Medical Neuroscience | Tutorial Notes

Upper Motor Neuronal Control—Upper Motor Neuron Syndrome

Map to Neuroscience Core Concepts[1]

NCC1. The brain is the body's most complex organ.

NCC3. Genetically determined circuits are the foundation of the nervous system.

NCC4. Life experiences change the nervous system.

Learning Objectives

After study of the assigned learning materials, the student will:

1. Discuss the signs associated with damage to upper motor neurons.

Tutorial Outline

I. Upper motor neuron syndrome

- A. presentation of clinical signs and symptoms of upper motor neuronal injury should be distinguished from those associated with damaged lower motor neurons (**Table 17.1**[2])
- B. initially, **spinal shock** occurs, which is characterized by flaccid paralysis (profound loss of muscle tone); this may resemble the signs of lower motor neuronal injury
- C. however, after several days to weeks, a consistent set of motor signs emerges:
  1. the **Babinski sign**: abnormal extensor plantar response to firm stroke of the sole of the foot (see **Figure 17.16**); but not a very sensitive sign
  2. **muscle spasticity**: increased muscle tone, hyperactive segmental reflexes, clonus (oscillatory motor response to muscle stretch) (see **Box 17E**)
     - a. decerebrate rigidity: greatly increased tone of extensor muscles in legs and (typically) flexor muscles in arms and neck
     - b. "clasped-knife" response: resistance to passive stretch that suddenly gives way (like closing the blade of a pocket knife)
  3. **paralysis** or **paresis**, especially for fine movements of the distal extremities
- D. persistent symptoms are explained by a loss of descending inputs from the cerebral cortex that govern the expression of volitional movements and/or the loss of

[1] Visit **BrainFacts.org** for *Neuroscience Core Concepts* (©2012 Society for Neuroscience) that offer fundamental principles about the brain and nervous system, the most complex living structure known in the universe.

[2] Figure references to Purves et al., *Neuroscience, 5th Ed.*, Sinauer Assoc., Inc., 2012. [click here]

descending inputs from the brainstem that modulate the gain of segmental and intersegmental reflexes

E. suggests that the net effect of input from upper motor neurons to lower motor neuronal circuits in the spinal cord is suppressive (because loss of input leads to hyperreflexia and an increase in muscle tone)

STUDY QUESTION

Consider a patient who is now in the so-called "chronic" phase (after the first 3 months or so have passed) following a stroke involving the **right anterior cerebral artery**. What signs and symptoms would you expect to discover in this patient?

A. weakness in the left lower leg, with ankle clonus and a positive Babinski sign, all on the left
B. weakness in the right lower leg, with ankle clonus and a positive Babinski sign, all on the right
C. weakness in the left arm and hand, with spasticity and mild clonus at the wrist and elbow, all on the left
D. weakness in the right arm and hand, with spasticity and mild clonus at the wrist and elbow, all on the right
E. profound weakness in the left lower leg with flaccidity and evidence of muscle wasting in the foot, all on the left
F. profound weakness in the right lower leg with flaccidity and evidence of muscle wasting in the foot, all on the right