Clinical Cases review: Motor signs and symptoms

Reading:
Lectures 1-4 spinal cord, brainstem motor, basal ganglia, cerebellum, motor cortex
Nolte Ch 10, 18, 19, 20, 22
Blumenfeld Ch 3, 6, 8, 10, 14, 15, 16

Motor signs may form confounding components of apparent emotional or cognitive deficits: individuals may lack motor control for speech or emotional expression, avoid tasks because they are embarrassed by their motor performance, or have motor apraxias without any cognitive problems.

**I Motor components of a Neurological Exam include:**

Mental status
   Cognitive/Emotional state
   Speech

Muscle and reflex function: spinal and cranial systems including eyes
   Muscle group :
      Strength
      Endurance
      Tone
      Voluntary control
      Reflexes

Presence of unusual involuntary motions or postures

Voluntary control tasks:
   Posture
   Walking
   Targetted limb and eye movements
   Sequences of movements
   Skills of life: tie shoe, get dressed, make coffee, write etc

Issues in each :
   Coordination
      Strategy
      Muscles used
      Quality
   Accuracy
   Initiation
      Speed of initiation
      Context appropriate initiation
   Sequencing
Each examines different aspects of the motor system: a single table cannot do real justice to the process of assessing and localizing lesions, degeneration or loss. However, here is a brief summary of types of symptoms and their possible causes.

II Symptoms by level and complexity:
Note that eye movements are not covered in any detail in this summary.

Muscle and reflex function: spinal and cranial systems
A Spinal: segmental pattern
1. Fasciculations, muscle weakness, hypotonia: lower motoneuron or peripheral nerve damage
2. Voluntary weakness, hypertonia, hyperreflexia, clasp knife, clonus, (spasticity), Jendrassik modulation of spastic reflexes: Corticospinal/reticulospinal damage (pyramid or upper MN syndrome).
3. Unusual reflexes: Babinski, grasp: corticospinal damage

B Cranial: cranial nerve patterns
1. Fasciculations, muscle weakness, hypotonia: motoneuron or peripheral nerve damage
2. Voluntary weakness, hypertonia, hyperreflexia, clasp knife, clonus (spasticity): Corticobulbar/reticulobulbar damage (pyramid or upper MN syndrome)
3. Unusual reflexes: routing reflex: corticobulbar damage

Presence of unusual involuntary motions or postures
A. Hyperkinetic
1. Myoclonus: muscle spasms: subacute spongiform encephalopathy (e.g. slow viruses, Jakob-Creutzfeld, BSE or Mad Cow disease), Epilepsy.
2. Athetosis: writhing sinuous motions: basal ganglia: striatal lesions, mostly putamen (or rarely globus pallidus) from perinatal brain damage.
4. Hemiballismus: flinging ballistic limb motions: basal ganglia: Subthalamic nucleus degeneration or lesion
5. Eye motions disrupted by random saccades: basal ganglia
6. Dystonias: inappropriate prolonged deforming contractions: basal ganglia: L-dopa intoxication. Neonatal brain damage. Focal dystonias may arise from repetitive use but involve basal ganglia / cortex: e.g. typist hands cramp in bizarre posture on typing.

B. Hypokinetiuc
7. Resting tremor: disappears with motion: Parkinson's (degeneration SNC)

C. Cerebellar
8. Intention tremor: begins with movement: Cerebellar damage
9. Postural tremor: fatigue, stress, benign familial central tremor (alleviated by small quantities of alcohol)

Voluntary control tasks:

A Posture
1. Dystonic and athetotic postures: basal ganglia: neonatal striatal damage, late untreated Parkinsonism.
2. Swaying posture: vestibular disorders, Cerebellar disorders: vermal/fastigial or flocculonodular damage.
3. Failed Romberg test: vestibular, Cerebellar disorders: vermal/fastigial or flocculonodular damage.
4. Trunk tremor (titubation): cerebellar fastigial effects.
5. Rigid postures: Rigid cocontracted muscles: "cog-wheel" or "lead pipe" rigidity, masked facies: flat expression, e.g. Head drop test, no Jendrassik effects: basal ganglia disorders (see Sequences of Movements: akinesia below, Parkinson's disease, SNc degeneration)

B Walking
1. Spastic interference, foot drop in walking: corticospinal, reticulospinal lesions
2. Wide base of support, ataxic gait, asynergia of limbs, dysmetric stepping: lesion of DSCT, spinocerebellum (includes some hypertonia (fastigial, vermis lesions), acute alcohol intoxication, chronic alcohol abuse).
3. Small shuffling steps (marche a petit pas), difficulty initiating, locomotor akinesia, bradykinesia, alleviated by target steps: basal ganglia, Parkinson's (degeneration SNc)

C Targetted limb and eye movements, speech
1. Weak spastic motions: Premotor Cortex, or pyramidal tract and reticulospinal lesions
2. Lack of fractionation of motion with normal tone: Non-trunk primary motor cortex or low pyramid lesions.
3. Ataxic, asynergic, dysmetric arm reaches with intention tremor, possible hypotonia: Cerebellar lateral lobes and dentate/interpositus lesions.
4. Ataxic, asynergic, dysmetric arm reaches, acute alcohol intoxication.
5. Dysmetric eye motions: cerebellum damage
6. Nystagmus: vestibular or cerebellar damage.
7. Dysarthria: slurred speech (head area of fastigial, vermis lesions), acute alcohol intoxication, damage to cerebellum, premotor or Brocas areas etc (see Cortex lectures)

D Sequences of movements
1. Akinesia, bradykinesia: inability or slowness in initiation of movements, worsened in sequences, helped by external cues: Basal ganglia, Parkinsons (SNc degeneration)

E Skills of life: tie shoe, write etc.
1. Micrographia: progressively smaller writing until nearly illegible: basal ganglia: Parkinson's (SNc degeneration).
2. Inability to sequence otherwise normal limb use: apraxias: supplementary motor cortex.
3. Neglect of limb use, denial of limb possession: non-dominant parietal cortex (see Cortex lectures).

**Symptoms by motor system component and lesion:**

*Note: this list covers the needs of the Basic Neuroscience Motor Systems only, the most prominent symptoms indicating types of effects (see above) are listed.*

Spinal cord level (see spinal cord I-IV etc for more detail):

Ventral root:
- Ipsilateral myotome faccic paralysis, fasciculation, hypotonia, areflexia

Dorsal root:
- Ipsilateral myotome and dermatome areflexia.

Ventral horn:
- Ipsilateral fasciculations, flaccid paralysis, hypotonia, areflexia in myotomes affected

Dorsal horn:
- Ipsilateral pain and temperature loss in dermatomes, perhaps fine touch

Central canal:
- Bilateral loss of pain and temperature in dermatomes, flaccid trunk paresis

Dorsal columns
- Ipsilateral loss of fine touch and proprioception

Lateral funiculus
- Ipsilateral spastic paralysis, contralateral pain and temperature loss

Hemisection
- Ipsilateral spastic paralysis, loss of fine touch and proprioception, contralateral pain and temperature loss

Motoneuron diseases
- Ipsilateral fasciculations, flaccid paralysis, hypotonia, areflexia in myotomes affected. Pattern of damage may be diffuse and patchy.

Amyotrophic Lateral Sclerosis
- Ipsilateral fasciculations, eventual flaccid paresis, combined with spastic paralysis/ paresis (upper and lower motoneuron signs) in motor system
Multiple Sclerosis
  Sensory and motor signs of CNS lesions in long myelinated tracts. NO lower motoneuron signs

Pyramidal decussation: alternating hemiplegia (special case)
  Ipsilateral upper arm and contralateral lower leg paresis. Tone may or may not be normal

Brain stem level: see Cranial nerves, Brainstem notes

Cerebral peduncles: contralateral spastic paresis in pattern based on portion of somatotopic pyramidal system involved in lesion.

Mid-brain / pons:
  Suppression / lesion above red nucleus:
    Decorticate posture (arms flex, legs extend)
  Suppression / lesion between red nucleus and life support systems of medulla:
    Decerebrate posture (arms extend, legs extend)

Cerebellum:
  Vermis, Fastigial, ICP: ipsilateral hypertonia, loss of balance, romberg sign, gait ataxia
  Dentate, Interpositus, SCP: ipsilateral hypotonia, intention tremor, dysmetria, reach ataxia
  PICA syndrome: lateral medullary syndrome (see brainstem lectures):
    Ipsilateral nystagmus, dysmetria, ataxia, dysarthria, loss of gag reflex, ipsilateral horners syndrome.
  AICA syndrome: lateral inferior pontine syndrome (see brainstem lectures)
    Contralateral weakness of face, contralateral spastic hemiparesis, Ipsilateral gait ataxia
  SCA syndrome: lateral superior pontine syndrome (see brainstem lectures)
    Ipsilateral limb and trunk ataxia, intention tremor, dysmetria,

Basal ganglia:
  Striatum: caudate: contralateral chorea, some athetosis. If degenerative a bilateral effect occurs
  Striatum: putamen: athetosis, some chorea, (affective disorders, dementia, see cortex lectures)
  Globus pallidus, internal: contralateral hyperkinesia,
  Globus pallidus, external: contralateral akinesia
  Substantia Nigra Pars Compacta: Parkinsons symptoms: akinesia, bradykinesia, resting tremor, rigidity, dystonia.
  Subthalamic nucleus: Contralateral hemiballism
Thalamus:
   VL: Contralateral hypotonia, paresis,
   VA: Contralateral akinesia

Internal Capsule: contralateral spastic paresis in pattern based on portion of somatotopic organized pyramidal system in capsule involved in lesion (see Cortex lectures).

Cortex:
   Primary motor (except trunk):
      Contralateral paresis, normal tone, babinski or grasp, routing
   Premotor and primary trunk:
      Contralateral spastic paresis, some apraxias
   Supplementary:
      Contralateral/bilateral apraxias
   Frontal eye fields:
      Temporary gaze paralysis

ACA syndrome
   Spastic paralysis of leg more than arm/face and incontinence other See Cortex lectures
MCA syndrome
   Spastic paralysis of arm/face more than leg, no incontinence
   Speech effects, other See Cortex lectures
PCA syndrome
   Motor effects minimal, See Cortex lectures