2 | Neurology (Limbs)

The neurological examination appears daunting, but in trained hands it is actually the most reliable system with very reliable signs and clear localisation algorithms. The main struggles candidates face are: (a) neurophobia, (b) inability to elicit signs accurately due to poor examination technique, (c) inability to elicit patient cooperation due to poor communication, and (d) cognitive overload when deciding on additional localisation steps or in 'piecing it all together'. It is the aim of this chapter to assist you to overcome these challenges by providing advice on examination technique and systematic localisation algorithms that can be used even in complicated or unfamiliar cases.

This is, of course, no substitute for having seen many cases. Regular practice shortens the standard examination sequence to 4–5 minutes, leaving the remaining 1–2 minutes for additional manoeuvres (such as checking for fatigability) that help to clinch the diagnosis.

Acronyms used in this section:

UMN	Upper motor neuron	CN	Cranial nerve
LMN	Lower motor neuron		

Walk-Through and Tips: Upper Limbs

Listen to the stem

In the neurology station the stem can be exceptionally helpful. For example:

- "Patient has longstanding weakness." → Be alert for congenital causes and muscular dystrophies.
- "Patient has weakness and numbness." → Prioritise a differential of neuropathy (which can lead to numbness) over myopathy or neuromuscular junction disease (in which sensation is normal).
- "Patient has weakness of fingers." → Be alert for median, ulnar, and radial nerve palsies; C7 and C8 lesions, and myotonic dystrophy.

- "… Examine as appropriate." (instead of examine upper or lower limbs) → Hint that this is a movement disorder or cerebellar disease, and you might be expected to examine more than one region.

Inspection

Approach the patient with a warm greeting, smile, and handshake. This immediately reveals dysarthria, hypophonia, facial droop, and grip myotonia. Step back and inspect the patient as a whole — not just the upper limbs. Look around the patient for walking aids, urinary catheters, motorised aids, limb splints, and other devices. Look at the face for any facial droop (stroke?), facial diplegia (myopathy?), mask-like facies (Parkinsonism?), or ptosis (various causes). Look at the posture of the limbs — is there tremor, chorea, contractures, or upper motor neuron posturing (flexion at the elbow and wrist)?

Now go closer to the patient. Ensure adequate exposure — the shirt should be removed so that the overriding scapula of facioscapulohumeral dystrophy is immediately revealed. Observe wasting particularly by comparing left and right, looking at the dorsal interossi of the fingers, and for any clawing of the toes. Look for scars over the limbs, neck, and head. Fasciculations are best observed at this stage (and again in the tongue). Do not flick for fasciculations; flicking does not make fasciculations appear. Although inspection alone can sometimes yield the diagnosis, avoid jumping to a 'spot diagnosis' based on the presence of a few signs (e.g., pes cavus = Charcot-Marie-Tooth, fasciculation = motor neuron disease). You can be misled, and even if you are right, you need to show evidence of a robust thought process rather than lucky 'guessing'.

Screening tests. (1) is an expected part of the upper limb examination, while (2) and (3) are our recommendations given how commonly myotonic dystrophy appears in PACES, as well as the possibility of mononeuropathies which can confuse you during power testing:

(1) **Pronator drift**: Ask the patient to hold both arms outstretched in front, with palms upwards and eyes closed. To improve sensitivity, ensure full forearm supination and finger adduction. Look for a pronator drift; i.e., pronation and downward drift (upper motor neuron weakness), claw hand (ulnar claw), or finger escape sign (cervical myelopathy). Push both palms downwards and look for an overshoot rebound (cerebellar disease).

(2) **Wrist and fingers cocked up**: Next, ask the patient to hold both hands outstretched with wrist in dorsiflexion, as if testing for asterixes. Look for wrist or finger drop (radial nerve palsy). In this position, walk behind the patient, looking for any winging of scapula (e.g., facioscapulohumeral dystrophy) or neck scars.

(3) **Make a tight fist and open quickly**: Look for any benediction sign (median nerve palsy), grip myotonia (myotonic dystrophy), or slow grip and release (Parkinsonism). If Parkinsonism is suspected, check rapid alternating movements (e.g., repeatedly make a fist and open).

Pitfall: Common errors in inspection

The inspection step is very important — missing some diagnoses here can be an unsalvageable calamity. Common flops include:

- Missing a diagnosis of myotonic dystrophy. This is usually due to a failure to recognise characteristic facial features (facial diplegia, ptosis, frontal balding) and therefore a failure to screen for grip and percussion myotonia. The tale is also told of the patient with myotonic dystrophy who always wears a cap at exams — so as not to give away obvious frontal balding to the candidate who fails to hunt for it. This can be circumvented by screening for grip myotonia in *all* upper limb cases.
- Missing a diagnosis of Parkinsonism. This can occur in patients with only a subtle rest tremor, if the candidate fails to examine tone carefully or fails to distinguish spasticity (velocity dependant — UMN) from rigidity (velocity independent — Parkinsonism). Therefore it is important to look out for hypophonia and mask-like facies.
- Missing a diagnosis of facioscapularhumeral dystrophy. Its classic features — overriding scapula, polyhill sign, winged scapula — are obvious on inspection, but will be missed if exposure is inadequate. If you opt not to remove the patient's shirt right from the start, you must certainly remove it later should the patient have proximal weakness with lower motor neuron signs and normal sensation.
- Using the "OK sign" as a screen. This has little value because it tests only the anterior interosseous nerve and is completely normal in a median nerve lesion at the carpal tunnel (which is also the most common median nerve lesion).

Be prepared to modify the examination routine or perform additional steps based on the suspected diagnosis. For example, if you notice mask-like facies, the next step is to demonstrate the signs of Parkinsonism and distinguish between idiopathic Parkinson's disease vs. Parkinson-plus syndromes. Completing the sensory exam takes a back seat. This is discussed further in the relevant clinical syndromes.

Determine UMN vs. LMN lesion

Tone. Before beginning, check if the patient has any pain. Explain, "*Sir, I will now like to see how relaxed you can be. Rest completely and let me move your hands.*" Assess tone over one joint at a time, isolating the joint tested. The usual sequence is elbow flexion/extension, forearm pronation/supination, and wrist flexion/extension; compare left and right at each step. In each joint, begin with large, slow movements to look for rigidity (Parkinsonism — velocity independent), then perform rapid extension/supination movements to catch spastic flexors (UMN — velocity dependant). Recall that a UMN lesion in the upper limbs results in greater spasticity and power in flexors (i.e., antigravity muscles) than in extensors; therefore rapid elbow extension, forearm supination, or wrist extension will best allow you to catch spasticity. Apart from UMN spasticity, be alert for the leadpipe rigidity and cogwheeling of Parkinsonism — this may be the last chance to catch Parkinsonism if you did not notice any tremor or mask-like facies.

Reflexes. Rest the patient's elbows on the bed/armrests, ensuring that he/she is completely relaxed, and fold both hands in front of the patient such that elbows are slightly flexed and left and right are symmetrical. In this position, test biceps and supinator jerks. Next, holding the patient's forearm so as to support its weight, test the triceps jerk. If there is hyporeflexia, reinforce by asking the patient to clench his/her jaw on the count of three. If there is hyperreflexia, additional reflexes (e.g., pectoral, finger) can be performed, but are not necessary and do not add additional localisation value.

Pitfall: Common errors in reflex testing

Reflex testing is a skill acquired from years of deliberate practice. Try to have a neurology consultant observe your technique at least once. Even at the PACES level, it is not uncommon to see candidates hold or swing the tendon hammer incorrectly. Some common errors include:

1. Failing to ensure that the arm is completely relaxed (i.e., its weight completely rests on another surface), which leads to artificially depressed reflexes. Ideally, the arm should be resting on a surface and not lifted up; if lifting the patient's arm is necessary (e.g., for the triceps jerk), instruct the patient to rest the weight of his/her arm completely on yours. The upper limb examination can be done with the patient either sitting in a chair or lying in a bed propped up at 45 degrees; you should be familiar with the necessary positioning in both circumstances.
2. Testing reflexes with the tendon in an over-stretched position (e.g., testing biceps and supinator jerk with elbow fully extended) or over-relaxed position (e.g., testing ankle jerk without first slightly flexing the knee and ankle). The elbow, knee, and ankle should all be slightly flexed when testing reflexes.
3. Asymmetry of left and right arm when eliciting reflexes. Both arms should be positioned symmetrically for accurate comparison.

The inverted supinator reflex

The inverted supinator reflex has specific localisation value. It is seen in a cord lesion at C5/6, when tapping the brachioradialis tendon leads to brisk finger flexion (C8) but minimal elbow flexion (C5/6). With a C5/6 lesion, the triceps reflex (C7) will be brisk and the biceps reflex (C5/6) will be depressed. Therefore, you should only ever call a supinator reflex inverted when the biceps reflex is depressed and the triceps reflex is brisk.

Decision point. By this stage, you must be able to identify if there are (1) UMN signs (hypertonia, brisk reflexes), (2) LMN signs, or (3) evidence of extrapyramidal dysfunction. Frank hyporeflexia and hypotonia may not always be present in LMN disorders (e.g., reflexes and tone are normal in myasthenia gravis); rather, the absence of UMN signs plus the presence of wasting or fasciculations will point towards a LMN pathology.

Power

Explain to the patient that you will like to see how strong he/she is. Isolate each joint and do not test at a mechanical disadvantage. The usual muscles tested are listed in Table A2.1. Identify the presence and distribution of weakness (i.e., symmetrical vs. asymmetrical, proximal vs. distal), grading power on the Medical Research Council scale out of 5. If there is any suggestion of a mononeuropathy or distal wasting/weakness, do specific tests for the medial, ulnar, and radial nerve (see Syndrome 2.8).

Table A2.1. Power testing, upper limb.

Action	Root	Nerve	Notes
Shoulder abduction	C5	Axillary	
Elbow flexion (in supination)	C6	Musculocutaneous	Elbow flexion in mid-pronation tests brachioradialis (C6, radial nerve), which is useful to distinguish C7 vs. radial nerve lesion.
Elbow extension	C7	Radial	Do not put patient at a mechanical disadvantage; test elbow flexion/extension at 90 degrees of flexion.
Wrist flexion	C6	Median, Ulnar	Do not put patient at a mechanical disadvantage; test wrist flexion/extension at neutral position.
Wrist extension	C7	Radial	
Finger flexion	C8	Median, Ulnar	Get the patient to curl his/her fingers around yours, and attempt to uncurl their fingers (this is better than 'squeeze my fingers' which does not impose resistance).
Index finger abduction	T1	Ulnar	Test the patient's first dorsal interossei against yours by placing the lateral border of your index finger's proximal phalanx against the patient's, and asking the patient to abduct his/her index finger. Repeat with little finger against little finger. Keep the wrist in slight extension, or the patient will be at a mechanical disadvantage.

Sensation

Spinothalamic tracts. Test pinprick sensation using either a neurotip or the sharp end of a bamboo skewer or toothpick. Using the forehead as a reference point, explain what you will do: *"Sir/Mdm, I will now like to test the feeling on your arms. This is a neurotip/toothpick. I am going to test this against your forehead, it should feel sharp. I am now going to test your arms. Each time I touch you, please let me know whether it feels equally sharp, or if it feels blunt or simply abnormal."* Try to exert a consistent amount of pressure — a bamboo skewer is favourable because you can gently grasp its

Table A2.2. Sensory test points, upper limb.

Location	Root	Nerve	Notes
Outer arm	C5	Axillary	
Radial forearm	C6	Musculocutaneous	
Thumb	C6	Median	If suspecting ulnar or median neuropathy, test thenar and hypothenar eminence and for a split ring finger.
Middle finger	C7	Median	
Little finger	C8	Ulnar	
Ulnar forearm	C8	Medial cutaneous of forearm	These nerves come directly from the brachial plexus
Inner arm	T1	Medial cutaneous of arm	

sides and slide your thumb and finger down. You would usually use the standard dermatomal test points (Table A2.2), but if peripheral neuropathy is suspected, it would be more impressive to test from distal to proximal to identify a glove and stocking distribution of numbness.

Dorsal columns. Test either proprioception or vibration sense. Test proprioception at the thumb, grasping the sides of the thumb (so as not to give a clue from pressure sensation), using small deflections of approximately 5–10°. Instruct the patient to tell you whether the direction of movement is up, down, or if they are not sure. Test vibration sense using a 128 Hz (not 512 Hz) tuning fork, using the forehead as reference point, and beginning at the bony prominence of the interphalangeal joint of the thumb. There are several acceptable ways to test vibration, such as placing the tuning fork for ≥8 seconds (normal if able to sense vibration after 8 seconds) or stopping the vibration with your fingers and asking the patient if the tuning fork is still vibrating (should be able to discern that vibration has stopped). If vibration sense at the thumb is impaired, it is ideal to move proximally to the next bony prominence (wrist, elbow, clavicle); however, this is not essential as the decision point is whether vibration/proprioception is affected, rather than the severity of dorsal column dysfunction.

Pitfall: Common errors in sensory testing

A number of common errors arise during sensory testing:

1. Do not use the sternum as a reference point when testing upper limb sensation. The sternum (T2-3) has a lower dermatome value than the upper limbs (C5-T1). A high cervical cord lesion leads to reduced sensation in both the sternum and upper limbs. In this situation, using the sternum as a reference point can give erroneously 'normal' sensation.
2. Communicate clearly to the patient that your intent is to check if there is any reduced sensation. An instruction of "please let me know whether you can feel it," taken literally by the patient, invites binary answers (i.e., "yes, I can feel it" or "no, I cannot feel anything"), and you will miss areas of diminished, but not absent, sensation.

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3. Always test two sensory modalities. Neglecting to test dorsal columns when pinprick sensation is normal can lead to misdiagnosis, for instance, of subacute combined degeneration as simple spastic paraparesis.
4. When testing proprioception, use small deflections (5–10° is adequate). Proprioception is actually very sensitive — try it on a friend! Using overly large deflections will reduce the sensitivity of proprioception testing and lead to falsely 'normal' proprioception.

Cerebellar

Omit cerebellar testing if the patient has poor vision, or if power is less than grade 3. When testing dysmetria (past-pointing), stress the cerebellar system by ensuring that the patient's arm is fully extended to touch your finger. Look not just at whether the patient is able to accurately touch your finger, but also whether he/she misses his/her nose. When testing dysdiadochokinesia, ensure that the moving hand is lifted a good distance above the stationary palm, and *tap lightly* on the stationary palm (i.e., demonstrate smooth acceleration and deceleration). Patients with cerebellar dysfunction are not able to gauge the 'stopping point' and tend to 'overshoot', leading to a hard slap on the stationary palm — some attempt to slap hard all the time to mask this 'overshooting'.

Subsequent steps in the upper limb examination may be performed to further localise the pathology (e.g., testing for fatigability in suspected myasthenia, demonstration of additional features of Parkinsonism). This has to be tailored to pathology found so far, and is discussed in the specific clinical syndromes.

Walk-Through and Tips: Lower Limbs

Key principles of neurological testing, discussed in the upper limb section, apply here. Only additional salient points are highlighted.

Listen to the stem

As in the upper limbs, the stem can be exceptionally helpful — for example:

- Patient has longstanding weakness" → Be alert for congenital/childhood causes (e.g., hereditary motor sensory neuropathy (Charcot-Marie-Tooth), old polio, or muscular dystrophies).
- "Patient has weakness and numbness" → Prioritise a differential of neuropathy (which can lead to numbness) over myopathy or neuromuscular junction disease (in which sensation is normal).
- "Patient has stiffness. Please examine lower limbs" → this is a giveaway for spastic paraparesis.
- "Patient has unsteady gait/frequent falls" → Cerebellar dysfunction, Parkinsonism, or sensory ataxia is more likely than spastic gait.

Inspection

As with the upper limb examination, approach the patient with a warm greeting, smile, and handshake. Inspect from the foot of the bed, looking for walking aids or wheelchairs, limb splints, urinary catheters, and devices. Expose both upper and lower limbs. Look at the lower limbs for any asymmetry (shortened leg in polio), wasting, pes cavus, clawed toes, and a champagne-bottle appearance (Charcot-Marie-Tooth); observe for contractures and surgical scars (e.g., tendon release). Look at the upper limbs for wasting, fasciculation, and abnormal posturing (e.g., overt hemiparesis). Look at the face for facial droop and ptosis.

Screening tests. Ask the patient to dorsiflex both ankles. This quick screen for foot drop is valuable — unilateral foot drop will prompt you to test power in additional muscles (particularly hip abduction). We recommend assessing gait at the end because gait is tricky to interpret without a prior idea of pathology, and walking takes too long in a weak patient.

Determine UMN vs. LMN lesion

Tone. Check if the patient has any pain and explain what you are doing. Assess internal and external rotation of the hip by rolling the legs on the bed, checking knee flexion and extension slowly, then lifting the knee rapidly to catch spastic knee extensors (in a UMN lesion, lower limb extensors are more spastic than flexors). Be careful when doing this manoeuvre — previous PACES candidates have been kicked in the face by spastic lower limbs. Equally, be wary of flaccid legs that can flop back and hit the patient's gluteal region — be prepared to catch the patient's leg if so.

Clonus. Flex the knee and ankle slightly, before firmly dorsiflexing the ankle. Up to 3 beats of clonus is normal.

Reflexes. Place your arm under the patient's knee and ask the patient to put the weight of his leg on your arm. Check the knee jerk, comparing left and right. Flexing the knee and ankle slightly so as to stretch the soleus and gastrocnemius tendons (but do not over-flex), check the ankle jerk. Reinforce if reflexes are depressed.

Plantar (or Babinski) reflex. Warn the patient beforehand — "*Sir this is the blunt end of a stick, I will be using it to scratch the bottom of your foot. It may be slightly uncomfortable but should not be painful. If it is too uncomfortable tell me and I will stop.*" As you go up the lateral border of the foot, begin with only light pressure, and increase the amount of pressure as tolerated to elicit a response. A positive (abnormal) Babinski sign is an extensor or upgoing plantar response, fanning out of the toes ± ankle dorsiflexion. This is a very reliable sign of a UMN lesion, but must be distinguished from a withdrawal response (i.e., extension of all toes/ankle, especially even before you cross the forefoot).

Pitfall: Plantars vs. patient welfare

Plantar testing is uncomfortable for the patient, so aim to test plantars just once or, at most, twice. Adjust the amount of pressure applied as you go up the lateral border of the foot: decrease pressure if the patient starts to withdraw, increase if patient does not respond. Aim to cross the forefoot with the right amount of pressure to elicit a response, but not too much pressure so as to lead to a withdrawal reaction. If you can elicit neither flexor nor extensor responses after 3 or more attempts, know when to move on. Some patients simply have equivocal plantars. A candidate who makes 'too many' attempts risks being penalised for patient welfare.

At this stage, decide if there are (1) UMN signs (hypertonia, brisk reflexes, upgoing plantar response, clonus), (2) LMN signs (hypotonia, hyporeflexia), or (3) neither.

Power

Explain to the patient that you will like to see how strong he/she is. Identify the presence and distribution of weakness (Table A2.3). Always test power against gravity first (e.g., ask the patient to extend the knee) before testing against resistance. Be particularly alert to an UMN pattern of weakness; i.e., relative preservation of power in antigravity muscles (extensors in the lower limbs, compared to the flexors), which may indicate UMN pathology even if tone and reflexes are equivocal.

Table A2.3. Power testing, lower limb.

Action	Root	Nerve	Notes
Hip flexion	L2	Femoral	
Hip extension	L4-5	Inferior gluteal	Ask the patient to press his/her heel into the bed. The gluteus maximus is normally strong enough to lift the buttock off the bed.
Knee extension	L3-4	Femoral	Ensure to test with knees flexed at 90°.
Knee flexion	L5, S1	Sciatic	
Ankle dorsiflexion	L4-5	Deep peroneal	These muscles are normally very strong (as they act against a person's body weight). You should not be able to overcome them easily with your upper limbs.
Ankle plantarflexion	S1	Tibial (from sciatic)	
Toe dorsiflexion	L5	Deep peroneal	
Hip abduction	L5	Superior gluteal	Not routine; test only in foot drop. To test, lie patient on his/her side and ask him/her to abduct the leg.

Table A2.4. Sensory test points, lower limb.

Location	Root	Nerve	Notes
Mid anterior thigh	L2	Femoral nerve	
Medial knee	L3	Femoral nerve	
Medial malleolus	L4	Saphenous nerve (from femoral nerve)	
Lateral malleolus	L5	Lateral cutaneous nerve of calf (from superficial peroneal nerve)	
Dorsum of foot, first webspace	L5	Deep peroneal nerve	
Lateral border of foot	S1	Tibial nerve	Or test sole of foot

Sensation

Spinothalamic tracts. The technique and instruction is similar to the upper limb examination. Standard dermatomal test points are listed in Table A2.4; again, if you suspect peripheral neuropathy, test from distal to proximal to elicit a glove and stocking pattern.

Dorsal columns. Test either proprioception or vibration sense, using the technique described in the upper limb examination. If you suspect that the dorsal columns will be abnormal (e.g., clear-cut glove and stocking numbness), vibration may be the better test because you can go proximally from the big toe → ankle joint → patella → anterior superior iliac spine relatively quickly, to identify the level of dorsal column loss.

Pitfall: Contradicting signs

Do not be confused by apparently contradictory signs (e.g., hypertonia, hyporeflexia, upgoing plantars) or an inconsistent sensory examination. Real patients may not always follow 'textbook' scripts. Rely on the most concrete signs first (particularly tone, plantars, clonus, reflexes) and give less weight to more subjective signs (e.g., sensation). If signs are truly mixed, present what you have found and explain what you found to be inconsistent, rather than disregarding some signs or force-fitting it into a certain script.

Cerebellar

The heel-shin test can only be done if the patient has good vision and has power greater than grade 3. If cerebellar dysfunction is suspected, tandem gait is a helpful additional test, if time permits.

Gait

Before proceeding, ask if the patient is able to walk, and ask the examiner if it is safe to do so. If there is a wheelchair at the bedside, verify that the patient requires a wheelchair to mobilise, instead of cheerfully asking the patient to walk — which betrays your failure of inspection. Common gaits include a spastic gait, high-stepping gait (foot drop), waddling gait (proximal weakness), Parkinsonian gait, and ataxic gait. Stress the gait if the abnormality is not obvious (e.g., tandem gait or stand on tiptoe). Consider doing Romberg's test if there is dorsal column loss.

Subsequent steps may further localise the pathology, and are described in specific clinical syndromes. Checking the back and neck for scars is particularly important in both spastic and flaccid diplegia.

Clinical Syndromes

Interpretation of the neurological examination is very logical. Principles of localisation and key differentials do not differ whether the stem is 'examine lower limb' or 'examine upper limb'. The two universal questions are:

1. **Where is the lesion?** First decide if the pathology is in the pyramidal tracts or extrapyramidal tracts (Parkinsonism and mimics), or if it is a cerebellar problem. If it is a pyramidal tract issue, distinguish between UMN and LMN lesions, then localise the lesion further along the neuroaxis. Figures A2.1 and A2.2 provide an overview of localisation. Table A2.5 provides a precis of localising LMN lesions.
2. **What is the lesion?** Each localisation comes with specific aetiologies to consider.

This is discussed in further detail in individual clinical syndromes.

Clinical syndrome	Key features
1. Bilateral UMN (UL or LL)	UMN signs in bilateral UL/LL ± sensory, cerebellar dysfunction
2. Unilateral UMN (UL or LL)	UMN signs in left or right UL/LL ± sensory, cerebellar dysfunction
3. Mixed UMN and LMN signs	UMN signs with wasting ± fasciculation, or bizarre distribution of UMN signs
4. LMN + normal sensation	Any distribution of weakness LMN signs Normal sensation
5. LMN + abnormal sensation	LMN signs Sensory loss ± Charcot foot

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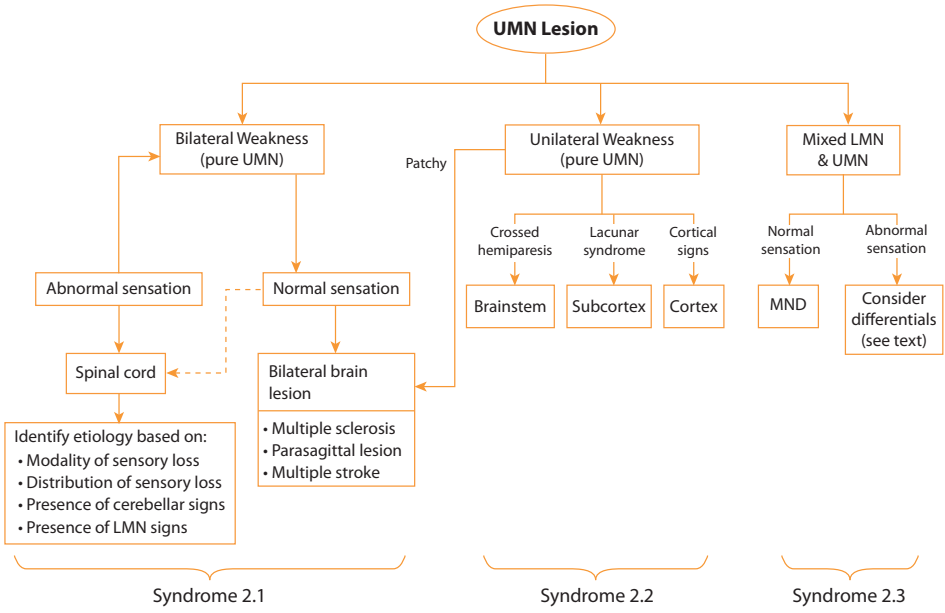
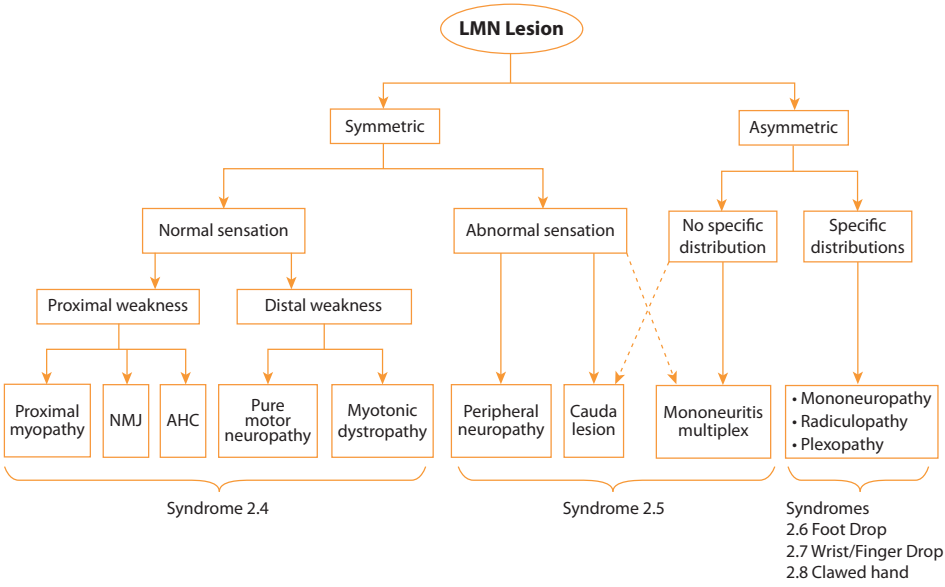
Clinical syndrome	Key features
6. Foot drop	Weak ankle dorsiflexion on screening High steppage/circumducting gait
7. Finger/wrist drop*	Weak wrist flexion on screening
8. Claw hand*	Unilateral weak/wasted/clawed hand
9. Cerebellar signs only	Stem: difficulty walking, falls rather than weakness Scanning speech, upward rebound in pronator drift Unilateral or bilateral cerebellar signs No weakness or sensory loss
10. Parkinsonism only*	Mask-like facies, hypophonic speech Pill-rolling rest tremor Cogwheel and leadpipe rigidity No weakness or sensory loss

**These syndromes tend to come with a 'examine the upper limbs' stem rather than a 'examine lower limbs' stem.*



MND: motor neuron disease

Figure A2.1. Localisation overview for UMN lesions.



AHC: anterior horn cell; NMJ: neuromuscular junction

Figure A2.2. Localisation overview for LMN lesions.

Table A2.5. Precis of localisation in LMN lesions.

Lesion	Prototype	Distribution of weakness	Sensation	Distinguishing features
AHC	Motor neuron disease	Proximal or distal	Normal	Fasciculations Mixed UMN signs in MND
Root and plexus	Radiculopathy	Myotomal	Dermatomal loss	Asymmetric
Peripheral nerve	Diabetic neuropathy	Distal	Symmetrical glove and stocking loss	
Mono-neuropathy	Carpel tunnel syndrome	In distribution of nerve	In distribution of nerve	Asymmetric
NMJ	Myasthenia gravis	Distal	Normal	Fatigability
Muscle	Dermatomyositis	Mostly proximal Distal in myotonic dystrophy	Normal	Some myopathies have pathognomic features