# SPASTICITY ASSESSMENT IN THE NEUROLOGICAL CLIENT

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# SPASTICITY DEFINITION

- A Motor disorder from an Upper Motor Neuron Lesion
- Cerebral origin spasticity characteristics
  - Hyperexcitability of monosynaptic pathways and hyperactive reflexes
  - Velocity Dependent increased resistance to passive limb movement
  - Rapid rise in excitability
    - Lance JW 1980
- "Pathological Neuromuscular activation and hyper-resistance around joints due to modification of visco-elastic muscle components"
    - Andringa et al 2019

# PREDICTORS OF SPASTICITY

- "Reduced sensorimotor function was the most important predictor both for any and severe spasticity, and spasticity could be predicted with high sensitivity and specificity 10 days poststroke."

Opheim et al. Neurology®2015;85:873–880

# PREVALENCE

- In stroke:
  - 4-27% in the first month post stroke
  - 17-46% in the first 3 months post stroke
  - 38% by 12 months post stroke
  - More common in chronic phases of stroke
- In TBI:
  - Varies from 13-20%
- Prevalent in SCI, MS and CP diagnoses

Dong et al 2017, Intiso et al 2020

# TO TREAT OR NOT TO TREAT

- Risk of no treatment:
  - Pain/discomfort
  - Contractures and skin breakdown
  - Decreased UE/LE function
  - Decreased Mobility
  - Poor QoL

# ASSESSMENT

**Table 1**
**Patient complaints and examination findings associated with spasticity**

| Complaints | Clinical Signs |
|---|---|
| • Muscle stiffness or tightness | • Resistance to passive movement |
| • Muscle spasms | • Clonus |
| • Clonus (shaking) | • Spasms |
| • Pain | • Co-contraction of agonist and antagonist muscles |
| • Difficulty performing voluntary movement | • Spastic dystonia |
| | • Decreased passive range of motion |
| • Limb deformity (cosmetic or functional concern) | • Abnormal posture |
| | • Limb deformity |

Bethoux F. Phys Med Rehabil Clin N Am. 2015

# ASSESSMENT

- Resistance to Passive Movement (Not a true indicator of spasticity)
  - Scales:
    - Modified Ashworth Scale and Tardieu Scales
      - Poor sensitivity to change
      - Poor inter-rater reliability
    - Triple Spasticity Scale
      - Good test-retest reliability and inter-rater reliability
      - 3 subsections: Stretch (slow and fast), clonus and dynamic muscle length
- Observe function!

# UPPER AND LOWER EXTREMITY NEURORECOVERY STAGES

**Hierarchical Properties of the Fugl-Meyer Assessment Scale Motor Function Sections**

| Twitchell[6] | Brunnstrom[7] | Fugl-Meyer et al[1] | | |
|---|---|---|---|---|
| | | | **Upper extremity** | **Lower extremity** |
| Flaccid paralysis with areflexia | Stage 1<br>Flaccid paralysis | | | |
| Reflex activity returns/ spasticity develops | Stage 2<br>Development of minimal movement in synergies | Stage 1<br>Reflex activity | - Tendon reflexes | - Tendon reflexes |
| Voluntary movement in stereotyped flexor and extensor synergies/ spasticity is at maximal level | Stage 3<br>Voluntary movement synergy dependent | Stage 2<br>Voluntary movement in flexor and extensor synergies | - Flexor synergy<br>- Extensor synergy | - Flexor synergy<br>- Extensor synergy |
| Voluntary movement with breaking up of synergies/ spasticity is reducing | Stage 4<br>Some movements out of synergy | Stage 3<br>Voluntary movement partially independent of synergies | - Hand to lumbar spine<br>- Shoulder flexion 0° - 90°<br>- Pronation/supination (elbow 90°) | In sitting position<br>- Knee flexion<br>- Ankle dorsiflexion |
| | Stage 5<br>Movements almost independent of synergy | Stage 4<br>Voluntary movement independent of synergies | - Shoulder abduction 0° - 90°<br>- Shoulder flexion 90° - 180°<br>- Pronation/supination (elbow 0°) | In standing position<br>- Knee flexion<br>- Ankle dorsiflexion |
| Normal voluntary movement with normal speed and dexterity/ slight hyperactivity of the tendon reflexes | Stage 6<br>Normal movement with normal speed | Stage 5<br>Normal reflex activity | - Tendon reflexes (symmetry) | - Tendon reflexes (symmetry) |
| | Wrist | Wrist | - 5 items | |
| | Hand | Hand | - 7 items | |
| | | Coordination<br>No dysmetria or ataxia and normal speed | - Tremor<br>- Dysmetria<br>- Time | - Tremor<br>- Dysmetria<br>- Time |

Comparison of sequence of stepwise recovery described by Twitchell 6 and Brunnstrom 7 with the stages and scale items used by Fugl-Meyer et al. 1

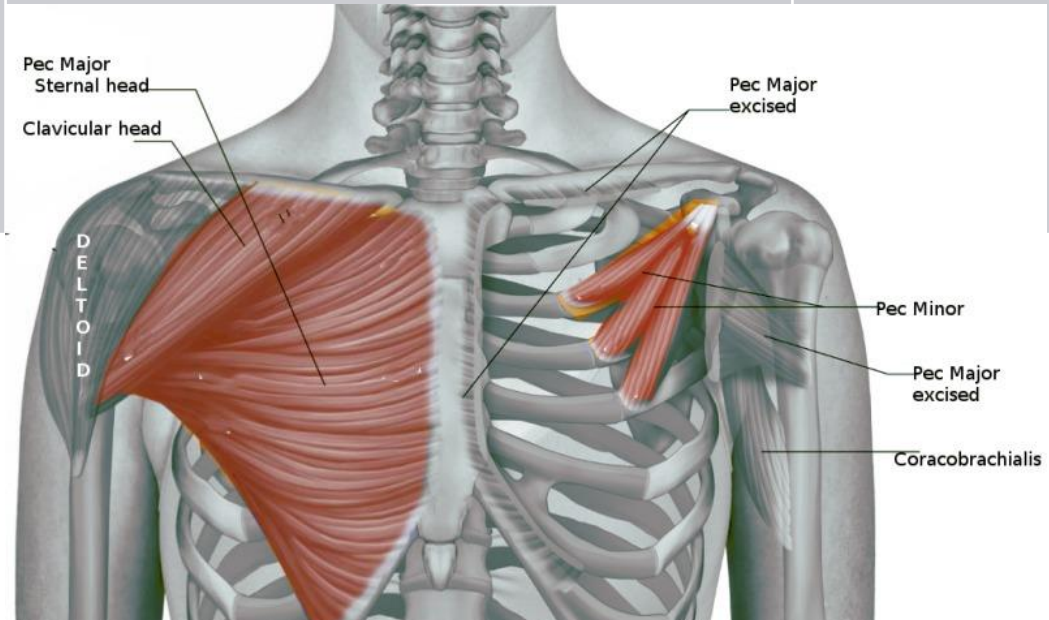
# SELECTIVE MOVEMENT SCREENING FOR THE UPPER AND LOWER EXTREMITY

- LE selective movement screen
  - Performed in sitting:
    - No volitional movement
    - Flexor or Extensor Synergy
    - Seated isolated hip flexion
    - Isolated and graded knee flex/extension
    - Isolated ankle DF/eversion with knee flexion or extension
  - Performed in standing:
    - Ankle DF
    - Hip abduction w/ ankle DF/eversion
    - Isolated knee flexion without hip flexion
- UE selective movement screen
  - Performed in sitting and then progressed to standing and gait
    - Initiation of scapular adduction/depression
    - Initiation of shoulder flexion and abduction in context of a reach
    - Elbow flexion/extension
    - Forearm supination/pronation
    - Isolated wrist extension
    - Isolated finger flexion/extension

# SELECTIVE MOVEMENT SCREEN

# PHYSICAL ASSESSMENT -- UE

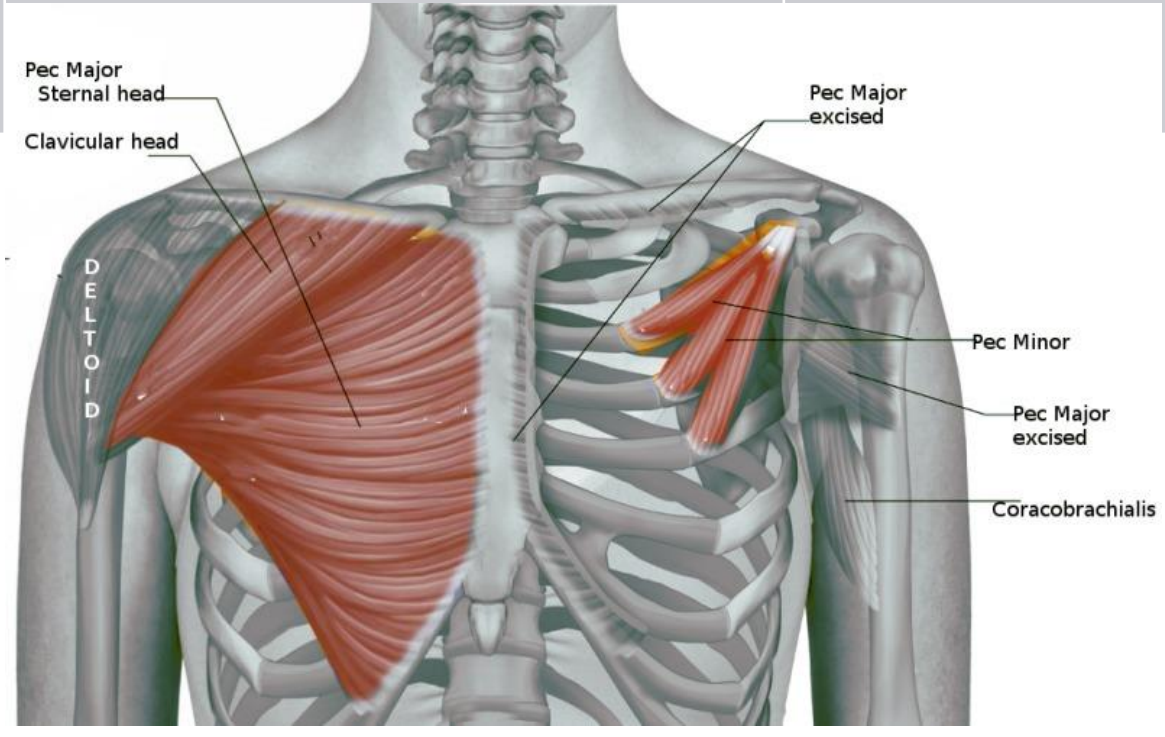
| Muscle | Presentation | Testing |
|---|---|---|
| **Pectoralis Major**<br>Origin: Clavicular part: anterior surface of medial half of clavicle<br>Sternocostal part: anterior surface of sternum, Costal cartilages of ribs 1-6<br>Abdominal part: Anterior layer of rectus sheath<br><br>Insertion: Crest of greater tubercle of humerus | • Glenohumeral IR with anterior humeral head and scapular abduction<br>• Possible contracture or pain | Passive: Move the Shoulder toward ER, abduction, and elevation<br>- *Vary level of elevation for different heads of muscle*<br>Active: Ask patient to quickly swing arms out to side from midline |



# SIGNS OF PECTORALIS MAJOR SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

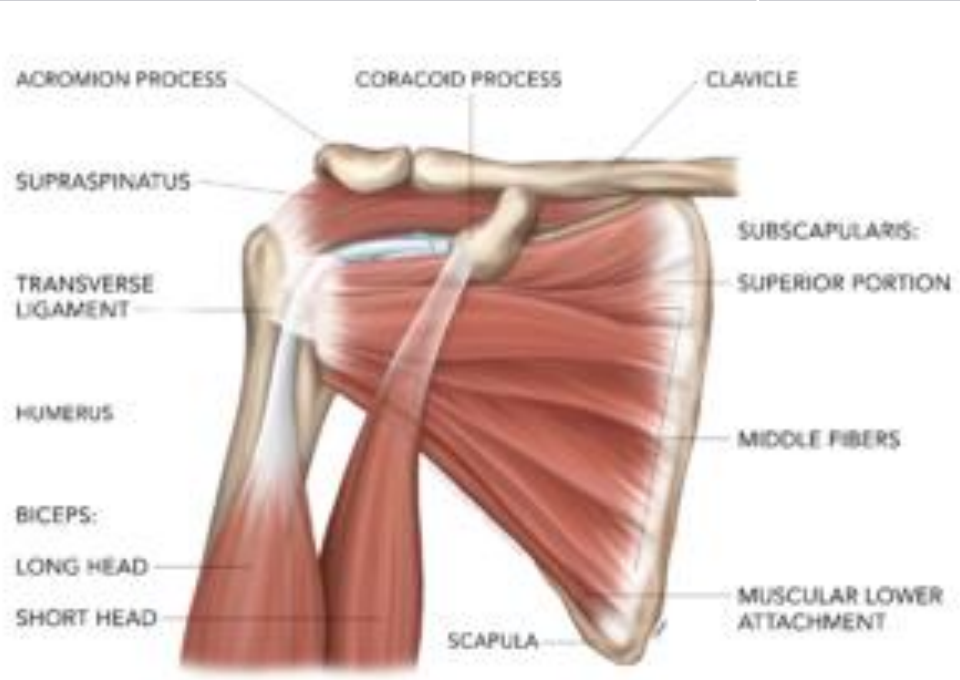
| Muscle | Presentation | Testing |
| --- | --- | --- |
| **Pectoralis Minor**<br>Origin: Anterior surface, costal cartilages of ribs 3-5<br><br>Insertion: Medial border and coracoid process of scapula | • Scapula Position: Ant tilt<br>• Humeral head positioning anteriorly | Move the scapula into depression w/ a lift of the anterior upper rib cage and clavicle, while elbows remain flexed |



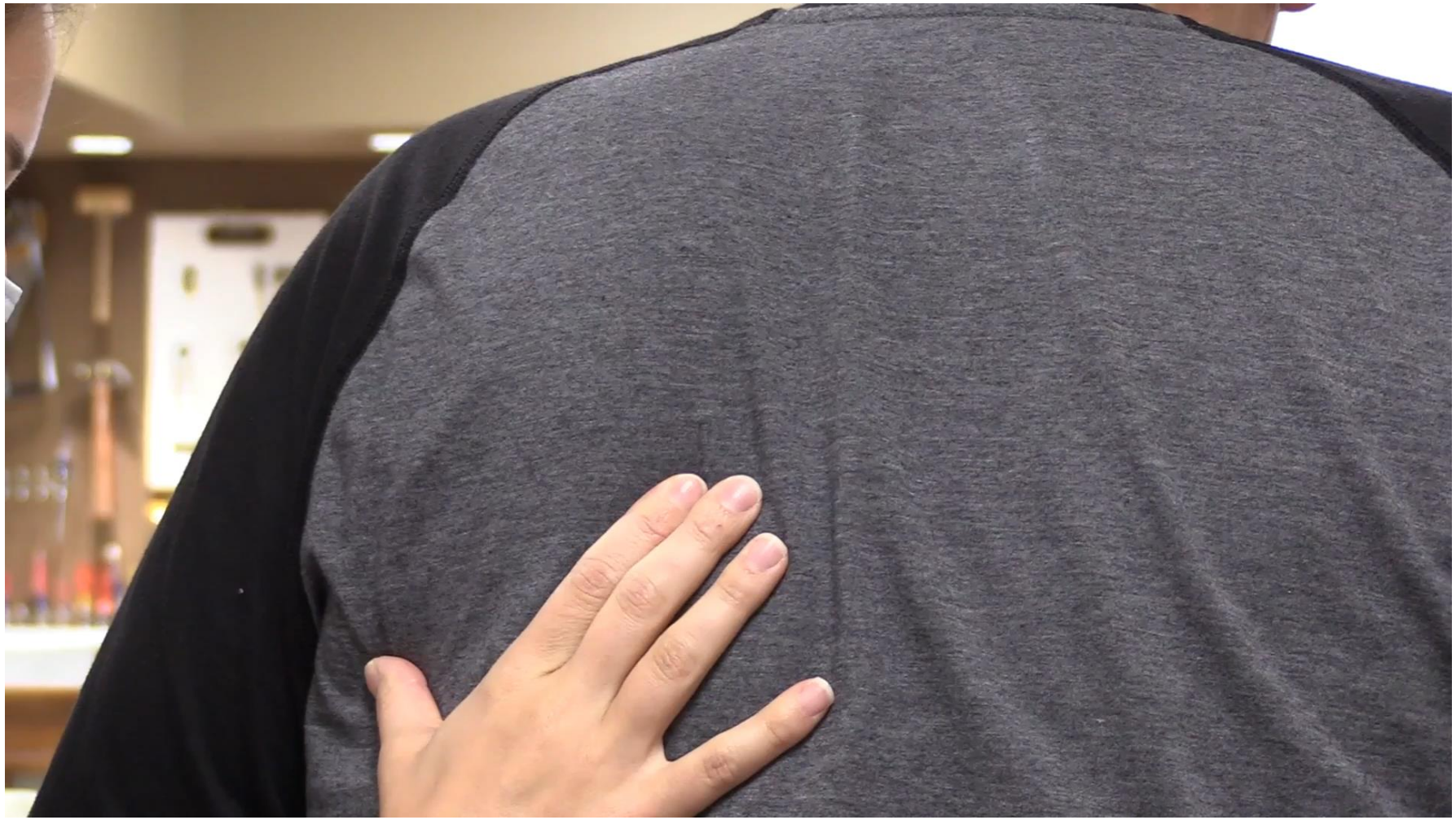
# SIGNS OF PECTORALIS MINOR SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Subscapularis**<br>Origin: Subscapular fossa of scapula<br><br>Insertion: Lesser tubercle of the humerus and the front of the capsule of the shoulder-joint. | • Scapula Position: Abducted<br>• Glenohumeral IR and adduction with anterior humeral head | Move the humerus into abduction while stabilizing the lateral border of the scapula |

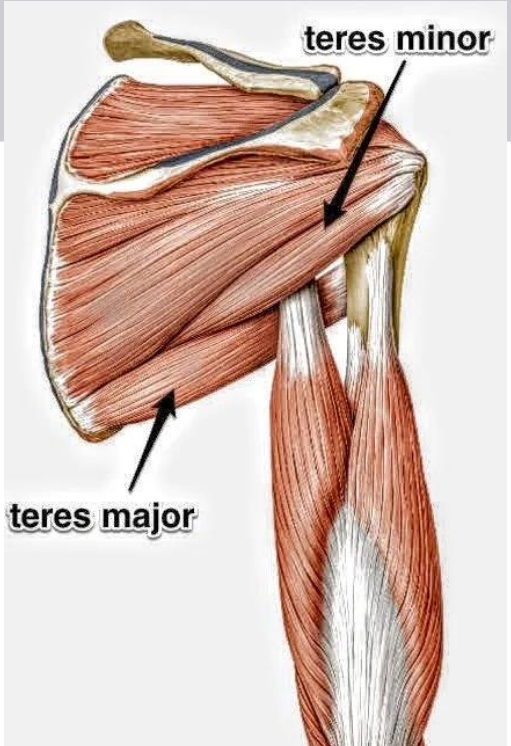


# SIGNS OF SUBSCAPULARIS SPASTICITY AND ASSESSMENT



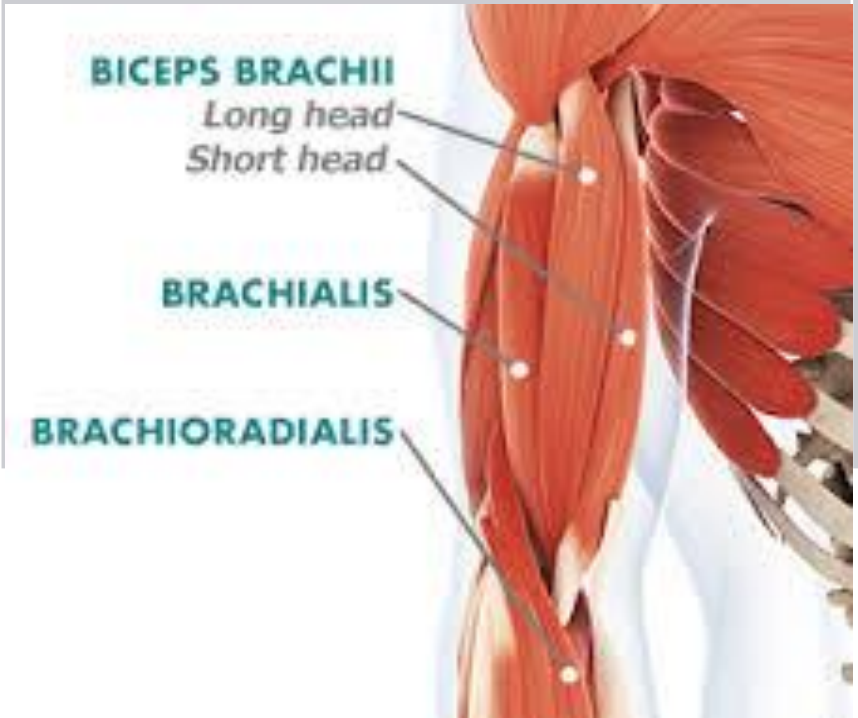
# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Teres Major**<br>Origin: Inferior angle and lower part of the lateral border of the scapula<br><br>Insertion: Intertubercular sulcus (medial lip) of the humerus | • Glenohumeral IR and humeral extension with anterior humeral head | Move the humerus into flexion while stabilizing the lateral border of the scapula |



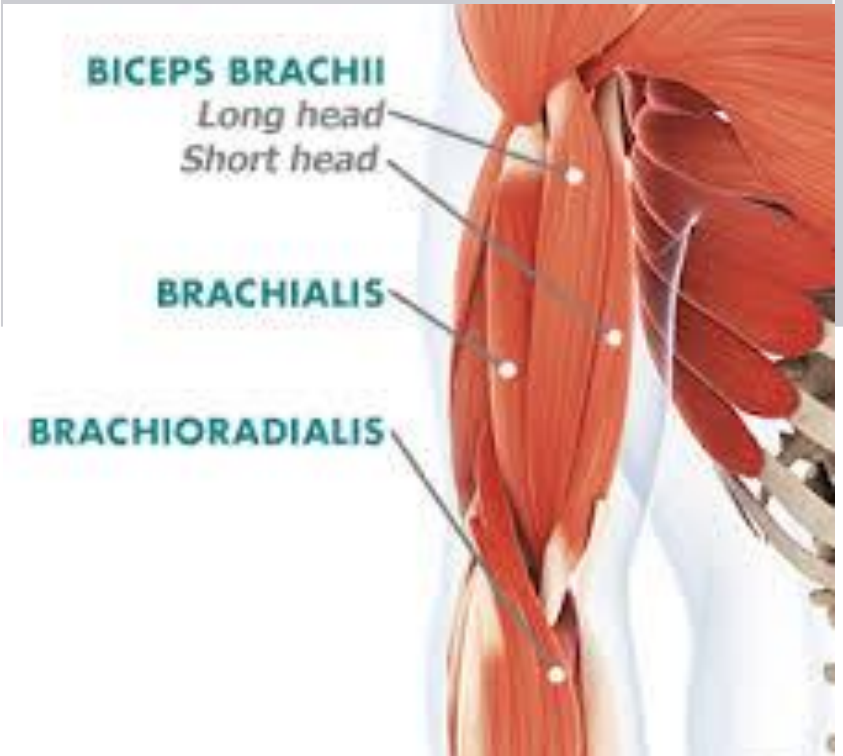
# SIGNS OF TERES MAJOR SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Biceps Brachii**<br>Origin: Short head: Apex of the Coracoid process of the scapula<br>Long head: Supraglenoid tubercle of the scapula<br><br>Insertion: Radial tuberosity of the radius and deep fascia of forearm (insertion of the bicipital aponeurosis) | • Posturing of elbow flex with forearm supination<br>• Shoulder **pain** – long head of biceps causing a superior subluxation<br>  | Passive – Supinate the forearm and quickly extend the elbow while stabilizing the humeral head<br><br>Active – Have the patient quickly extend elbow while the forearm is toward supination |

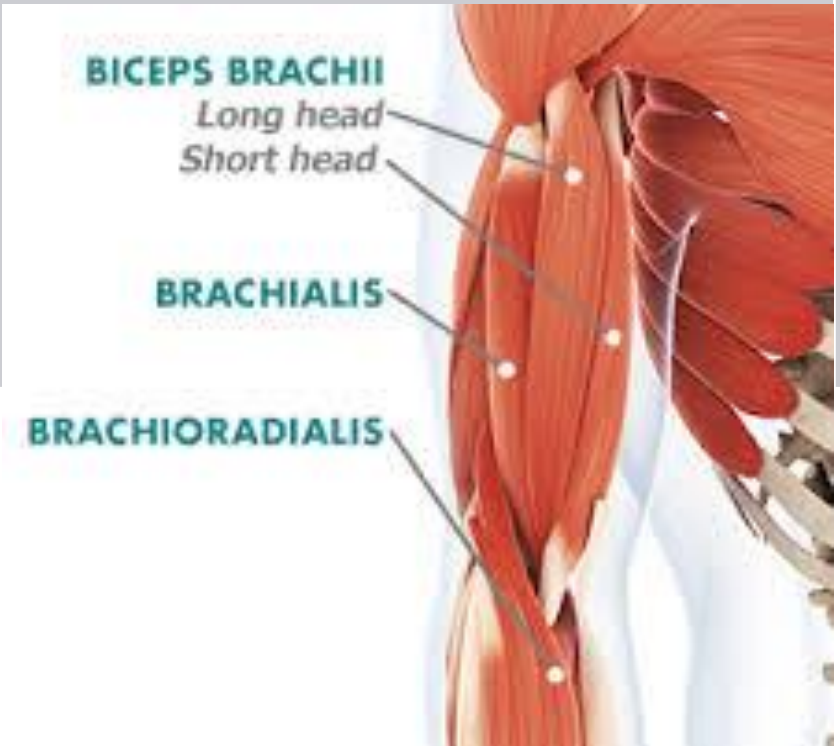
# SIGNS OF BICEPS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Brachioradialis** -<br>Origin: Lateral supracondylar ridge of humerus, lateral intermuscular septum of arm<br><br>Insertion: (Proximal to) styloid process of radius<br>(can pronate/supinate forearm) | Muscle definition with elbow flex, usually forearm neutral/mid-position<br><br>  <br> | Passive – Place the forearm in a neutral position and quickly extend the elbow while stabilizing the humeral head<br><br>Active – Have the patient quickly extend elbow while the forearm arm is in a neutral position |

# SIGNS OF BRACHIORADIALIS SPASTICITY AND ASSESSMENT

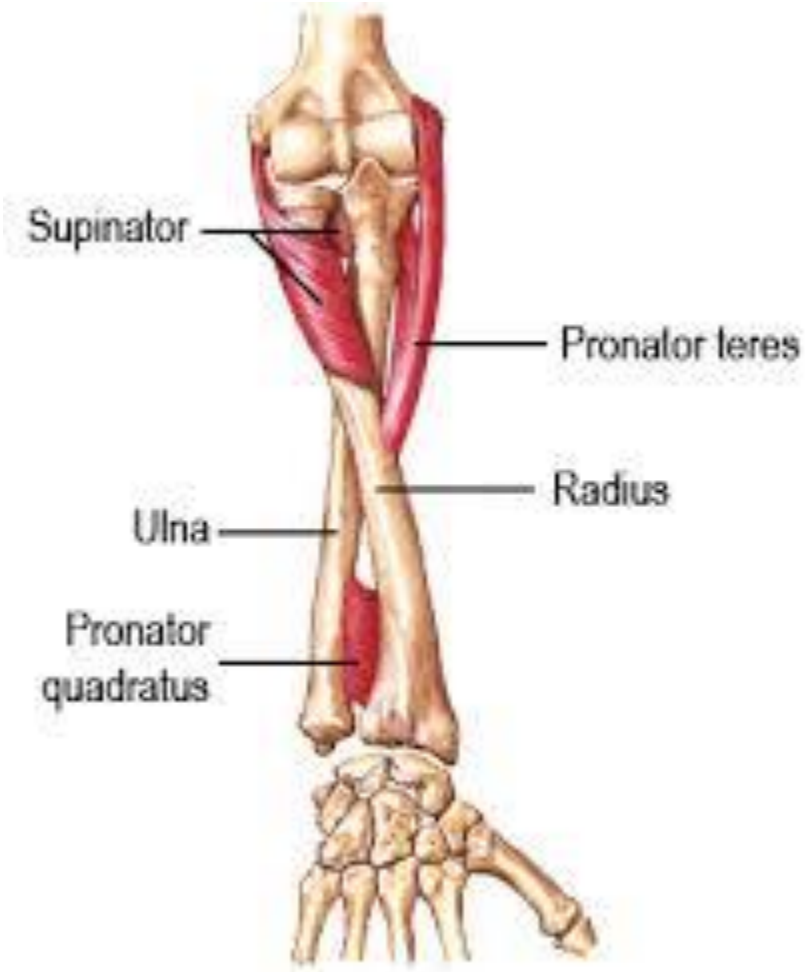
# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Brachialis**<br>Origin: Distal half of anterior surface of humerus<br><br>Insertion: Coronoid process of the ulna; Tuberosity of ulna<br>(no effect position forearm; flexes elbow regardless forearm position) | Elbow flex – when forearm is pronated and/or supinated<br>  | Passive – Pronate the forearm and quickly extend the elbow while stabilizing the humeral head<br>Active – Have the patient quickly extend elbow while arm is toward Pronation to inhibit the biceps influence |

# SIGNS OF BRACHIALIS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

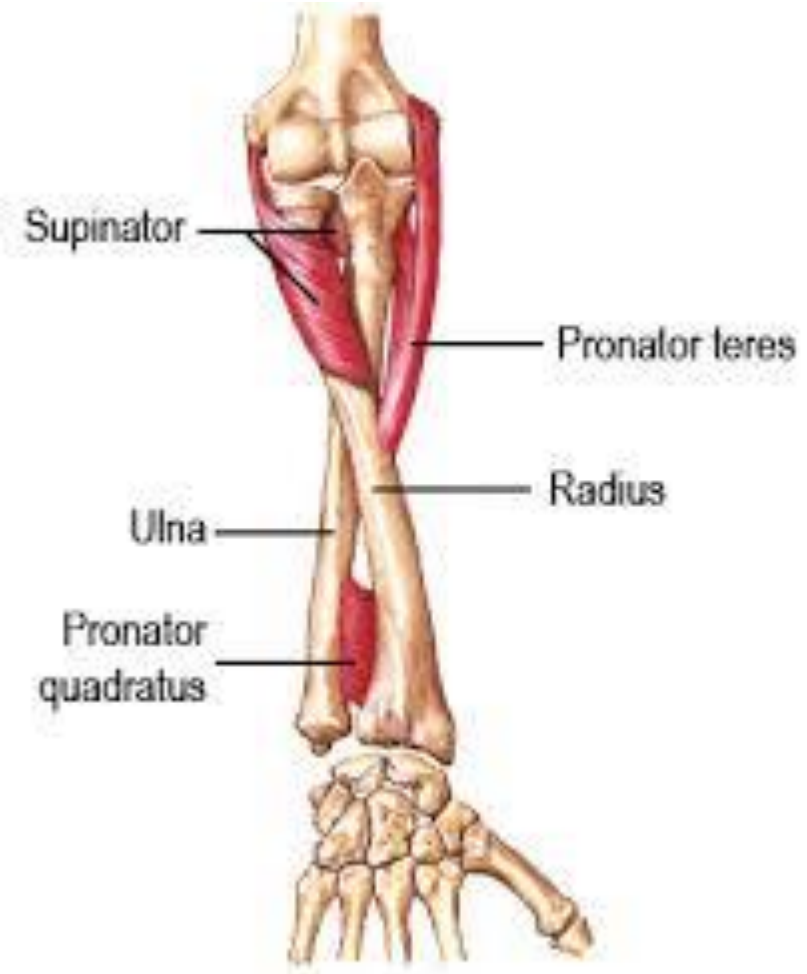
| Muscle | Presentation | Testing |
|---|---|---|
| **Pronator Teres**<br>Origin: Humeral head: medial supracondylar ridge of humerus<br>Ulnar head: Coronoid process of ulna<br><br>Insertion: Lateral surface of radius (distal to supinator) | • Positioned in forearm pronation<br>• Unable to supinate with elbow flexed | Passive: Quickly move forearm into supination with elbow flexed and extended<br><br>Active: Ask the patient to quickly turn their "palm up" with elbow flexed and extended |



# SIGNS OF PRONATOR TERES SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

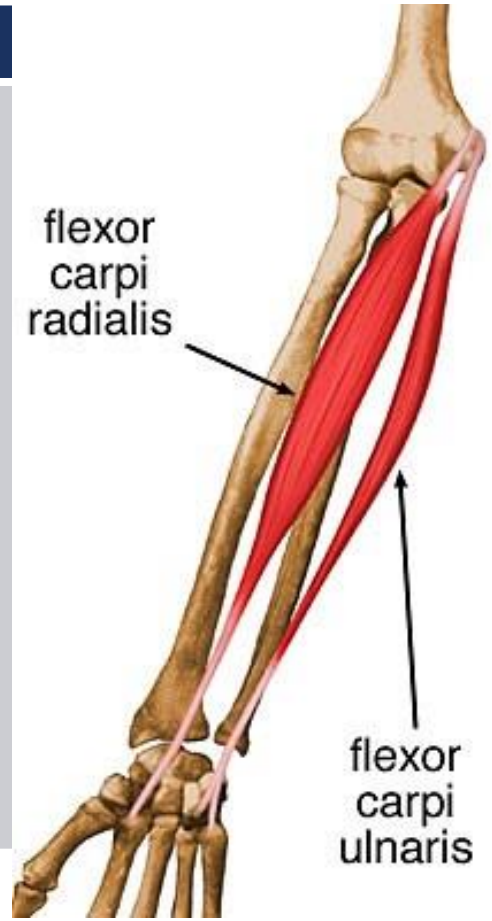
| Muscle | Presentation | Testing |
|---|---|---|
| **Supinator**<br>Origin: Lateral epicondyle of humerus, radial collateral ligament, annular ligament, supinator crest of ulna<br><br>Insertion: Lateral, posterior, and anterior surfaces of proximal third of radius | • Positioning in forearm supination<br>• Forearm supinates with full elbow extension<br>• Limited forearm pronation | Passive: Quickly move forearm into pronation with elbow flexed and extended<br><br>Active: Ask the patient to quickly turn their "palm down" with elbow flexed and extended |



# SIGNS OF SUPINATOR SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

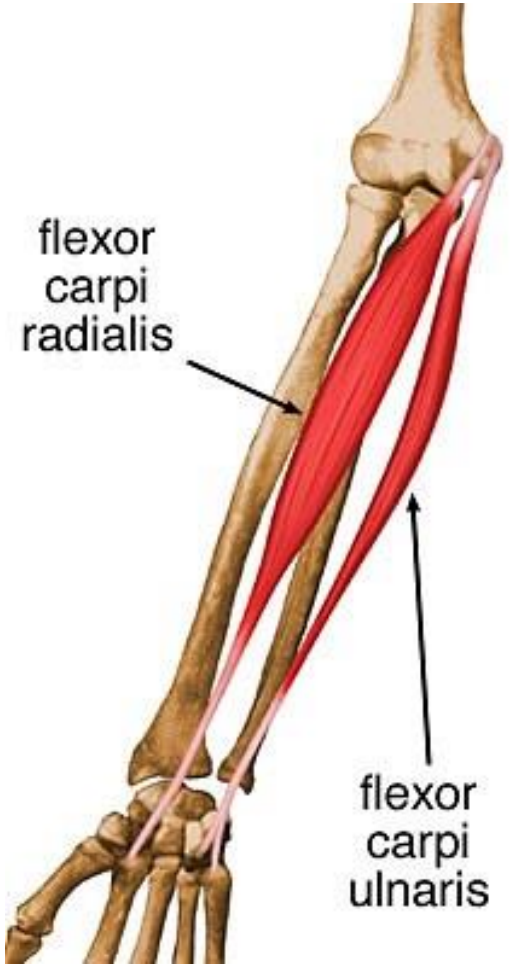
| Muscle | Presentation | Testing |
|---|---|---|
| **Flexor Carpi Ulnaris**<br>Origin: Medial epicondyle of humerus, olecranon and posterior border of ulna<br><br>Insertion: Pisiform bone, hamate bone, base of metacarpal bone 5 | Tendon prominent with passive wrist extension with fingers flexed or wrist positioned ulnar deviation | Passive: With the elbow extended, quickly move wrist into extension and radial deviation<br><br>Active: Ask the patient to quickly extend their wrist leading with their thumb to encourage radial deviation |



# SIGNS OF FLEXOR CARPI ULNARIS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Flexor Carpi Radialis**<br>Origin: Medial epicondyle of humerus<br><br>Insertion: Bases of metacarpal bones 2-3 | Tendon prominent with passive wrist extension with fingers flexed or wrist positioned radial deviation | Passive: With the elbow extended, quickly move wrist into extension and ulnar deviation<br><br>Active: Ask the patient to quickly extend their wrist leading with their 5th finger to encourage ulnar deviation |



# SIGNS OF FLEXOR CARPI RADIALIS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Flexor Digitorum Profundus**<br>Origin: Proximal half of anterior surface of ulna, interosseous membrane<br><br>Insertion: Palmar surfaces of distal phalanges of digits 2-5 | • With wrist extended: Excessive finger flex at the DIP joints<br>• Responds to quick stretch into finger extension<br>• Unable to achieve full Passive finger extension<br>• Resistance into wrist extension | Passive: With wrist in flexion; quickly lift the tips of fingers at the DIP joints toward extension<br><br>Active: Ask the patient to quickly "flick" finger open into finger or to release their grip on an object, noting the DIP joint extension |

# SIGNS OF FLEXOR DIGITORUM PROFUNDUS SPASTICITY AND ASSESSMENT

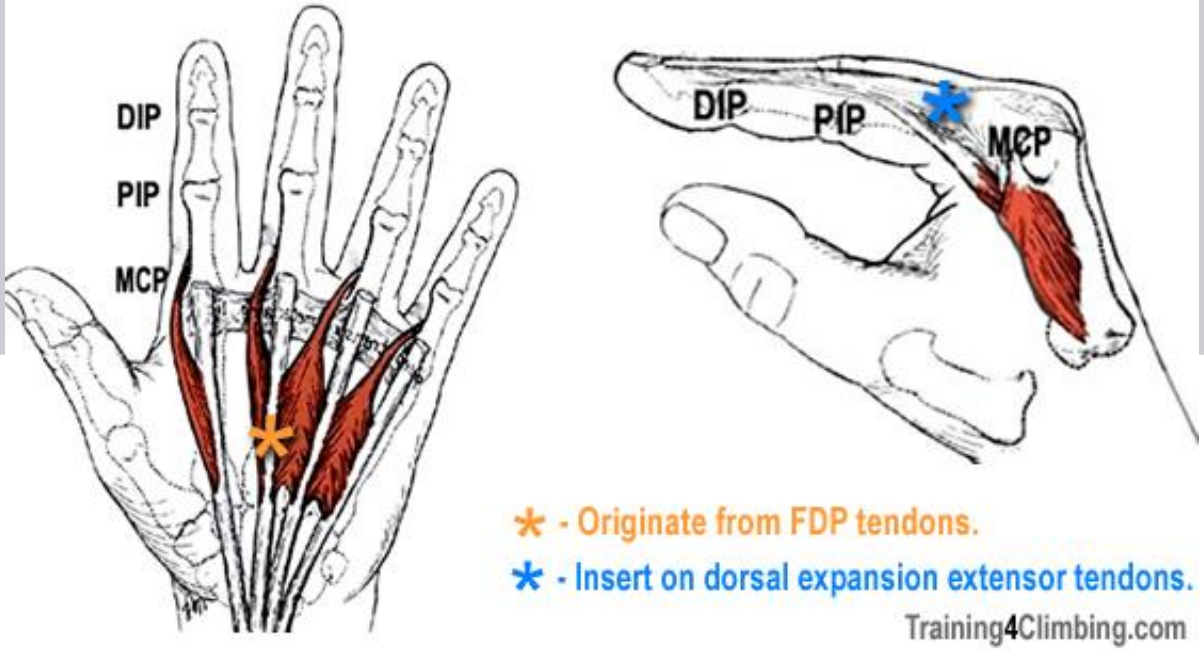
# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Flexor Digitorum Superficialis**<br>Origin: Humeroulnar head: Medial epicondyle of humerus, coronoid process of ulna<br>Radial head: Proximal half of anterior border of radius<br><br>Insertion: Sides of middle phalanges of digits 2-5 | • With wrist extended: Excessive finger flex at the PIP joints<br>• Responds to quick stretch into finger extension<br>• Unable to achieve full Passive finger extension<br>• Resistance into wrist extension | Passive: With wrist in flexion; quickly lift the tips of fingers at the PIP joints toward extension<br><br>Active: Ask the patient to quickly "flick" finger open into finger or to release their grip on an object, noting the PIP joint extension |

# SIGNS OF FLEXOR DIGITORUM SUPERFICIALIS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Testing |
|---|---|---|
| **Lumbricals**<br>Origin: Tendons of flexor digitorum profundus muscle<br><br>Insertion: Extensor expansion of hand | • With wrist neutral: posturing with MP flex and DIP + PIP extension<br>• decreased spread at distal metacarpal arch | Passive: With wrist in neutral; quickly lift the tips of fingers at the MP joints toward extension<br><br>Active: Ask the patient to quickly "flick" finger open into finger or to release their grip on an object, noting the distal carpal arch spread and MP extension abilities |



# SIGNS OF LUMBRICALS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Test |
|---|---|---|
| **Flexor Pollicis Longus**<br>Origin: Anterior surface of radius and interosseous membrane<br><br>Insertion: Palmar surface of distal phalanx of thumb | • Flexed thumb IP joint with varying degrees of flexion at the 1st MCP joint<br>• Resistance to passive & quick stretch | Passive: With wrist in neutral; quickly lift the tip of thumb at the DIP joints toward extension<br><br>Active: Ask the patient to quickly give a "thumbs up", watching the DIP thumb extension |

# SIGNS OF FLEXOR POLLICIS LONGUS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Test |
|---|---|---|
| **Flexor Pollicis Brevis**<br>Origin: Superficial head: Flexor retinaculum, tubercle of trapezium bone<br>Deep head: Trapezoid and capitate bones<br><br>Insertion: Lateral aspect of base of proximal phalanx 1 (via radial sesamoid bone) | • Positioning thumb in hand with CMC and MCP flexion<br>• Resistance to passive stretch and quick stretch response | Passive: With wrist in neutral; quickly lift the tip of thumb at the MCP joints toward extension<br><br>Active: Ask the patient to quickly give a "thumbs up" watching the MCP joint extension |

# SIGNS OF FLEXOR POLLICIS BREVIS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT -- UE

| Muscle | Presentation | Test |
|---|---|---|
| **Adductor Pollicis**<br>Origin: Transverse head: Palmar base of metacarpal bone 3<br>Oblique head: Capitate bone, palmar bases of metacarpal bones 2 & 3<br><br>Insertion: Medial base of proximal phalanx 1 (via ulnar sesamoid bone) | 1st MC is adducted toward palm of hand toward the 3rd MC | Passive: With wrist in neutral; quickly move the 1st MC out into abduction, away from the palm of the hand<br><br>Active: Ask the patient to quickly spread hands outward as to catch a large ball |

# SIGNS OF ADDUCTOR POLLICIS SPASTICITY AND ASSESSMENT

# QUESTIONS REGARDING UE SPASTICITY?

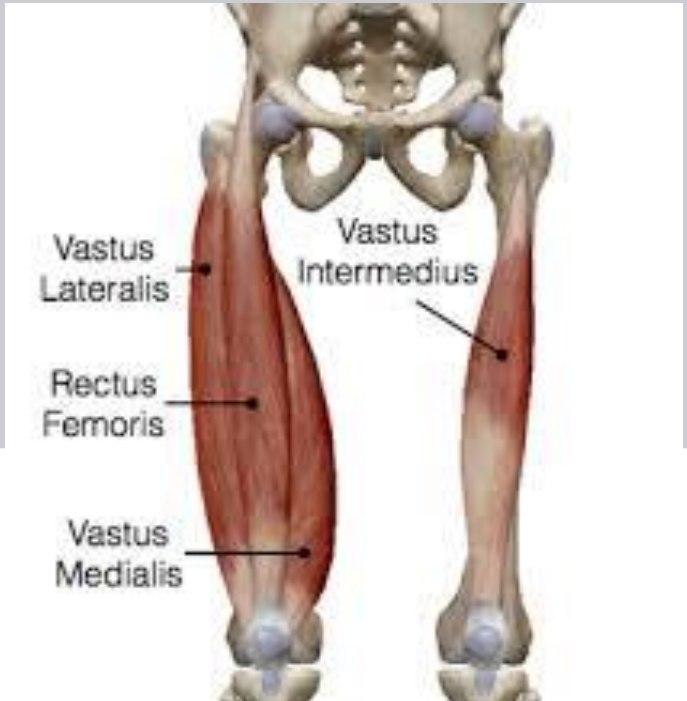
# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Hip Adductor Magnus**<br>Origin: <u>Adductor part:</u> Inferior pubic ramus, ischial ramus<br><u>Ischiocondylar part:</u> Ischial tuberosity<br><br>Insertion: <u>Adductor part</u>: Gluteal tuberosity, linea aspera (medial lip), medial supracondylar line<br><u>Ischiocondylar part:</u> Adductor tubercle of femur | • Unable to spread legs for hygiene<br>• Cross over stepping gait<br><br>  | Passive: Quickly pull the femur outward into abduction<br><br>Active: Ask the patient to quickly spread the knees in supine or sitting; See catching or resistance with stepping out to the side especially with increased speed |

# SIGNS OF HIP ADDUCTOR SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

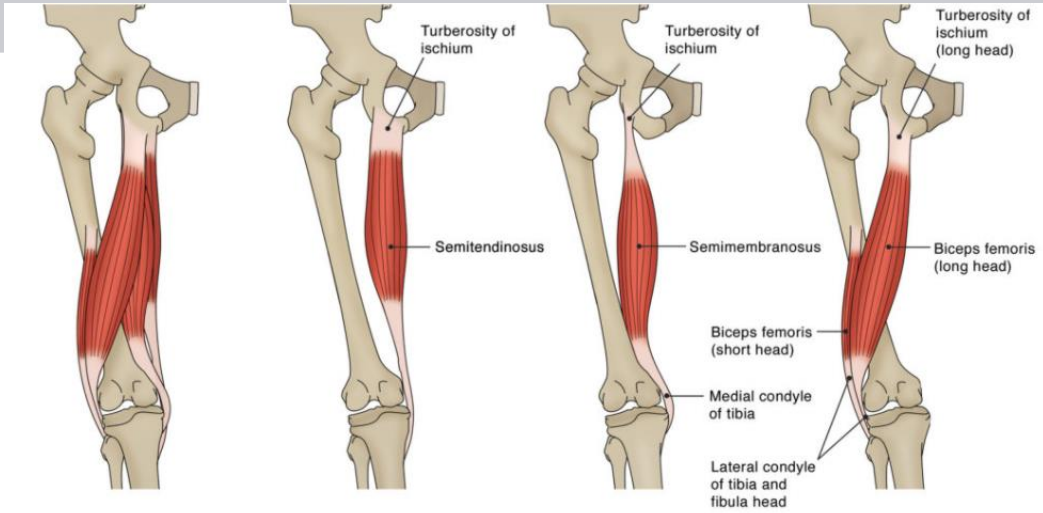
| Muscle | Presentation | Test |
|---|---|---|
| **Quadriceps**<br>Origin: Anterior inferior iliac spine, intertrochanteric line of femur, greater trochanter, gluteal tuberosity, ,anterior surface of femoral shaft<br><br>Insertion: Tibial tuberosity via patellar ligament, patella lateral and medial condyle of tibia | • Stiff legged walk with knee flexion<br>• Difficulty bending knee is sitting or supine<br>• Possible knee pain and patella alta | Passive: Quickly push the knee toward flexion<br><br>Active: Ask the patient to quickly bend the knees in supine or sitting; observe patient in gait both at comfortable and fast pace |



# SIGNS OF QUADRICEPS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Hamstrings**<br>Origin: Ischial tuberosity, linea aspera and lateral supracondylar line of femur<br><br>Insertion: Medial surface of tibia and lateral side of the fibular head | • Limited knee extension in supine<br>• Limited terminal knee extension at terminal swing in gait w/ or w/o catch seen | Passive: Quickly pull the tibia outward into knee extension<br><br>Active: Ask the patient to quickly extend the knee or kicking action; Also watch terminal swing phase with gait at faster speeds. |



# SIGNS OF HAMSTRINGS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Gastrocnemius**<br>Origin: Lateral head: Posterolateral aspect of lateral condyle of the femur<br>Medial head: Posterior surface of medial femoral condyle, popliteal surface of femoral shaft<br><br>Insertion: Posterior surface of the calcaneus via the calcaneal tendon | • Clonus reflex present<br>• Foot postured in plantarflexion with possible contracture<br><br>  <br> | Passive: Quickly pull the foot upward into dorsiflexion w/ knee extended<br><br>Active: Ask the patient to quickly pull their toes up toward dorsiflexion in supine or sitting; Have patient walk at faster speed and note clonus or inability to release from terminal swing to pre-swing; Have patient jump/hop |

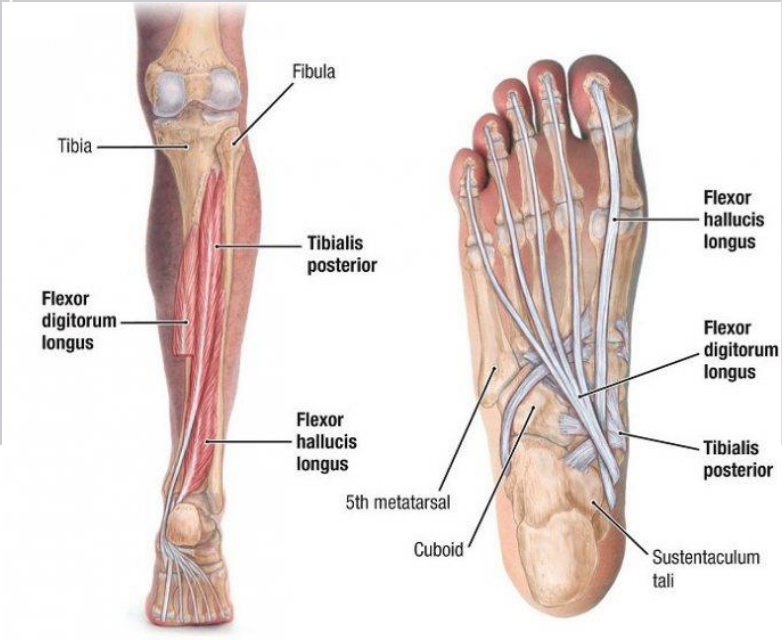
# SIGNS OF GASTROCNEMIUS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

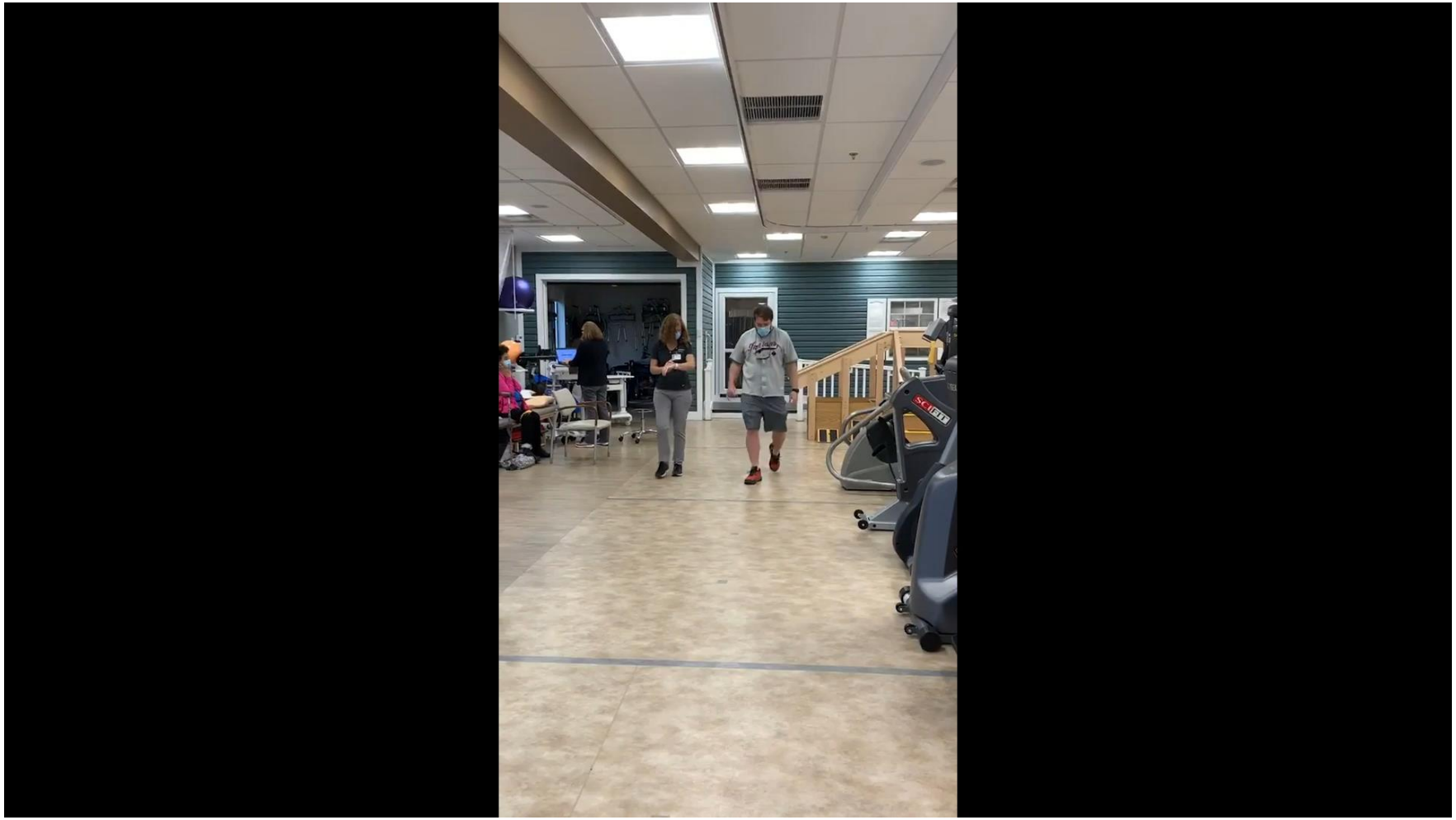
| Muscle | Presentation | Test |
|---|---|---|
| **Soleus**<br>Origin: Soleal line, medial border of tibia, head of fibula, posterior border of fibula<br><br>Insertion: Posterior surface of calcaneus (via calcaneal tendon) | • Clonus reflex present<br>• Foot postured in plantarflexion with possible contracture<br><br>  | Passive: Quickly pull the foot upward into dorsiflexion w/ knee flexed<br><br>Active: Ask the patient to quickly pull his toes up toward dorsiflexion in supine or sitting; Have patient walk at faster speed and note clonus or inability to release from terminal swing to pre-swing; Have patient jump/hop |

# SIGNS OF SOLEUS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Tibialis Posterior**<br>Origin: Posterior surface of tibia, posterior surface of fibula and interosseous membrane<br><br>Insertion: Tuberosity of navicular bone, all cuneiform bones, cuboid bone, bases of metatarsal bones 2-4 | • Foot postured in plantarflexion and inversion, possible forefoot adduction, involuntary positioning into inversion with knee extension<br><br>  | Passive: Quickly pull the foot upward into dorsiflexion and eversion w/ knee flexed<br><br>Active: Ask the patient to quickly pull his toes up toward dorsiflexion and eversion while sitting; Have patient walk at faster speed and note calcaneal inversion/forefoot supination throughout gait cycle; Have patient step quickly side to side |

# SIGNS OF TIBIALIS POSTERIOR SPASTICITY AND ASSESSMENT



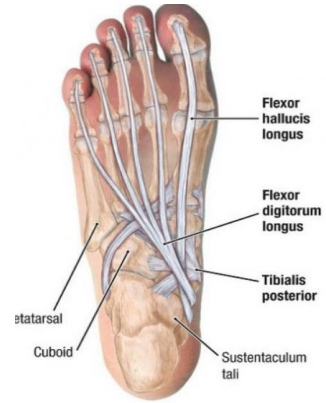
# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Tibialis Anterior**<br>Origin: Lateral surface of tibia, interosseous membrane<br><br>Insertion: Medial cuneiform bone, base of 1st metatarsal bone | TA tendon becomes more prominent with the associated calcaneal inversion | Passive: Quickly pull the foot downward into plantarflexion and eversion w/ knee flexed<br><br>Active: Ask the patient to walk at faster speed and note if the TA tendon becomes more prominent over the dorsum on the foot with the associated calcaneal inversion |

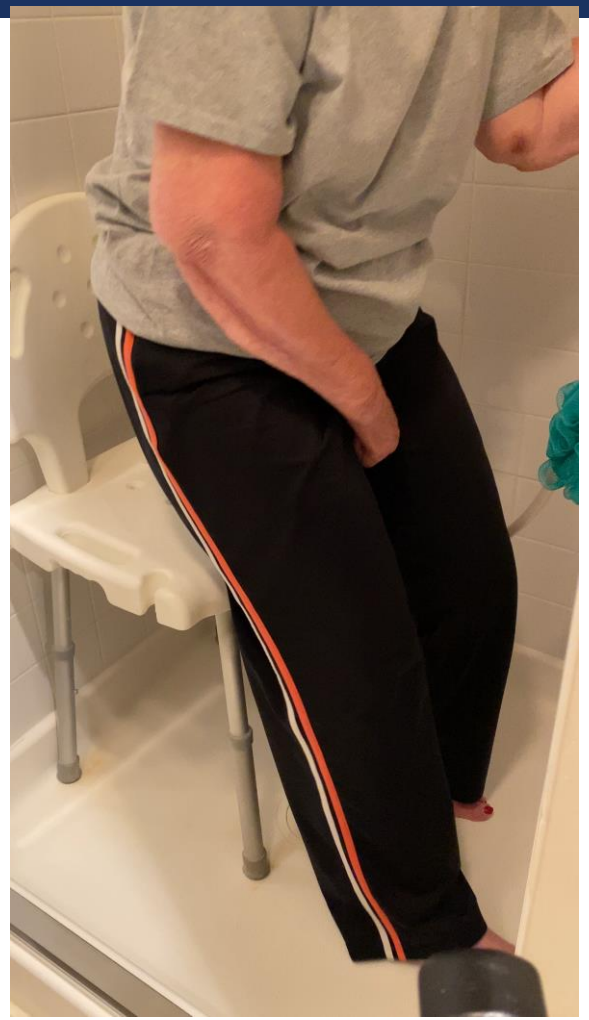
# SIGNS OF TIBIALIS ANTERIOR SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Flexor Digitorum Longus**<br>Origin: Posterior surface of tibia (inferior to soleal line)<br><br>Insertion: Bases of distal phalanges of digits 2-5 | • Toe curling especially in standing and gait<br>• Ankle inversion<br>• Painful toes | Passive: Quickly move the toes into extension<br><br>Active: Standing on the impaired LE, observe toe response while asking the patient to step forward and back both slow and fast speeds |

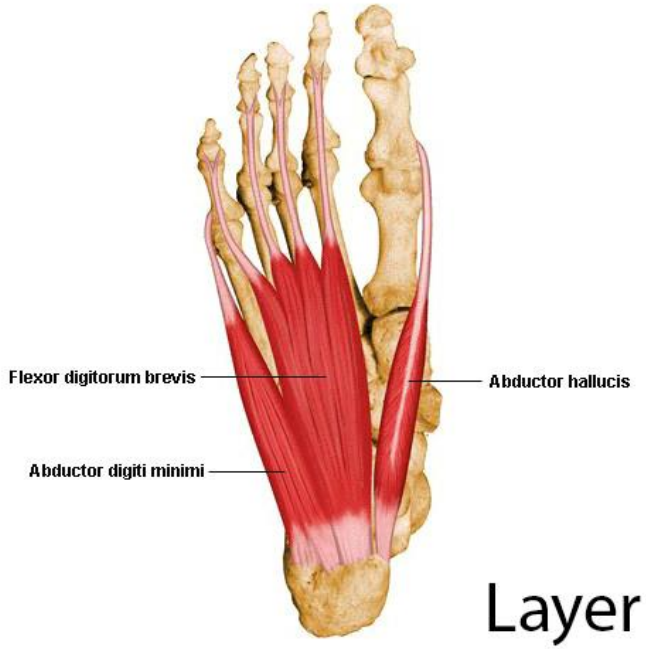



# SIGNS OF FLEXOR DIGITORUM LONGUS SPASTICITY AND ASSESSMENT



# PHYSICAL ASSESSMENT - LE

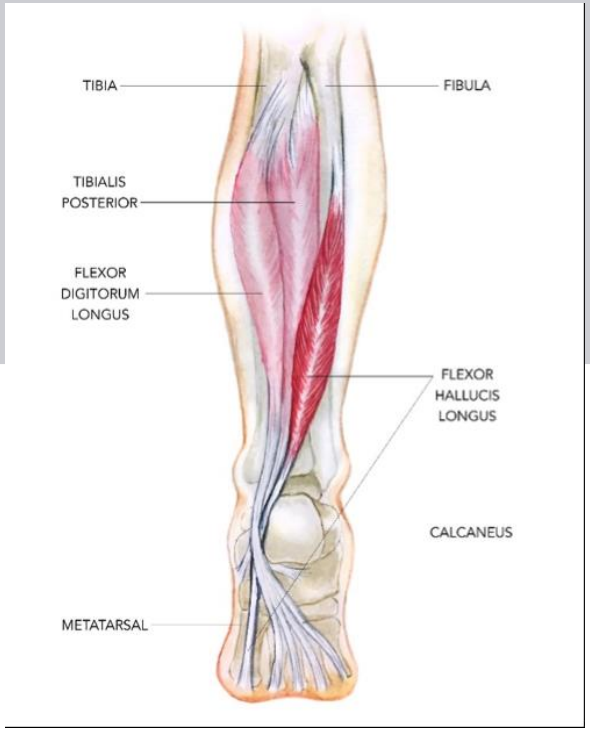
| Muscle | Presentation | Test |
|---|---|---|
| **Flexor Digitorum Brevis**<br>Origin: Medial process of calcaneal tuberosity, plantar aponeurosis and intermuscular septum<br><br>Insertion: Middle phalanges of digits 2-5 | • Toe curling especially in standing and gait<br>• Painful toes | Passive: Quickly move the toes into extension<br><br>Active: Standing on the impaired LE, observe toe response while asking the patient to step forward and back both slow and fast speeds |

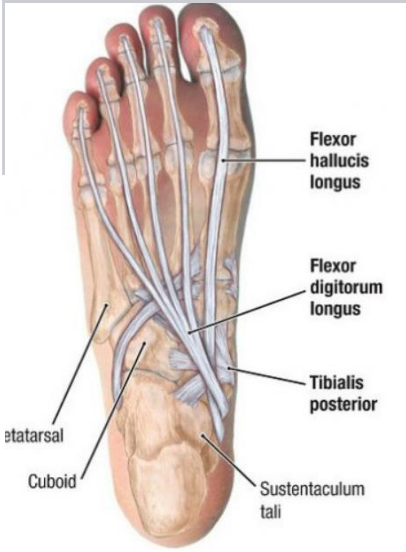


# FLEXOR DIGITORUM BREVIS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Flexor Hallucis Longus**<br>Origin: (Distal 2/3 of) Posterior surface of fibula, interosseous membrane, posterior intermuscular septum of leg, fascia of tibialis posterior muscle<br><br>Insertion: Base of distal phalanx of great toe | • Big toe flexion especially in standing and gait<br>• Ankle inversion | Passive: Quickly move the big toe into extension<br><br>Active: Standing on the impaired LE, observe toe response while asking the patient to step forward and back both slow and fast speeds |

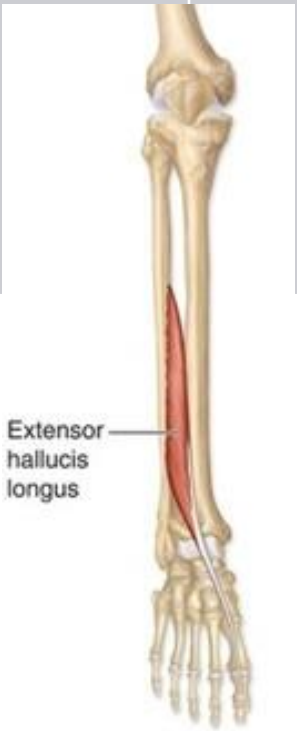


# SIGNS OF FLEXOR HALLUCIS LONGUS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

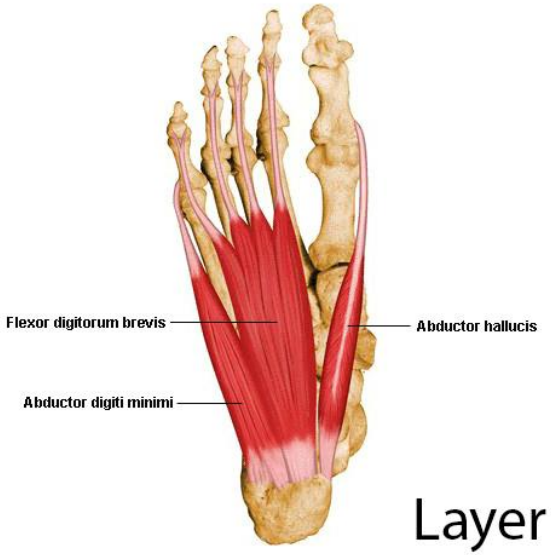
| Muscle | Presentation | Test |
|---|---|---|
| **Extensor Hallucis Longus**<br>Origin: Middle third of medial surface of fibula, interosseous membrane<br><br>Insertion: Base of distal phalanx of great toe | • Noted big toe extension especially with active movement<br>• Painful dorsum of big toe | Passive: Quick move the big toe into plantarflexion |



# SIGNS OF EXTENSOR HALLUCIS LONGUS SPASTICITY AND ASSESSMENT

# PHYSICAL ASSESSMENT - LE

| Muscle | Presentation | Test |
|---|---|---|
| **Abductor Hallucis**<br>Origin: Medial process of calcaneal tuberosity, flexor retinaculum, plantar aponeurosis<br><br>Insertion: Base of proximal phalanx of great toe | • Big toe abduction especially in standing and gait<br>• Forefoot Adduction (also seen with flexor hallucis brevis) and supination | Passive: Quickly move the big toe in toward adduction. Usually not addressed unless forefoot supination still seen after Toe flexors and Tibialis Posterior spasticity is addressed |



# SIGNS OF ABDUCTOR HALLUCIS SPASTICITY AND ASSESSMENT

# QUESTIONS REGARDING LE SPASTICITY?

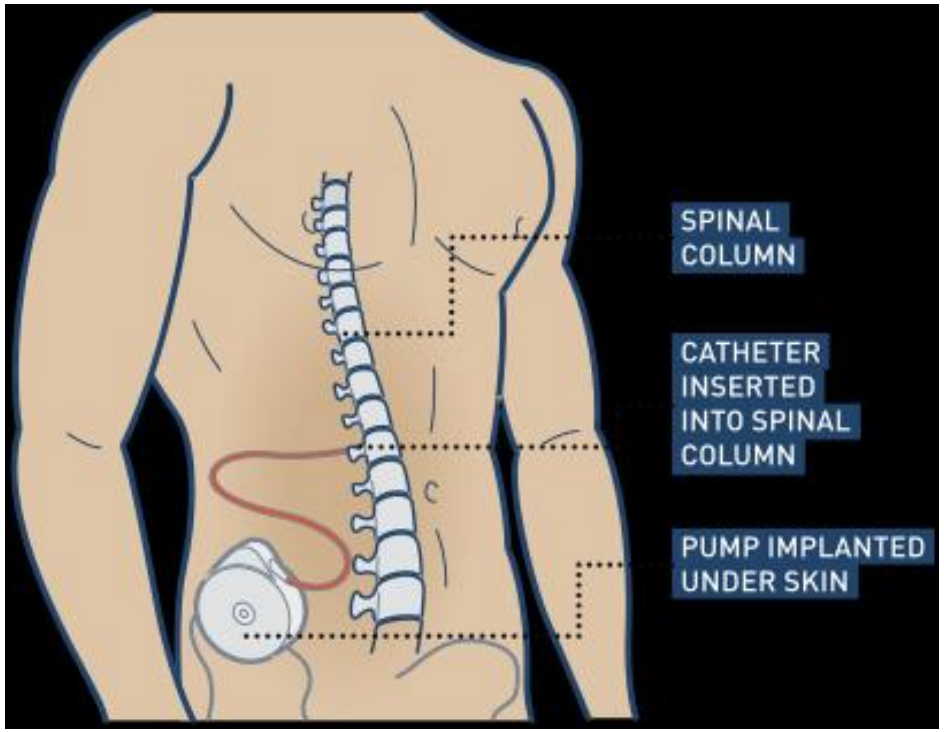
# MEDICAL MANAGEMENT

- Oral Medications:
  - Dantrolene
  - Diazepam
  - Gabapentin
  - Baclofen
  - Tizanidine
- Side Effects
  - Sedation
  - Drowsiness
  - Dizziness
  - Hypotension
  - Weakness
  - Risk of withdrawal

Bethoux F 2015, Dong et al 2017

# MEDICAL MANAGEMENT

- Intrathecal Baclofen Pump Therapy
  - Screening process prior to surgical procedure
  - Gradual titration
  - Possible Side Effects
    - Weakness
    - Device malfunction
    - Cerebrospinal fluid leak




Bethoux F 2015

# MEDICAL MANAGEMENT

- Local Injections
  - Phenol/alcohol neurolysis
  - Botulinum Toxin
    - Botox ®
    - Dysport ®
    - Xeomin ®


Bethoux F 2015, Intiso et al 2020

- Possible Side Effects/
  - Local
    - Transient pain
    - Local hematoma and swelling
  - Systemic
    - Generalized weakness
    - Dysphagia
    - Fatigue
    - Flu-like symptoms
    - Possible promotion of Nab (neutralizing antibodies) that counteract the effect of the neurotoxin with repeated injections and high doses

# STANDARD OF CARE

- Intramuscular injections performed every 3-4 months
- Evaluated prior to first dose and 2 weeks after injection
- Dosage determined by physician based on severity of spasticity and number of sites
  - Dose escalation paced with onset of therapeutic effect
  - Approved dosage is different between toxins
- Therapeutic effect approximately 3 months

# POST MEDICAL MANAGEMENT

- Therapy Indicated
  - Gain ROM and establish stretching regimen
  - Strengthen antagonists
  - Task-specific training to improve function and use of hemiplegic UE
- Some evidence to support casting post injection prolongs effect

Farina et al 2008, Ro et al 2020

# QUESTIONS?

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