

Cranial Nerve Motor Nuclei

Objectives

- To learn the locations of the cranial nerve motor nuclei and review the functions of the various cranial motor nerves
- To learn the cortical control of the cranial motor nuclei
NTA Ch 13, pgs. 383-396
Key Figs: 13-1, 13-3, 13-4
- To learn the vestibular and central control of reflexive and voluntary eye movement
NTA Ch. 13, pgs. 402-409
Key Figs: 13-14, 13-15
- To be able to use cranial nerve motor functions to help localize the site of a CNS lesion
NTA Ch 13, pgs. 397-401
Key Figs: 13-11
Clinical Cases
#11 Hoarse voice and falling to the right; CC11-1
#12 Diplopia and MS; CC11-3

Note

You may be able to skip over the basic functions of the nerves that are covered in this chapter. Focus on corticobulbar control and eye movement control.

Self evaluation

- Be able to identify all structures listed in key terms and describe briefly their principal functions
- Use neuroanatomy on the web to test your understanding

F-1 Ventral surface of brain stem and exiting cranial nerves

Review the exit points for each of the cranial nerves. For each nerve, identify the structures that the nerve innervates and their functions.

F-2 Location of cranial nerve nuclei within the brain stem

The position of the cranial nerve nuclei within the brain stem is shown as viewed from the dorsal surface. Motor nuclei (somatic and special visceral) are shaded red; sensory nuclei are shaded blue; parasympathetic (general visceral

efferent) nuclei are shaded green. Note that the trochlear nucleus is positioned on the ventral surface and the trochlear nerves cross over on the dorsal surface before exiting the brain stem. Finally, note the circuitous route taken by the facial nerve (VII) before it exits from the brain stem.

X-10 Pyramidal Decussation

Identify the spinal accessory nucleus. Note its location in relation to the ventral horn. The spinal accessory nucleus is “in line” with the nucleus ambiguus and is the most caudal nucleus in the special visceral efferent cell column. What muscles do motor neurons in the spinal accessory nucleus innervate? What is the rostrocaudal extent of the spinal accessory nucleus?

X-15 Caudal medulla

Identify the following nuclei: gracile nucleus; cuneate nucleus; spinal trigeminal nucleus; nucleus ambiguus; and the hypoglossal nucleus. Identify the following fiber tracts: spinal trigeminal tract; anterolateral system; medial lemniscus; pyramidal tract.

X-20 Mid-medulla just rostral to the obex

Identify the following nuclei: hypoglossal nucleus, dorsal motor nucleus of vagus; solitary nucleus; vestibular nuclei; spinal trigeminal nucleus; inferior olivary nucleus; reticular formation; general area of the nucleus ambiguus. Identify the following fiber tracts: solitary tract; spinal trigeminal tract; anterolateral system; medial lemniscus; pyramidal tract.

What is the rostro-caudal organization of the nucleus ambiguus? Through which cranial nerve do most of the efferents from nucleus ambiguus course?

X-25 Rostral medulla

Identify the following nuclei: vestibular nuclei; cochlear nuclei; spinal trigeminal nucleus; inferior olivary nucleus. Identify the following fiber tracts: spinal trigeminal tract; inferior cerebellar peduncle; medial lemniscus; MLF. What is the function of vestibular fibers in MLF?

F-6 Course of the Facial and Abducens Nerves

This slide illustrates the trajectories of the facial and abducens nerves in the pons. Compare the three-dimensional course of these nerves shown in this slide with their appearance in the myelin-stained section X030. (Note that the segment of the facial nerve from the nucleus to the genu cannot be seen in slide X030 because the fibers do not form clearly identifiable fascicles in a single plane.) Be sure to identify the genu of the facial nerve, the portion that curves dorsally around the abducens nucleus. Together, the abducens nucleus and genu of the facial nerve form a surface landmark on the ventricular floor, the facial colliculus. The fibers

emerging from the nucleus ambiguus also take a “hair pin” course en route to the periphery; however, this path cannot be observed without special intra-axonal-staining techniques.

X-30 Pons at the level of the facial colliculus

Identify the following nuclei: abducens nucleus; facial nucleus; spinal trigeminal nucleus; superior olivary nucleus; reticular formation; pontine nuclei. Identify the following fiber tracts: MLF; VIIth nerve; genu of VIIth nerve; spinal tract of V; trapezoid body; medial lemniscus; middle cerebellar peduncle; descending cortical fibers. What are the consequences of a lesion affecting the area of the VIth nucleus?

X-35 Rostral pons at level of the sensory and motor trigeminal nuclei

Identify the following nuclei: main trigeminal sensory nucleus; trigeminal motor nucleus; pontine nuclei; superior olivary nuclei. Identify the following fiber tracts: MLF; medial lemniscus; lateral lemniscus; superior cerebellar peduncle; middle cerebellar peduncle; descending cortical axons (ie., corticospinal and corticobulbar tracts).

X-40 Midbrain at level of inferior colliculus

Identify the following nuclei: inferior colliculus; trochlear nucleus. Identify the following fiber tracts: lateral lemniscus; medial lemniscus; MLF; decussation of the superior cerebellar peduncles. The trochlear nucleus innervates the ipsilateral eye muscles. True or False?

X-37 Rostral Pons

Identify the various components of the trochlear nucleus and nerve. Be certain that you can reconstruct the course of this nerve from its origin in the midbrain to where it exits the brain stem.

X-45 Midbrain at level of the superior colliculus

Identify the following nuclei: superior colliculus; mesencephalic trigeminal nucleus; oculomotor nucleus; Edinger-Westphal nucleus; red nucleus; substantia nigra. Identify the following fiber tracts: MLF; medial lemniscus; brachium of the superior colliculus; basis pedunculi; oculomotor nerve; and mesencephalic trigeminal tract. What are the consequences of a lesion affecting the oculomotor nerve?

X-50 Midbrain-diencephalon junction

Identify the rostral pole of the Edinger-Westphal nucleus. What is the function of this nucleus?

X-100 Sagittal section - close to the midbrain

Identify the following: medial longitudinal fasciculus; III nerve rootlets; approximate location of the oculomotor and trochlear nuclei; and hypoglossal nucleus. What nuclei are interconnected by the MLF?

What structure at this level is important in controlling vertical eye movements?

X-120 Horizontal section

The corticobulbar tract descends through the genu of the internal capsule. What artery (or arteries) supply the genu?

H-2 Vasculature

Using this slide, review the arterial supply to the brain stem and cerebellum. Locate the vertebral and basilar arteries on the ventral surface of the brain stem, and branches arising from them: the posterior inferior cerebellar artery, the anterior inferior cerebellar artery and the superior cerebellar artery.

SA-02 Lateral brain surface

Identify the primary somatic sensory cortex, located in the postcentral gyrus. The secondary somatic sensory area is located within the lateral sulcus. Higher-order somatic sensory areas are located in the banks of the postcentral sulcus and the superior parietal lobule.

Key Structures and Terms

Edinger-Westphal nucleus
Trochlear nucleus
Trigeminal nuclei:
spinal
principal
mesencephalic
motor
Abducens nucleus
Facial nucleus (motor)
Vestibular nuclei
nucleus ambiguus
Dorsal motor nucleus of X
Spinal accessory nucleus
Pontine gaze center
Reticular formation
Sulcus limitans
Facial colliculus
Medial lemniscus
Spinal tract of V
MLF
Genu of VIIIth nerve
IVth ventricle
Cerebral aqueduct
Brain stem vasculature