Peripheral Nervous System Examination – Upper + Lower Limbs

History
The patient may present with symptoms that are purely sensory/motor or movement (i.e.: tremor). It is important to find out the involvement of one modality (i.e.: pain/temperature/proprioception/paraesthesiae/2-point discrimination/movement/reflexes etc).

Distribution, time of onset, duration of symptoms will give clues about the diagnosis. Family history is also important, as some conditions are hereditary. Previous injuries, procedures, neurological problems may have resulted in the current symptom – so be sure to ask about these.

Examination of the upper and lower limbs – General Pattern (Taller & O Connor pp 390)
The following pattern is followed when asked to examine the upper + lower limbs:

1. ***Motor System (GPMAFTPRC)***
    a. General Inspection
        i. Posture
        ii. Muscle bulk
        iii. Abnormal movements
    b. Fasciculations
    c. Tone
    d. Power
    e. Reflexes
    f. Coordination
2. ***Sensory System (PTVPL)***
    a. Pain & Temperature
    b. Vibration & Proprioception
    c. Light Touch

General Inspection (Upper + Lower Limbs)

- Abnormal posture (hemiplegia – paralysis of one side of body)
- Muscle Wasting (denervated muscle, muscle disease, muscle atrophy) – compare one side to the other.
- Abnormal movements: tremors
- Skin: neurofibromatosis, herpes zoster, cutaneous angiomata, scars, injuries, urinary catheter.
- Shake hands with patient → inability to relax the hand grip → dystrophia myotonica.
- Hold out both arms outward, supinated position, close eyes → watch for drift (i.e.: pronation of wrist, flexion of fingers, downward/upward, searching movement – Refer to Taller pp 391 for causes).

Upper Limbs (Taller & O Connor pp 391)

Motor System
General Inspection (Patient at edge of bed, arms and shoulder girdles exposed)

- Inspect for muscle wasting

- Relax arms, rest on lap. Inspect for fasciculations → irregular contractions of muscles

Tone (wrists & elbows – both arms)

- Tell patient to relax their arm. Hold their elbow with one arm, and with the other arm rotate their wrists (in supinated position) in an unpredictable random manner
- Now rotate their elbows the same way but have their arm in a pronated position.

Power (Testing examiner's ability to overcome patient's voluntary muscle resistance)

- Take into account the patient's age, gender & build. Range of grading mechanism, refer to Talley pp 392.
- Note any painful muscle or joint disease which may impair your judgement (i.e.: rheumatoid arthritis etc). Look for the following:
    - Loss of power, if any, 1) one side/both sides 2) proximal/distal/general,
- In each of the movements, tell the patient to "push/pull against you as hard as they can" – this avoids confusion.
- Test for the following:
    - *Shoulder*
        - Abduction: patient abducts arms with both elbows flexed. (C5, C6 – deltoid/supraspinatus)
        - Adduction: patient adducts arms with both elbows flexed (C6-C8 – pectoralis major, latissimus dorsi)
    - *Elbow*
        - Flexion: patient should bend elbows and not let examiner straighten arm out (C5, C6 – biceps, brachialis)
        - Extension: patient should straighten elbow and not let examiner bend it (C7, C8 – triceps brachii)
    - *Wrist*
        - Flexion: patient bends wrist and not let examiner straighten it out (C6, C7 – flexor carpi ulnaris, radialis)
        - Extension: patient straightens wrist and not let examiner to bend it (C7, C8 – extensor carpi group)
    - *Fingers*
        - Flexion: patient squeezes two of examiner's fingers (C7, C8 – flexor digitorum profundus and sublimis)
        - Extension: patient straightens fingers and not let examiner push – use side of hands (C7, C8 – extensor digitorum communis, extensor indicis, extensor digiti minimi)
        - Abduction: patient spreads out fingers, not let examiner push them together (C8, T1 – dorsal interossei)
        - Adduction: patients holds paper in between their fingers, and examiner tries to pull it out (C8, T1 – plantar interossei)

Reflexes

- Make sure the patient is relaxed, resting his/her arms on her lap – with hands pronated. RELAX THE PATIENT AS MUCH AS POSSIBLE.
- Biceps (C5, C6):

    - Once elbows are flexed and in relaxed position – place 1 forefinger on biceps tendon and gentle let the tendon hammer fall onto that finger (hold tendon hammer near its end – let gravity do most of the work).
    - If the reflex is absent: *reinforcement manoeuvre*. Ask patient to count back from "97" or clinch teeth and try reflex again.
    - Reflex low/absent indicates the following possibilities: myopathy, neuropathy (motor nerve), spondylosis (ventral root), poliomyelitis (ventral horn cell), sensory root or sensory nerve problem.
- Triceps (C7, C8):
    - Support elbow with one hand, tap over triceps tendon → forearm should extend
- Brachioradialis (C5, C6)
    - Have arm in pronated position. Place 2 fingers over lower end of radius just above the wrist.
    - Strike this spot with a tendon hammer → elbow flexion should occur
    - **Inverted brachioradialis response:** forearm extension, finger flexion.
- Fingers (C8)
    - Patient hand is supinated and examiner places 2 fingers over patient's fingers. Slight stroke with tendon hammer should result in all fingers flexed.

Coordination (Cerebellar function)

The cerebellum plays a vital role in coordinating voluntary movements. To test this, a standard series of tests is developed. Always demonstrate the movements yourself before asking the patient to do so.

- Finger nose test: Ask the patient to touch his/her nose, turn the finger and touch your finger held at nearly outstretched limits. This should be done slowly, and then fast. Do this with patient's eyes open & closed.
    - Look for: intention tremor, past pointing.
- Rapidly alternating movements: Patient pronates and supinates their hand on dorsum of other hand as fast as possible.
    - Look for clumsiness → dysdiadochokinesis.
- Rebound: Patient lifts their arms towards ceiling, ask them to stop suddenly
    - Look for: hypotonia (cerebellar disease delays stopping)

Sensory System

Pain (pin-prick) testing (Spinothalamic pathway → pain + temperature)

- Inform patient about the type of pain that should be experienced (They may get scared at the sight of a pain). Test the pain felt at the anterior chest wall (i.e.: "is it sharp/dull")
- "Prick" the patient lightly along each dermatome of the upper limb until any dullness is sensed. Always compare right with left side along same dermatomes. Map out any dullness by starting from most dull area → normal sensation.
- Dermatomes: C3, C4, C5, C6, C7, C8, T1, T2 (associated with pp 400)

Temperature testing (Spinothalamic pathway)

- Use a tuning fork (usually cold) for this part of the examination. Touch the patient along the same dermatomes as for pain and see if they can detect cold.

- Dermatomes: C3, C4, C5, C6, C7, C8, T1, T2

Vibration Testing (Posterior Columns)

- Use a 128Hz tuning fork. Patient's eyes closed. Vibrate the fork and place on 1 of distal interphalangeal joints → ask patient if they feel it "yes/no". Deaden the fork and patient should say when this occurs "now". Compare the other side.
- Test over ulnar head at wrist, elbows (olecranon), shoulders. Test bony prominences.

Proprioception (Posterior Columns)

- Patient's eyes open → hold the distal interphalangeal joints by their side and show patient: "up/down".
- Patients eyes closed: repeat the manoeuvre randomly, ask patient to identify the positions.
- Test at wrists and elbows in a similar manner (usually only done if any lesion is suspected).

Light touch testing (Posterior Columns)

- Touch the skin lightly with a wisp of cotton, along the same dermatomes as explained above. Patient's eyes must be closed: say "yes" when touch is felt. Compare left and right sides.

Lower Limbs (Talley & O Connor pp 408)

Gait (if possible, expose patient's legs and thighs entirely)

- Check for urinary catheters present
- Ask the patient to do the following manoeuvres:
    - Walk a few steps normally
    - Walk heel/toe in a line
    - Walk on heels in a line
    - Squat down and up (you may want to be ready to support the patient)

Motor System

Note: You have done your general inspection already. You may want to lie your patient on the bed for the lower limbs portion.

Fasciculations and Muscle Wasting

- Inspect for fasciculations.
- Feel the muscle bulk of the quadriceps and calves. Run hand along shin to feel for muscle wasting of anterior tibial muscles.

Tone (knees & ankles)

- If patient is lying down, place one hand beneath one knee and move the knee in a random/unpredictable fashion. Check for hypotonia and hypertonia. If patient sitting at edge of bed, pull leg to horizontal and let go to see oscillations. Inspect for hyper/hypotonia.
- To test tone of ankles, repeat the procedure. Randomly move the ankles and feel for hypo/hypertonia.

Power

- In each of the movements tell patient to "push/pull against you as hard as they can". This will avoid any confusion. Test for the following:
  - *Hip*
    - Flexion: With patient's leg straight, ask them to lift it up and not let you push down (L2, L3 – psoas & iliacus)
    - Extension: Ask patient to keep whole limb down and not let you pull it from calf or ankle (L5-S2 – gluteus maximus)
    - Abduction: Ask the patient to abduct whole limb, not letting you push it back (L4-S1 – gluteus medius & minimus, sartorius, tensor fasciae latae)
    - Adduction: Ask the patient to keep legs adducted and not let you pull them apart (L2-L4 – adductors longus, brevis, magnus)
  - *Knee*
    - Flexion: Ask the patient to bend the knee and not let you straighten it (L5, S1 – hamstrings)
    - Extension: Ask the patient to straighten their leg and not let you push it back (L3, L4 – quadriceps femoris)
  - *Ankle*
    - Plantarflexion: Ask patient to push foot down and not let you push it back (S1, S2 – gastrocnemius, soleus, plantaris)
    - Dorsiflexion: Ask patient to bring foot up and not let you pull it back (L4, L5 – tibialis anterior, extensor digitorum/hallucis longus, brevis)
  - *Tarsals*
    - Eversion: Ask the patient to evert the foot against resistance.
    - Inversion: With foot in plantarflexion, ask to invert against resistance.
  - *Toes*
    - Flexion/Extension: Ask the patient to flex and extend toes against resistance (use side of hand).

Reflexes (Knee/Ankle/Plantar)

- Knee jerk (L3, L4):
  - Support the knees at the popliteal fossa so that they are slightly bent. Slightly hit the infrapatellar tendon. Extension of the knee joint is normal.
  - *Reinforcement manoeuvre* may be helpful when testing for this.
- Ankle jerk (S1, S2):
  - Have knees slightly bent, thigh slightly rotated, foot dorsiflexed and tap on your fingers, which are in turn on the sole of the foot. Plantarflexion should normally occur.
- Plantarflexion (L5-S2):
  - Explain to the patient before attempting this procedure.
    - Make sure foot is in upright position, and RELAXED. Use a key and stroke laterally, moving superiorly, and medially towards the middle metatarsophalanheal joint.
    - Flexion of the big toe is normal (Abnormal: Babinski's)

Coordination (Cerebellar function)

- Heel-shin test (eyes open or closed): With knee flat, ask the patient to place the heel of one leg onto the shin of the other, and move up and down between foot/knee at moderate pace and accurately. Check for side to side oscillations and overshooting.
- Toe-finger test: With knee bent, patients lifts their foot and touches examiner's finger
- Foot-tapping test: tap heel of foot on opposite shin as fast as possible (check for loss of rhythmicity).

Sensory System

Pain + Temperature (Spinothalamic pathway)

- Use a new pin, prick the following dermatomes with reference to anterior chest wall. "If its dull, say yes".
- Dermatomes to be tested: L2 (anterior thigh), L3 (front of knee), L4 (medial leg), L5 (lateral leg + medial dorsum of foot), S1 (heel + sole), S2 (posterior thigh – have patient bend their knees for this).
- For temperature, use a cold tuning fork and ask them to say "yes" when they can feel the coldness.

Vibration & Proprioception (Posterior Columns)

- Vibration: test at the ankles, knees and ASIS (if need be).
- Proprioception: big toes, knees and hips (if need). Patient's eyes are closed.

Light tough (Posterior Columns)

- Use a cotton wisp and test for light touch along the following dermatomes: L3, L4, L5, S1, S2 – ask the patient to say "yes" when they feel the light touch.

Make sure when you perform the examination, you always compare the fasciculations, tone, power, reflexes, pain, temperature, vibration, proprioception, light touch.

Never do one limb all at once and then proceed to the other limb. Always COMPARE between the sides.