

# Lower Limb Neurological Examination

## Diagnosing in neurology

Throughout the exam, think is the pathology:

-Unilateral or bilateral?

-UMN or LMN?

-Weakness: proximal, distal or pyramidal?

-Sensory loss: glove and stocking, sensory level, dermatomal or peripheral nerve?

By the time you get to the sensory exam you should know what you are expecting to find and use it to confirm and/or narrow down differentials.

See the [neurology differentials](#) page.

## Introduction

- Wash hands, Introduce self, Patients name & DOB & what they like to be called, Explain examination and get consent
- Expose patient's legs (undress lower half to underwear)

## Inspection

- **General inspection**
  - **Patient:** patient well, posture, habitus, other signs of neurological conditions (e.g. hypomimia, facial muscle wasting)
  - **Around bed:** walking aids, orthoses
- **Gait** – first ask if they can walk and if they need assistance/aids
  - Normal walking (**hemiplegic, spastic, foot drop, ataxic, myopathic (waddling), parkinsonian**)
  - Heel to toe walking (**ataxia**)
  - Stand on heels and then toes (**tests distal power**)
  - Romberg's test if steady: close eyes while standing (**reduced stability = sensory ataxia i.e. reduced joint position sense**)
- **Local inspection**
  - **Tremors**
  - **Muscles:** muscle wasting – in general and look closely for plantar foot wasting and for dorsal foot guttering (**LMN lesion**), fasciculations (**LMN lesion**), associated bony deformity (e.g. pes cavus)
  - **Skin:** neurofibromas, café au lait spots, scars (including small muscle biopsy scars)

## Tone

- **Tone:** patient relaxes legs flat while lying. Roll each leg side to side with a hand either side of the knee (**↑=UMN lesion, ↓=LMN lesion**)
- **Spasticity:** place one hand under the patient's knee and briskly lift up the knee (**spasticity = foot kicks out involuntarily = UMN lesion**)
- **Clonus:** hold the sole of the patient's foot in one hand, and elevate it while holding their ipsilateral flexed knee in the other hand. Forcefully flex the ankle a few times, and then hold it firmly in the flexed position. Feel for involuntary, rhythmic beats of gastrocnemius contraction (**>2 beats = UMN lesion**)

## Power

Test one side at a time and always support the joint being tested with one hand (use as a lever). You must use all your strength!

**MRC grades:** 5 = full power, 4 = some resistance, 3 = **GRAVITY**, 2 = gravity eliminated, 1 = flicker of muscle contraction, 0 = nothing.

- **Hip flexion (L2/L3):** Patient lift leg off bed with knee extended. Stabilise contralateral hip joint with one hand and push down on the quadriceps just above the knee of the leg being tested. "**Don't let me push your leg down**"
- **Hip extension (L4/L5):** With leg still elevated to about 30°, stabilise the ipsilateral hip joint with one hand and hold the underside of the patient's knee with the other hand. "**Push my hand down into the bed**"
- **Knee extension (L3/L4):** With their knee flexed to about 90°, stabilise their ipsilateral knee joint with one hand and hold the anterior side of ankle with your other hand and try and push it towards them. "**Try and kick your leg out. Don't let me push it towards you.**"
- **Knee flexion (L5/S1):** In the same position, but holding the posterior side of their ankle, try and pull it away. "**Try and pull your heel towards your bottom. Don't let me pull it away**"
- **Ankle dorsiflexion (L4/L5):** With their leg straight on the bed and the ankle actively dorsiflexed, stabilise the ankle with one hand and make a fist with your other hand and use the dorsal side of your fist to try and push the patient's foot downwards "**Point your foot upwards towards your head. Don't let me push it down**"
- **Ankle plantarflexion (S1/S2):** In the same position but with their ankle actively plantarflexed, try and pull it up with your fingers on the ball of the patient's foot. "**Point your foot downwards towards the bottom of the bed. Don't let me pull it up**"
- **Big toe extension (purely L5):** With their big toe actively flexed, isolate the toe's metatarsophalangeal joint with one hand and try and push it down with the index finger of your other hand "**Point your big toe upwards towards your head. Don't let me push it down**"

Note to help remember roots: each joint involves 4 sequential nerve roots, and each joint starts 1 root lower than the proximal one!

## Reflexes

Hold the tendon hammer by the end of the plastic rod (not in the middle) to make a pendulum-type swing. If you cannot elicit a reflex, ensure the patient is fully relaxed, get them to close their eyes and grit their teeth when you strike the tendon.

Reflexes may be brisk, normal, reduced or absent.

- **Knee (L3,4 kick the door):** With the knee relaxed in passive flexion (hold up with your left wrist under the patient's knee), locate the tibial tuberosity and inferior border of the patella and strike the patellar tendon in-between.
- **Ankle (S1,2 in the shoe):** Externally rotate the patient's leg and flex their knee (so their lower leg rests over their contralateral shin). Hold their foot with your left hand and gently passively dorsiflex their ankle. Strike the Achilles tendon with the hammer in your right hand. *Note: to test their left ankle reflex, move round to the base of the bed.*
- **Plantar (Babinski) response:** Warn the patient and then scrape the plantar surface of their foot in a semi-circle from the heel, around the lateral edge and to the ball of the big toe with using an orange stick (big toe ↑=UMN lesion, big toe ↓=normal).

## Co-ordination

- **Heel-shin test:** Ask the patient to touch their heel to their contralateral knee. Then ask them to move their heel down the tibia to their contralateral ankle. Now get them to move it back up, through the air, back to their contralateral knee again. Repeat this about 3 times for each side (mal-coordination = cerebellar lesion).

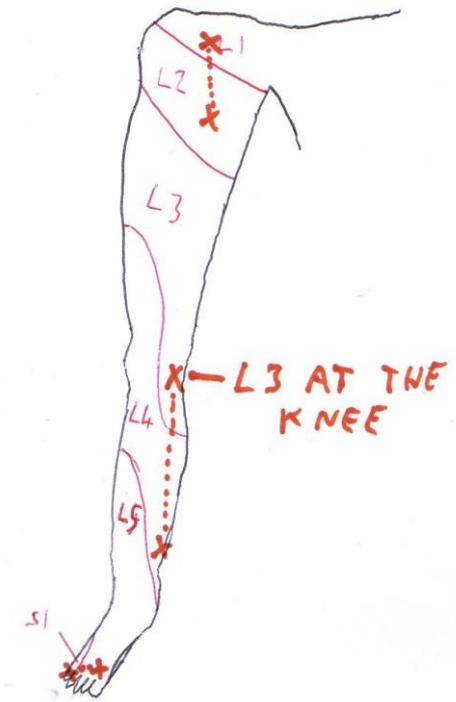
## Sensation

For pain and light touch, show the patient how each should feel on their sternum first. Depending on the pathology you found in the motor part of the examination, you should focus this part of the exam and either test from distal to proximal in 3 lines (if you are expecting to find glove and stocking sensory loss or a sensory level) or testing dermatomes ± peripheral nerves (if you are suspecting nerve/nerve root pathology)

- **Pain (spinothalamic):** use neurological pin  
"Close your eyes and every time you feel it say 'sharp' if it feels sharp like it did on your sternum or 'blunt' if it feels blunt"
- **Light touch (dorsal column):** use cotton wool bud  
"Close your eyes and every time you feel it say 'yes'"

For the modalities below, start distally and only work up proximally if cannot feel it...

- **Proprioception (dorsal column):** Hold the proximal phalanx of big toe with your index finger above and your thumb below. Use your other hand's index finger and thumb to hold each side of the distal phalanx. Show the patient the up and down position. Now get them to close their eyes and repeatedly wiggle it up and down. Stop in one position and ask them if it is up for down. Do it 3 times. If they get it wrong, move to the metatarsophalangeal joint, then ankle and so on until they can correctly state the position.
- **Vibration (dorsal column):** Twang the long prongs of a 128Hz (long) tuning fork. Place the round base on their sternum to demonstrate what it will feel like. Now hold it over the interphalangeal joint of their big toe. Ask if they can feel it vibrate and then get them to tell you when it stops vibrating (hold the prongs to stop the vibration). If they cannot sense vibration, move to the metatarsophalangeal joint, then medial malleolus, then tibial tuberosity and so on until they can feel the vibration.
- **Temperature (spinothalamic):** Use the long prongs of the tuning fork and see if the patient can identify them as cold on their sternum. If so, hold a prong horizontally over the skin on the dorsum of the distal foot and see if the patient can feel it as cold. Move proximally up the leg until they can feel it as cold.



## To complete

- Thank patient and cover them
- "To complete my exam, I would examine the cranial nerves and also do an upper limb neurological examination"
- Summarise and suggest further investigations

<u>UMN Lesion</u>	<u>LMN lesion</u>
Increased tone	Wasting and fasciculation
Spasticity	Decreased tone
Weakness	Weakness
Brisk reflexes, extensor plantar response	Reduced reflexes