EXAMINATION OF THE NERVOUS SYSTEM

INTRODUCTION

The following guidance on examination of the nervous system was agreed at a series of meetings in summer 2002 of the consultant neurologists of Guy's, King's and St. Thomas School of Medicine. The objective is to inform teachers and students of the core methods for performing a basic examination of the nervous system. These should enable the student to detect and record the physical signs of common and important disorders of the nervous system. The student should understand the principle behind each test and what it is designed to detect. Objective Structured Clinical Examinations (OSCEs) will be based on this advice.

It may be necessary to modify and extend the basic examination to deal with individual clinical problems. In practice individual neurologists use a wide range of techniques for examining the nervous system. More advanced techniques are included in small print. These are used in special situations and knowledge of them is not part of the core curriculum.

ORDER OF EXAMINATION

The conventional order for describing the examination is:

General appearance
Higher functions
Cranial nerves
Motor system
Sensory system
Stance and gait

In individual cases it may be better to focus the examination first on the affected part. It is often convenient to examine stance and gait before examining the patient on the couch.

HIGHER FUNCTIONS

Ask if the patient is left or right handed. Establish if the patient is alert and able to give a clear history. If relevant, examine the mental state and perform the Mini Mental State Examination.

CRANIAL NERVES

Cranial Nerve I – Olfactory nerve: (*need containers with coffee or peppermint*)
Ask if the patient can appreciate taste and smell. Further testing is not necessary unless the patient complains of abnormal taste or smell or there is a special reason to test olfaction. If testing is needed check that the airway is clear and test each nostril with a basic smell, such as peppermint or coffee.
Ask patient to shut eyes, sniff room air and say whether they can smell, ask patient to sniff, presenting individual smell to each nostril in turn.

Cranial Nerve II - Optic nerve: (*need 3- or 6-metre Snellen chart and pinhole*)
Visual acuity
Ask patient if they are aware of reduced vision in either eye. Test visual acuity wearing distance glasses, if worn, in each eye separately with Snellen chart. Use 3-metre chart at 3 metres or 6-metre chart at 6 metres, which produce equivalent results.
If visual acuity less than 6/6 use a pinhole. Record visual acuity right (VAR) X/60 with/without aid of pinhole/glasses and visual acuity left (VAL) Y/60 with/without aid of pinhole/glasses.

Visual fields (*need 7 mm red pin*)
Ask patient if they are aware of a field defect in either eye. Establish that the small red pin target (7 mm) is visible with each eye. Test extent of visual field by testing each eye from each quadrant asking the patient to state as soon as they can see the pinhead at all (regardless of colour).
Check whether patient can see red in central vision. Test limits of visual field for red. Test paracentral visual field for red.
Test for visual neglect with small finger movements using binocular stimulation.

Fundoscopy (*need ophthalmoscope and darkened room*)
Use the ophthalmoscope to examine the fundus of each eye separately with the other eye fixating in the distance. Hold ophthalmoscope correctly (examining right eye with ophthalmoscope in right hand and using right eye and examining left eye with ophthalmoscope in left hand and using left eye unless good reason not to be able to do so). The index finger should be on the focussing wheel. Assess red reflex for presence of media opacities. View fundus at an appropriate distance from the patient and focus the ophthalmoscope.

Cranial nerves III, IV and VI – Oculomotor, trochlear and abducent nerves: (*need torch and orange stick*)
Inspect for ptosis (drooping eyelid), pupil size, strabismus (squint), proptosis.
If proptosis is suspected inspect from behind, tilting the head back to compare each eye.
Test for pupil light reaction in each separately.
Test for afferent pupillary defect.
Test for pupil near response.
Ask if the patient has double vision. Confirm that the double vision is binocular by covering one eye.
Ask whether the images are separated vertically or horizontally and in which direction the separation is maximal.
Examine the range of slow pursuit horizontal and vertical eye movements with a cross pattern using a pen or orange stick or similar object (which is better than a finger). If double vision is present extend the cross into an H pattern and determine in which directions of gaze double vision is present and maximal.
Look for nystagmus within a 30^{o} range.
Examine fast vertical and horizontal eye movements looking for horizontal or vertical gaze play or internuclear ophthalmoplegia.

Cranial Nerve V – Trigeminal Nerve: (*need cotton wool, pin or neurotip, tendon hammer*)

Ask if the patient has any numbness or altered sensation in the face.
Test light touch in each of the three divisions.
If an abnormality is found determine its extent with a pin.
Test the corneal reflex with a wisp of cotton wool, touching cornea not sclera. Avoid touching eyelashes and eliciting a 'threat' reaction.

Test motor function by palpating masseter.
Test the pterygoids with the jaw wide open to avoid misinterpreting minor deviation on jaw opening due to temperomandibular joint dysfunction.
Test jaw jerk with tendon hammer.

Cranial Nerve VII – Facial nerve: (*need effervescent ascorbic acid tablet*)

Test frontalis – wrinkle the forehead.
Test orbicularis oculi – burying of the eyelashes should be looked for.
If bilateral weakness is suspected this can be confirmed by manual examination.
Test orbicularis oris – the patient is asked to show their teeth and whistle.
Blowing out the cheeks is not useful and testing platysma is not required.

Ask about taste and test with ascorbic acid tablet or sugar or salt.

Cranial Nerve VIII – Auditory and vestibular nerves: (*need 256 or 512 Hz tuning fork and auroscope*)

Ask if the patient has a problem with their hearing. Test by first speaking and then whispering numbers at three feet with masking of the non-tested ear using a piece of paper held over the non-test ear and scratching it when speaking or whispering.
If hearing loss is reported (history or examination) first perform the Weber test. Strike a 256 or 512 Hz tuning fork on your knee and apply it firmly to the patient's forehead. Ask whether they hear it more on one side or the other or equally. The tuning fork lateralises to the side of greater conductive loss or the side with the better cochlea in sensori-neural hearing loss. Then perform the Rinne test with the same tuning fork. First apply the tuning fork firmly to the mastoid process and then hold it in front of the external auditory meatus. Ask the patient which is louder. Patients with normal middle ear function hear better by air than bone conduction.

Examine the external auditory meatus and tympanic membrane with an auroscope.

Examination of the vestibular nerve includes testing stance and gait, see below.

Cranial Nerve IX – Glossopharyngeal nerve: (*need orange stick***)**

Not necessary.
Examine sensation on the posterior wall of the tonsillar fossa with an orange stick.

Cranial Nerve X – Vagus nerve: (*need torch, orange stick, tongue depressor*)

Test articulation, coughing and elevation of the soft palate on saying Aah! If any of these are abnormal test gag reflex by touching the posterior pharyngeal wall on each side with an orange stick and comparing the responses.

Cranial Nerve XI – Accessory nerve:

Test sternocleidomastoid examined with the head tilted to the opposite side and with resistance against the tester's hand placed at the angle of the jaw. The muscle belly is visible and may be palpated. Neck flexion is a useful screening test but not sufficient.

Test trapezius by asking the patient to shrug the shoulders and palpating the muscles.

Cranial Nerve XII – Hypoglossal nerve: (*need torch*)

Observe the tongue rest in the floor of the mouth for wasting and fasciculation. Observe protrusion of the tongue and note deviation.
Observe tongue movements for slowness seen in UMN lesions.

MOTOR SYSTEM

UPPER LIMBS

The patient should be seated with the upper limbs exposed to show the shoulders and their arms outstretched and the hands supinated and then pronated.

Observation

Look for:

- Any obvious abnormality
- Skin changes (including scars, ulcers, café au lait patches, neurofibromas)
- Deformity (including joint swelling, asymmetry)
- Wasting (especially first dorsal interosseous, abductor pollicis brevis, shoulder muscles)
- Involuntary movements (fasciculation, tremor, dystonia, chorea, myoclonus).

Ask the patient to close their eyes (to show drift downwards in pyramidal weakness or pseudoathetosis due to loss of joint position sense).
Test coordination at this stage by asking the patient to touch the tip of their nose with the index finger of each hand in turn.

Tone

Test wrist pronation-supination for a pronator catch in spasticity.

Test for rigidity by slow rotation of the stabilised wrist. Ask the patient to extend and flex the opposite shoulder to accentuate rigidity.

Power

Test the following muscle groups in order, comparing each side as you progress. Each movement should be tested in isolation: thus to test elbow flexion you must fix the upper arm with your free hand.

Movement	**Starting position**	**Note**
Shoulder abduction	90^0 abduction	
Elbow flexion	90^0 flexion	
Elbow extension	90^0 flexion	
Wrist extension	Full extension	Test extensor carpi radialis in particular
Extensor digitorum communis	Full extension	Apply pressure over PIP joints
Grip		Open patient's grip
First dorsal interosseous	Full abduction	Test in isolation
Abductor pollicis brevis	Full abduction	in a plane at right angles to the palm

Reflexes

Test biceps, supinator (= brachioradialis) and triceps. If the reflexes are absent use reinforcement.
Test finger jerks

Co-ordination

Ask the patient to touch the tip of your stationary finger, at full stretch, *accurately and gently*, and then the tip of their own nose with first one and then the other index finger.

Ask the patient to tap on your hand or their thigh as fast as possible with each hand in turn.
Impairment of rapid repetitive movements is called dysdiadochokinesis.
Test fine finger movements to detect bradykinesia if parkinsonism is suspected.

LOWER LIMB

Stance and Gait

Ask the patient to rise from a chair without using their hands and stand still with their feet together.
If the patient is steady, do Romberg's test: asks the patient to shut their eyes.
Ask the patient to stand on their toes and then their heels, steadying the patient by gently holding their hands.
Watch the patient walk across the room turn round and come back to you looking for:

- Whether the gait is normal or abnormal
- Painful gait
- Unsteadiness
- Footdrop
- Hemiparetic gait
- Spastic gait
- Stooped posture, slowness and loss of arm swinging
- Others: marche á petit pas, Waddling gait

If, and only if, the patient is steady, test heel-toe walking

Then ask the patient to recline on a couch undressed to 'briefs'
(in clinical examinations and student demonstrations shorts will suffice)

Observation

Look for:

- Any obvious abnormality
- Skin changes (including hair loss, ulcers, café au lait patches, neurofibromas)
- Deformity (including joint swelling, pes cavus, claw toes, asymmetry)
- Wasting (especially quadriceps and tibialis anterior (when the tibia stands out like a keel, extensor digitorum brevis)
- Involuntary movements (fasciculation, tremor, dystonia, chorea, myoclonus).

Tone

Check that the patient does not have pain in their limbs. Roll the leg on the couch and then quickly flex the knee to detect a quadriceps catch (present in spasticity). Test for ankle clonus.

Power

Test the following muscle groups in order, comparing each side as you progress:

Movement	Starting position	Note
Hip flexion	Max voluntary flexion	Knee straight
Hip extension	Lying flat	Hand under knee
Knee flexion	90^0 flexion	
Knee extension	90^0 flexion	
Ankle dorsiflexion	Full dorsiflexion	
Ankle plantar flexion	Full plantar flexion	
Extensor hallucis longus	Full dorsiflexion	Test for L5 root lesion or peripheral neuropathy

If proximal weakness is suspected test hip extension and knee flexion in prone position.
If the ankle is weak test inversion and eversion.

Co-ordination

Ask the patient to lift the heel high and then carefully place it on the knee of the other limb and run it down the shin once. This test is difficult to interpret if hip flexion is weak.

Reflexes

Examine the knee and ankle reflexes (with the joints at 90^0) and (with an orange stick) the plantar responses. If the reflexes are absent use reinforcement.

SENSATION

Ask if the patient has noted altered sensation in any part of their body. If the answer is negative, show the patient what each of the following feel like with their eyes open and them check that they can appreciate them on the distal phalanx of the index finger and hallux with their eyes closed:

Light touch with your finger tip
Vibration with a 128 Hz tuning fork struck on your knee
Joint position sense
Pinprick with a neurotip (discard in 'Sharps' container after) with the patient's eyes open asking whether they can feel that it is sharp and hurts like a pin.

If the patient reports an abnormality map out its extent with light touch or pinprick testing or compare the two sides and draw it on a body chart.

STANCE AND GAIT

See above