

NEUROLOGICAL EXAMINATION-2

MOTOR SYSTEM EXAMINATION

► COMPONENTS :

BULK
TONE
POWER
REFLEXES



Look at the position of the patient overall

- ▶ Look especially for a hemiplegic positioning, flexion of elbow and wrist with extension of knee and ankle.
- ▶ Look for wasting
- ▶ Look for fasciculation
- ▶ Test for tone
- ▶ Test muscle groups in a systematic way for power
- ▶ Test reflexes

General observation and Bulk

- ▶ Muscle groups being examined to be exposed completely.
- ▶ Inspect on a whole for any assymetry between sides
- ▶ Then palpate individually, which gives insight about bulk, regarding any inflammation or tenderness.
- ▶ Both the sides being examined need to be exposed .



TONE

- ▶ Ensure the patient is relaxed, or at least distracted by conversation.
- ▶ Repeat each movement at different speeds.

Arms

- ▶ Take the hand as if to shake it and hold the forearm. First pronate and supinate the forearm. Then roll the hand round at the wrist.
- ▶ Hold the forearm and the elbow and move the arm through the full range of flexion and extension at the elbow.



Legs

- ▶ Tone at the knee
- ▶ Put your hand behind the knee and lift it rapidly. Watch the heel. Hold the knee and ankle. Flex and extend the knee.
- ▶ Tone at the ankle
- ▶ Hold the ankle and flex and dorsiflex the foot.



ABNORMAL TONE

- ▶ Flaccidity or reduced tone – common causes: lower motor neurone or cerebellar lesion; rare causes: myopathies, 'spinal shock' (e.g. early after a stroke), chorea.
- ▶ Spasticity: upper motor lesion.
- ▶ Rigidity and cogwheel rigidity: extrapyramidal syndromes – common causes: Parkinson's disease, phenothiazines.
- ▶ Myotonia (rare) – cause: myotonic dystrophy (associated with frontal balding, ptosis, cataracts and cardiac conduction defects) and myotonia congenita. Percussion myotonia may be found in both conditions.

POWER

Test the following muscle groups and movements:

- ▶ shoulder abductors and adductors
- ▶ elbow flexors and extensors
- ▶ wrist extensors and flexors
- ▶ hip flexors
- ▶ knee flexors and extensors
- ▶ ankle dorsiflexors, and plantar flexors

Muscle strength is graded on a 0 to 5 scale •

Ask the patient to move actively against your opposing Resistance; assign Grade 5 if the patient overcomes the opposing movement.

If the patient can only move against gravity, assign Grade 3

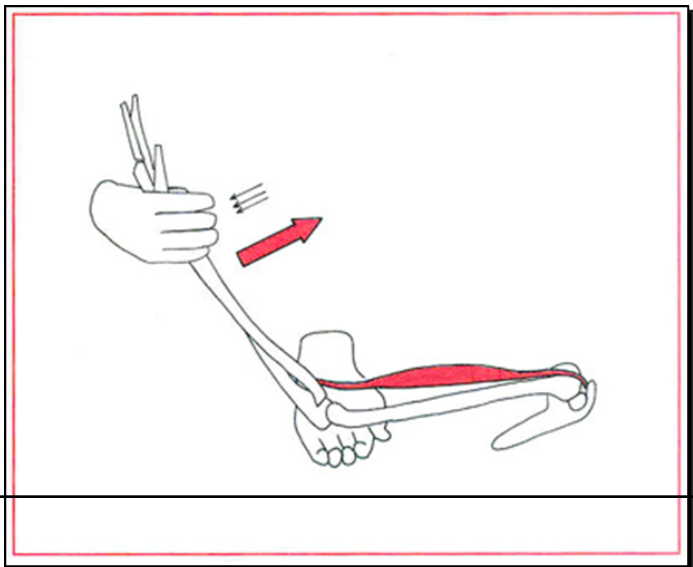
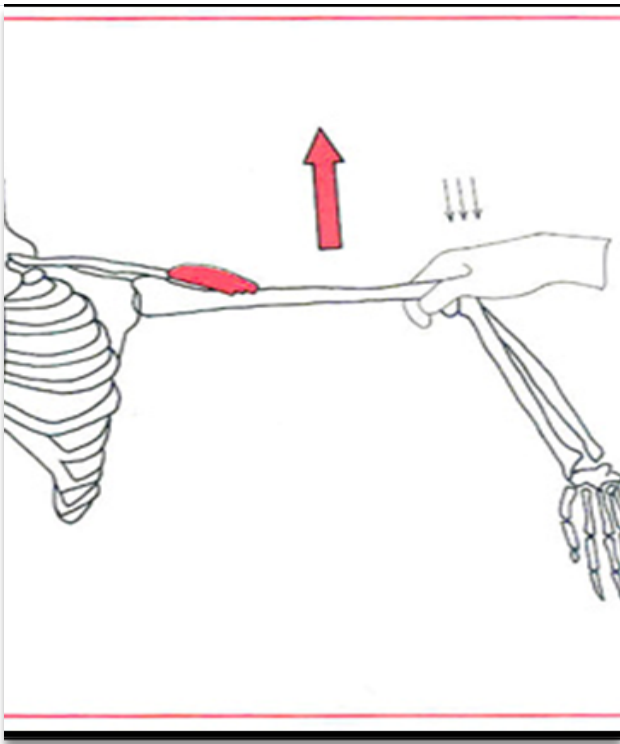
Power when tested is graded conventionally using the Medical Research Council scale (MRC). This is usually amended to divide grade 4 into 4+, 4 and 4-, as below:

- 5 = normal power
- 4+ = submaximal movement against resistance
- 4 = moderate movement against resistance
- 4- = slight movement against resistance
- 3 = moves against gravity but not resistance
- 2 = moves with gravity eliminated
- 1 = flicker
- 0 = no movement

Power should be graded according to the maximum power attained, no matter how briefly this is maintained.

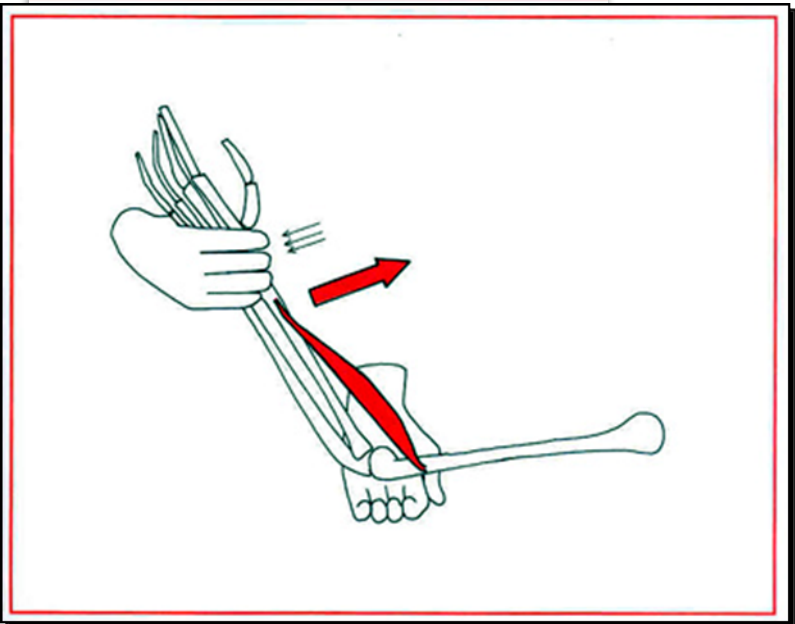
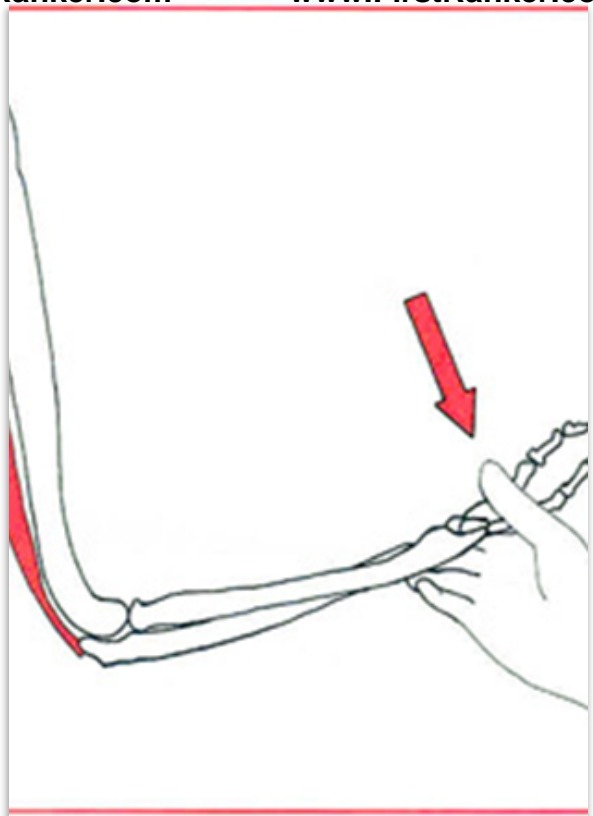
Testing shoulder abduction

Testing elbow flexion



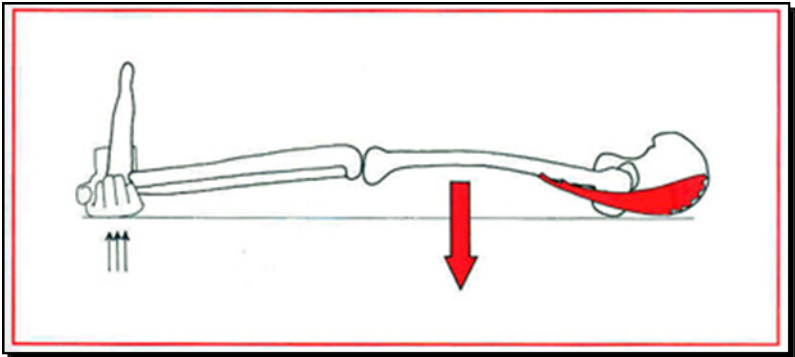
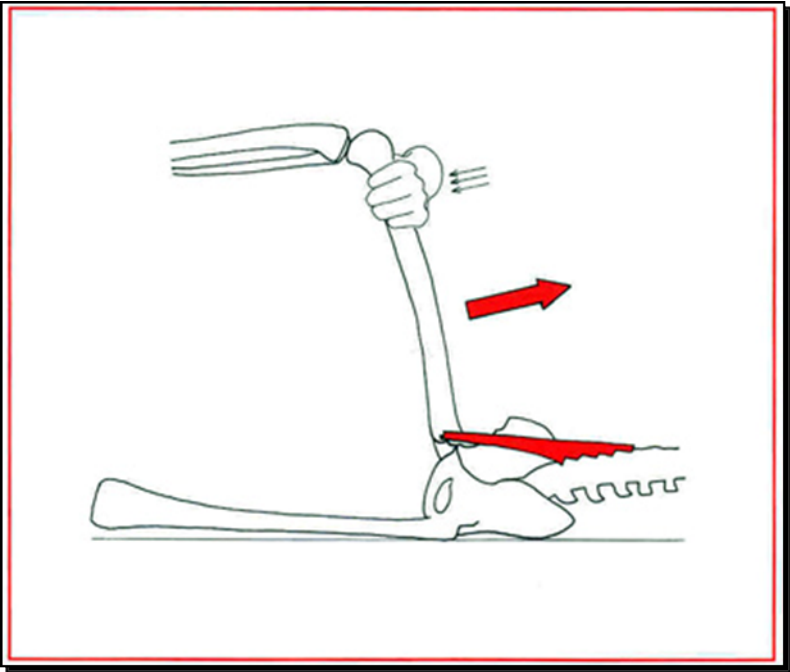
Testing elbow
extension

Testing strength of
brachioradialis

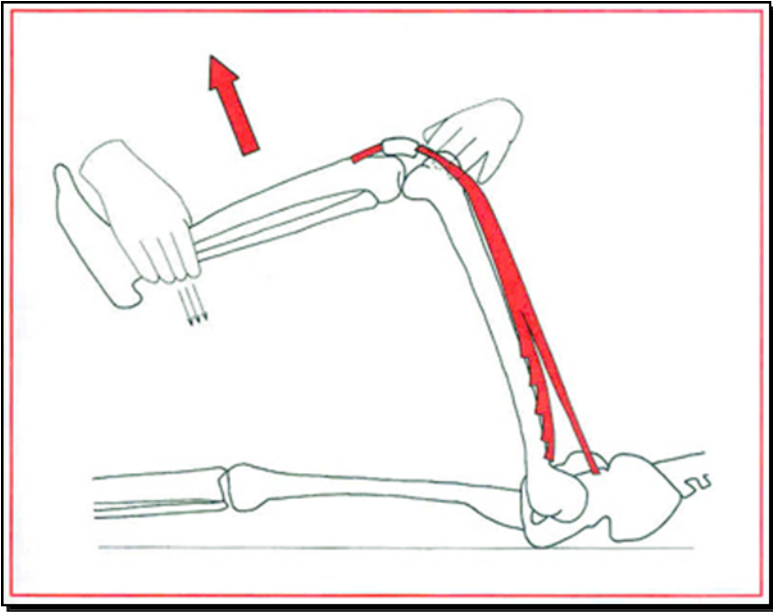


Testing hip flexion

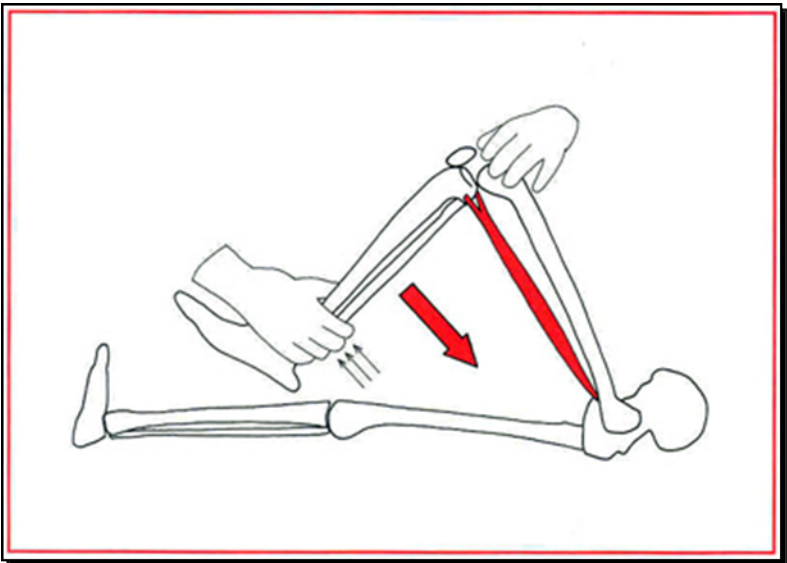
Testing hip extension



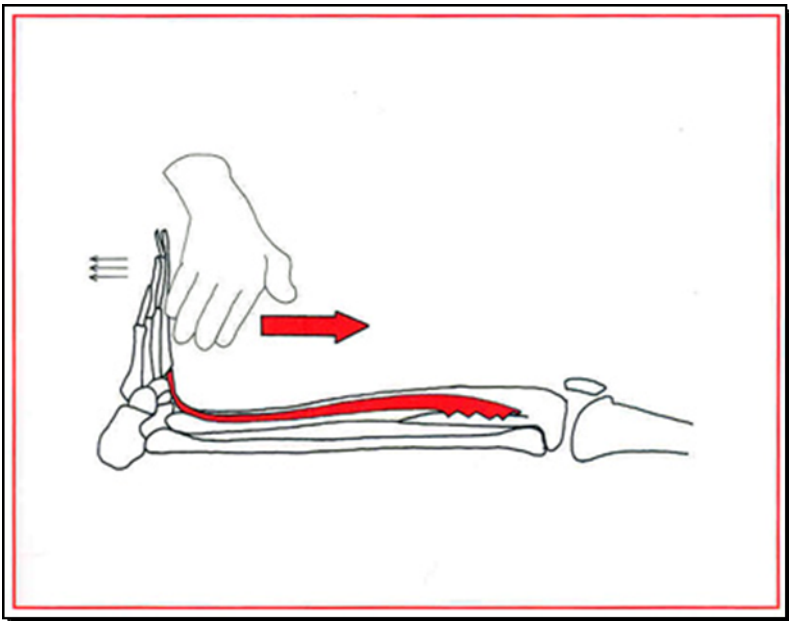
Testing knee extension



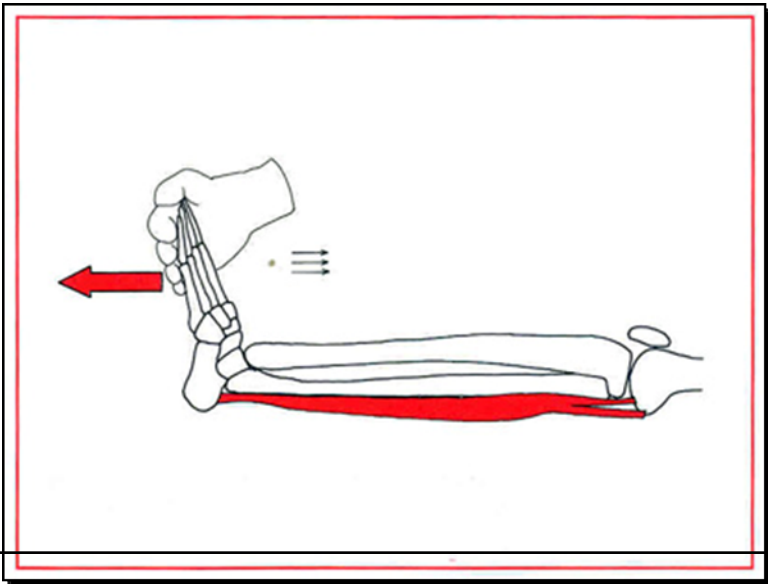
Testing knee flexion



Testing dorsiflexion of the foot



Testing plantarflexion of the foot



Deep Tendon reflexes

- ▶ Reflex arc made has afferent (sensory) & efferent (motor) component.
- ▶ Synapse happens in spinal cord, which receives input from upper motor neuron
- ▶ Disruption of any part of path alters reflexes: e.g.
 - UMN lesion → reflexes more brisk (hyper-reflexia)
 - LMN lesions → opposite effect (hypo-reflexia)
- ▶ Reflexes are graded as 0-4+ scale: 0 = no reflex, 1+ = hyporeflexia, 2+ = normal, 3+ = hyper-reflexia, 4+ = clonus (multiple movements after a single stimulus)

- ▶ Reflexes are generally assessed at 5 places - 3 in the upperlimb (biceps, triceps, brachioradialis);
2 in the lower limb (patellar & achilles)
- ▶ Basic Technique for assessing a reflex:
 - Clearly identify tendon of muscle to be tested
 - Position limb so that the muscle is at rest.
 - Strike tendon briskly
- ▶ Observe for muscle contractions & limb movements.

Biceps jerk (C 5, 6)

- ▶ Identify biceps tendon
- ▶ Have the patient flex elbow against resistance while you palpate the antecubital fossa.
- ▶ Place the arm on yours so it's bent at an angle of 90 degrees
- ▶ Place one of your fingers on tendon and strike it briskly
- ▶ Muscle should be contracting and flexion at the forearm.



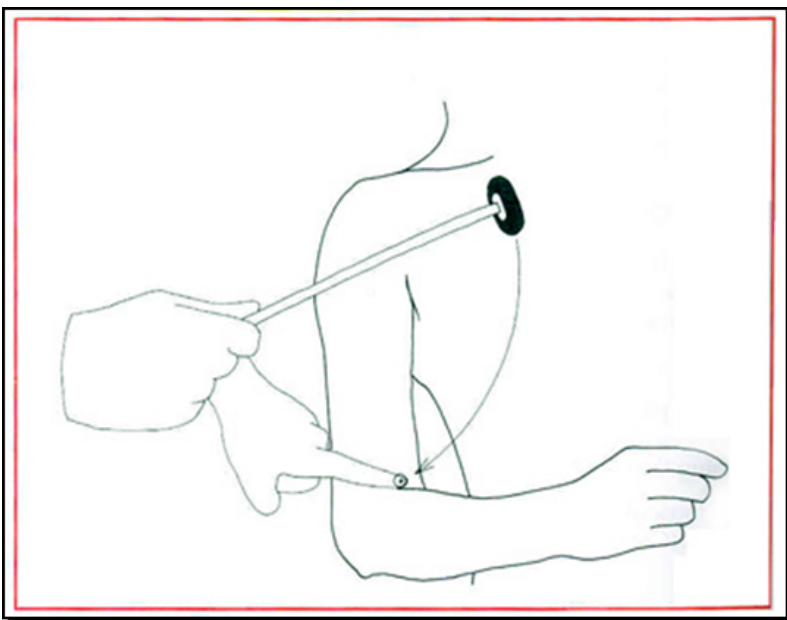
Triceps jerk (C 7, 8)

- ▶ Identify triceps tendon.
- ▶ Have the patient extend elbow against resistance while you palpate above it
- ▶ Allow the arm to hang down ninety degrees or have hands on hips
- ▶ Strike tendon directly or place finger on the tendon & strike it
- ▶ Triceps muscle contracts & arm extends.

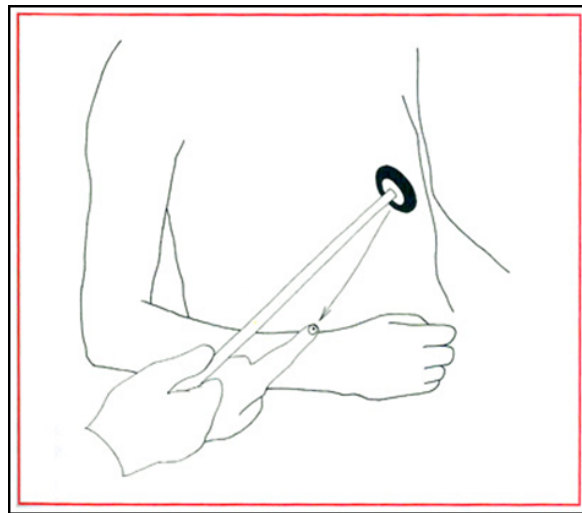


Brachioradialis or supinator

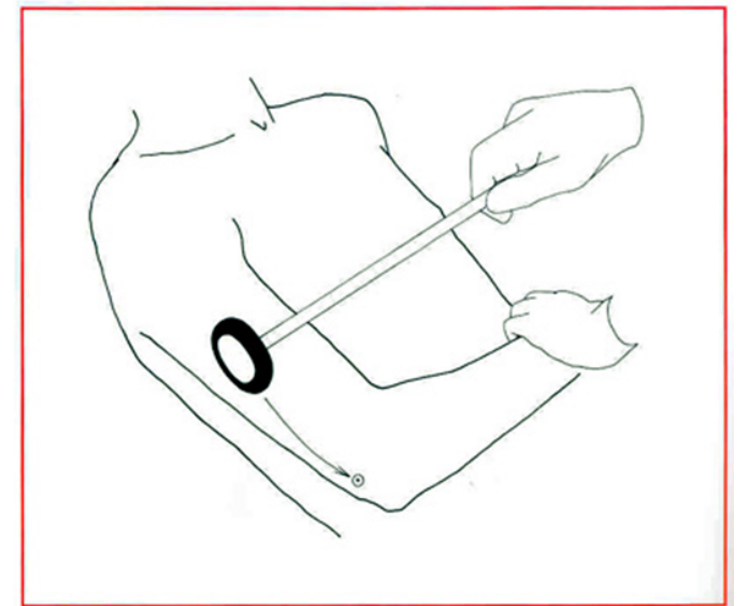
- ▶ Tendon for brachioradialis is ~ 10 cm proximal to wrist ,its difficult to see or feel it
- ▶ Place the arm resting on patient's thigh, bent @ elbow
- ▶ Strike firmly
- ▶ Muscle will contract & arm will flex elbow & supinate



Testing the biceps reflex



Testing the supinator reflex



Testing the triceps reflex

Patellar reflex (L2,L3, 4)

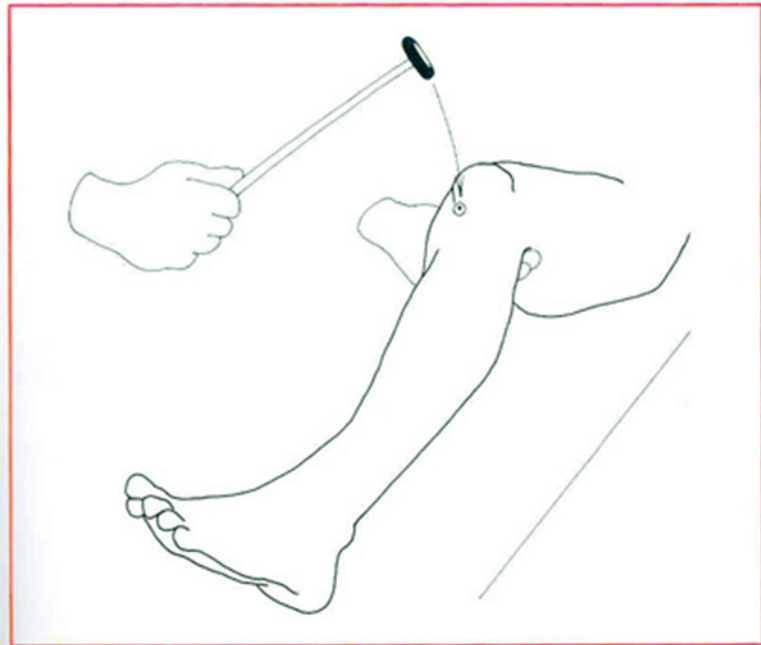
- ▶ Patellar tendon extends below THE knee cap.
- ▶ it's thick & usually visible & palpable – if not, palpate while patient extends lower leg.
- ▶ Strike firmly over the tendon.
- ▶ Muscle will contract & leg extend at the knee



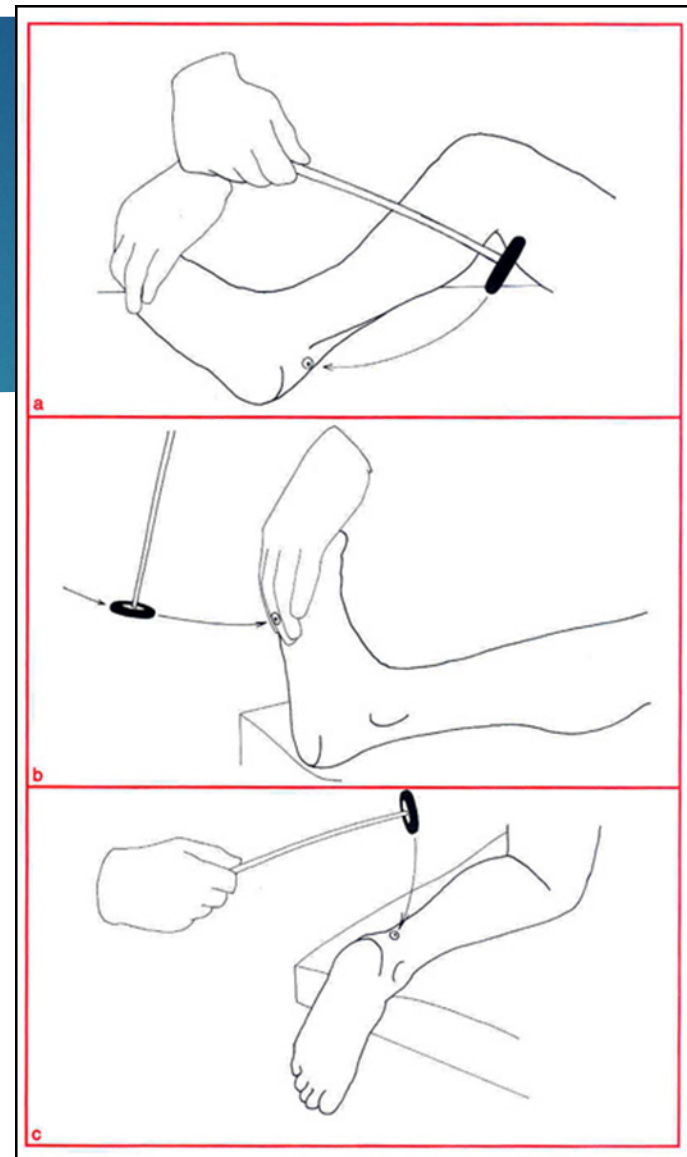
Achilles tendon jerk (S1, S2)

- ▶ Achilles tendon is a thick structure connecting calf muscles with heel.
- ▶ In case of a trouble palpating, palpate as patient pushes their foot into your other hand
- ▶ Hold foot at 90 degrees
- ▶ Strike tendon firmly
- ▶ Muscles will contract & foot plantar-flex (move downward)





Testing the knee reflex



The ankle jerk– three ways to get it

Interpreting the DTRs

- ▶ Increased reflex or clonus – this indicates upper motor neuron lesion above the root at that level. Often associated with hypertonia.
- ▶ Absent reflexes - generalized – indicates peripheral neuropathy
- ▶ Absent reflexes isolated – indicates either a peripheral nerve or, more commonly, a root lesion.
- ▶ Reduced reflexes (more difficult to judge) – occurs in a peripheral neuropathy, muscle disease and cerebellar syndrome.
- ▶ Pendular reflex – this is usually best seen in the knee jerk where the reflex continues to swing for several beats. This is associated with cerebellar disease.
- ▶ Slow relaxing reflex – this is especially seen at the ankle reflex and may be difficult to note. It is associated with hypothyroidism

Superficial reflexes

- ▶ This group of reflexes includes
 - The plantar response
 - The superficial abdominal reflex
 - Cremasteric reflex.
- ▶ These are polysynaptic reflexes, which are evoked by cutaneous stimulation.

Babinski's reflex

- ▶ Gently stroke bottom of foot, starting laterally & near heel – moving up & across the feet (metatarsal heads)
- ▶ If no response, increase your pressure
- ▶ **Normal** = great toe moving downward and other toes curling in with a flexor plantar response
- ▶ In UMN lesion (or in newborns), great toe will extend and other toes fan out – called **positive babinski's response** or **babinski's sign positive**

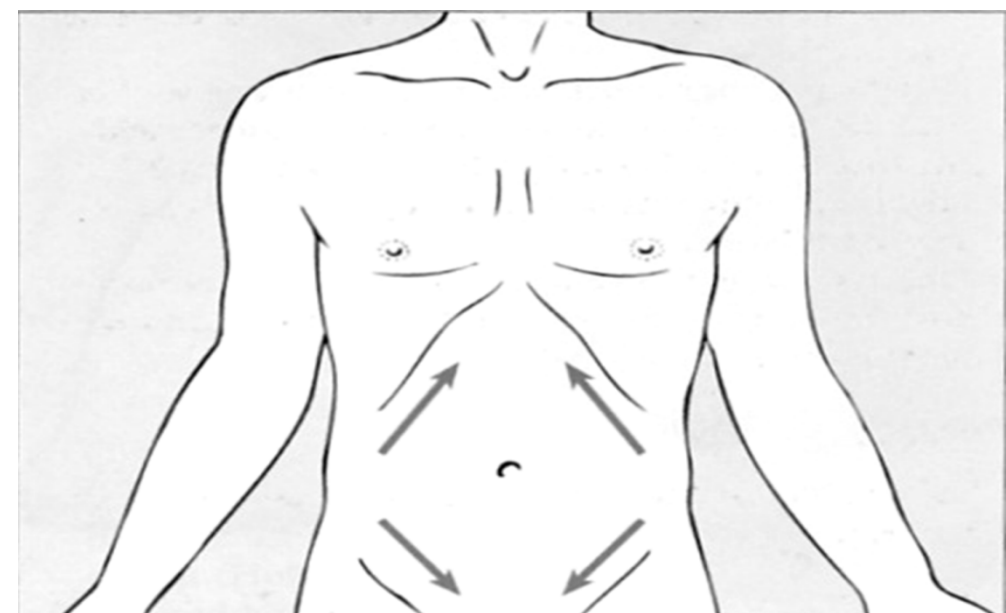


Babinski Response – UMN lesion



Other superficial reflexes

- ▶ Test **the abdominal reflexes** by lightly but briskly stroking each side of the abdomen, above (T8, T9, T10) and below (T10, T11, T12) the umbilicus, in the directions illustrated.
- ▶ Use a key, wooden end of a cotton-tipped applicator, or a tongue blade twisted and split longitudinally.
- ▶ Note the contraction of the abdominal muscles and deviation of the umbilicus toward the stimulus.
- ▶ Feel with your retracting finger for the muscular contraction.
- ▶ Abdominal reflexes may be absent in both central and peripheral nervous system disorders



- ▶ The **cremaster reflex** is produced by scratching the skin of the medial thigh, which should produce a brisk and brief elevation of the testis on that side.
Both the cremaster reflex and the abdominal reflex can be affected by surgical procedures (in the inguinal region and the abdomen, respectively)
- ▶ The "anal wink" is a contraction of the external anal sphincter when the skin near the anal opening is scratched. This is often abolished in total spinal cord damage (along with other superficial reflexes).

Cerebellar system.

- ▶ Signs of cerebellar disease, from head to foot.
- 1. **Scanning speech** – Causes enunciation of individual syllables
eg. British parliament becomes "Brit-tish Par-la-ment"
- 2. **Nystagmus** – fast phase towards the side of the lesion.
- 3. **Finger to nose & finger to finger test** –
Ask patient to fully extend arm then touch nose or ask them to touch their nose then fully extend to touch your finger.

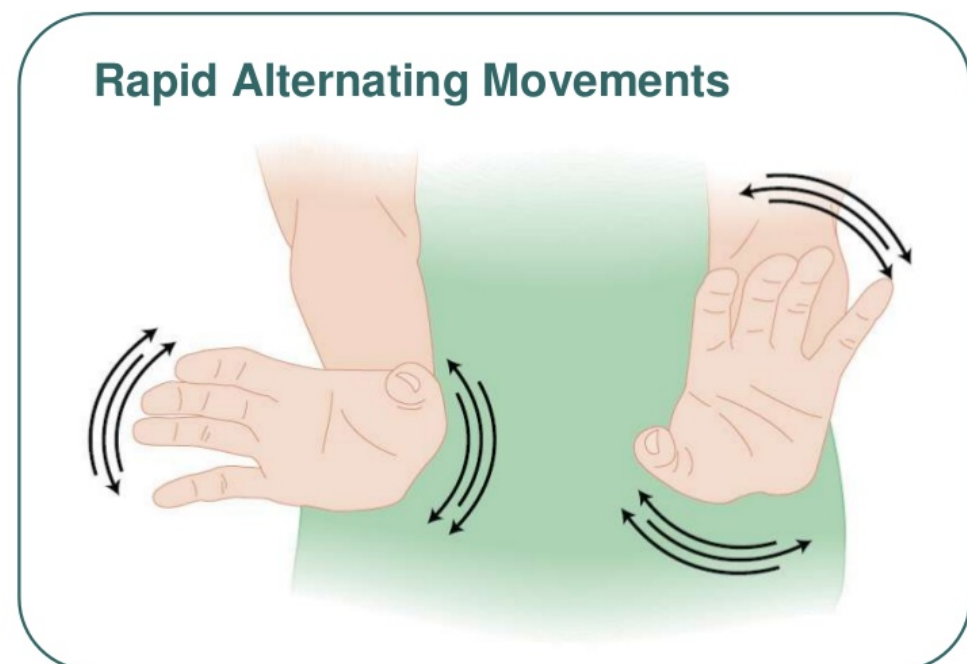
You increase the difficulty of this test by adding resistance to the patient's movements or move your finger to different locations. Abnormality of this is called **dysmetria**.



► **Rapid alternating movements**

Ask patient to place one hand over the next and have them flip one hand back and forth as fast as possible (alternatively you can ask the patient to quickly tap their foot on the floor as fast as possible)

if abnormal, this is called dysdiadochokinesia.

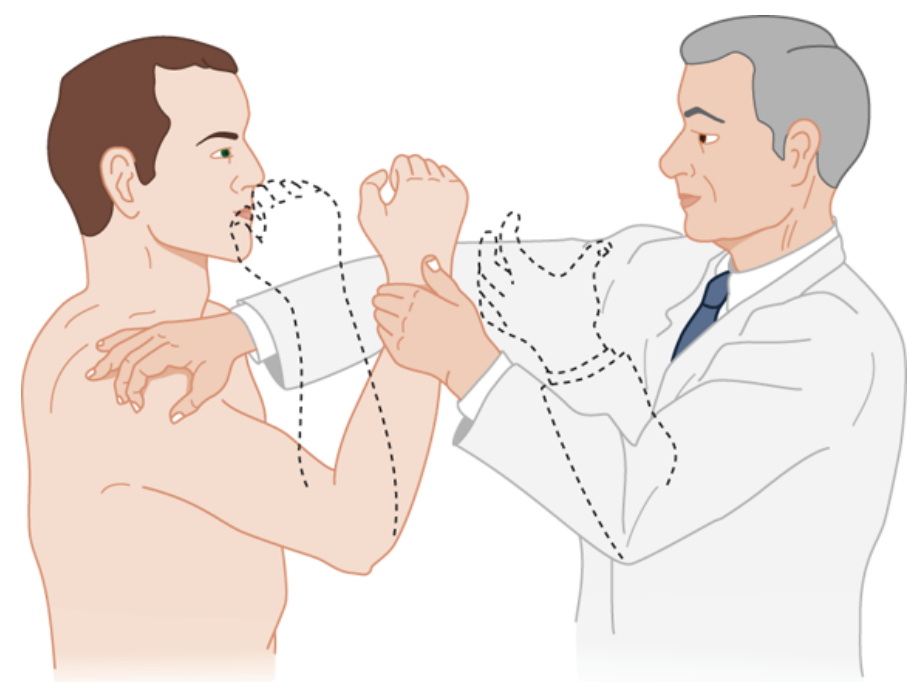


► **Rebound phenomenon** (of Stewart & Holmes)

Have the patient pull on your hand and when they do, slip your hand out of their grasp. Normally the antagonists muscles will contract and stop their arm from moving in the desired direction.

A positive sign is seen in a spastic limb where the exaggerated "rebound" occurs with movement in the opposite direction.

However in cerebellar disease this response is completely absent causing the limb to continue moving in the desired direction. (Be careful that you protect the patient from the unarrested movement causing them to strike themselves.)



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► **Heel to shin test**

Have patient run their heel down the contralateral shin (this is equivalent the finger to nose test).

Abnormal exam occurs when they are unable to keep their foot on the shin.

► **Hypotonia**

“Pendular” knee jerk, leg keeps swinging after knee jerk more than 4 times (4 or less is normal).



Gait

- Always examine patient's gait.
- It is a co-ordinated action requiring integration of sensory and motor functions.
- The gait may be the only abnormality on examination.
- The most commonly seen are: hemiplegic, parkinsonian, marche a' petits pas, ataxic and unsteady gaits.

Approach to a gait examination

- ▶ **Ask the patient to walk**
- ▶ Ensure you are able to see the arms and legs adequately
- ▶ Is the gait symmetrical?
- ▶ Gait can usually be divided into symmetrical and asymmetrical.
- ▶ **If symmetrical:**
 - Look at the size of paces
 - Small or normal
- ▶ **If small paces**
 - Look at the posture and arm swing
 - Stooped with reduced armswing – parkinsonian (may be difficult to start and stop – festinant gait).
 - Upright with marked armswing – marche a' petits pas – often in Bilateral diffuse cortical dysfunction, diffuse lacunar infarcts , Multiple sclerosis,

- ▶ **If normal paces:**

- A.Look at the lateral distance between the feet**

- 1.normal
- 2.widely separated - **broad based**
- 3.Legs unco-ordinated – **cerebellar gait**.
- 4.Crossing over, toes dragged – **scissoring**- may be seen in : spastic paraparesis – common causes: cerebral palsy, multiple sclerosis, cord compression.

- B. look at knees**

1. normal
2. knees lifted high – **high-stepping gait/neuropathic gait** - seen with foot drop due to loss of dorsiflexion, Charcot–Marie–Tooth disease, Polio, Multiple sclerosis ,Syphilis, Guillain–Barré syndrome , Spinal disc herniation , Anterior Compartment Muscle Atrophy, Deep fibular nerve Injury , Spondylolisthesis

► **Look at the pelvis and shoulders**

1. normal

2. marked rotation of pelvis and shoulder – **waddling gait** – indicates a weak or an ineffective proximal muscles – commonly associated

with proximal myopathies, bilateral congenital dislocation of the hip.

► **Look at the whole movement**

1. normal

2. disjointed as if forgotten how to walk – **apraxic gait** – indicates the cortical integration of the movement is abnormal, usually with frontal

lobe pathology – common causes: normal pressure hydrocephalus, cerebrovascular disease.

► bizarre, elaborate and inconsistent – functional cause.

► **If asymmetrical**

► Is the patient in pain?

yes – painful or antalgic gait- arthritis, trauma – usually obvious

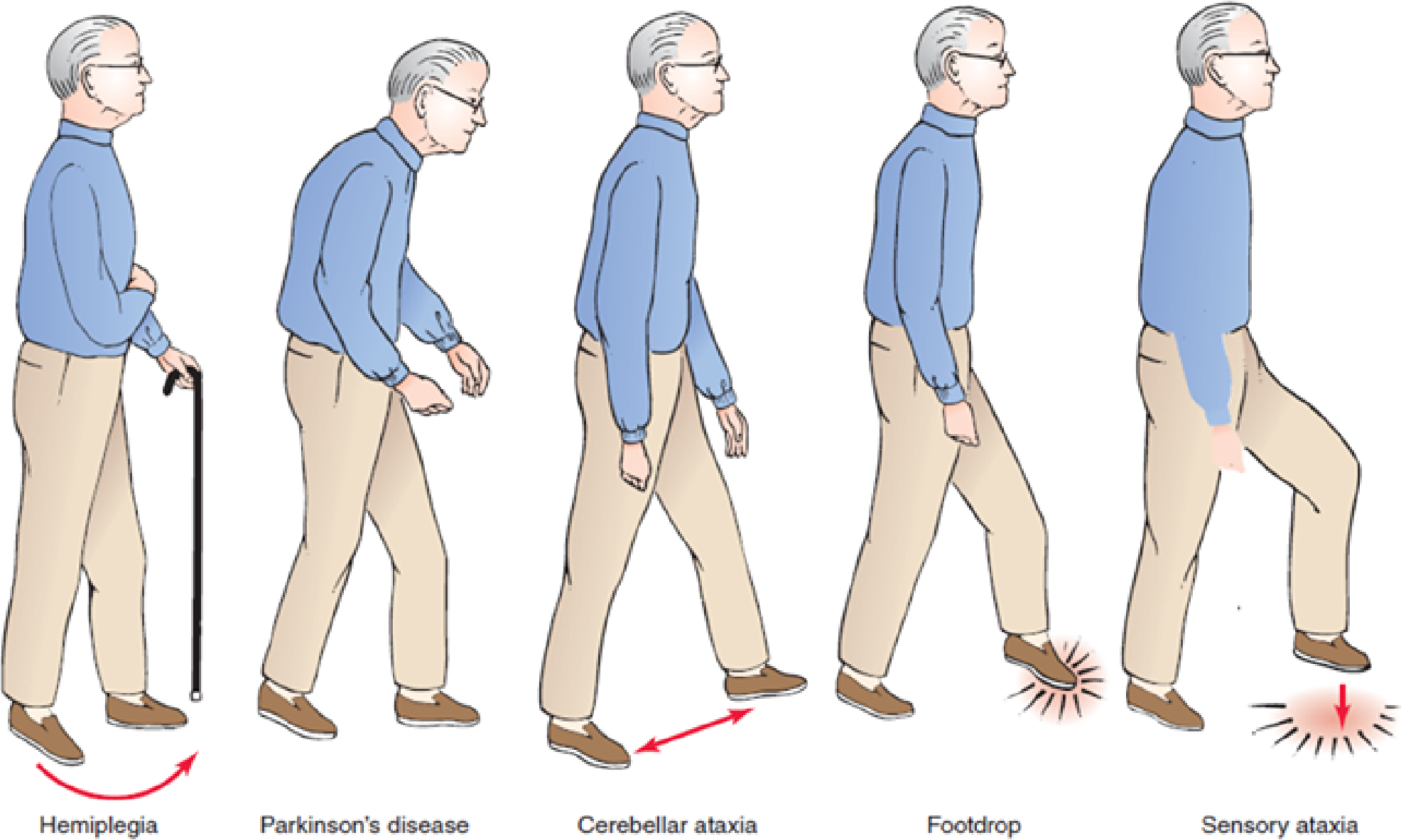
► Look for a bony deformity

orthopaedic gait- common causes: shortened limb, previous hip surgery, trauma.

► Does one leg swing out to the side?

yes – hemiplegic gait-unilateral upper motor neurone lesion – common

causes: stroke, multiple sclerosis



SPASTIC GAIT

SCISSORS GAIT

PROPULSIVE GAIT

STEPPAGE GAIT

WADDLING GAIT





Myopathic gait



► **High stepping gait**



► *Hypokinetic gait*



► *Hemiparetic gait*



► Ataxic gait

Sensory system examination

► 2 main pathways

► **Spinothalamic tracts**

–Pain, temperature, crude touch

–Impulses enter from periphery → cross to other side of cord within ~ 2 vertebral levels → travel up that side to brain

► **Dorsal Columns**

–Vibration, position, fine touch

–Impulses from periphery enter cord → travel up that side → cross to opposite side at the base of brain → then travel to their terminus(dorsal column medial lemniscal pathway)

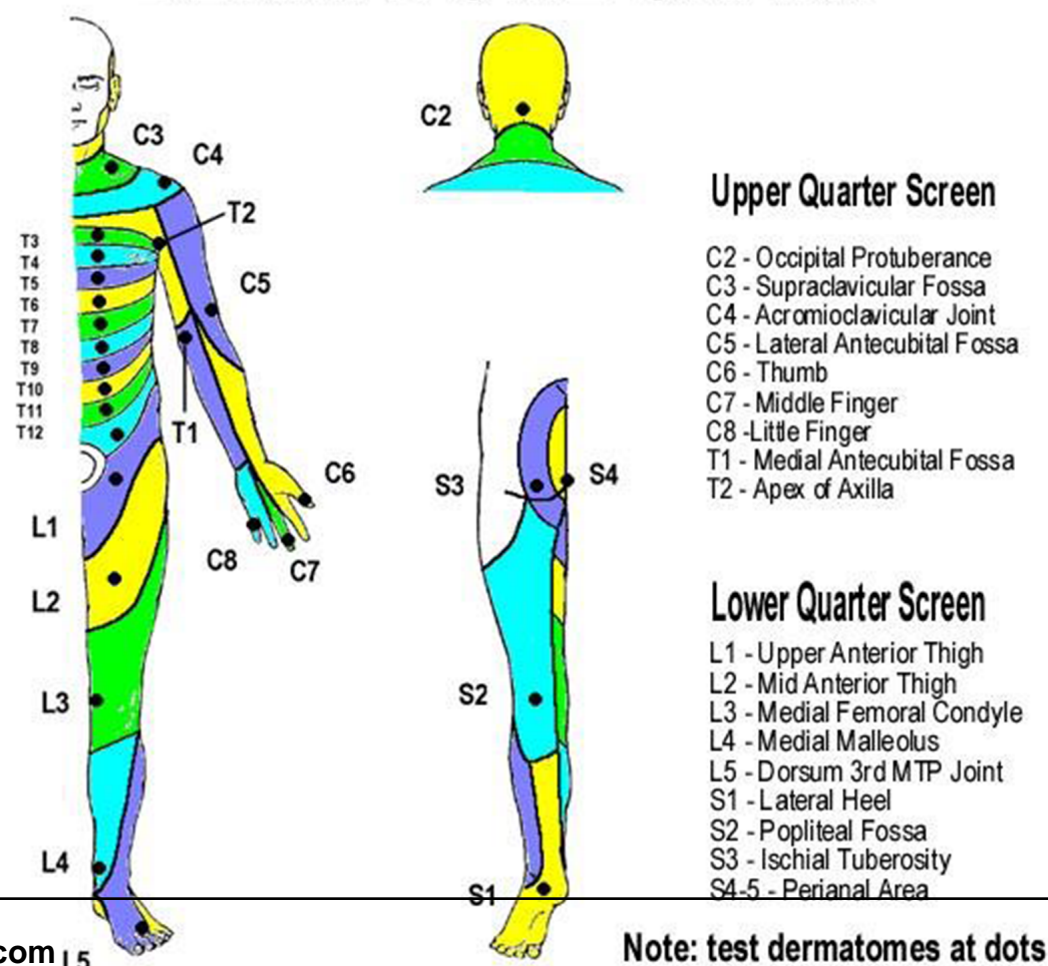
Special stand points

- ▶ Subjective “ examination
- ▶ Requires good cooperation on the patient`s side.
- ▶ Allows accurate localisation of the pathology.
- ▶ Preliminary diagnosis is needed. Examine according to the expected damage only !
- ▶ Most often we compare different parts of the body.
- ▶ Do not tell the patient what should be felt !
- ▶ The patient should not see the examined part of the body !

Nerves and Their Distributions

- ▶ Specific dermatomes not usually memorized – reference charts are helpful to pin down deficits
- ▶ •Distributions (& spinal root contributions) for specific peripheral nerves are looked up in appropriate setting

University of Scranton - Department of Physical Therapy **DERMATOME CHART**



Spinothalamics – Pain, Temperature & Crude Touch

- ▶ Pin pricks or tooth picks may be used.
- ▶ Ask patient to close eyes
- ▶ Do not allow any visual clues.
- ▶ Start top of foot.
- ▶ Orient patient by first touching w/sharp implement, then non-sharp object (e.g. the soft end of a q-tip)
- ▶ This clarifies the patient what you're defining as sharp & dull
- ▶ 2 sec. b/t each stimulus to avoid summation (frequent consecutive stimuli perceived as one strong stimulus)



Spinothalamics – continued

- ▶ Touch lateral aspect of foot w/either sharp or blunt .
- ▶ Move medially across top of foot, noting their response to touch , with a gap of 2 sec between stimuli as mentioned above
- ▶ Remember to cross dermatomes
- ▶ Temperature tested by using a tuning fork (run under cold or warm water)
- ▶ Instructions to patients : 1. Tell me if you feel the stimulus !
2.Name the area stimulated !"
3.“Is it equal on both sides?
4. (“Tell me if the sensation changes” (As you map out the extent of abnormality by moving from the abnormal to the normal area.

Spinothalamics – continued

- ▶ Light touch assessed by gently brushing your finger against the extremity and asking the patient (eyes closed) to note when they feel it
- ▶ Upper extremities checked in same fashion as mentioned for lower limb, like across dermatomes, well timed stimuli etc.

Dorsal Columns - Proprioception

- ▶ Allows body to “know” where it is in space
- ▶ Important for balance, walking
- ▶ Ask patient to close eyes–With one hand, grasp either side of great toe at the interphalangeal (IP) joint.
- ▶ Place your other hand on the lateral and medial aspects of the great toe distal to the IP.
- ▶ Orient patient as to up and down:
- ▶ Flex the toe (pull it upwards) while telling patient what you’re doing.
- ▶ Extend toe (pull it downwards) while informing them of which direction you’re moving it.



Dorsal Columns – Proprioception (continued)

- ▶ Alternately deflect toe up or down without out telling patient in which direction you are moving.
- ▶ Patient should be able to correctly identify movement & direction.
- ▶ Both feet to be tested.
- ▶ If position sense is impaired, move proximally to the next joint
- ▶ If position sense intact distally , then it is OK proximally as well.
- ▶ Upper extremities assessed in same fashion,deflecting fingers up & down

▶ **Romberg's test**

- This is a simple test primarily of joint position sense.
- make patient Stand upright, place feet together, then close eyes
- if patient loses balance- indicates a positive Romberg test.

NOTE: THE ROMBERG TEST IS NOT A SIGN OF CEREBELLAR DISEASE.

It is a sign of a disturbance of proprioception, either from neuropathy or posterior column disease. The patient does not know where their joint is in space and so uses their eyes. In the dark or with eyes closed they have problems.

- ▶ ~~if they are swaying even with open eyes – indicates cerebellar pathology .~~





Dorsal Columns – Vibratory Sensation

- ▶ Ask patient to close eyes and don't give any visual cues.
- ▶ Place the stem of a vibrating 128 Hz tuning fork on top of interphalangeal joint of great toe.
- ▶ Place fingers of your other hand on bottom-side of joint
- ▶ Ask patient if they can feel vibration.
- ▶ You should be able to feel same sensation w/fingers on bottom side of joint.





- ▶ Patient determines when vibration stops.
- ▶ Correlate this with when you can't feel it transmitted through the joint yourself.
- ▶ Test for both the feet.
- ▶ Check more proximal joints (e.g. ankle) if sensation impaired.
- ▶ Upper extremities assessed similarly, with the tuning fork placed on distal finger joint.

Special Sensory Testing



- ▶ **Two point discrimination:**

The ability to discriminate between two blunt points when applied simultaneously. (3-5 mm on the finger, 4-7 cm on the trunk)

- ▶ **Sensory inattention (perceptual rivalry)**

The ability to detect sensory stimuli applied simultaneously on both limbs.
Subdominant parietal lobe, associative areas

- ▶ **Stereoesthesia**

An object is placed in the patient's hand.

Ask patient to describe its size, shape, surface, material !

Stereoesthesia indicates disturbance of the sensory afferent tracts.

Special Sensory Testing (continued)

► **Astereognosis.**

Inability to identify an object by palpation

The primary sense data being intact

Lesion of the opposite hemisphere, postcentral gyrus

► **Tactile agnosia**

The patient is unable to recognize an object by touch in both the hands.

Disorder of perception of symbols.

Lesion of the dominant parietal lobe, associative areas.

► **Graphaesthesia**

The ability to recognize numbers or letters traced out on the palm.

Loss of graphesthesia indicates either parietal lobe damage on the side opposite the hand tested or damage to the dorsal column pathway at any point between the tested point and the contralateral parietal lobe.

Summary of NEUROLOGICAL examination

- Wash Hands
- Cranial Nerves:
- CN1 (Olfactory) Smell
- CN2 (Optic) Visual acuity; Visual fields
- CNs 2&3 (Optic, Oculomotor) Pupillary Response to light
- CNs 3, 4 & 6 (Oculomotor, Trochlear, Abducens) Extra-Ocular Movements
- CN 5 (Trigeminal) Facial sensation; Muscles Mastication (clench jaw, chew); Corneal reflex (w/CN 7)
- CN 7 (Facial) Facial expression
- CN 8 (Auditory) Hearing
- CN 9, 10 (Glossopharyngeal, Vagus) Raise palate ("ahh"), gag
- CN 11 (Spinal Accessory) Turn head against resistance, shrug shoulders

► CN 12 (Hypoglossal) Tongue

Time Target: < 15 minutes

CONTINUED ---- >>>>

SUMMARY OF NEUROLOGICAL examination(CONTINUED)

Motor testing:

- muscle bulk
- tone
- strength of major groups

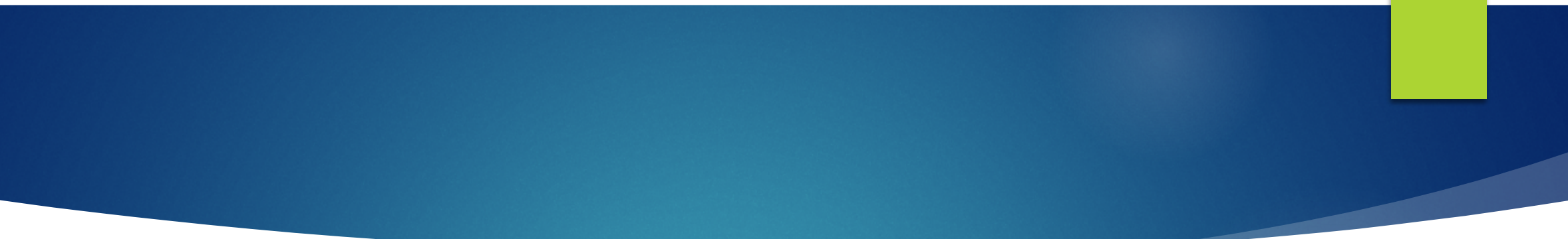
□ Sensory testing –

- in distal lower & upper extremities:
- pain/crude touch
- □ proprioception
- vibration

Reflexes

- Achilles
- patellar
- brachioradialis
- biceps
- triceps
- Coordination (finger nose, heel shin, etc.)
- Gait, Romberg
- Wash Hands

Time Target: < 15 minutes

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- ▶ Videos uploaded after sorting permission from “**The University of Utah**” neurology center.