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Cranial Nerves IX and X: The Glossopharyngeal and Vagus Nerves

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Definition

Glossopharyngeal nerve lesions produce difficulty swallowing; impairment of taste over the posterior one-third of the tongue and palate; impaired sensation over the posterior one-third of the tongue, palate, and pharynx; an absent gag reflex; and dysfunction of the parotid gland.

Vagus nerve lesions produce palatal and pharyngeal paralysis; laryngeal paralysis; and abnormalities of esophageal motility, gastric acid secretion, gallbladder emptying, and heart rate; and other autonomic dysfunction.

See Section V, The Autonomic Nervous System, for detailed treatment of the autonomic functions of these nerves.

Technique

Listen to the patient talk as you are taking the history. Hoarseness, whispering, nasal speech, or the complaint of aspiration or regurgitation of liquids through the nose should make you especially mindful of abnormality. Give the patient a glass of water to see if there is choking or any complaints as it is swallowed.

Have the patient open the mouth and inspect the palatal arch on each side for asymmetry. Use a tongue blade to depress the base of the tongue gently if necessary. Ask the patient to say "ahhh" as long as possible. Observe the palatal arches as they contract and the soft palate as it swings up and back in order to close off the nasopharynx from the oropharynx. Normal palatal arches will constrict and elevate, and the uvula will remain in the midline as it is elevated. With paralysis there is no elevation or constriction of the affected side.

Now warn the patient that you are going to test the gag reflex. Gently touch first one and then the other palatal arch with a tongue blade, waiting each time for gagging.

Laryngoscopy is necessary to evaluate the vocal cord. See Chapter 62 on the facial nerve and taste for the testing of taste.

Basic Science

Two groups of motor and sensory nuclei serve these nerves. All are located in the medulla.

The *nucleus ambiguus* is a motor nucleus located in the mid to upper medulla. It supplies the striated ("branchial") muscles of the pharynx, larynx, and upper esophagus via the ninth, tenth, and eleventh nerves. Supranuclear innervations from the lower part of the precentral gyrus are partly crossed and partly uncrossed. There are multiple connections with nuclei of neighboring brainstem nuclei for coordination of swallowing, gagging, and coughing. The

other motor nuclei are the *dorsal motor nucleus* (X) and the *inferior salivary nucleus* (IX), located in the medulla dorsal and lateral to the twelfth nucleus. Parasympathetic fibers originating in these nuclei supply smooth muscles in the pulmonary, gastrointestinal, and cardiovascular systems. They cause secretion of various glands of the gastrointestinal system. The principal supranuclear control is from the hypothalamus; there may be cortical innervation.

Sensory nuclei include the *solitary tract and nucleus*, also known as the gustatory nucleus. It is a long nuclear column extending the length of the medulla, located lateral to the dorsal motor nucleus of the vagus, that receives sensory fibers from the ninth, tenth, and seventh (via the *nervus intermedius*) nerves. The sensory fibers carried in the ninth nerve have their cell station in the superior or petrosal ganglion. They include the following:

1. Taste from posterior third of tongue (See Chapter 62 for a discussion of taste).
2. Chemoreceptor and baroreceptor impulses from the carotid glomus and carotid sinus
3. General sensation from the posterior portion of the oral cavity

The sensory fibers carried in the tenth nerve have their cell station in the nodose or jugular ganglion. They include the following:

1. Visceral sensory impulses from the pulmonary, gastrointestinal, and cardiac systems
2. Chemoreceptor and baroreceptor impulses from the aorta and carotid arteries

The second sensory group comprises the *nucleus of the spinal tract of the trigeminal nerve* (see Chapter 61, The Trigeminal Nerve, for a description of this nucleus). Pain and temperature impulses from certain parts of the ear reach this nucleus via the petrosal ganglion of the ninth and the jugular ganglion of the tenth nerve. Pain sensation from the dura of the posterior fossa also travels here via the jugular ganglion.

The roots of the ninth and tenth nerves exit together from the medulla and leave the skull through the jugular foramen in the company of the eleventh nerve.

The superior and petrosal ganglia of the glossopharyngeal nerve are in the jugular foramen. The nerve descends on the side of the pharynx and then enters the pharynx. Areas supplied include the posterior third of the tongue and posterior pharynx, soft palate, the stylopharyngeus muscle, the pharyngeal plexus, secretory glandular fibers, and other areas.

After leaving the jugular foramen, the vagus nerve courses in the internal carotid sheath and is widely distributed to

the upper gastrointestinal system. With a few exceptions, it supplies all the muscles of the soft palate, pharynx, and larynx, in addition to the structures in the pulmonary, gastrointestinal, and cardiovascular systems previously mentioned. Its ganglia are the nodose and jugular.

Clinical Significance

For all practical purposes, the ninth nerve cannot be tested separately, and isolated lesions are almost unknown. In the cerebellopontine angle, the eighth and ninth nerves can be involved by tumors. At the jugular foramen the ninth, tenth, and eleventh nerves can all be involved (e.g., by a glomus tumor or other masses). Diphtheria can cause ninth nerve paralysis. Glossopharyngeal neuralgia, similar to trigeminal neuralgia, does occur rarely. It consists of a stabbing, lancinating pain at the base of the tongue or around the palate.

The vagus nerve has many ramifications of clinical significance, as befits such a complex nerve. See Section V, the Autonomic Nervous System.

Bilateral supranuclear denervation leads to dysphagia and dysarthria. This occurs in a condition known as pseudobulbar palsy. Multiple small lesions in the cortex and/or brainstem interrupt the corticobulbar supply to the motor nuclei of various cranial nerves. Etiologies include multiple sclerosis, hypertensive lacunes, and other causes of bihemispheric disease.

Bilateral nuclear involvement of the vagus causes death with pharyngeal and laryngeal paralysis and cardiac arrhythmias. Unilateral nuclear or infranuclear involvement of the vagus causes ipsilateral paralysis of the soft palate, pharynx, and larynx. The voice is hoarse or nasal, the involved palatal arch is paralyzed, and liquids will enter the nasopharynx or trachea. The vocal cord on the involved side is paralyzed. Causes include meningitis, carotid aneurysms, neoplasms, trauma, and diphtheria. Diseases that involve all peripheral nerves, such as diabetes and amyloidosis, and toxins such as lead, produce neuropathies of

these nerves. Neoplasms can involve the nerve at any point in its course.

Recurrent laryngeal nerve paralysis is an important condition. There is paralysis of the vocal cord ipsilaterally. The voice may be hoarse but can be normal, with the lesion discoverable only by laryngoscopy. Bilateral recurrent laryngeal paralysis produces paralysis of both cords, with a whispering voice, stridor, and even death due to tracheal obstruction by the cords. Causes of recurrent laryngeal damage include surgery on neoplasms of the thyroid, cervical adenopathy of any cause, aortic aneurysms, mediastinal tumors, and lead poisoning.

Swallow syncope, or unconsciousness produced by swallowing, is a rare complication of ninth and tenth nerve lesions. The probable mechanism is a vasovagal reflex produced by esophageal distention, with resulting cardiac inhibition. A similar syncopal syndrome has been reported with glossopharyngeal neuralgia.

Gustatory sweating is discussed in Chapter 62 (Cranial Nerve VII: The Facial Nerve and Taste).

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