Lecture #04 Cranial Nerves

Question 1: Which is caused by brainstem damage due to occlusion of a branch of the posterior cerebral artery, in addition to ipsilateral oculomotor (III) nerve palsy?

a) Contralateral sympathetic autonomic deficits

b) Ipsilateral hemiparesis

c) Contralateral hemiparesis

d) Contralateral Horner's syndrome with miosis and ptosis

e) Ipsilateral hypoglossal nerve palsy

HINT:

The oculomotor nerve is somatic and exits the brainstem ventromedially

EXPLANATION:

Occlusion of a branch of the posterior cerebral artery can damage the ventral midbrain, Weber's syndrome, where the oculomotor nerve exits and the crus cerebri is located. Damage to the oculomotor nerve causes ipsilateral oculomotor palsy (partial eye movement paralysis) and damage to the crus cerebri causes contralateral body and lower face paralysis or paresis.

ANSWER: ['Contralateral hemiparesis']

Lecture #04 Cranial Nerves

Question 2: Where are the special sensory cranial nerve nuclei located?

a) Caudal diencephalon and rostral midbrain

b) Caudal medulla and rostral spinal cord

c) Caudal pons and rostral medulla

d) Caudal midbrain and rostral pons

e) Midbrain tectum

HINT:

These are the nerves of balance and hearing

EXPLANATION:

There is a single special sensory cranial nerve, the vestibulocochlear eighth nerve. It has several associated cranial nerve sensory nuclei, including four vestibular nuclei, superior, medial, lateral, and inferior, and two major auditory sensory nuclei, the dorsal and ventral cochlear nuclei. These nuclei are all located in the rostral medulla and caudal pons, mostly following the rule of fours. The rule of fours is that cranial nerves 1-4 have nuclei and exits at the midbrain and above, cranial nerves 5-8 at the level of the pons, and 9-12 at the medulla and below.

ANSWER: ['Caudal pons and rostral medulla']

Lecture #04 Cranial Nerves

Question 3: Where are the cell bodies of third order neurons of cranial nerves?

a) Infranuclear

b) Cranial nerve sensory nuclei

c) Sensory ganglia

d) Cranial nerve motor nuclei

e) Thalamus

HINT:

Primary sensory neurons are peripheral, secondary neurons are in the brainstem cranial nerve sensory nuclei

EXPLANATION:

Primary sensory neurons are peripheral, secondary neurons are in the brainstem cranial nerve sensory nuclei. Secondary neurons send axons that decussate and synapse on third order neurons in the thalamus, the relay to the cerebral cortex.

ANSWER: ['Thalamus']

Lecture #04 Cranial Nerves

Question 4: A 65 year old man has been experiencing progressive weakness of movements of the eyes and tongue. What cranial nerve cell column is he suffering from strokes to?

a) Somatic motor

b) Special sensory

c) Parasympathetic

d) Somatic sensory

e) Pharyngeal motor

HINT:

Distinguish the cranial nerve column related to eyes and tongue from that related to other head musculature

EXPLANATION:

Muscle weakness implicates either the somatic or the pharyngeal motor cranial nerve column. Cranial nerves 3, 4, 6, and 12 (oculomotor, trochlear, abducens, and hypoglossal) are the traditional somatic motor column, with nuclei located most medially. The pharyngeal motor column consists of cranial nerves 5, 7, 9, 10, and traditionally 11 (trigeminal, facial, glossopharyngeal, vagus, and spinal accessory). They control muscles of mastication, facial expression, speech, and swallowing as well as the sternocleidomastoid and trapezius neck muscles. The spinal accessory nerve, which controls those neck muscles, is now regarded as somatic. The most lateral motor column is the visceral or autonomic motor column. Cranial nerves 3, 7, 9, and 10 (oculomotor, facial, glossopharyngeal, and vagus) have autonomic motor nuclei. The medial to lateral ordering of the columns changes during development and is only a rough guide.

ANSWER: ['Somatic motor']

Lecture #04 Cranial Nerves

Question 5: To which cranial nerve component (column) do axons conveying hearing and balance belong?

a) Special somatic sensory

b) Special visceral sensory

c) Pharyngeal sensory

d) Somatic sensory

e) Visceral sensory

HINT:

Begin by distinguishing sensory from motor cranial nerve columns

EXPLANATION:

The laterally located sensory cranial nerve columns are the special visceral or simply visceral or autonomic, the somatic, and the special somatic or simply special columns. Cranial nerves 7, 9, and 10 (facial, glossopharyngeal, and vagus) have visceral nuclei. Cranial nerve V, the trigeminal, has the somatic sensory nuclei (spinal, main or chief or principal, and mesencephalic). Cranial nerve 8, the vestibulocochlear nerve, has the special sensory nuclei. The medial to lateral ordering of the columns changes during development and is only a rough guide.

ANSWER: ['Special somatic sensory']

Lecture #04 Cranial Nerves

Question 6: Which is the cranial nerve component (column) of the hypoglossal nerve?

a) Somatic sensory

b) Visceral motor

c) Somatic motor

d) Special motor

e) Pharyngeal motor

HINT:

Begin by identifying sensory vs motor

EXPLANATION:

The hypoglossal nerve is a motor nerve that controls the tongue. Cranial nerves 3, 4, 6, and 12 (oculomotor, trochlear, abducens, and hypoglossal) are the traditional somatic motor column, with nuclei located most medially. The pharyngeal motor column consists of cranial nerves 5, 7, 9, 10, and traditionally 11 (trigeminal, facial, glossopharyngeal, vagus, and spinal accessory). They control muscles of mastication, facial expression, speech, and swallowing as well as the sternocleidomastoid and trapezius neck muscles. The spinal accessory nerve, which controls those neck muscles, is now regarded as somatic. The most lateral motor column is the visceral or autonomic motor column. Cranial nerves 3, 7, 9, and 10 (oculomotor, facial, glossopharyngeal, and vagus) have autonomic motor nuclei. The medial to lateral ordering of the columns changes during development and is only a rough guide.

ANSWER: ['Somatic motor']

Lecture #04 Cranial Nerves

Question 7: Where are corticobulbar axons located?

a) Lateral corticospinal tract

b) Posterior limb of internal capsule

c) Genu of internal capsule

d) Medial corticospinal tract

e) Anterior limb of internal capsule

HINT:

The main cerebral output is via the internal capsule

EXPLANATION:

The anterior limb of the internal capsule has frontal cortex axons involved in emotion, motivation, cognition processing, and decision making. The genu of the internal capsule contains the corticobulbar axons of the upper motor neurons for the facial motor nucleus that innervates the facial muscles. The upper face has bilateral upper motor neuron projections, the lower face projection is only contralateral, as is the corticospinal projection. The posterior limb of the internal capsule contains the contralaterally projecting corticospinal upper motor neuron axons. If both the genu and posterior limb are damaged, contralateral lower face and body will be paretic.

ANSWER: ['Genu of internal capsule']

Lecture #04 Cranial Nerves

Question 8: Which syndrome includes ipsilateral loss of the gag reflex?

a) Medial midbrain

b) Lateral medullary

c) Ventral midbrain

d) Medial medullary

e) Dorsal midbrain

HINT:

The gag reflex involves cranial motor nerves of the pharyngeal column

EXPLANATION:

The posterior inferior cerebellar artery travels along the lateral surface of the medulla. Occlusion of the posterior inferior cerebellar artery results in lateral medullary syndrome or Wallenberg's syndrome. Lateral medullary syndrome, one of the most complex syndromes, includes ipsilateral loss of face pain and temperature due to damage to the spinal nucleus of the trigeminal, contralateral loss of body pain and temperature due to damage to the spinothalamic, and dysphagia, dysarthria, and dysphonia due to damage to the nucleus ambiguus. The gag reflex is affected. There may be ipsilateral Horner's syndrome with miosis and ptosis.

ANSWER: ['Lateral medullary']

Lecture #04 Cranial Nerves

Question 9: Which deficits will result from a stroke in the internal capsule that spares only the anterior limb?

a) Contralateral hemiparesis and contralateral lower facial paralysis

b) Ipsilateral hemiparesis without facial paralysis

c) Cognitive deficits and emotional lability

d) Anterograde amnesia and emotional lability

e) No clinically deficits upon routine testing

HINT:

The posterior limb and genu of the internal capsule are affected

EXPLANATION:

The anterior limb of the internal capsule has frontal cortex axons involved in emotion, motivation, cognition processing, and decision making. The genu of the internal capsule contains the corticobulbar axons of the upper motor neurons for the facial motor nucleus that innervates the facial muscles. The upper face has bilateral upper motor neuron projections, the lower face projection is only contralateral, as is the corticospinal projection. The posterior limb of the internal capsule contains the contralaterally projecting corticospinal upper motor neuron axons. If both the genu and posterior limb are damaged, contralateral lower face and body will be paretic.

ANSWER: ['Contralateral hemiparesis and contralateral lower facial paralysis']

Lecture #04 Cranial Nerves

Question 10: What does the sulcus limitans divide?

a) Spinal cord from medulla

b) Sensory from motor nuclei

c) Visceral from pharyngeal nuclei

d) Somatic from pharyngeal nuclei

e) Open from closed medulla

HINT:

The sulcus limitans is visible on the floor of the fourth ventricle and separates groups of cranial nerve columns

EXPLANATION:

The sulcus limitans is visible on the floor of the fourth ventricle. It separates the medially located cranial nerve motor columns from the laterally located sensory columns.

ANSWER: ['Sensory from motor nuclei']

Lecture #04 Cranial Nerves

Question 11: Which is clinically the most obvious exception to the bilateral projection of cranial nerve upper motor neurons?

a) Mesencephalic nerve

b) Trigeminal nerve

c) Facial nerve

d) Hypoglossal nerve

e) Ambiguus nerve

HINT:

consider the paralysis produced by corticobulbar damage

EXPLANATION:

The corticobulbar fibers controlling the upper face project bilaterally, and one side can retain control if the motor output from the other is lost. The lower face, however, has innervation from the contralateral side only, like the body below it. The facial nerve innervates the muscles of facial expression.

ANSWER: ['Facial nerve']

Lecture #04 Cranial Nerves

Question 12: A research subject is suspected of having a stroke. When he is asked to protrude his tongue, it deviates to the left. Where is the stroke?

a) Right medial medullary syndrome

b) Right lateral medullary syndrome

c) Left medial medullary syndrome

d) Left lateral medullary syndrome

e) Left genu of the internal capsule

HINT:

Note which cranial nerve is involved and the level of the brainstem at which it and its nucleus are found.

EXPLANATION:

A blockage of the anterior spinal artery, the vertebral artery, or the basilar artery can deprive the ventral and medial medulla of oxygen and result in medial medullary syndrome. The pyramid is affected because it is at the ventral surface, the hypoglossal nerve is affected, because this somatic motor nerve courses medially to exit ventrally, and the medial lemniscus is affected, because it lies as a dorsal to ventral ribbon adjacent to the midline of the rostral medulla. The pyramidal damage causes contralateral body paresis, the hypoglossal damage causes tongue weakness and deviation to the side of the lesion, and the medial lemniscus damage causes loss of touch, pressure, vibration, and position sense on the contralateral side of the body.

ANSWER: ['Left medial medullary syndrome']

Lecture #04 Cranial Nerves

Question 13: Which is a list of only parasympathetic visceral motor nuclei?

a) Intermediolateral cell column, Edinger-Westphal, superior salivatory

b) Intermediolateral cell column, Edinger-Westphal, inferior salivatory

c) Trochlear, Horner's, superior and inferior salivatory

d) Trochlear, Intermediolateral cell column

e) Edinger-Westphal, inferior and superior salivatory, dorsal motor nucleus of vagus

HINT:

The parasympathetic visceral motor nuclei are the autonomic motor nuclei

EXPLANATION:

The trochlear nucleus, cranial nerve 4, is somatic motor. The intermediolateral cell column is the thoracic lateral horn of the spinal cord and contains the preganglionic sympathetic neurons. Horner's is a sympathetic autonomic syndrome affecting the eye, not a nucleus. The Edinger-Westphal nucleus is the parasympathetic preganglionic nucleus for pupil constriction and ciliary muscle focusing of the eye. The inferior (for the parotid gland) and superior (for the submandibular and sublingual glands) salivatory nuclei provide parasympathetic control of the salivary glands. The dorsal motor nucleus of the vagus provides parasympathetic control of the pharynx and the vomiting (emetic) reflex.

ANSWER: ['Edinger-Westphal, inferior and superior salivatory, dorsal motor nucleus of vagus']

Lecture #04 Cranial Nerves

Question 14: Taste fibers that travel in the facial, glossopharyngeal, and vagus nerves project to which brainstem area?

a) Chief (or main, or principal) sensory nucleus

b) Caudal solitary nucleus

c) Anterior perforated substance

d) Olfactory tubercle

e) Rostral solitary nucleus

HINT:

An alternate name for the gustatory receiving area is the gustatory nucleus

EXPLANATION:

The nucleus of the solitary tract has caudal and rostral divisions with different functions. The rostral division of the solitary tract nucleus receives taste fibers from the facial, glossopharyngeal, and vagus nerves. It is also called the gustatory nucleus. Unlike other second order neurons, neurons in the gustatory nucleus project ipsilaterally to higher centers.

ANSWER: ['Rostral solitary nucleus']

Lecture #04 Cranial Nerves

Question 15: An occlusion of the posterior inferior cerebellar artery likely causes which brainstem-related deficit?

a) Contralateral facial paralysis of lower face only

b) Contralateral facial paralysis

c) Contralateral loss of body pain and temperature sense

d) Ipsilateral body paralysis

e) Contralateral Horner's syndrome with miosis and ptosis

HINT:

The posterior inferior cerebellar artery travels along the lateral surface of the medulla

EXPLANATION:

The posterior inferior cerebellar artery travels along the lateral surface of the medulla. Occlusion of the posterior inferior cerebellar artery results in lateral medullary syndrome or Wallenberg's syndrome. Lateral medullary syndrome, one of the most complex syndromes, includes ipsilateral loss of face pain and temperature due to damage to the spinal nucleus of the trigeminal, contralateral loss of body pain and temperature due to damage to the spinothalamic, and dysphagia, dysarthria, and dysphonia due to damage to the nucleus ambiguus. The gag reflex is affected. There may be ipsilateral Horner's syndrome with miosis and ptosis.

ANSWER: ['Contralateral loss of body pain and temperature sense']

Lecture #04 Cranial Nerves

Question 16: To which cranial nerve component (column) do axons of the trochlear nerve belong?

a) Somatic motor

b) Pharyngeal motor

c) Special visceral motor

d) Pharyngeal sensory

e) Visceral motor

HINT:

Begin by identifying sensory vs motor

EXPLANATION:

The trochlear nerve is a motor nerve that controls the superior oblique eye muscle. Cranial nerves 3, 4, 6, and 12 (oculomotor, trochlear, abducens, and hypoglossal) are the traditional somatic motor column, with nuclei located most medially. The pharyngeal motor column consists of cranial nerves 5, 7, 9, 10, and traditionally 11 (trigeminal, facial, glossopharyngeal, vagus, and spinal accessory). They control muscles of mastication, facial expression, speech, and swallowing as well as the sternocleidomastoid and trapezius neck muscles. The spinal accessory nerve, which controls those neck muscles, is now regarded as somatic. The most lateral motor column is the visceral or autonomic motor column. Cranial nerves 3, 7, 9, and 10 (oculomotor, facial, glossopharyngeal, and vagus) have autonomic motor nuclei. The medial to lateral ordering of the columns changes during development and is only a rough guide.

ANSWER: ['Somatic motor']

Lecture #04 Cranial Nerves

Question 17: A stroke of the right corticobulbar tract in the genu of the internal capsule will result in which?

a) Only paralysis of the right lower face

b) Only paralysis of the left lower face

c) No paralysis because the left corticobulbar fibers end bilaterally in motor nuclei of the brainstem

d) Complete paralysis of the right side of the face

e) Complete paralysis of the right side of the face

HINT:

Distinguish bilateral vs contralateral corticobulbar projections

EXPLANATION:

The corticobulbar fibers controlling the upper face project bilaterally, and one side can retain control if the motor output from the other is lost. The lower face, however, has innervation from the contralateral side only, like the body below it.

ANSWER: ['Only paralysis of the left lower face']

Lecture #04 Cranial Nerves

Question 18: A 65 year old man presents with a history of progressive weakness of the muscles of mastication, some difficulty in swallowing accompanied by rather raspy speech, difficulty in speaking and weakness of facial expression. What cranial nerve cell column is he suffering from lesions to?

a) Somatic sensory

b) Special sensory

c) Somatic motor

d) Pharyngeal (Branchial) motor

e) Parasympathetic

HINT:

Distinguish the cranial nerve column related to eyes and tongue from that related to other head musculature

EXPLANATION:

Muscle weakness implicates either the somatic or the pharyngeal motor cranial nerve column. Cranial nerves 3, 4, 6, and 12 (oculomotor, trochlear, abducens, and hypoglossal) are the traditional somatic motor column, with nuclei located most medially. The pharyngeal motor column consists of cranial nerves 5, 7, 9, 10, and traditionally 11 (trigeminal, facial, glossopharyngeal, vagus, and spinal accessory). They control muscles of mastication, facial expression, speech, and swallowing as well as the sternocleidomastoid and trapezius neck muscles. The spinal accessory nerve, which controls those neck muscles, is now regarded as somatic. The most lateral motor column is the visceral or autonomic motor column. Cranial nerves 3, 7, 9, and 10 (oculomotor, facial, glossopharyngeal, and vagus) have autonomic motor nuclei. The medial to lateral ordering of the columns changes during development and is only a rough guide.

ANSWER: ['Pharyngeal (Branchial) motor']

Lecture #04 Cranial Nerves

Question 19: Which cranial nerves carry special visceral sensory fibers?

a) Optic, vestibulocochlear

b) Olfactory, facial, glossopharyngeal, vagus

c) Glossopharyngeal, vagus, hypoglossal

d) Glossopharyngeal, vagus, accessory, hypoglossal

e) Oculomotor, trochlear, abducens

HINT:

Begin by identifying sensory vs motor

EXPLANATION:

The laterally located sensory cranial nerve columns are the special visceral or simply visceral or autonomic, the somatic, and the special somatic or simply special columns. Cranial nerves 7, 9, and 10 (facial, glossopharyngeal, and vagus) have visceral nuclei. Cranial nerve V, the trigeminal, has the somatic sensory nuclei (spinal, main or chief or principal, and mesencephalic). Cranial nerve 8, the vestibulocochlear nerve, has the special sensory nuclei. The medial to lateral ordering of the columns changes during development and is only a rough guide.

ANSWER: ['Olfactory, facial, glossopharyngeal, vagus']

Lecture #04 Cranial Nerves

Question 20: An upper motor neuron (supranuclear) lesion of the facial nerve is produced by interrupting the corticobulbar fibers to the facial motor nucleus. Such a lesion on the left side of the brain will produce which?

a) Complete paralysis of the left side of the face

b) Only paralysis of the right lower face

c) Only paralysis of the left lower face

d) Complete paralysis of the right side of the face

e) No paralysis at all because the corticobulbar fibers are crossed and uncrossed

HINT:

Distinguish bilateral vs contralateral corticobulbar projections

EXPLANATION:

The corticobulbar fibers controlling the upper face project bilaterally, and one side can retain control if the motor output from the other is lost. The lower face, however, has innervation from the contralateral side only, like the body below it.

ANSWER: ['Only paralysis of the right lower face']

Lecture #04 Cranial Nerves

Question 21: A patient is diagnosed with a right medial medullary syndrome. What cranial nerve signs would you expect to see in this patient?

a) Left facial paralysis

b) Right tongue atrophy

c) Right facial paralysis

d) Left lower facial paralysis

e) Left tongue atrophy

HINT:

Consider the cranial nerves and nuclei located at the level of the medulla

EXPLANATION:

A blockage of the anterior spinal artery, the vertebral artery, or the basilar artery can deprive the ventral and medial medulla of oxygen and result in medial medullary syndrome. The pyramid is affected because it is at the ventral surface, the hypoglossal nerve is affected, because this somatic motor nerve courses medially to exit ventrally, and the medial lemniscus is affected, because it lies as a dorsal to ventral ribbon adjacent to the midline of the rostral medulla. The pyramidal damage causes contralateral body paresis, the hypoglossal damage causes tongue weakness and deviation to the side of the lesion, and the medial lemniscus damage causes loss of touch, pressure, vibration, and position sense on the contralateral side of the body.

ANSWER: ['Right tongue atrophy']