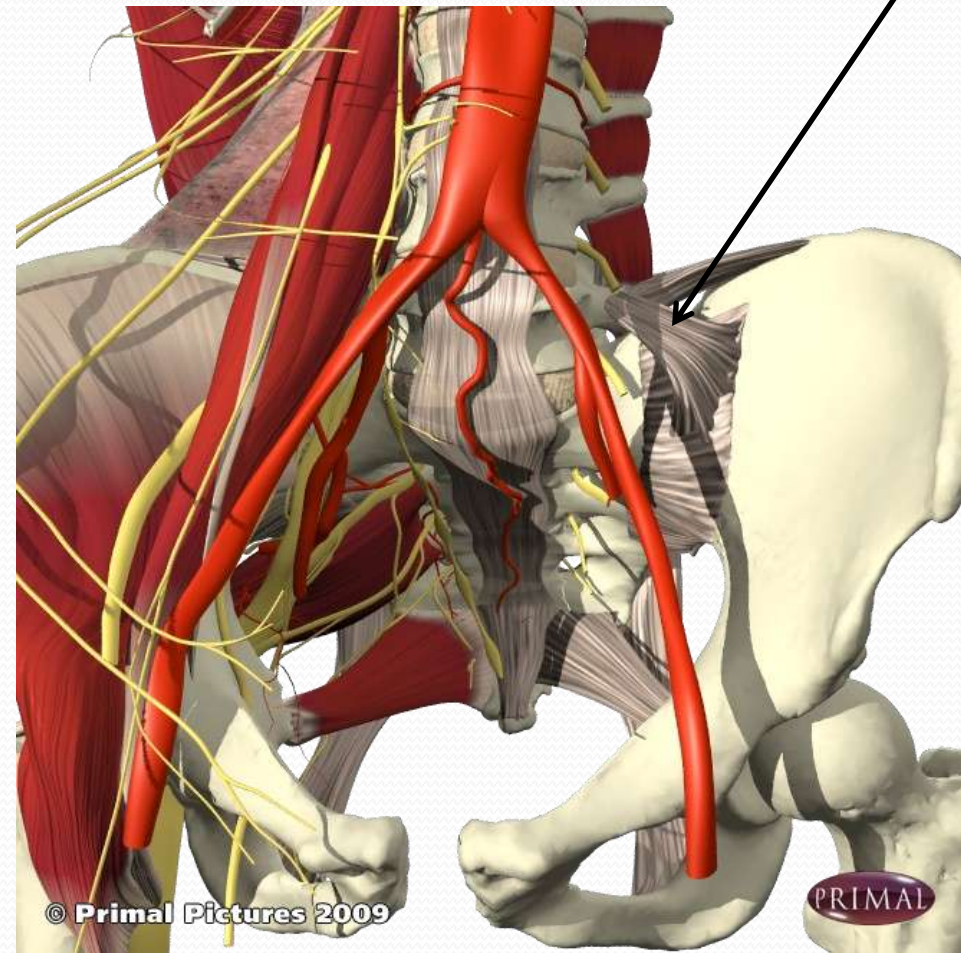
- Etiology
 - Marginal osteophytes on L5 and S1
 - Thickening of the lumbosacral ligament
 - Disorder's of the tunnel's vascular components
 - Extrinsic and intrinsic neural tumors
 - Regional inflammation



Lower Extremity Entrapment / Tunnel Syndromes

Lumbosacral Tunnel

- Clinical Signs and Symptoms
 - Pain and decreased sensation in the L5 distribution
 - Usually no weakness or atrophy



Lower Extremity Entrapment / Tunnel Syndromes

Lumbosacral Tunnel

- Treatment
 - Anesthetic blocks
 - Stretches and exercises to remodel the local musculature and modify the mechanics
 - Manipulation of the SIJ and lumbar spine

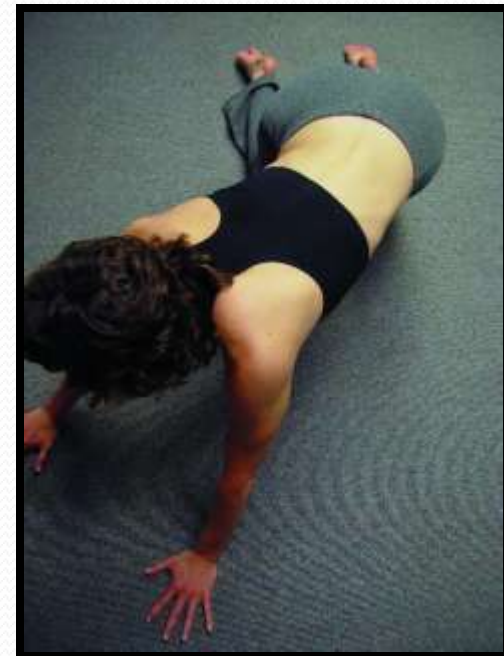


Hip Flexor Stretches

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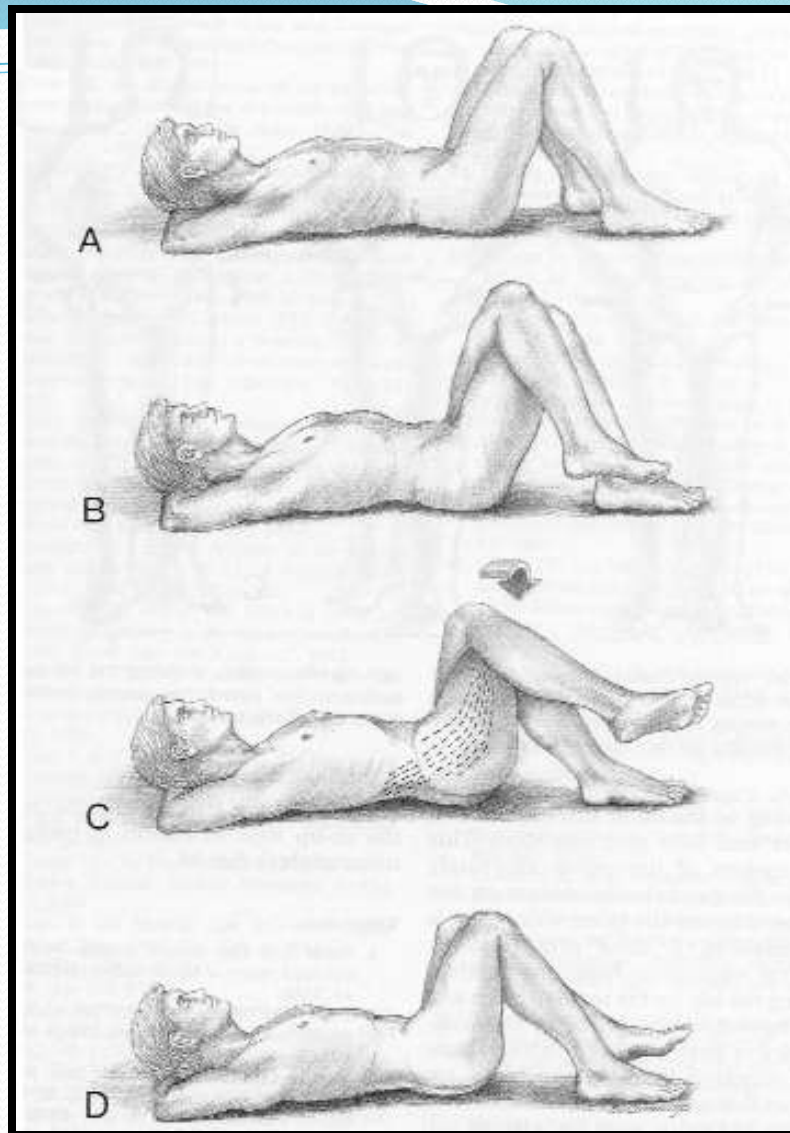


Buttock muscle stretches



Quadratus Lumborum Stretches

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Lumbar rotator musculature stretches

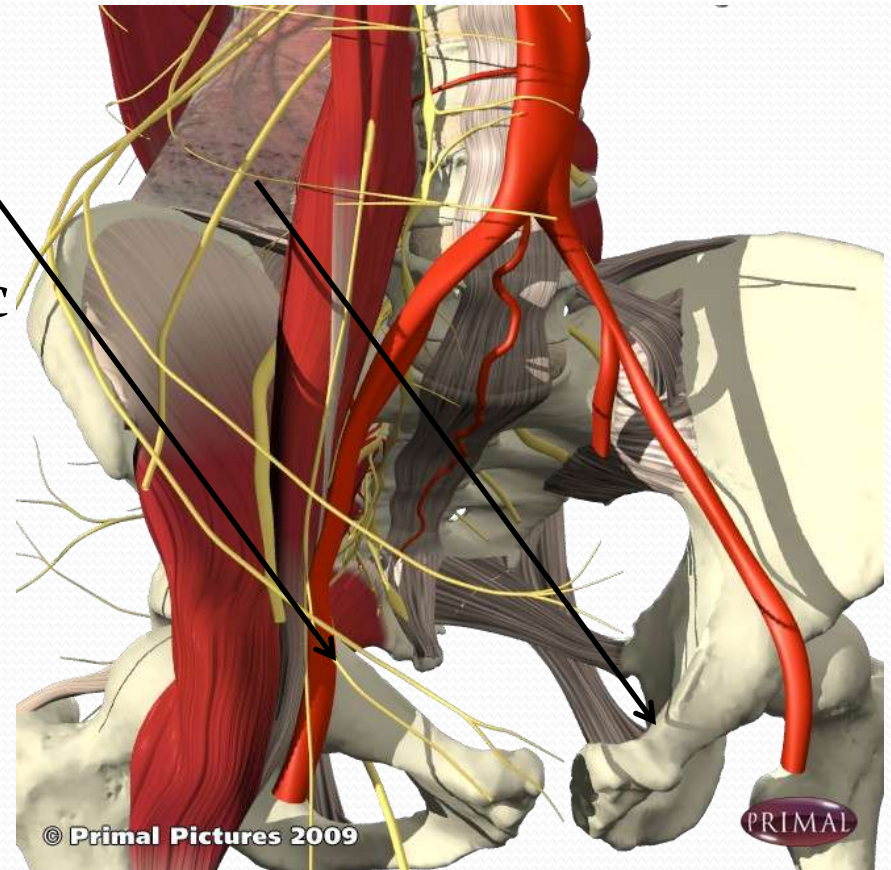


Deep tissue massage of the hamstrings

Lower Extremity Entrapment / Tunnel Syndromes

Iliacus muscle syndrome (syndrome of the femoral nerve in the muscular lacuna)

- Etiology
 - Surgical procedures within the pelvis MCC
 - Hematomas and dynamic relationships
 - Bleeding within the nerve sheath



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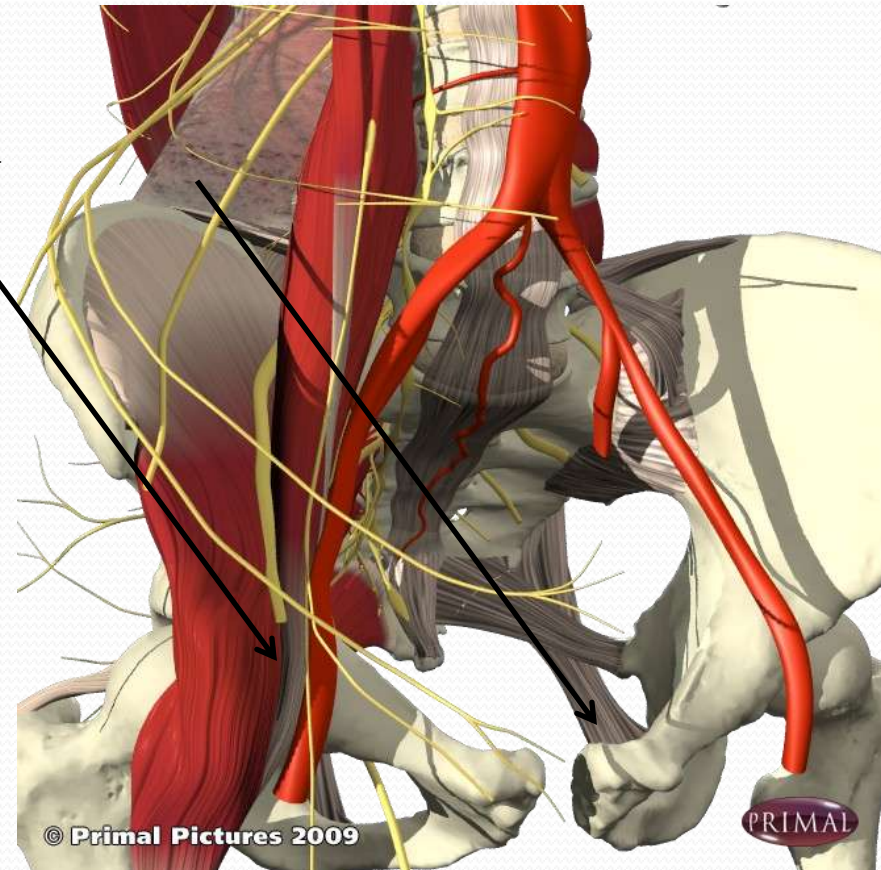
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Lower Extremity Entrapment / Tunnel Syndromes

Iliacus muscle syndrome

(syndrome of the femoral nerve in the muscular lacuna)

- Clinical Signs and Symptoms
 - High lesions (paresis of superior type)- difficulty standing from a seated position due to iliopsoas muscle weakness
 - Paresis of inferior type- difficulty extending knee and hypotrophy of anterior thigh compartment
 - Hip extension aggravates pain, other movements are painless
 - Absence of patellar reflex
 - Sensory disturbances through femoral nerve's dermatome



Lower Extremity Entrapment / Tunnel Syndromes

Iliacus muscle syndrome

(syndrome of the femoral nerve in the muscular lacuna)

- Treatment

- Stretches of the iliacus muscle (hip flexors)
- Manipulation of the SIJ and lumbar spine
- Exercises may stabilize quadriceps hypotrophy

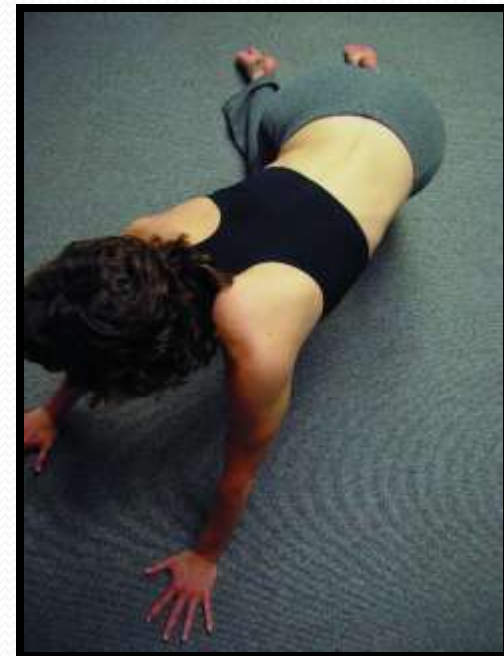


Hip Flexor Stretches

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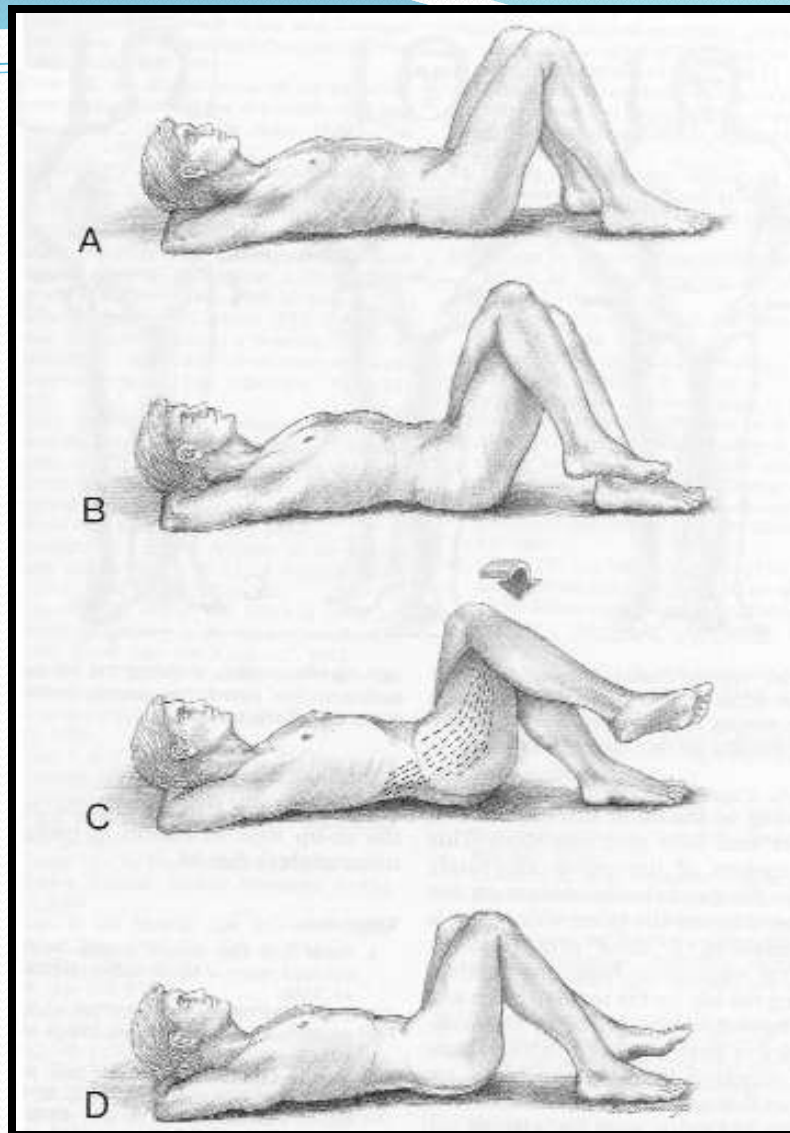


Buttock muscle stretches



Quadratus Lumborum Stretches

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Lumbar rotator musculature stretches



Deep tissue massage of the hamstrings



Flexion Stretches



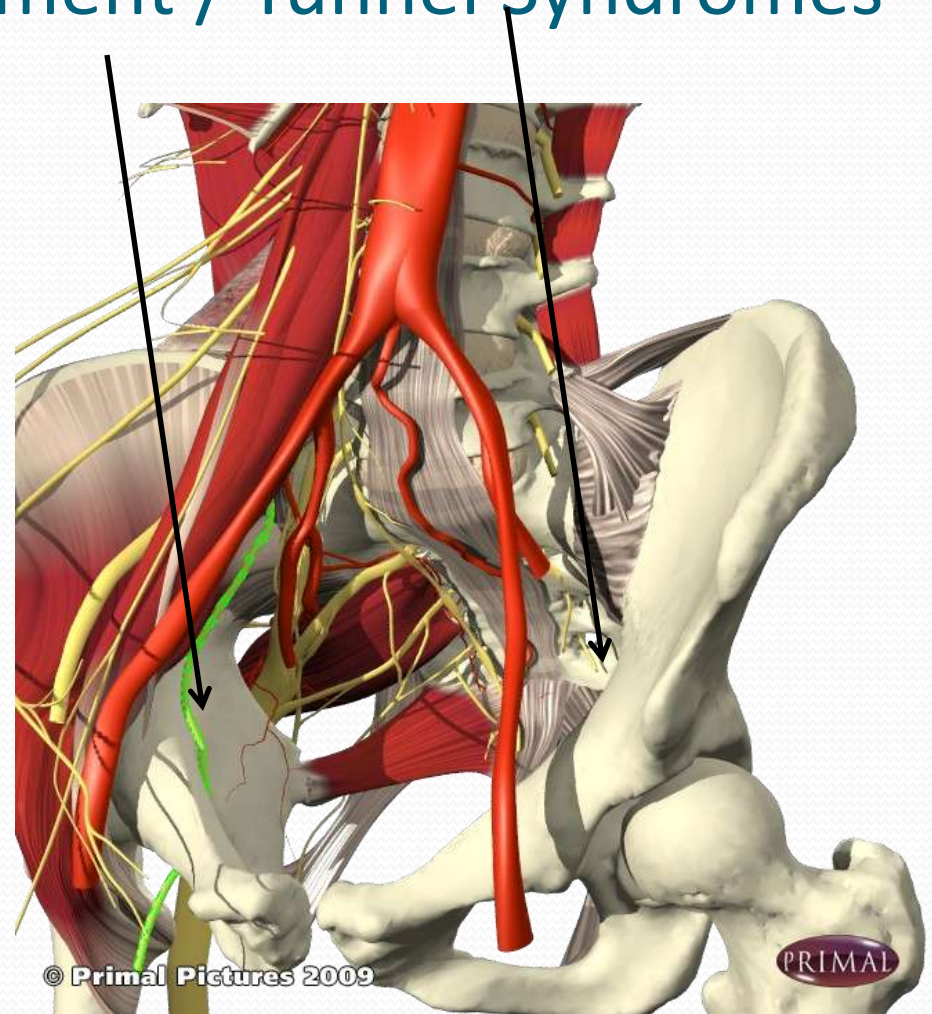
Extension Stretches

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Lower Extremity Entrapment / Tunnel Syndromes

Obturator Tunnel

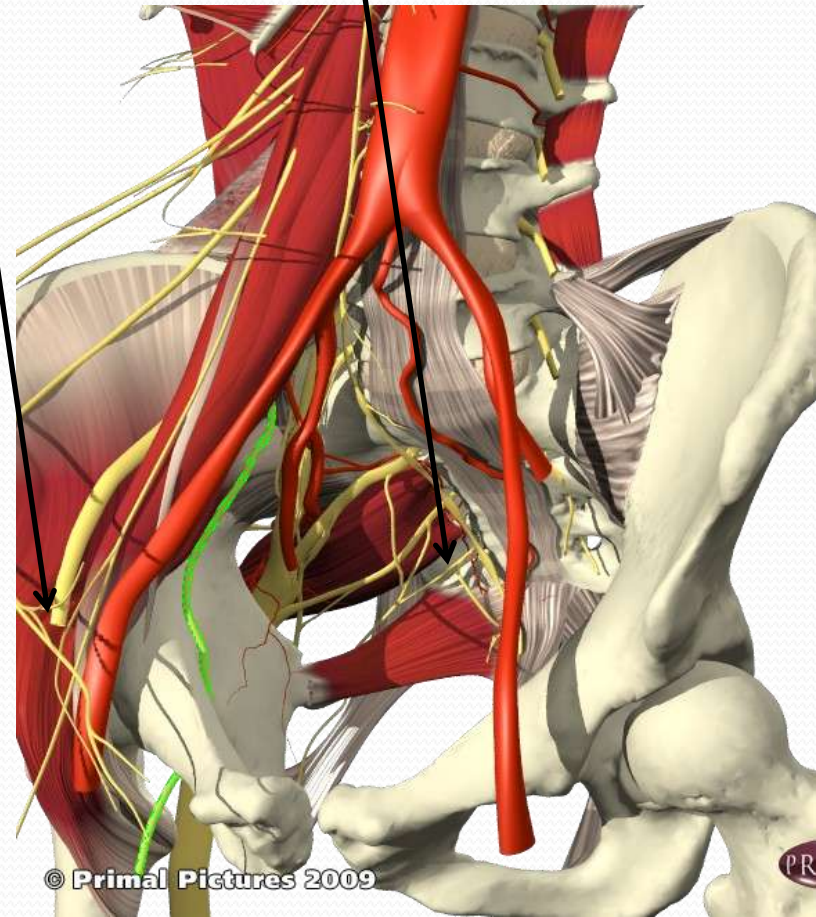
- Etiology
 - Nerve compression by pelvic fracture, pelvic hematomas secondary to anticoagulation or trauma, retroperitoneal masses, intrapelvic tumors
 - Pregnancy
 - Complications of genitourological surgery or total hip arthroplasty
 - Obturator hernias or tissue edema
 - Inflammatory changes of the pubic bone in osteitis pubis



Lower Extremity Entrapment / Tunnel Syndromes

Obturator Tunnel

- Clinical Signs and Symptoms
 - Strong nonlocalized pain and resting pain with radiation from the symphysis pubis to the knee
 - Medial knee pain (Howship Romberg's symptom)
 - Occasional sharp pain in posteromedial knee
 - Adductor paresis (prolonged compression) with circumduction of affected leg occurs deep non-localized pain and spasm among adductor muscles
 - medial knee pain or adductor spasm combined w/ medial thigh and knee pain can be considered characteristic for obturator tunnel syndrome



Lower Extremity Entrapment / Tunnel Syndromes

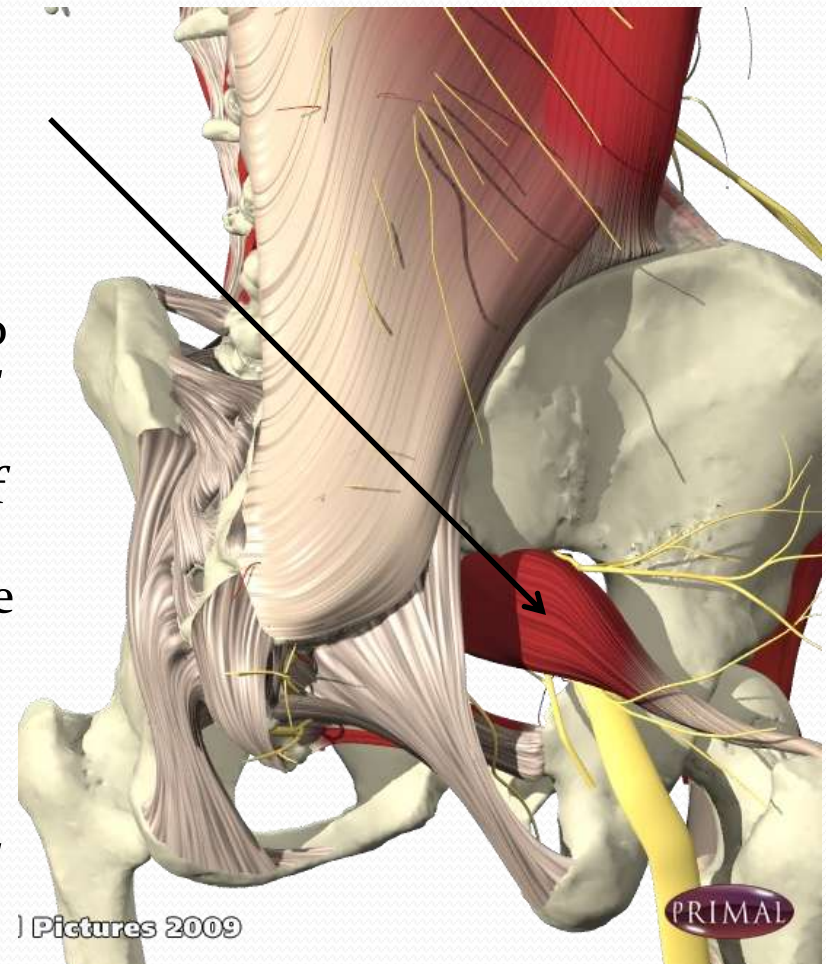
Obturator Tunnel

- Treatment
 - PT and rest
 - Manipulation of the SIJ and lumbar spine
 - Secondary to pelvic pathology- treatment of cause

Lower Extremity Entrapment / Tunnel Syndromes

Piriformis

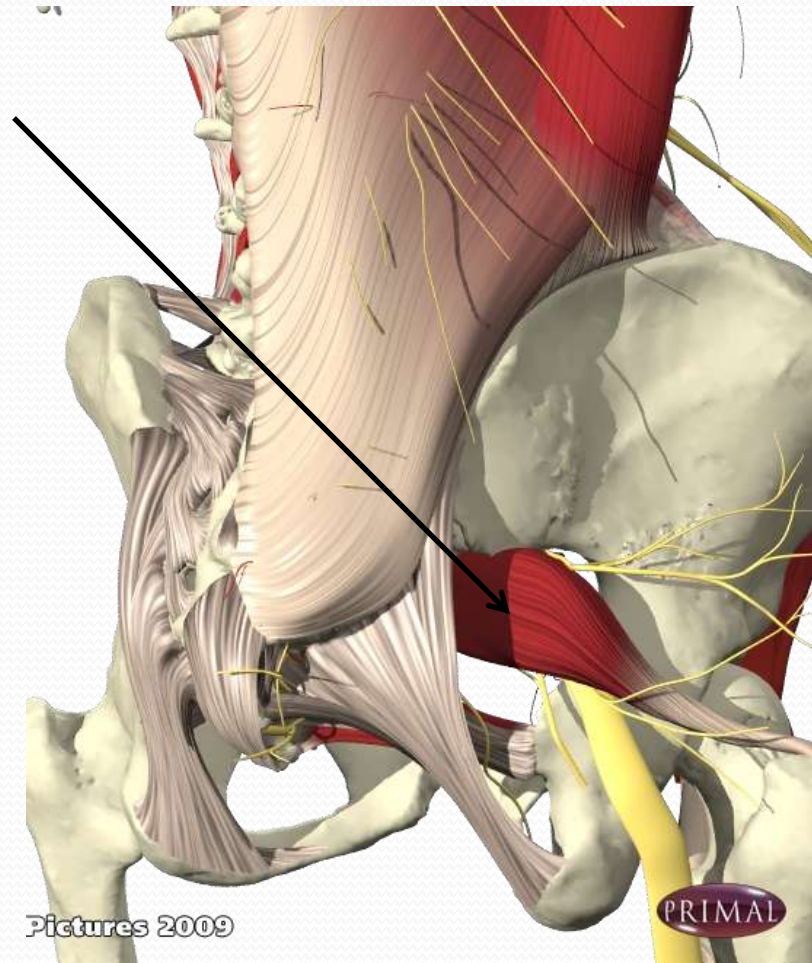
- Etiology
 - Link with sacroiliac disease with piriformis muscle spasm
 - Muscle spasm secondary to irritation of the piriformis at either its origin by Sacroiliac disease or at insertion by bursitis or trochanteric diseases
 - Inflammatory or degenerative changes of the muscle, tendon, or fascia
 - Degeneration or deformities affecting the bony origin or insertion of the muscle
 - Anomalies in the nerve's course through the muscle or between the muscle's tendon and the bone
 - Trauma-scarring, spasm, muscle mass of gluteus Maximus
 - Compression of the vessels supplying the nerve



Lower Extremity Entrapment / Tunnel Syndromes

Piriformis

- Clinical Signs and Symptoms
 - Pain in sacral or gluteal region most constant symptom
 - Pain increases with sitting or walking and decreases with lying supine
 - Pain originating in the SI joint and region of the greater sciatic foramen and piriformis
 - peripheral nerve distribution not radicular in origin
 - increased pain with internal rotation of the hip or hip flexion with an extended knee
 - decreased pain with external rotation of the hip
 - Positive Lasegue-Lazarevic sign at 25°



Lower Extremity Entrapment / Tunnel Syndromes

Piriformis

- Treatment
 - Deep stroking with stretch the piriformis muscle
 - Correct foot biomechanics – excess foot pronation.
Fallen medial longitudinal arch
 - Manipulation of the SIJ, lumbar spine and hip
 - Ice or heat depending on phase of healing
 - Corticosteroid



Deep tissue stroking with stretches of the piriformis muscle



Stretching of the piriformis muscle

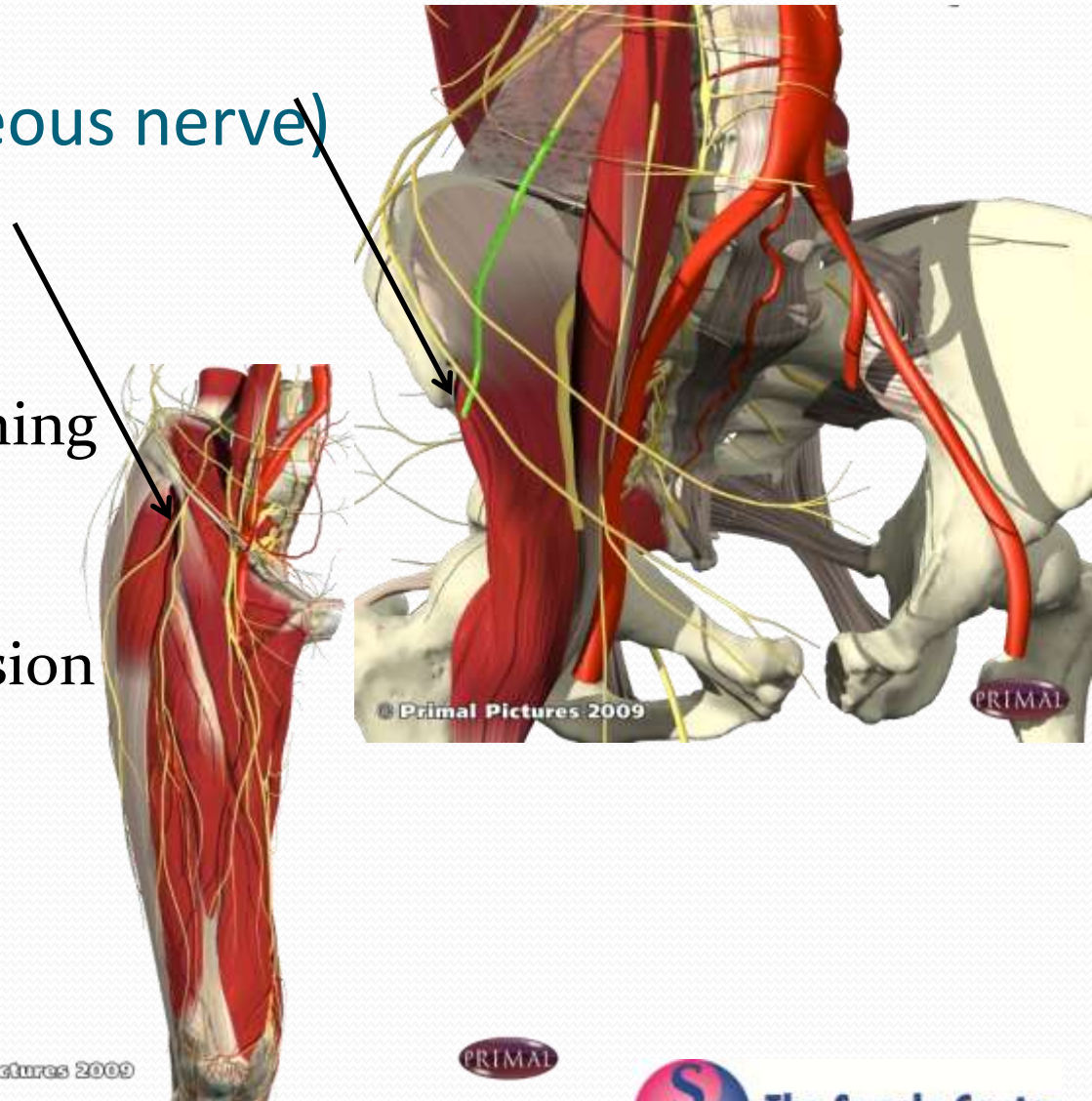
Lower Extremity Entrapment / Tunnel Syndromes

Meralgia Paresthetica

(lateral femoral cutaneous nerve)

- Etiology

- Acute or chronic stretching of the nerve
- Leg length changes, scoliosis, increased tension of the abdominal musculature and fascia lata (due to prolonged periods of standing)



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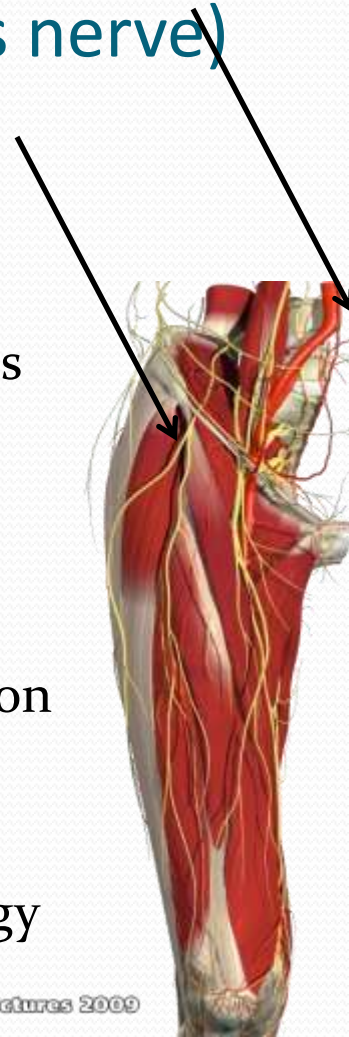


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Lower Extremity Entrapment / Tunnel Syndromes

Meralgia Paresthetica (lateral femoral cutaneous nerve)

- Clinical Signs and Symptoms
 - Paresthesia, burning pain, dyesthesias with light touch or leg extension while sleeping
 - Hypesthesia, trophic skin changes (long-term)
 - Femoral nerve traction test
 - Local pressure over inguinal ligament, especially close to ASIS may produce local pain or local irritation in the nerve's distribution
 - Differential diagnosis
 - Intraspinal/extraspinal radiculopathies of L2-L3 nerve roots and lumbar plexus pathology



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Lower Extremity Entrapment / Tunnel Syndromes

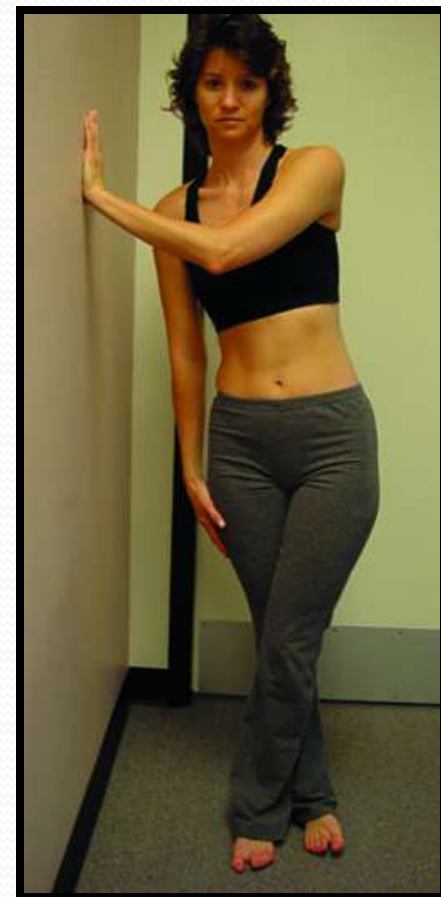
Meralgia Paresthetica

(lateral femoral cutaneous nerve)

- Treatment
 - Ice or heat depending on the phase of rehabilitation
 - Stretch and deep stroking massage of the Tensor Fascia Lata and hip musculature
 - Manipulation of the hip, SIJ and lumbar spine



Deep tissue and stretches of the TFL and hip musculature



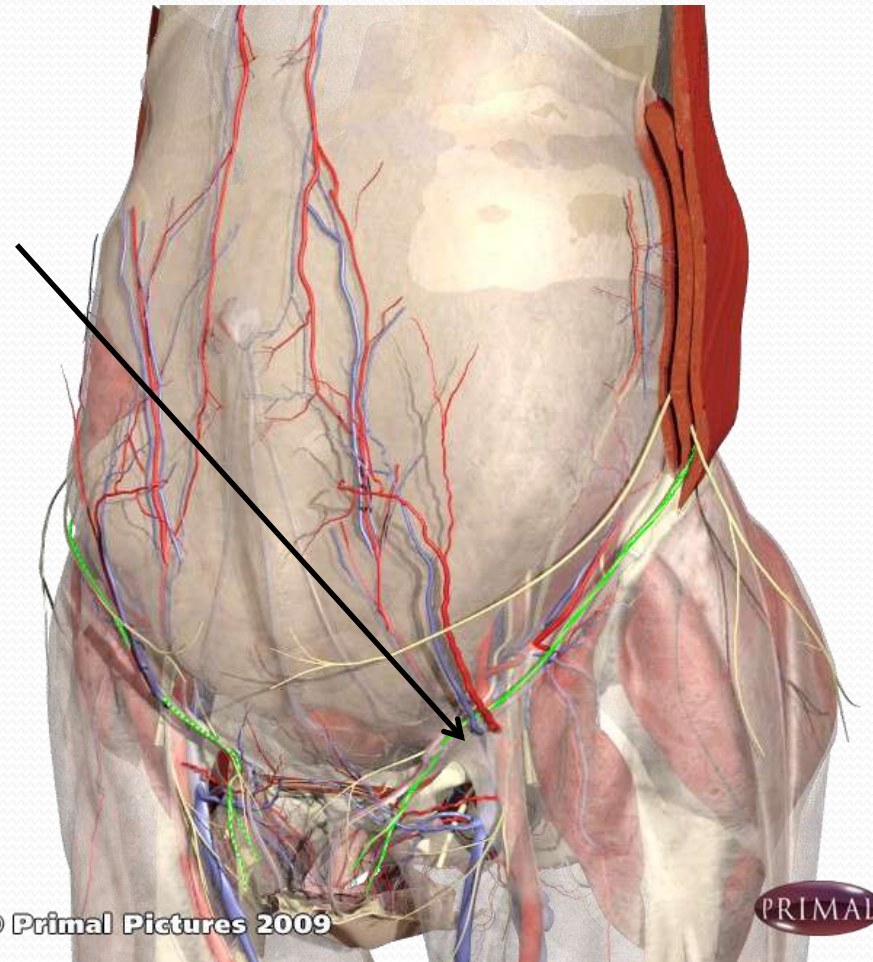
Stretch TFL and Hip Musculature

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Lower Extremity Entrapment / Tunnel Syndromes

Ilioinguinal

- Etiology
 - Nerve is susceptible to stretching because its length is fixed between its origin and where it pierces the abdominal musculature at the ASIS
 - Inguinal hernias
 - Dynamic or permanent changes in hip position creates tension on the nerve
 - Altered abdominal movements
 - Prolonged coughing

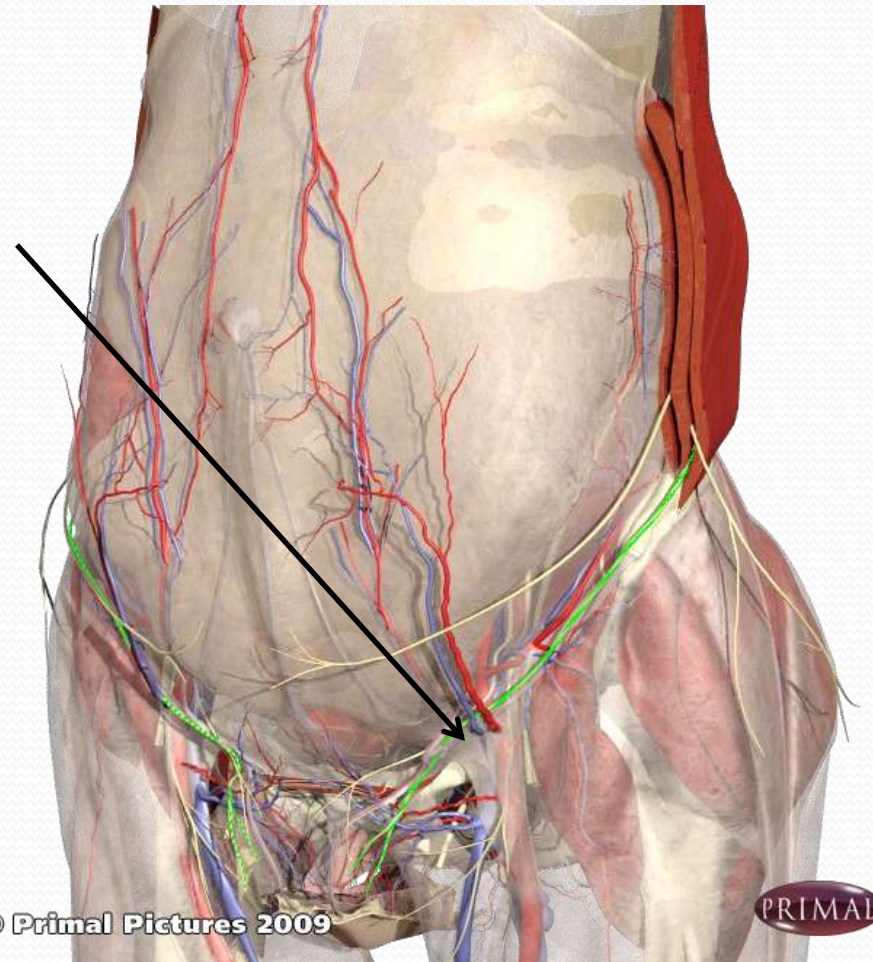


Lower Extremity Entrapment / Tunnel Syndromes

Ilioinguinal

- Clinical Signs and Symptoms

- Pain in inguinal region that may irradiate the hip
- Erect posture or abdominal wall tension increases symptoms
- Pressure medially and distal to ASIS will reproduce their pain as radiation along the inguinal ligament
- Sensory disturbances along ilioinguinal dermatomes
- Abdominal weakness and atrophy seen with pt. trying to rise from supine position
- Differential diagnosis - retroperitoneal and renal pathologies, genitofemoral nerve damage or entrapment, meralgia paresthetica



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Lower Extremity Entrapment / Tunnel Syndromes

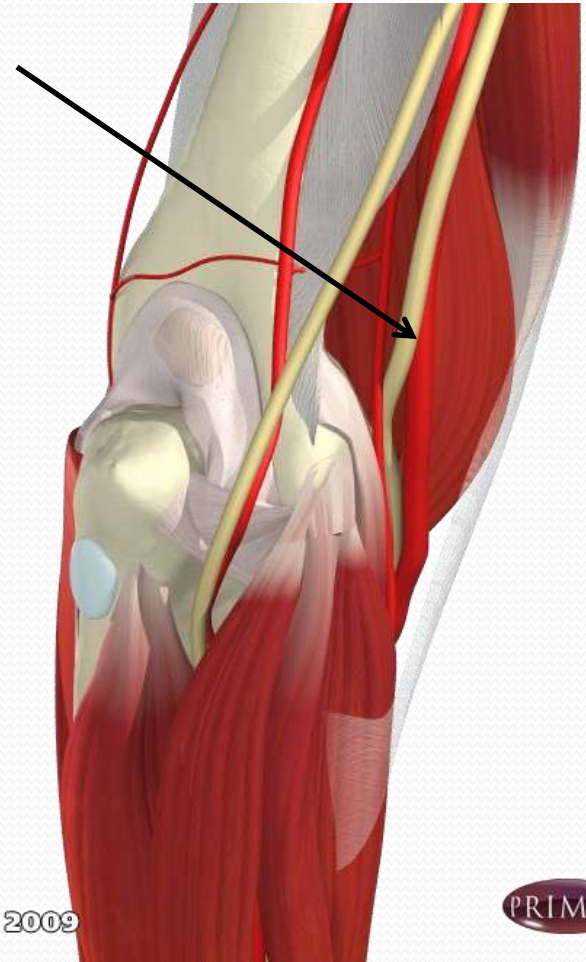
Ilioinguinal

- Treatment
 - Posterior pelvic rotation exercises
 - Support for the abdomen with pregnant patient to de-torque the pelvis rotation.
 - Local ice to reduce inflammation
 - Manipulation of the SIJ and lumbar spine. Consider pelvic blocking to de-torque the pelvis rotation.

Lower Extremity Entrapment / Tunnel Syndromes

Saphenous Nerve

- Etiology
 - Trauma along the adductor canal or vastoadductor membrane
 - Inflammatory disorders such as saphenous vein thrombophlebitis
 - Changes in knee position, deformation with torsion irritate the nerve in the vasto-adductor membrane



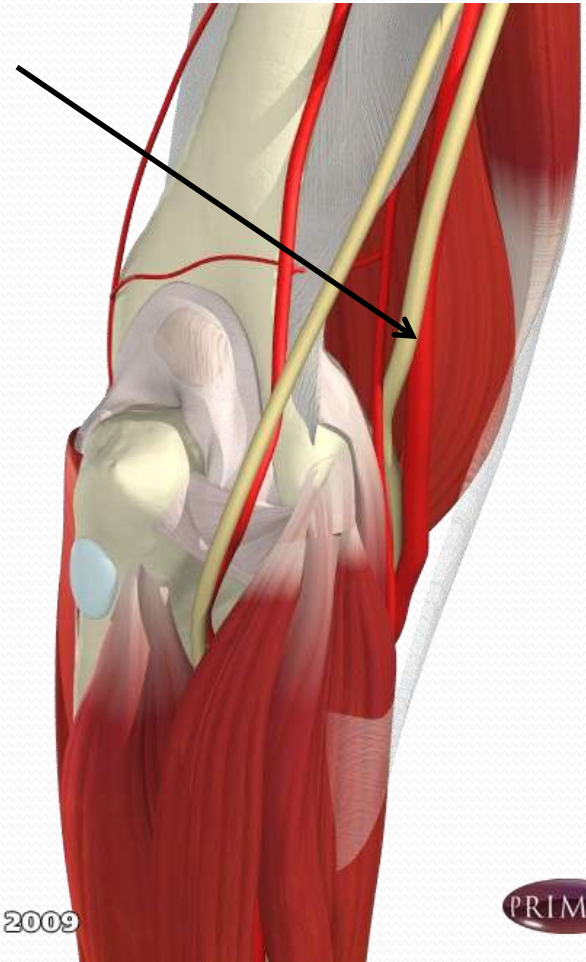
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Lower Extremity Entrapment / Tunnel Syndromes

Saphenous Nerve

- Clinical Signs and Symptoms
 - Constant medial leg pain when walking and climbing
 - Pressure over adductor canal or where the nerve crosses the medial femoral condyle produces strong pain radiating down medial malleolus
 - Hyperalgesia and hyperesthesia in infrapatellar region and hypalgesia and hypesthesia along the medial leg and foot
 - Resisted adduction produces pain in canal
 - Pain with knee hyperextension[?] altered gait loads foot abnormally and may lead to development of metatarsalgia



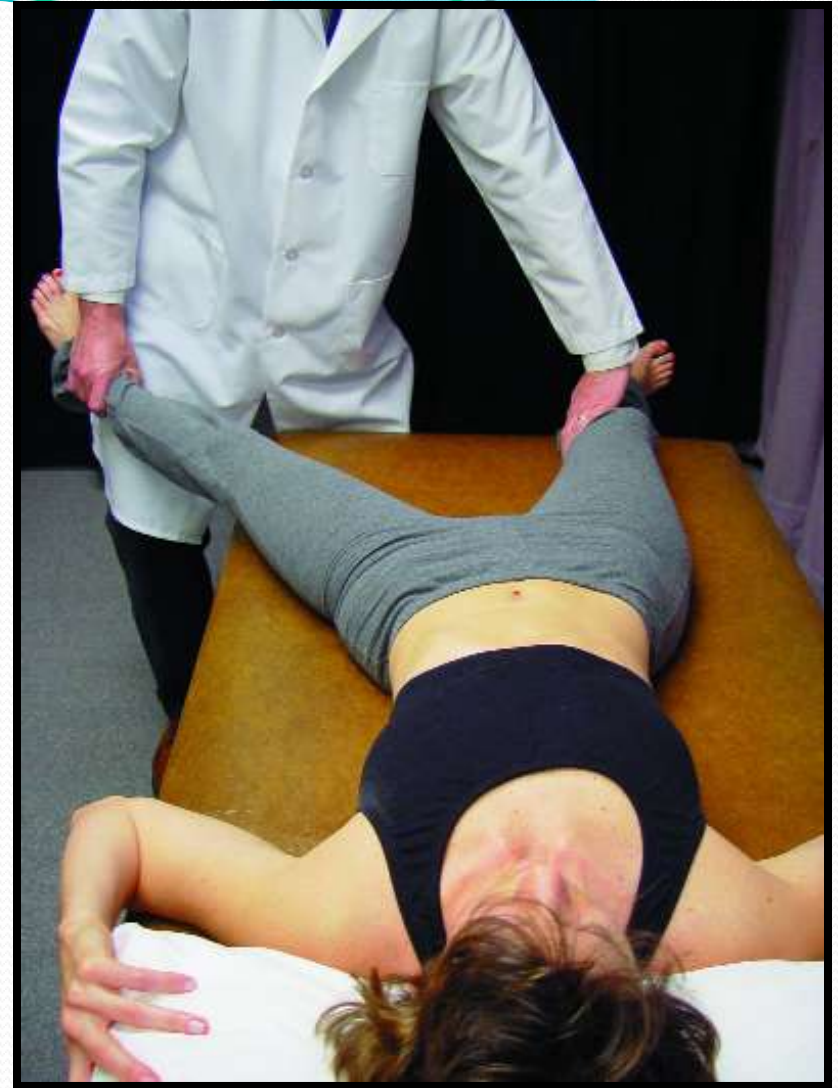
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Lower Extremity Entrapment / Tunnel Syndromes

Saphenous Nerve

- Treatment
 - Stretching with deep stroking massage of the adductor musculature
 - Ice or heat depending on the phase of rehabilitation
 - Manipulation of the knee, SIJ and lumbar spine



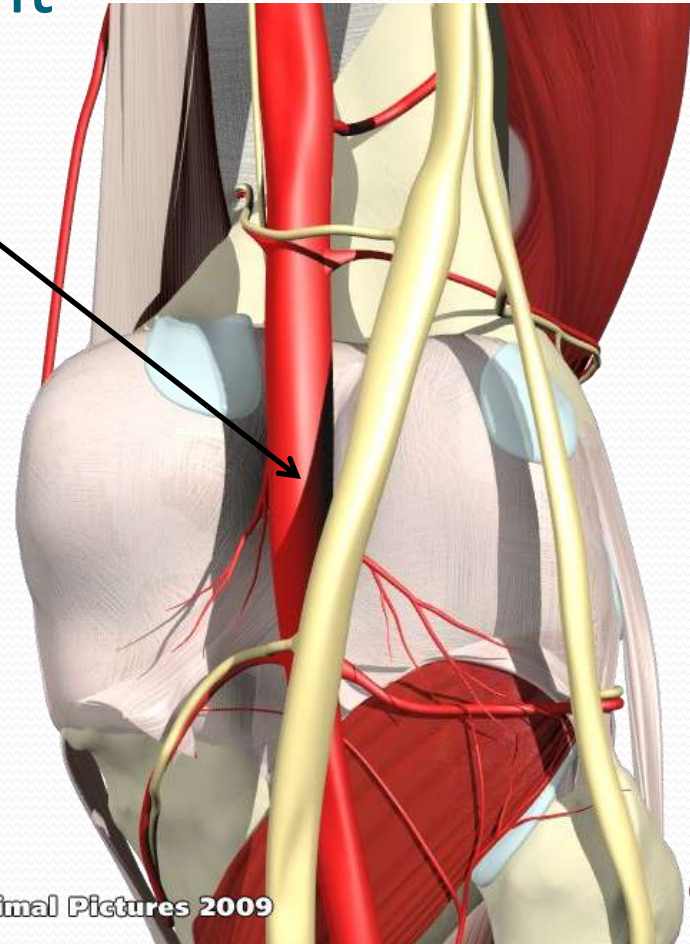
Stretching of the Adductors

800-549-5993 www.TheSupplyCenter.com

Lower Extremity Entrapment / Tunnel Syndromes

Popliteal Artery Entrapment

- Etiology
 - Intermittent claudication associated with popliteal artery that is compressed between the gastrocnemius and medial femoral condyle or by the gastrocnemius tendinous origin itself



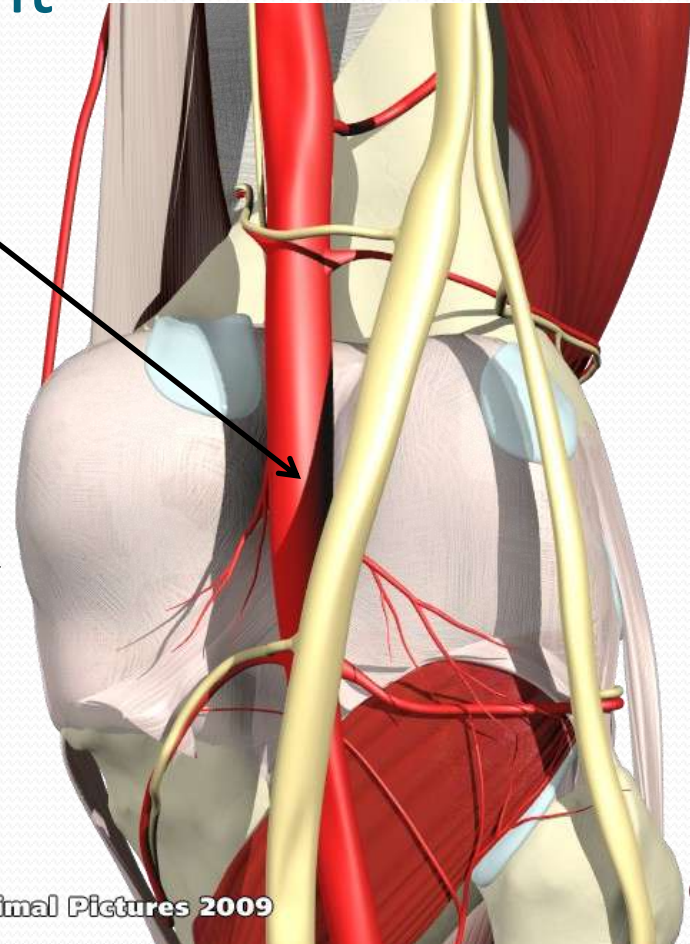
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Lower Extremity Entrapment / Tunnel Syndromes

Popliteal Artery Entrapment

- Clinical Signs and Symptoms
 - Young, active patients with intermittent claudication
 - Ischemic conditions involve only foot or entire leg, leads to numbness, tingling, feelings of cold, pain and paresthesia
 - Intermittent leg cramping
 - Claudication most constant symptom
 - Weakening or disappearance of the dorsalis pedis pulse with maximum dorsiflexion or plantarflexion with extended knee implicates popliteal artery compression
 - Relief with rest



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Orthopedic Lower Leg/Ankle/Foot

- **Homan's Sign**
- **Procedure:** The patient is in supine position with the knees extended. The examiner raises the affected leg to 45 degrees and firmly squeezes the calf. Then the examiner dorsiflexes the foot while maintaining the pressure on the calf.
- **Positive Finding:** Thrombophlebitis is indicated when deep calf or leg pain is elicited during the maneuver.



Lower Extremity Entrapment / Tunnel Syndromes

Popliteal Artery Entrapment

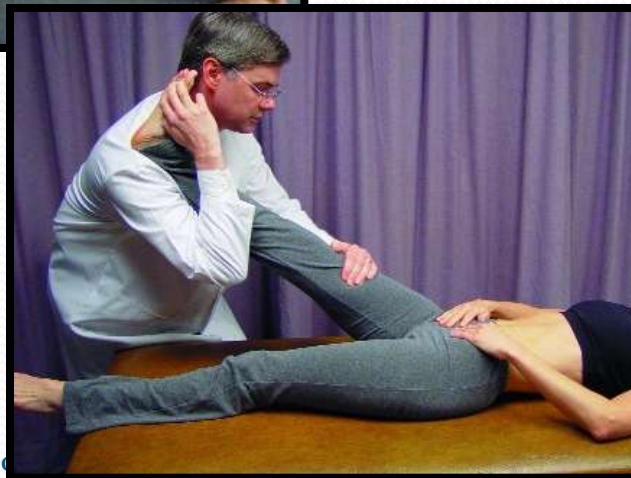
- Treatment
 - Stretch of the gastrocnemius muscle
 - Deep stroking massage with stretches
 - Manipulation of the knee, SIJ and lumbar spine
 - Ice or heat depending on phase of rehabilitation
 - Correct foot biomechanics (orthotics) or shoe wear

Types of Treatment

Stretching Using Contract Relax



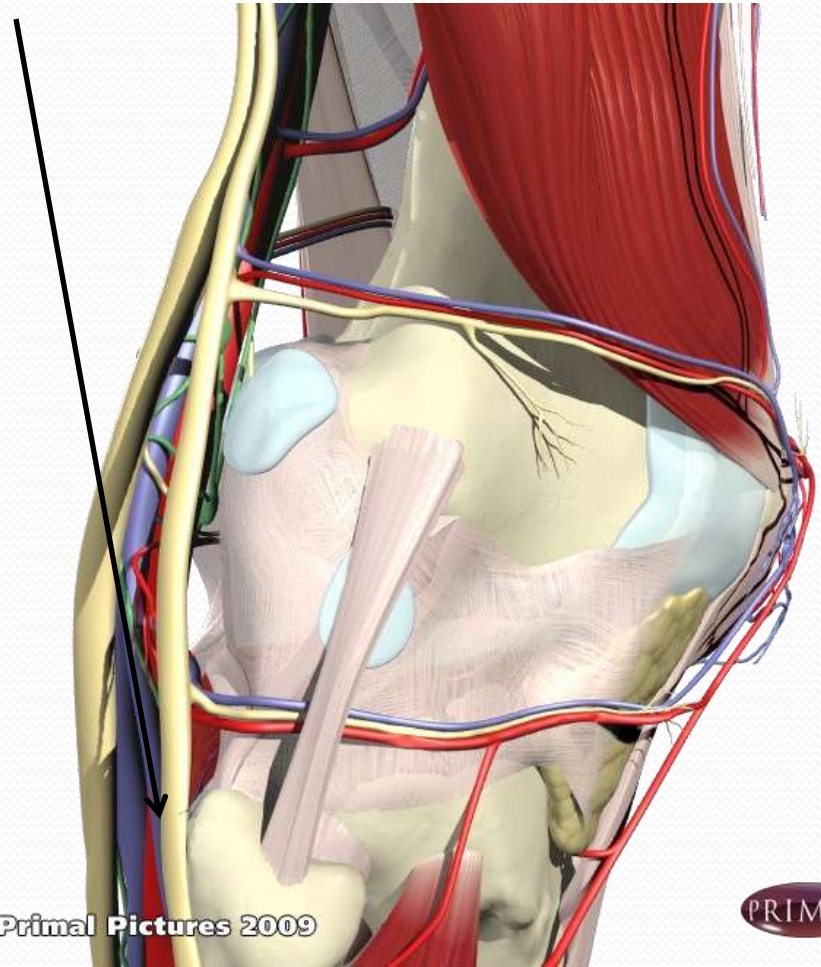
Gastrocnemius stretches



Lower Extremity Entrapment / Tunnel Syndromes

Peroneal Tunnel

- Etiology
 - External causes- casts, prolonged crossed legs
 - Fibular fracture
 - Synovial cysts or ganglions
 - Repetitive actions requiring inversion or pronation



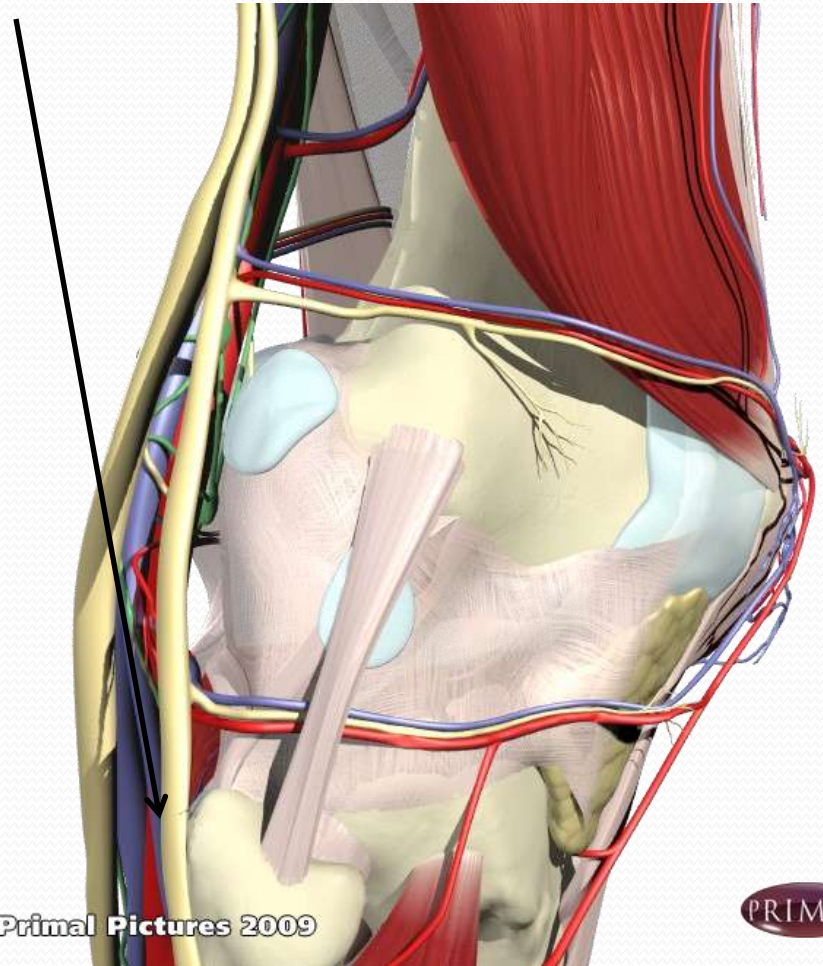
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Lower Extremity Entrapment / Tunnel Syndromes

Peroneal Tunnel

- Clinical Signs and Symptoms
 - Pain initially in compressed region before spreading distally into common peroneal nerves dermatome, which includes dermatomes of deep and superficial peroneal nerves
 - Radiation of pain to thigh may occur
 - Palpation/pressure over tunnel will increase pain- pain not felt in lumbar stenosis, root entrapment, or more proximal compression
 - Weak dorsiflexion and inversion



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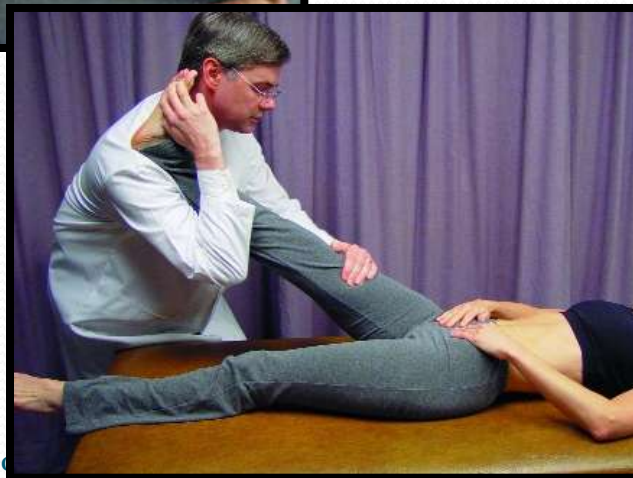
Lower Extremity Entrapment / Tunnel Syndromes

Peroneal Tunnel

- Treatment
 - Stretch of the gastrocnemius muscle
 - Deep stroking massage with stretches
 - Manipulation of the knee, SIJ and lumbar spine
 - Ice or heat depending on phase of rehabilitation
 - Correct foot biomechanics (foot orthotics) or shoe wear



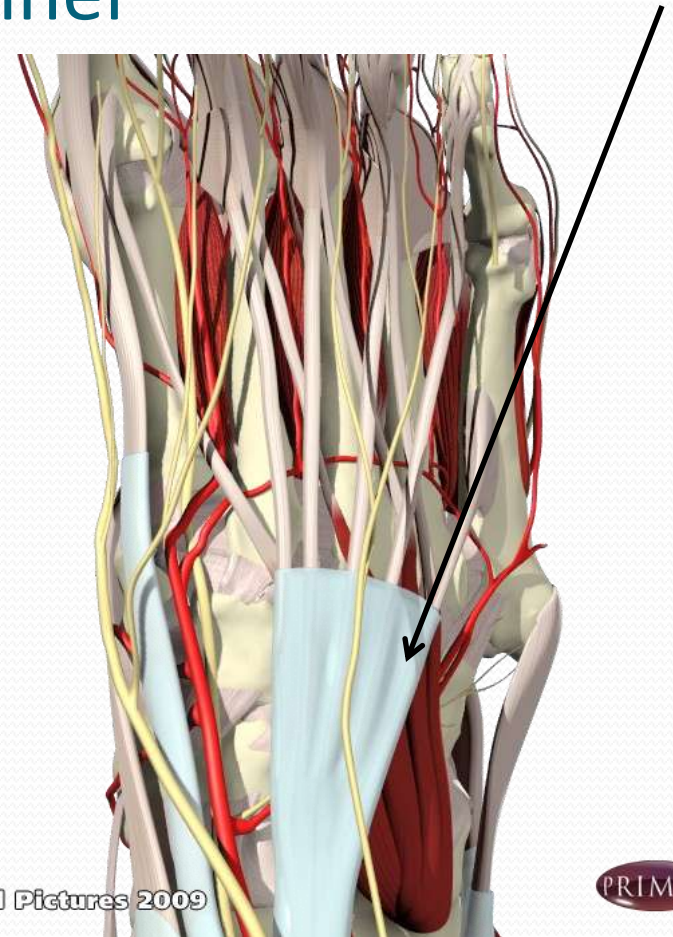
Gastrocnemius stretches



Lower Extremity Entrapment / Tunnel Syndromes

Superficial Peroneal Nerve Tunnel

- Etiology
 - Trauma is most common proposed etiology
 - Rare cause
 - Surgical trauma, lipomas, muscular hernias, tight boots, repetitive compression at foot in sports, dynamic compression



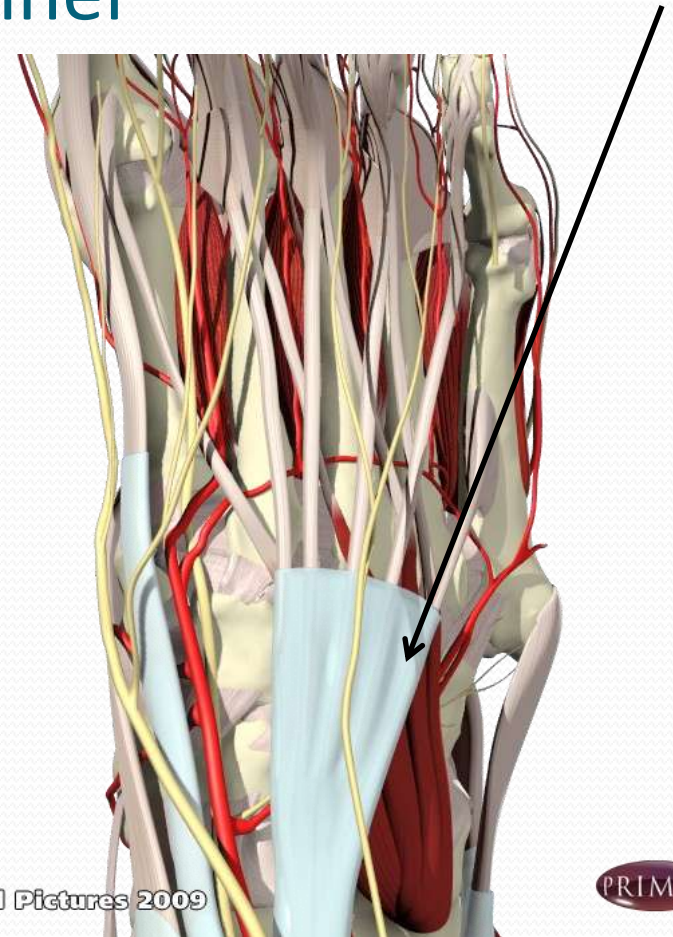
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Lower Extremity Entrapment / Tunnel Syndromes

Superficial Peroneal Nerve Tunnel

- Clinical Signs and Symptoms
 - Pain on dorsum of foot accompanied sometimes by dysesthesias or complete anesthesia in the nerve's dermatome
 - Pain or parasthesias over the nerve's dermatome with
 - 1. Resisted dorsiflexion and eversion with pressure over tunnel,
 - 2. Passive plantarflexion and inversion,
 - 3. #2 with pressure over tunnel



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Lower Extremity Entrapment / Tunnel Syndromes

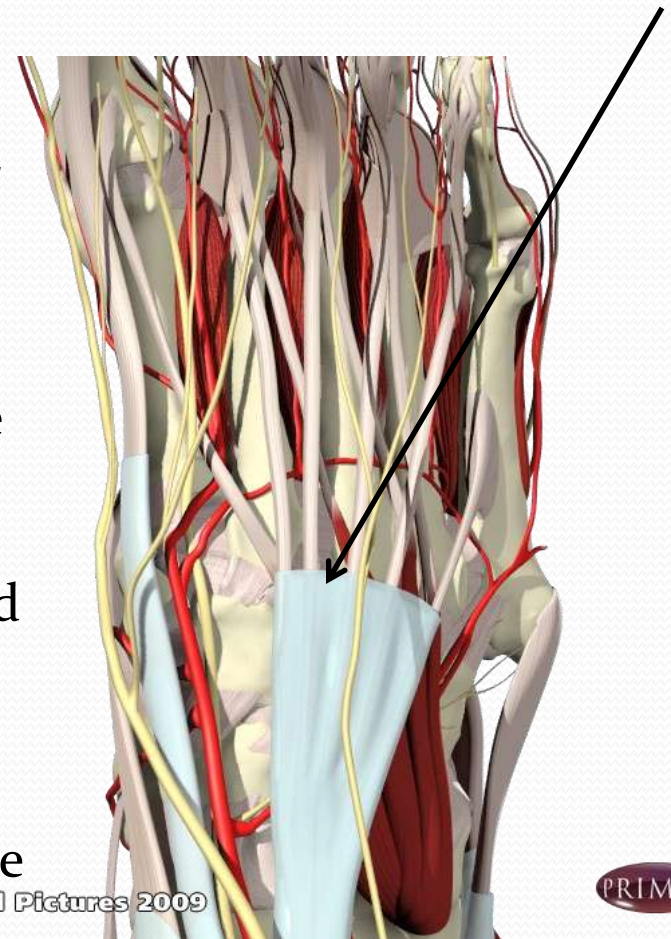
Superficial Peroneal Nerve Tunnel

- Treatment
 - Correct foot/shoe wear
 - Foot orthotics
 - Ice or heat depending on phase of rehabilitation
 - Manipulation of the ankle, SIJ and lumbar spine

Lower Extremity Entrapment / Tunnel Syndromes

Anterior Tarsal Tunnel

- Etiology
 - Bony, joint, vascular, neural, or muscular disorders will alter the tunnel's volume
 - Sudden movement or repetitive actions far from tunnel can stretch and damage the nerve b/c soft tissue structures in the tunnel act distal to the tunnel
 - Repetitive compression from shoe straps and prolonged stretching from prolonged plantar flexion of high heeled shoes
 - Inflammation of tendons
 - Primary neurovascular diseases such as neuromas or aneurysms may decrease the tunnel's volume



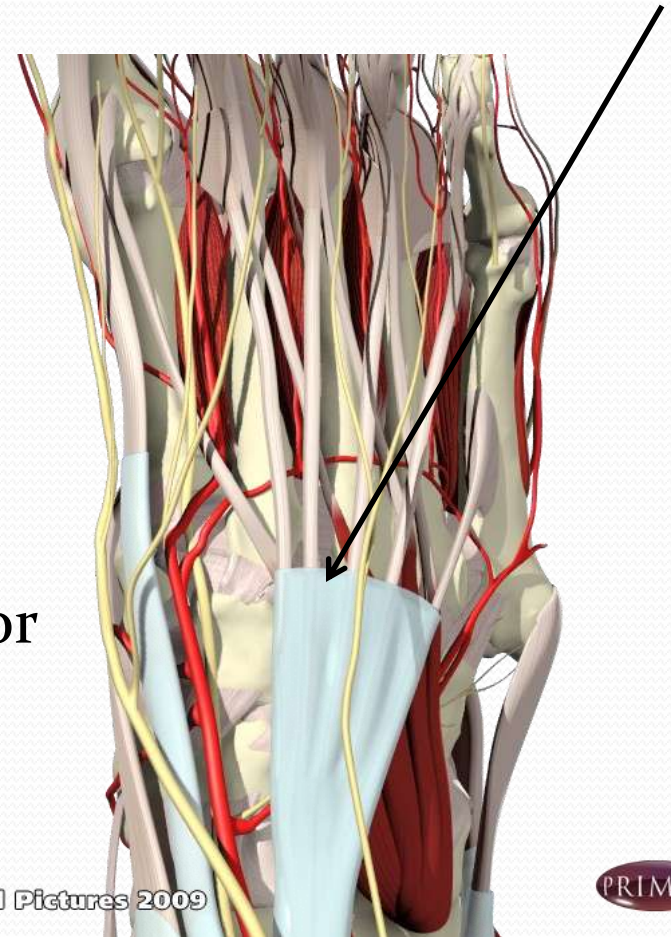
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Lower Extremity Entrapment / Tunnel Syndromes

Anterior Tarsal Tunnel

- Clinical Signs and Symptoms
 - Burning pain localized to dorsal space between the great and the second toes
 - Blunt undefined pain felt deep in foot coexists with disturbed extensor digitorum brevis (EDB) muscle function when motor fibers are compressed
 - Assess EDB with foot max. dorsiflexed and ask pt. to further extend great toe.



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Lower Extremity Entrapment / Tunnel Syndromes

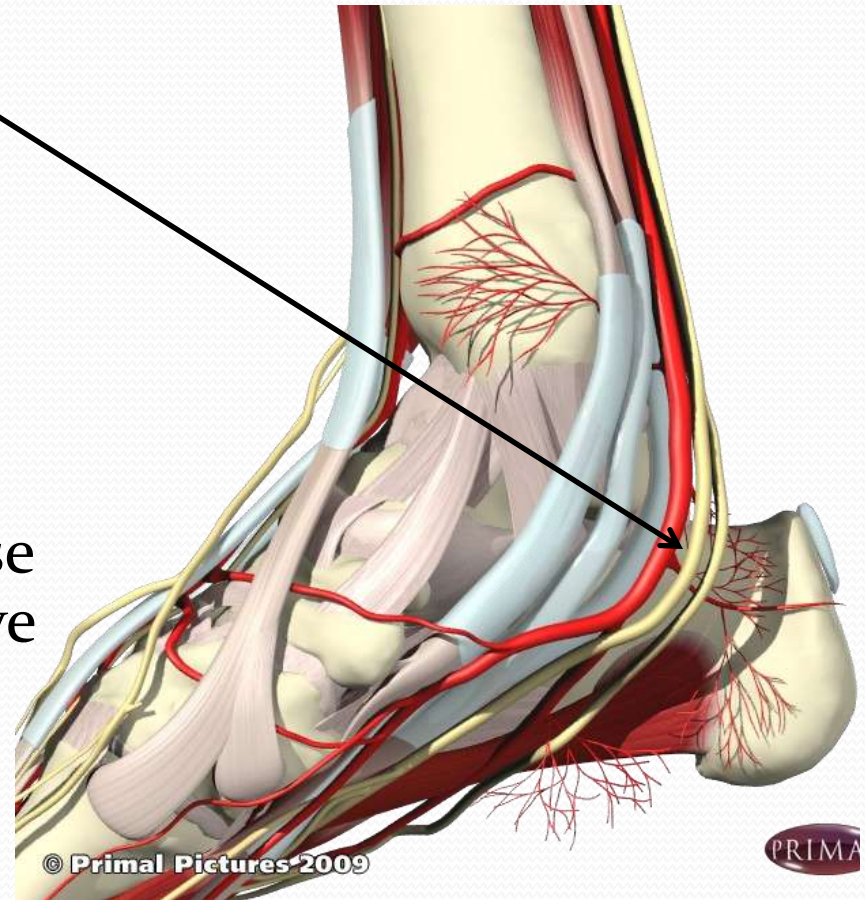
Anterior Tarsal Tunnel

- Treatment
 - Correct foot/shoe wear
 - Foot orthotics
 - Ice or heat depending on phase of rehabilitation
 - Rest, immobilization of foot at 90°
 - Manipulation of the ankle, SIJ and lumbar spine

Lower Extremity Entrapment / Tunnel Syndromes

Tarsal Tunnel

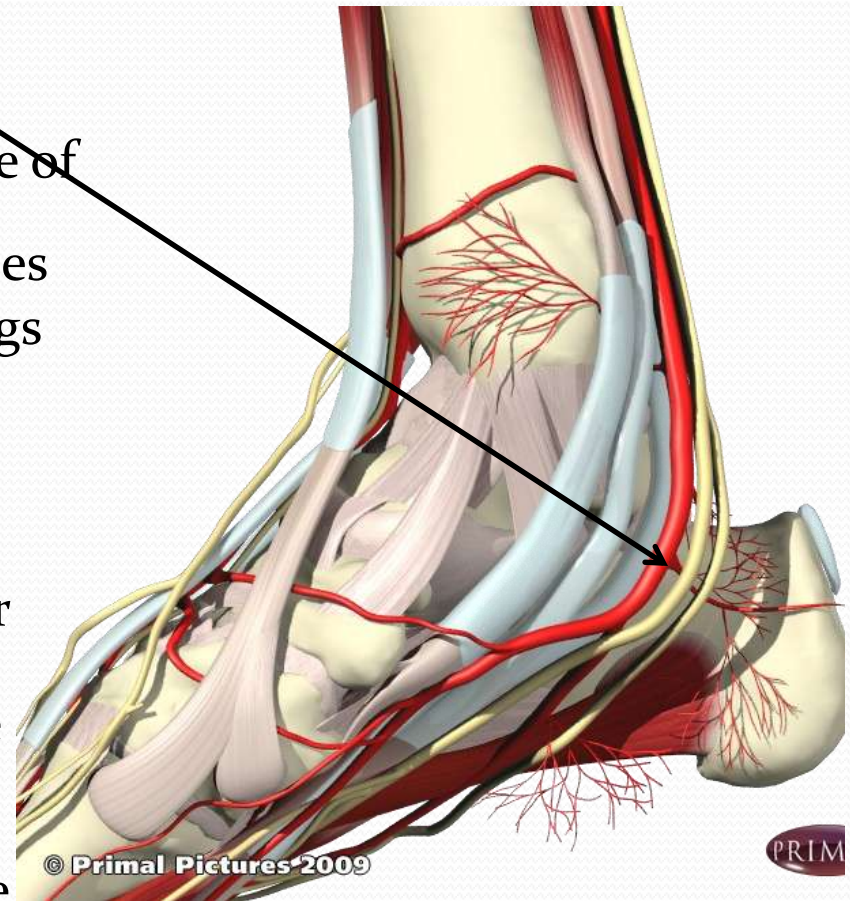
- Etiology
 - Mechanical pressure from changes in the tissue relationships within the tunnel
 - Trauma and congenital or acquired anomalies predispose people to a higher risk of nerve compression
 - Increased vascular compromise during standing and walking



Lower Extremity Entrapment / Tunnel Syndromes

Tarsal Tunnel

- Clinical Signs and Symptoms
 - Pain and paresthesia esp. in dermatome of medial plantar nerve, medial plantar surface, and great, second, and third toes
 - Burning, numbness, pressure, or feelings of pins and needles
 - Hypesthesia and loss of two-point discrimination are early signs of nerve compression
 - Inspection may reveal retromalleolar or submalleolar swelling
 - Forced eversion and dorsiflexion of the foot can reproduce pain
 - Symptoms usually confined to the dermatome of the medial plantar nerve



Lower Extremity Entrapment / Tunnel Syndromes

Tarsal Tunnel

- Treatment
 - Correct foot/shoe wear
 - Foot orthotics
 - Ice or heat depending on phase of rehabilitation
 - Manipulation of the ankle, SIJ and lumbar spine

Orthopedic Lower Leg/Ankle/Foot

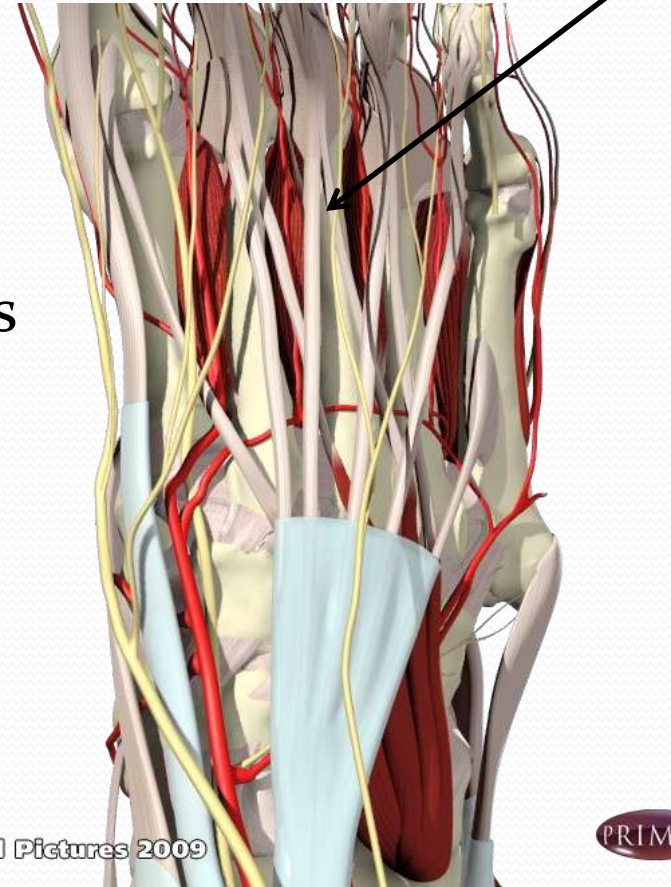
- **Helbing's Sign**
- **Procedure:** The patient is standing on a firm surface. The examiner stands behind the patient and observes the positions of the Achilles tendons. The absence of curving of the tendons as the patient bears weight is a normal finding.
- **Positive Finding:** Medial curving of the Achilles tendon is a positive sign for a pes planus condition.



Lower Extremity Entrapment / Tunnel Syndromes

Metatarsalgia

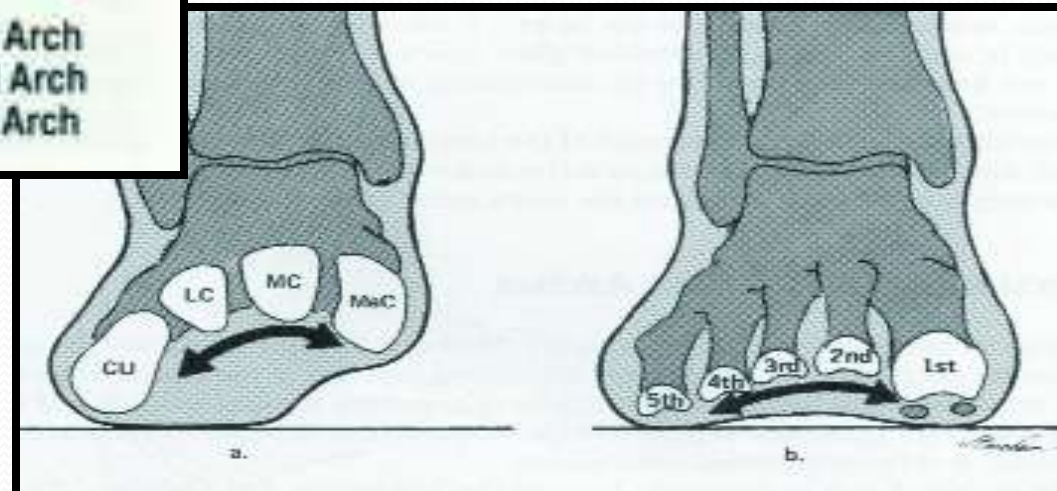
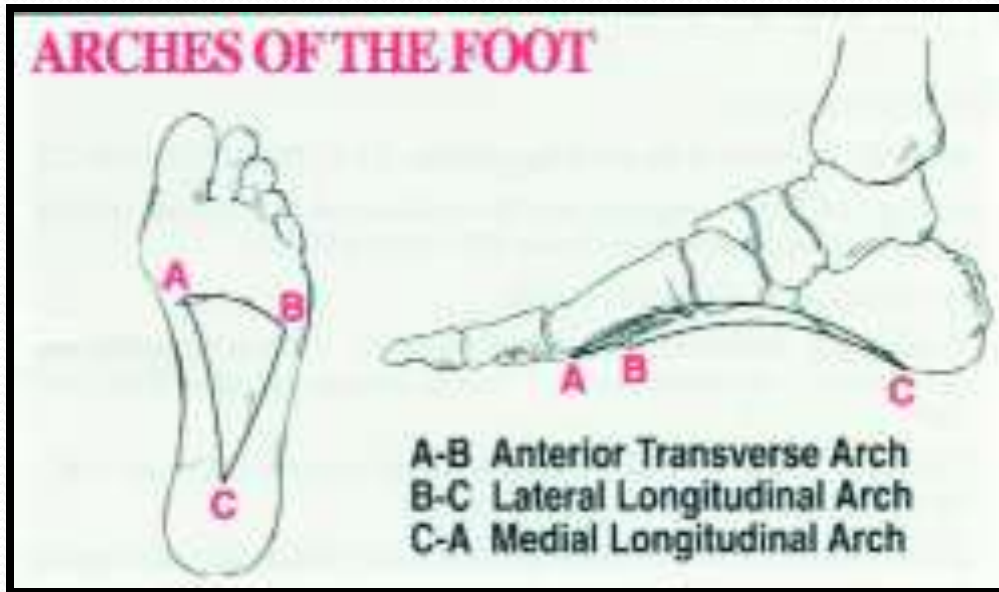
- Etiology
 - Trauma, inflammatory disease, functional anatomy, and degenerative changes of the tunnel's tissues
 - Hormonal factors producing edema, i.e. in pregnant or premenstrual women
 - Rheumatic inflammatory disease, ganglions, and synovial cysts



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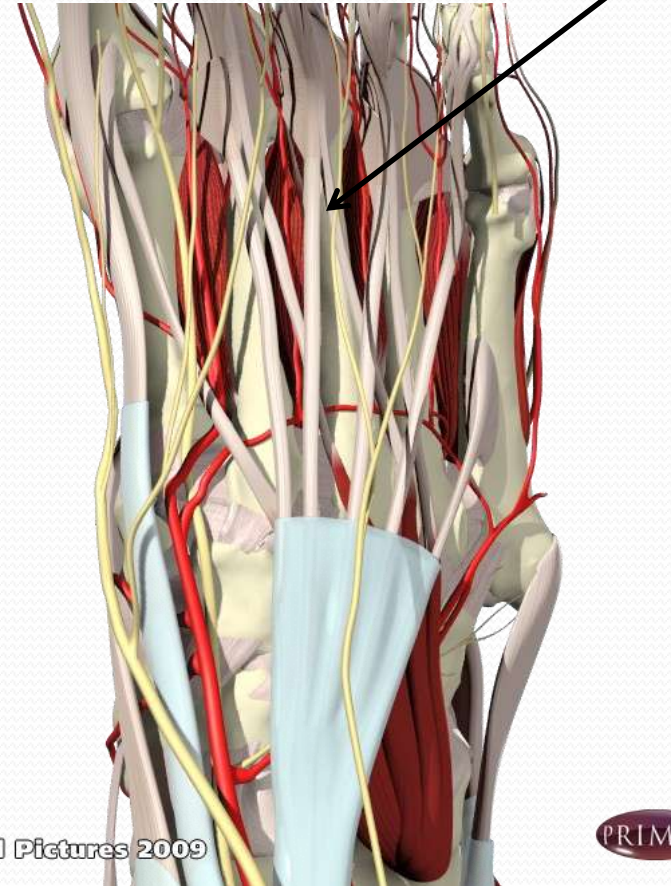
Structure & Function of the Lower Extremity



Lower Extremity Entrapment / Tunnel Syndromes

Metatarsalgia

- Clinical Signs and Symptoms
 - Cutting or electrical in sensation but never diffuse and burning
 - Toe hyperextension in high heeled shoes or while crouching aggravates pain
 - Trigger point at the metatarsal heads especially between 3rd and 4th heads



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Orthopedic Lower Leg/Ankle/Foot

- **Helbing's Sign**
- **Procedure:** The patient is standing on a firm surface. The examiner stands behind the patient and observes the positions of the Achilles tendons. The absence of curving of the tendons as the patient bears weight is a normal finding.
- **Positive Finding:** Medial curving of the Achilles tendon is a positive sign for a pes planus condition.



Orthopedic Lower Leg/Ankle/Foot

- **Morton's Test**
- **Procedure:** The patient is in supine position. Using one hand to grasp the affected forefoot, the examiner applies transverse pressure to the metatarsal heads with the other hand.
- **Positive Finding:** Sharp pain in the foot is a positive test for metatarsalgia or neuroma.



Lower Extremity Entrapment / Tunnel Syndromes

Metatarsalgia

- Treatment
 - Correct foot/shoe wear
 - Foot orthotics especially lifting the transverse arch
 - Ice or heat depending on phase of rehabilitation
 - Manipulation of the foot, SIJ and lumbar spine