

THE CRANIAL NERVES

The twelve pairs of cranial nerves are continuous with the brain and are numbered from anterior to posterior, according to their attachments to the brain.

CN-I is attached to the cerebral hemispheres. CN-II is attached to the central cerebrum via the optic chiasma (hypothalamus), CN-III and IV to the midbrain. CN-V, VI, VII, and VIII to the pons. CN-IX, X XI and XII to the medulla. Some cranial nerves are purely afferent (sensory); others are entirely efferent (motor); and some are mixed (both sensory and motor).

Olfactory Nerve (CN-I):

Sensory for smell. It passes through the cribriform plate of the ethmoid bone. Elderly people usually have a reduced acuity of the sensation of smell that probably results from a progressive reduction in the number of olfactory cells. To test, a person is blindfolded and asked to identify common odors placed near the nostrils. Because loss of the sense of smell (anosmia) is usually unilateral, each naris has to be tested separately. Chronic rhinitis is the most common cause of anosmia. Most deficiencies of the sense of smell result from infections of the nasal mucosa rather than neurological disease. Other causes of damage to these nerves include head trauma and tearing of the nerves, smoking, cocaine, or brain tumors impinging on the nerves.

Optic Nerve (CN-II):

Sensory for vision. Its nerve arise from the ganglion cells of the retina and pass through the optic foramen (optic canal). At the hypothalamus, the two nerves cross forming the optic chiasma. Pituitary tumors may compress the optic chiasma. All visual fields must be tested in order to determine where along the pathway a defect may lie.

Oculomotor Nerve (CN-III):

Motor to the muscles that move the eye except the superior oblique and the lateral rectus. It also innervates the levator palpebrae superioris muscle (elevation of the eyelid), the sphincter pupillae (pupillary constriction and accommodation), and ciliary muscles. It passes through the superior orbital fissure. Damage to this cranial nerve may result in ptosis (drooping of the eyelid) owing to paralysis of the levator palpebrae superioris muscle; lateral strabismus (squinting) owing to the unopposed action of the lateral rectus and superior oblique muscles; dilation of the pupil owing to paralysis of the sphincter pupillae muscle; loss of accommodation of the light reflex owing to paralysis of the sphincter pupillae and the ciliary muscles; proptosis (prominence of the eyeball) owing to relaxation of the ocular muscles; diplopia (double vision).

Trochlear Nerve (CN-IV):

Motor to the superior oblique muscle of the eyeball. It passes through the superior orbital fissure. It is the smallest cranial nerve. It is the only cranial nerve to emerge from the dorsal side of the brain, and so also has the longest pathway. Because of its small size and long path, it is vulnerable to head injury or surgical injury which will result in loss of function of the superior oblique muscle, limiting the ability to looking down and outward (inferolateral ocular movement). Be sure and orient yourself to the attachment of the superior oblique muscle to the eyeball. As it loops around the orbit above the eyeball, it attaches to the upper, inner surface of the eyeball and pulls the back of the eye up causing the front of the eye to move down and outward. This may cause diplopia (double vision). Because the eye cannot look down as far as it should when turned in, persons with a trochlear nerve lesion often have difficulty walking downstairs. To counter this, they often hold their heads down and inclined to the other side.

Trigeminal Nerve (CN-V):

Mixed: motor and sensory. Motor for the muscles of mastication. Sensory from the face. Three branches for sensory from the face: ophthalmic, maxillary and mandibular. It is the largest cranial nerve. (A) Ophthalmic branch: sensory from superior part of face: eyeball, lacrimal gland, conjunctiva, nasal mucosa, skin of scalp, forehead, upper eyelid, and nose. This branch passes through the superior orbital fissure. (B) Maxillary branch: passes through the foramen rotundum. It supplies the bottom of the nose, skin over the maxilla, the upper teeth and gums. (C) Mandibular branch: passes through the foramen ovale. It supplies the skin over the mandible and the lower teeth and gums. Lesions of the motor part of this nerve result in difficulty in chewing, biting or lateral jaw movement. Lesions of the sensory part of this nerve result in loss of sensation from the face, according to the affected branch. Trigeminal neuralgia (tic douloureux) is the most common condition affecting the sensory part of this nerve. It is characterized by pain of sudden onset in the area of distribution of one of the trigeminal nerve divisions, usually the maxillary nerve branch. Dental caries (cavities) present their pain via either the maxillary or mandibular branches. Before dental work, anesthetic is injected near the appropriate nerve to block sensation.

Abducens Nerve (CN-VI):

Motor to the lateral rectus muscle of the eyeball which allows the eye to 'abduct'. It passes through the superior orbital fissure. Injury will result in difficulty in rotating the eyeball outward and will produce diplopia (double vision).

Facial Nerve (CN-VII):

Mixed: motor and sensory. It passes through the stylomastoid foramen. The motor portion of this nerve supplies the muscles of the face and scalp: buccinator, platysma and so on, along with motor control to the submandibular, sublingual and lacrimal glands. The sensory portion of this nerve carries sensory information for taste from the anterior 2/3 of the tongue and the palate. Lesions of the facial nerve cause facial paralysis that is usually unilateral. There is also a loss of taste sensation in the anterior 2/3 of the tongue and decreased salivation. In the most common condition, Bell's palsy, paralysis results from infection and inflammation of the nerve as it passes through the facial canal. The resulting pressure on the nerve causes the paralysis of the facial muscles.

Vestibulocochlear Nerve (CN-VIII):

Sensory. Passes through the internal auditory meatus. Two parts: vestibular nerve for equilibrium; cochlear nerve for hearing. Lesions, mostly tumors, on or near this cranial nerve may result in tinnitus (ringing or buzzing in the ears); impairment or loss of hearing; loss of balance (vertigo).

Glossopharyngeal Nerve (CN-IX):

Mixed: sensory and motor. Passes through the jugular foramen. Its motor function is to a small muscle of the pharynx and the parotid gland for saliva secretion. Its sensory function is for sensation from the pharynx, tonsil and posterior 1/3 of the tongue and for blood pressure within the carotid arteries via the carotid sinus. Since cranial nerves IX, X, and XI are so close together, usually damage to IX exhibits damage to X and XI. In other words, it is very rare to find impairment of cranial nerve IX alone. Damage to IX could result in loss of taste from the back of the tongue and absence of the gag reflex.

Vagus Nerve (CN-X):

Mixed: sensory and motor. Passes through the jugular foramen. It passes through the neck next to the carotid arteries, after which the two travel together next to the esophagus through the diaphragm into the abdomen. It has motor control over the voluntary muscles of the pharynx, vocal cords, larynx, heart (slows the heart rate), lungs digestive organs. Damage to the vagus nerve produces palpitation (forcible pulsation of the heart), tachycardia (rapid beating of the heart), vomiting, slowing of respiration, and a sensation of suffocating, paralysis of the vocal cords and larynx.

Accessory Nerve (CN-XI):

Motor. It passes through the jugular foramen. It has motor control over muscles of the pharynx, palate, the sternocleidomastoid and trapezius muscles. If the nerve is damaged, paralysis of the sternocleidomastoid may result producing weakness in turning of the head to the opposite side. Also, paralysis of the trapezius muscle will result in the dropping of the shoulder outward.

Hypoglossal Nerve (CN-XII):

Motor. It passes through the hypoglossal canal. It supplies the muscles of the tongue, thyroid cartilage and hyoid bone. Complete damage to this nerve causes unilateral paralysis of the tongue and atrophy of that side. When the tongue is protruded, it deviates to the paralyzed side because of the unopposed action of the normal half. When it is retracted, the paralyzed side rises higher than the normal side. The larynx may also deviate toward the unaffected side during swallowing.

► Twelve Pairs of Cranial Nerves and the Regions and Functions They Serve



