

Year 2 – Spine and Neurological Examination

Dear All,

Please find below clarification of the clinical examination skills taught to the 2nd Year medical students with respect to Spine and Neurological Examination. The students always find this topic stressful and this document is intended to facilitate standardization. Please note that this is the first time the students have been formally taught neurological examination and that they are only in their second year. Therefore, we have taught the students a foundation on which to further their skills in future years. These notes are very basic and in short form for quick key reference. Nuances / specifics are not covered. The students are aware that they can perform the examination with or without a verbal description to the examiner. They must show good communication with and, give clear instructions to the patient.

1. Spinal Examination

The students have been specifically taught how to examine the whole spine using the look, feel, move and special tests approach. They have been taught to:

LOOK:

Assess for normal cervical lordosis, thoracic kyphosis and lumbar lordosis, presence of any spinal deformities, scoliosis, kyphosis, skin changes, scars etc.

Check that the head is above pelvis from in front and from the side.

FEEL:

Palpate - spinous processes in the midline, paraspinal muscles, over the sacroiliac joints / the Posterior Superior Iliac Spines (using one finger in one place at one time).

MOVE:

Assess cervical (C) thoracic (T) and lumbar (L) spine movements actively (+/- then passively)

C- Flexion / extension, left and right rotation, lateral bending then

L - Flexion / extension, lateral bending then

T - Thoracic rotation done with pelvis secured sitting on the edge of the bed.

SPECIAL TESTS:

3 tests were chosen at the inception of C21.

1. Perform Schobers test to measure lumbar spine flexion:

For this test the students have been made aware of its principles – the test confirms that the lumbar spine is actually moving. The students have been told to place their fingers on

the lower lumbar spinous processes and observe that their fingers move apart and together during flexion and extension. The students are aware that the original description was using a marker pen and measuring tape to quantify the movement.

2. Perform Adams forward bending test to assess for any fixed spinal deformity:

For this test the students have been made aware that they have already partly performed the test when assessing lumbar spine flexion. The student asks the patient to bend forward until the hips and spine are at approximately 90 degrees. The arms should hang perpendicularly, and the patient should gently place their chin on their chest (neck flexion). The student looks from behind and from the side to assess the shape of the spine i.e. is it normal or is there any deformity - scoliosis, rib hump or exaggerated kyphosis? The test makes structural deformity more obvious and reduces the presence of any nonstructural deformity (i.e. muscle spasm).

3. Assess straight leg raising (Lasègue's sign):

The students are aware that this test assess the presence of radicular leg pain possibly arising from a lumbar spine disc prolapse tenting a nerve root. The patient is laid flat on the examination couch (pillow under head). The normal leg is passively lifted from the ankle with the knee kept straight. The angle between the bed and leg is normally greater than 70 degrees. The affected leg is then examined. The angle at which the patient feels radicular pain going down the leg is recorded. This is a positive straight leg raise test or Lasègue's sign. The patient might only feel back pain – this is a negative test, but the presence of back pain should be recorded. The test can be reinforced by dorsiflexing the ankle or flexing the cervical spine. Flexing the knee should relieve the symptoms.

2. Neurological Examination

The students have been specifically taught how to examine upper and lower limb neurology using the inspection, tone, power, reflexes, sensation and coordination approach. The teaching is specific to the spine and not peripheral nerves. To standardize and simplify the teaching we have adopted the American Spinal Injuries Association (ASIA) International Standard Examination Chart which is used worldwide in assessing spinal cord injury. The students have been taught the following with the patient lying comfortably inclined on an examination couch:

INSPECTION:

Posture, Contractures, Scars, Wasting, Involuntary movements, Fasciculations, Tremor etc.

TONE:

Assess muscle tone – gently move the limb passively – assess for flaccidity / rigidity / normality.

POWER:

Assess power / strength using the MRC grading (out of 5 – see chart below).
Assess myotomes as per American Spinal Injury Association (ASIA) Chart (see chart below).
The students can choose to do one limb at a time, or they can test each myotome left versus right one at a time.

Please note that at this stage in their training they have been specifically taught:

C5 - elbow flexion

C6 - wrist extension

C7 - elbow extension

C8 - finger flexion

T1 - little finger abduction

L2 - hip flexion

L3 - knee extension

L4 - ankle dorsiflexion

L5 - great toe extension

S1 - ankle plantar flexion

REFLEXES:

Assess deep tendon reflexes.

The students have been taught how to perform the following reflexes:

Biceps (C5/6) / Brachioradialis (C5/6) / Triceps (C7/8)

Knee (L3/4) / Ankle (S1/2) / Plantar response (Babinski).

The students are aware that there are different ways of performing tendon reflexes. They are expected to demonstrate competency in the technique that they chose to perform. They have to know basic anatomy (i.e. they are hitting the correct tendon structure and not other structures – e.g. the patella itself), how to swing the tendon hammer safely and not to hurt the patient.

The students are aware of the following:

Assess for inverted radial reflex and Hoffman's sign

Assess for ankle clonus.

SENSATION:

The students have been taught to use the dermatome map as per the American Spinal Injury Association (ASIA) Chart (see chart below). The students are aware that they can assess for Pain / Temperature / Light touch / Vibration / Joint Position Sense. But, for the current stage of their training and for the time available during an ISCE we have told the students that the most important thing is that they know the key dermatomes and they start with a crude assessment – i.e. explain to the examiner that they can test all of the above but that they will start with a crude assessment using their finger to touch the key dermatomes (this assesses pain sensation modality in the spinothalamic tract). They can then ask the examiner, or the examiner can specifically instruct the student to test the different sensory modalities per dermatome (spinal cord level).

COORDINATION:

The students have been taught to assess coordination using:

Finger nose test – patient touches the students' finger with their finger and then they touch their nose and repeat.

Hand dexterity – touching thumb with fingers sequentially and repeat.

Heel shin test – patient actively lifts leg off couch and runs heel down contralateral shin, lift and repeat. The student should passively show the patient how to do this first.

Gait – the student should ask the patient to get off the couch and walk or should indicate that they would like to do this (if appropriate i.e. not in an acutely injured or stroke patient).

Romberg's test – the student should ask the patient to stand up and perform this test or should indicate that they would like to do this (again if appropriate). The student asks the patient to stand with their feet together and arms by their side. They then ask the patient to close their eyes and they assess for unsteadiness / swaying / loss of balance. This indicates a positive test / Romberg's sign.

Finally, the students must know the difference between upper and lower motor neuron signs:

Sign	UMN	LMN
Weakness	More diffuse	More focal
Atrophy	Mild general	Severe focal
Atrophy vs Weakness	Severe weakness Mild atrophy	Severe atrophy Mild weakness
Fasciculations	Never seen	+/-
Muscle Tone	Increased	Decreased
Muscle Stretch Reflexes	Increased	Decreased / Absent
Clonus	+/-	Never present
Plantar Response	+/-	Absent

Kind regards,

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RIGHT		KEY SENSORY POINTS		KEY SENSORY POINTS		LEFT	
MOTOR KEY MUSCLES		Light Touch (LTR)	Pin Prick (PPR)	Light Touch (LTL)	Pin Prick (PPL)	MOTOR KEY MUSCLES	
C5 Elbow flexors						C5 Elbow flexors	
C6 Wrist extensors						C6 Wrist extensors	
C7 Elbow extensors						C7 Elbow extensors	
C8 Finger flexors						C8 Finger flexors	
T1 Finger abductors (little finger)						T1 Finger abductors (little finger)	
T2						T2	
T3						T3	
T4						T4	
T5						T5	
T6						T6	
T7						T7	
T8						T8	
T9						T9	
T10						T10	
T11						T11	
T12						T12	
L1						L1	
L2 Hip flexors						L2 Hip flexors	
L3 Knee extensors						L3 Knee extensors	
L4 Ankle dorsiflexors						L4 Ankle dorsiflexors	
L5 Long toe extensors						L5 Long toe extensors	
S1 Ankle plantar flexors						S1 Ankle plantar flexors	
S2						S2	
S3						S3	
S4-5						S4-5	
RIGHT TOTALS (MAXIMUM)		(50)	(56)	(56)	(56)	LEFT TOTALS (MAXIMUM)	
MOTOR SUBSCORES		SENSORY SUBSCORES		SENSORY SUBSCORES		MOTOR SUBSCORES	
UER [] + UEL [] = UEMS TOTAL []		LTR [] + LTL [] = LT TOTAL []		PPR [] + PPL [] = PP TOTAL []		LER [] + LEL [] = LEMS TOTAL []	
MAX (25) (25) (50)		MAX (56) (56) (112)		MAX (56) (56) (112)		MAX (25) (25) (50)	

NEUROLOGICAL LEVELS: 1. SENSORY R [] L [] 2. MOTOR R [] L [] 3. NEUROLOGICAL LEVEL OF INJURY (NLI) [] 4. COMPLETE OR INCOMPLETE? [] 5. ASIA IMPAIRMENT SCALE (AIS) []

Muscle Function Grading

- 0 = total paralysis
- 1 = palpable or visible contraction
- 2 = active movement, full range of motion (ROM) with gravity eliminated
- 3 = active movement, full ROM against gravity
- 4 = active movement, full ROM against gravity and moderate resistance in a muscle specific position
- 5 = (normal) active movement, full ROM against gravity and full resistance in a functional muscle position expected from an otherwise unimpaired person
- 5* = (normal) active movement, full ROM against gravity and sufficient resistance to be considered normal if identified inhibiting factors (i.e. pain, disuse) were not present
- NT = not testable (i.e. due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of > 50% of the normal range of motion)

Sensory Grading

- 0 = Absent
- 1 = Altered, either decreased/impaired sensation or hypersensitivity
- 2 = Normal
- NT = Not testable

Non Key Muscle Functions (optional)

Movement	Root level
Shoulder: Flexion, extension, abduction, adduction, internal and external rotation	C5
Elbow: Supination	
Elbow: Pronation	C6
Wrist: Flexion	
Finger: Flexion at proximal joint, extension.	C7
Thumb: Flexion, extension and abduction in plane of thumb	
Finger: Flexion at MCP joint	C8
Thumb: Opposition, adduction and abduction perpendicular to palm	
Finger: Abduction of the index finger	T1
Hip: Adduction	L2
Hip: External rotation	L3
Hip: Extension, abduction, internal rotation	L4
Knee: Flexion	
Ankle: Inversion and eversion	
Toe: MP and IP extension	
Hallux and Toe: DIP and PIP flexion and abduction	L5
Hallux: Adduction	S1

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved below the neurological level, and more than half of key muscle functions below the neurological level of injury (NLI) have a muscle grade less than 3 (Grades 0-2).

D = Motor Incomplete. Motor function is preserved below the neurological level, and at least half (half or more) of key muscle functions below the NLI have a muscle grade ≥ 3.

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

NOTE: When assessing the extent of motor sparing below the level for distinguishing between AIS B and C, the motor level on each side is used, whereas to differentiate between AIS C and D (based on proportion of key muscle functions with strength grade 3 or greater) the neurological level of injury is used.

Steps in Classification

The following order is recommended for determining the classification of individuals with SCI.

- Determine sensory levels for right and left sides.**
The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.
- Determine motor levels for right and left sides.**
Defined by the lowest key muscle function that has a grade of at least 3 (on supine testing), providing the key muscle functions represented by segments above that level are judged to be intact (graded as a 5).
Note: in regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level, if testable motor function above that level is also normal.
- Determine the neurological level of injury (NLI)**
This refers to the most caudal segment of the cord with intact sensation and antigravity (3 or more) muscle function strength, provided that there is normal (intact) sensory and motor function rostrally respectively.
The NLI is the most cephalad of the sensory and motor levels determined in steps 1 and 2.
- Determine whether the injury is Complete or Incomplete.**
(i.e. absence or presence of sacral sparing)
If voluntary anal contraction = No AND all S4-5 sensory scores = 0 AND deep anal pressure = No, then injury is Complete.
Otherwise, injury is Incomplete.
- Determine ASIA Impairment Scale (AIS) Grade:**
Is injury Complete? If YES, AIS=A and can record ZPP (lowest dermatome or myotome on each side with some preservation)
Is injury Motor Complete? If YES, AIS=B
(No-voluntary anal contraction OR motor function more than three levels below the motor level on a given side, if the patient has sensory incomplete classification)
Are at least half (half or more) of the key muscles below the neurological level of injury graded 3 or better?
NO ↓ AIS=C
YES ↓ AIS=D

If sensation and motor function is normal in all segments, AIS=E
Note: AIS E is used in follow-up testing when an individual with a documented SCI has recovered normal function. If at initial testing no deficits are found, the individual is neurologically intact; the ASIA Impairment Scale does not apply.