How Are Brain Stem Nuclei Organized?

Worksheet

Brain stem nuclei are organized along two axes: rostrocaudally into the midbrain (CN III, IV), pons (CN V-VIII), and medulla (CN IX-XII); and mediolaterally into functional columns (from midline outward: somatic motor, branchial motor, visceral motor, visceral sensory, somatic/special sensory) that reflect the embryological organization of the neural tube.

Questions

1. CN VI (abducens) nucleus is located in which brain stem region?

A) Midbrain
B) Pons
C) Medulla
D) Diencephalon

2. Which functional column lies closest to the midline of the brain stem?

A) Somatic sensory
B) Visceral sensory
C) Somatic motor
D) Branchial motor

3. A patient has tongue deviation from a hypoglossal nerve lesion. Which brain stem region is most likely affected?

A) Midbrain
B) Pons
C) Medulla
D) Cerebellum

4. What embryological structures give rise to the mediolateral columnar organization of brain stem nuclei?

A) Neural crest cells only
B) Basal plate (motor) and alar plate (sensory) of the neural tube
C) Notochord segments
D) Somite boundaries

5. A lesion damages CN VII (facial) nucleus. In which brain stem region is the damage located?

6. A patient shows signs of a hypoglossal nerve (CN XII) palsy - tongue deviation on protrusion. Which brain stem segment is affected?

7. Damage to a somatic motor column nucleus near the midline of the midbrain produces which sign?

8. Define: Which cranial nerve nuclei are found in the midbrain?

9. Define: Which cranial nerve nuclei are found in the pons?

10. Define: Which cranial nerve nuclei are found in the medulla?

Answer Key

1. B) Pons - CN V, VI, VII, and VIII nuclei are all located in the pons.

2. C) Somatic motor - The somatic motor column is the most medial column, adjacent to the midline (e.g., CN III, IV, VI, XII nuclei).

3. C) Medulla - CN XII nucleus is in the medulla oblongata.

4. B) Basal plate (motor) and alar plate (sensory) of the neural tube - The basal plate gives rise to motor columns (medial) and the alar plate to sensory columns (lateral), a pattern preserved from the spinal cord into the brain stem.

5. CN VII arises from nuclei in the pons. A lesion causing facial nerve palsy signs (with other pontine signs) localizes to the pons. This differs from a purely peripheral facial nerve lesion, which occurs after the nerve exits the brain stem.

6. CN XII nucleus is located in the medulla oblongata. A lesion there (or along its exit pathway) causes ipsilateral tongue weakness. This localizes the lesion to the medulla, not the pons or midbrain.

7. The somatic motor column lies most medially and includes the oculomotor (CN III) and trochlear (CN IV) nuclei in the midbrain. Damage causes eye movement deficits - e.g., ptosis, 'down and out' eye position from CN III palsy. This reflects the medial position of somatic motor nuclei in the functional column scheme.

8. CN III (oculomotor) and CN IV (trochlear).

9. CN V (trigeminal), VI (abducens), VII (facial), and VIII (vestibulocochlear).

10. CN IX (glossopharyngeal), X (vagus), XI (accessory), and XII (hypoglossal).