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Lower limb peripheral neurological examination

To begin:

WIPE

- Wash hands
- Introduce self, stating your name and role
- Identify patient (check name, DOB and what they would like to be called)
- Permission – gain consent for the exam including a brief outline of what it will entail and how long it will take.
- Position – patient should sit comfortably on a couch (backrest at 30-45 degrees) with legs extended
- Pain – ask if the patient is in any pain
- Privacy – ensure curtains/doors are closed, consider blanket for areas not being examined
- Exposure – legs exposed from hips to feet

General inspection and active observation

Look for	Example of why
Conscious level	ACVPU – alert, confused, responds to voice, responds to pain or unresponsive Glasgow coma scale 3-15 gives greater range of level of response
General appearance	Is patient alert, orientated, in pain, generally appearing well or unwell?
Body habitus	Cachectic, well-nourished or large body habitus
Face	Facial droop or asymmetry, reduced facial expression, ptosis, pupil asymmetry
Speech	Is speech normal for the patient? Does patient understand instructions? Dysarthria, receptive or expressive dysphasia

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Specific inspection LL:

Look for	Example of why
Gait/posture	Use of mobility aids. Does gait appear normal? Abnormal posture e.g. leaning to one side. Limb posture e.g. contractures, spastic posturing (leg extended), scissoring of gait
Skin & musculature	Scars, wasting
LL movements	Involuntary movements, fasciculations, tremors

Around the bed:

Look for	Example of why
Treatments	Medications, oxygen, NG tube, IV infusions, urinary catheter
Observation chart	Note the patient's current status and NEWS score. If there are no up-to-date observations consider taking a full set of observations.

Gait & balance

What to examine	Assessing for	Associated with
Ask the patient to stand from a seated position	Difficulty rising from the chair / needing more than one attempt / using arms to push up	Proximal muscle weakness – may be due to myopathy, or radiculopathy Slowness to rise in people with Parkinson's Associated with / marker of frailty

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Ask the patient to walk away from you and then turn and walk back towards you, observing: • Posture • Stride length • Step height • Stability and base • Arm swing • Turning • Speed • Initiation of gait	Hemiparesis – Hip and knee extended and adducted, moves stiffly and patient swings (circumducts) the leg to avoid foot dragging on floor	Cerebral stroke or tumour
	Ataxic gait – unsteady, broad based and staggering	Cerebellar ataxia – may be multiple sclerosis, alcohol, cerebellar lesion May have associated nystagmus, dysarthria, and cerebellar signs in the limbs
	Shuffling or “festinant gait”- patient leans forward, takes progressively smaller steps and increases pace, multiple small steps to turn, slow walking	Parkinsonism - Stooped and flexed posture with a loss of arm swing, difficulty getting going and may ‘freeze’ during walking
	Spastic gait – legs stiff, hips and knees flexed and adducted and feet plantar flexed, “scissoring of legs”	Cerebral palsy, Multiple Sclerosis (MS), Motor Neurone Disease (MND) Spinal cord compression or subacute combined degeneration of the spinal cord
	Neuropathic gait - high stepping gait with foot drop to prevent tripping over feet	Peripheral nerve compromise e.g. common peroneal nerve palsy, polyneuropathy caused by diabetic neuropathy or inherited neuropathies such as Charcot Marie Tooth
	Waddling gait – pelvis shifts from side to side as the patient walks creating a waddling motion “Trendelenburg's sign”	Proximal weakness from myopathies or proximal neuropathies. Trendelenburg's sign can also be positive due to hip pathology

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Assess gait on tiptoes and heels	Tests for distal weakness of plantar flexion and dorsiflexion	Weakness of plantarflexion: Myopathy, peripheral neuropathies, motor neurone disease S1/S2 neuropathy
Co-ordination: Ask patient to walk heel to toe (tandem gait)	Unsteadiness / stumbling	Impaired proprioception, vestibular dysfunction, cerebellar cause
Romberg's test – Ask patient to stand still with feet together, look ahead, and then close their eyes.	Unsteadiness / stumbling without correction (Stand next to the patient to support and prevent falling)	Positive test associated with impaired proprioception or vestibular dysfunction called “sensory ataxia”

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Now ask the patient to lie down

Tone

What to examine	Assessing for:
Ask the patient to relax their leg. Move the legs through the following movements:	
Roll leg from side to side (hip internal and external rotation)	Flaccidity or increased tone • Hypertonia can be upper motor neuron lesion(s) • Hypotonia can be lower motor neuron lesion(s) or cerebellar disease • Spasticity "velocity dependent hypertonia", where the tone increases if you move the joint more rapidly (suggests UMN lesion) • Lead pipe rigidity (increased tone throughout the whole movement of the muscle, velocity independent)
Lift from under the knee upwards off the couch. Slowly then quickly.	
Ankle clonus – if reflexes are abnormally brisk	Briskly dorsiflex the foot. Clonus is present if the foot beats rapidly. • Clonus can be physiological but 5 + beats is abnormal • Upper motor neuron lesion(s) e.g. stroke, multiple sclerosis, cerebellar

Power

What to examine:	Grading power & nerve root supply of the lower limb
Test power of each muscle group: • Start with the biggest muscle groups (and work distally) • Compare right with left as you move down Nb. These are typically tested by nerve root rather than peripheral nerve	Use the MRC scale to assess power, where: 5 – normal power 4 – some movement against resistance 3 – movement against gravity only 2 – movement with gravity eliminated 1 – flicker of movement 0 – no movement
Hip flexion: Ask patient to, with a straight leg, raise each leg off the couch and resist against you pushing down on their thigh	Muscle: Iliopsoas muscle Nerve root: L1/L2

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	Peripheral nerve: femoral
Hip extension: Then place your hand under each thigh and ask patient to push their leg down onto your hand as you try and lift it up	Muscle: gluteal muscles Nerve root: L5/S1/S2 Peripheral nerve: sciatic and gluteal
Knee flexion: Ask patient to bend their knee (one leg at a time) and put their foot flat on the couch. Isolate the joint by stabilising their lower thigh. Hold their ankle, ask them to pull their foot towards them. Repeat on the other side	Muscle: hamstrings Nerve root: S1 Peripheral nerve: sciatic
Knee extension: Then ask them to kick out against your hand on their shin. Repeat on the other side	Muscle: quadriceps Nerve root: L3/L4 Peripheral nerve: femoral
Ankle dorsiflexion: Ask patient to bring toes up towards them (dorsiflex) while you resist this movement using the side of your hand	Muscle: tibialis anterior Nerve root: L4/L5 Peripheral nerve: peroneal nerve
Ankle plantar flexion: Ask patient to push toes down (plantar flex) against your hand	Muscle: soleus and gastrocnemius Nerve root: S1/S2 Peripheral nerve: tibial
Great toe extension: against resistance e.g. two fingers	Muscle: extensor hallucis longus Nerve root: L5 Peripheral nerve: peroneal nerve

Reflexes

What to examine	**Assessing reflexes**
Use a tendon hammer in a “swinging arc” to test the deep tendon reflexes. Use gravity, rather than hitting. If reflexes absent or diminished ask the patient to grit their teeth or clench their hands to reinforce the reflex	

Knee jerk – support knees with an arm, directly tap the patellar tendon with the hammer	May be: • Absent • Reduced • Normal • Brisk Brisk (or increased) reflexes suggest upper motor neurone Reduced or absent reflexes suggest lower motor neurone Nerve roots for reflexes: Knee jerk – L3/4 Ankle jerk – S1/2
Ankle jerk – bend knee to the side on the couch to expose the Achilles tendon, place a hand under the forefoot to dorsiflex the foot. Directly tap the Achilles tendon.	
Plantar reflex – the Babinski response. Firm pressure with the blunt end of a neuro tip starting from the heel then move along the lateral border ending medially at the MTP joint of the great toe	Normal = first movement of great toe is flexion (it goes down). If it goes up (an extensor response) with fanning of the toes, suggests an upper motor neurone lesion

Co-ordination

What to examine	Examination notes	Extra notes
Heel-shin test	Ask patient to put one heel on opposite knee, run down shin to ankle then lift heel and repeat	Testing for smooth accurate movements Testing for a loss of coordination / ataxia but can be abnormal for other reasons e.g. weakness

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Sensation

What to examine	Examination notes	Extra notes
Light touch and pain: Get patient to close their eyes. Use the sternum to demonstrate "normal"	Move down in a dermatomal distribution (L1-S2) compare side to side. Ask if the patient can feel the sensation and if it feels the same on both sides	Assess: • Light touch – cotton wool • Pain – neuro tip
Vibration: Eyes closed – use the sternum to demonstrate "normal"	Tuning fork; start with most distal bony prominence (great toe) and if they can't feel it move to next proximal joint i.e. medial malleolus then tibial tuberosity	128Hz tuning fork Ask the patient to tell you when vibration stops
Proprioception: eyes closed	Using your thumb and forefinger stabilise the distal interphalangeal joint of the big toe & demonstrate moving the toe up and down, then ask them to tell you if the toe is up or down as you move it.	Hold the toe on either side to prevent pressure on the nail

To finish

- Ensure the patient is dressed and comfortable
- Wash hands