• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

A 5-year-old male demonstrates persistent food-seeking behavior. He is obese, and his mother reports that he sometimes exhibits aggressive and bizarre behaviors. These clinical findings may be explained by a lesion in which of the following hypothalamic nuclei?

- A. Lateral [17%]
- B. Suprachiasmatic [7%]
- C. Supraoptic [5%]
- D. Anterior [7%]
- ✔ E. Ventromedial [64%]

Explanation:

User Id: 477875

The body's satiety center resides within the ventromedial nucleus of the hypothalamus. The neurons here detect blood glucose elevations and signal satiety in response. Bilateral lesions of the ventromedial nuclei cause hyperphagia and obesity. Episodes of rage and/or savage behavior are also sometimes noted. The most common cause of such lesions is tumor invasion, for example by a craniopharyngioma. Lesions of the ventromedial nuclei are the cause of obesity in only exceedingly rare cases.

(Choice A) The lateral nuclei of the hypothalamus signal hunger. Bilateral lesions would cause one to lose the desire to eat. In adults, starvation ensues, in infants, failure to thrive.

(Choice B) The suprachiasmatic nuclei are located immediately above the optic chiasm and receive visual input from the retina via the optic tract. The suprachiasmatic nuclei help to regulate circadian rhythms by relaying light information to other hypothalamic nuclei and to the pineal gland.

(Choice C) The supraoptic and paraventricular nuclei produce vasopressin (ADH) and oxytocin, which are carried down axons to the posterior pituitary (neurohypophysis), which releases these hormones into the circulation.

(Choice D) When the body temperature rises, the anterior hypothalamic nuclei coordinate cooling by stimulating the parasympathetic nervous system to produce vasodilation and sweating. Destruction of these nuclei can result in uncontrolled hyperthermia and death. The posterior hypothalamic nuclei regulate heat conservation and heat production when the body is cold.

- A. Lateral [17%]
- B. Suprachiasmatic [7%]
- C. Supraoptic [5%]
- D. Anterior [7%]
- ✔ E. Ventromedial [64%]

Explanation:

The body's satiety center resides within the ventromedial nucleus of the hypothalamus. The neurons here detect blood glucose elevations and signal satiety in response. Bilateral lesions of the ventromedial nuclei cause hyperphagia and obesity. Episodes of rage and/or savage behavior are also sometimes noted. The most common cause of such lesions is tumor invasion, for example by a craniopharyngioma. Lesions of the ventromedial nuclei are the cause of obesity in only exceedingly rare cases.

(Choice A) The lateral nuclei of the hypothalamus signal hunger. Bilateral lesions would cause one to lose the desire to eat. In adults, starvation ensues, in infants, failure to thrive.

(Choice B) The suprachiasmatic nuclei are located immediately above the optic chiasm and receive visual input from the retina via the optic tract. The suprachiasmatic nuclei help to regulate circadian rhythms by relaying light information to other hypothalamic nuclei and to the pineal gland.

(Choice C) The supraoptic and paraventricular nuclei produce vasopressin (ADH) and oxytocin, which are carried down axons to the posterior pituitary (neurohypophysis), which releases these hormones into the circulation.

(Choice D) When the body temperature rises, the anterior hypothalamic nuclei coordinate cooling by stimulating the parasympathetic nervous system to produce vasodilation and sweating. Destruction of these nuclei can result in uncontrolled hyperthermia and death. The posterior hypothalamic nuclei regulate heat conservation and heat production when the body is cold.

Educational Objective:
The ventromedial hypothalamic nuclei contain the satiety center and regulate food intake. Lesions of the ventromedial nuclei result in obesity secondary to hyperphagia as well as aggressive, savage behavior.

Time Spent: 320 seconds

Last updated: [7/7/2010]

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

A patient recovering from a traumatic injury to the face now finds himself unable to chew his food. On physical examination, his jaw deviates to the right side. The nerve that has been injured in this patient exits the skull through which of the following foramina?

- A. Foramen rotundum [16%]
- ✔ B. Foramen ovale [60%]
- C. Foramen spinosum [12%]
- D. Foramen lacerum [4%]
- E. Jugular foramen [7%]

Explanation:

User Id: 477875

This patient has symptoms consistent with injury of the third division of the trigeminal nerve (CN V3, mandibular nerve), which provides sensory innervation to the face and motor innervation to the muscles of mastication. The muscles of mastication include the three muscles that close the jaw (masseter, medial pterygoid, and temporalis muscles), and the single muscle that opens the jaw (lateral pterygoid muscle). Thus, a patient who is unable to chew food or hold the jaw closed due to weakness (jaw deviation) has likely suffered an injury to this nerve. The third branch of the trigeminal nerve exits the skull through the foramen ovale, which also contains the lesser petrosal nerve, the accessory meningeal artery, and the emissary veins.

(Choice A) The second division of the trigeminal nerve (CN V2, maxillary nerve) exits the skull via the foramen rotundum.

(Choice C) The foramen spinosum contains the middle meningeal artery and middle meningeal vein and the meningeal (recurrent) branch of CN V3.

(Choice D) The foramen lacerum contains the meningeal branch of the ascending pharyngeal artery and the artery and nerve of the pterygoid canal. This foramen is otherwise occluded by cartilage.

(Choice E) The jugular foramen contains cranial nerves IX, X and XI, the inferior petrosal and sigmoid sinuses, and the posterior meningeal artery.

Educational Objective:

• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

- A. Foramen rotundum [16%]
- ✔ B. Foramen ovale [60%]
- C. Foramen spinosum [12%]
- D. Foramen lacerum [4%]
- E. Jugular foramen [7%]

Explanation:

This patient has symptoms consistent with injury of the third division of the trigeminal nerve (CN V3, mandibular nerve), which provides sensory innervation to the face and motor innervation to the muscles of mastication. The muscles of mastication include the three muscles that close the jaw (masseter, medial pterygoid, and temporalis muscles), and the single muscle that opens the jaw (lateral pterygoid muscle). Thus, a patient who is unable to chew food or hold the jaw closed due to weakness (jaw deviation) has likely suffered an injury to this nerve. The third branch of the trigeminal nerve exits the skull through the foramen ovale, which also contains the lesser petrosal nerve, the accessory meningeal artery, and the emissary veins.

(Choice A) The second division of the trigeminal nerve (CN V2, maxillary nerve) exits the skull via the foramen rotundum.

(Choice C) The foramen spinosum contains the middle meningeal artery and middle meningeal vein and the meningeal (recurrent) branch of CN V3.

(Choice D) The foramen lacerum contains the meningeal branch of the ascending pharyngeal artery and the artery and nerve of the pterygoid canal. This foramen is otherwise occluded by cartilage.

(Choice E) The jugular foramen contains cranial nerves IX, X and XI, the inferior petrosal and sigmoid sinuses, and the posterior meningeal artery.

Educational Objective:
The third branch of the trigeminal nerve (CN V3) exits the skull through the foramen ovale and innervates the muscles of mastication, including the masseter, the medial and lateral pterygoids, and the temporalis muscles.

Time Spent: 22 seconds

Last updated: [7/7/2010]

A 43-year-old male complains of double vision when walking down stairs. He has no other concerns. He eats a balanced diet and takes one multivitamin daily. He jogs for 30 minutes every morning. His past medical history is significant for type 2 diabetes mellitus, which is well controlled with glyburide. A lesion of which of the following structures is most likely responsible for this patient's complaints?

- A. Optic nerve [7%]
- B. Oculomotor nerve [20%]
- C. Abducens nerve [9%]
- ✔ D. Trochlear nerve [55%]
- E. Medial longitudinal fasciculus [9%]

Explanation:

User Id: 477875

Vertical diplopia is most noticeable when the affected eye looks toward the nose, as occurs when reading the newspaper or walking downstairs. One of the more common causes of vertical diplopia is a palsy of cranial nerve IV (trochlear nerve). Most such palsies have traumatic or idiopathic etiologies.

(Choice A) The optic nerve (cranial nerve II) transmits visual information to the brain. Damage to this nerve causes loss of vision.

(Choice B) The oculomotor nerve (cranial nerve III) innervates the superior rectus, medial rectus, inferior rectus, and inferior oblique. These muscles collectively perform most eye movements. Palsies of this nerve can cause vertical and horizontal diplopia, ptosis, and an enlarged and nonreactive pupil.

(Choice C) The abducens nerve (cranial nerve VI) innervates the lateral rectus, which is responsible for abduction of the eye. Palsies of this nerve can cause horizontal diplopia and esotropia (inward deviation).

(Choice E) A lesion of the medial longitudinal fasciculus is associated with internuclear ophthalmoplegia, which presents with impaired horizontal eye movement and weak adduction of the affected eye with simultaneous abduction nystagmus of the contralateral eye.

Educational Objective:
Trochlear nerve palsy is characterized by vertical diplopia.

A 43-year-old male complains of double vision when walking down stairs. He has no other concerns. He eats a balanced diet and takes one multivitamin daily. He jogs for 30 minutes every morning. His past medical history is significant for type 2 diabetes mellitus, which is well controlled with glyburide. A lesion of which of the following structures is most likely responsible for this patient's complaints?

- A. Optic nerve [7%]
- B. Oculomotor nerve [20%]
- C. Abducens nerve [9%]
- ✔ D. Trochlear nerve [55%]
- E. Medial longitudinal fasciculus [9%]

User Id: 477875

Explanation:

Vertical diplopia is most noticeable when the affected eye looks toward the nose, as occurs when reading the newspaper or walking downstairs. One of the more common causes of vertical diplopia is a palsy of cranial nerve IV (trochlear nerve). Most such palsies have traumatic or idiopathic etiologies.

(Choice A) The optic nerve (cranial nerve II) transmits visual information to the brain. Damage to this nerve causes loss of vision.

(Choice B) The oculomotor nerve (cranial nerve III) innervates the superior rectus, medial rectus, inferior rectus, and inferior oblique. These muscles collectively perform most eye movements. Palsies of this nerve can cause vertical and horizontal diplopia, ptosis, and an enlarged and nonreactive pupil.

(Choice C) The abducens nerve (cranial nerve VI) innervates the lateral rectus, which is responsible for abduction of the eye. Palsies of this nerve can cause horizontal diplopia and esotropia (inward deviation).

(Choice E) A lesion of the medial longitudinal fasciculus is associated with internuclear ophthalmoplegia, which presents with impaired horizontal eye movement and weak adduction of the affected eye with simultaneous abduction nystagmus of the contralateral eye.

Educational Objective:
Trochlear nerve palsy is characterized by vertical diplopia.

Time Spent: 8 seconds

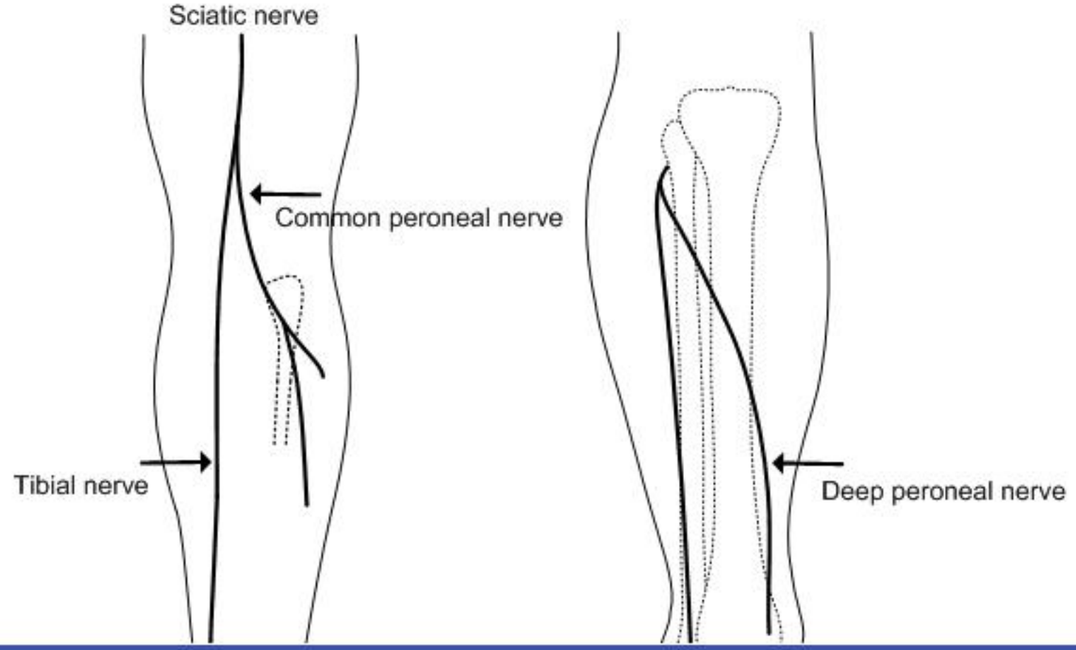
Last updated: [3/5/2013]

A patient presents to your office with right leg numbness. When he walks, you notice that he lifts his right foot higher than he does his left, and that his right foot slaps to the ground with each step. On neurologic exam, you also ascertain that he is unable to evert the right foot. Which of the following nerves has most likely been injured?

- A. Tibial [12%]
- ✔ B. Common peroneal [70%]
- C. Superficial peroneal [12%]
- D. Sural [2%]
- E. Obturator [3%]

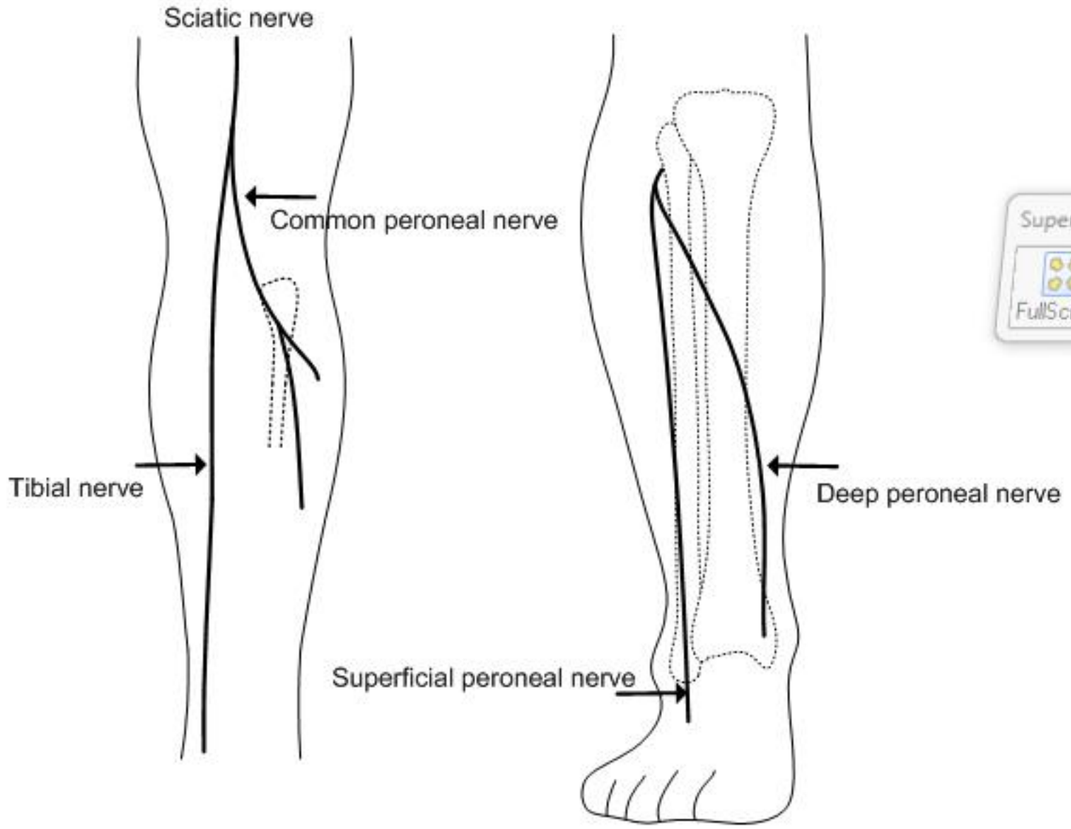
Explanation:

User Id: 477875



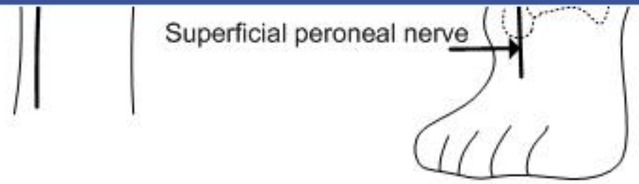
Explanation:

User Id: 477875



The common peroneal nerve is the most commonly injured nerve in the leg. It begins in the proximal popliteal fossa, where the sciatic nerve divides into the tibial nerve and common peroneal nerve. From there, the common peroneal nerve courses laterally into the anterior compartment of the leg, passing superficially around the head and neck of the fibula. Blunt trauma to the lateral leg and fractures of the neck of the fibula can injure this nerve.

Patients with common peroneal nerve damage present with an equinovarus (plantarflexed and inverted) posture of the affected foot due to paralysis of the peroneus longus and peroneus brevis muscles (mediate



The common peroneal nerve is the most commonly injured nerve in the leg. It begins in the proximal popliteal fossa, where the sciatic nerve divides into the tibial nerve and common peroneal nerve. From there, the common peroneal nerve courses laterally into the anterior compartment of the leg, passing superficially around the head and neck of the fibula. Blunt trauma to the lateral leg and fractures of the neck of the fibula can injure this nerve.

Patients with common peroneal nerve damage present with an equinovarus (plantarflexed and inverted) posture of the affected foot due to paralysis of the peroneus longus and peroneus brevis muscles (mediate foot eversion), paralysis of the tibialis anterior muscle (mediates dorsiflexion), and paralysis of the extrinsic extensors of the toes. Injury to this nerve also causes loss of sensation to the anterolateral leg.

The classic finding on gait exam in patients with common peroneal nerve injury is "foot drop," where the affected leg is lifted high off of the ground while walking due to an inability to dorsiflex the foot. The affected foot will also classically slap to the ground with each step.

(Choice A) Tibial nerve injury causes dorsiflexion and eversion of the foot with sensory loss on the sole of the foot.

(Choice C) The superficial peroneal nerve innervates the peroneus longus and peroneus brevis muscles in the lateral compartment of the leg, which together evert the foot. It also provides sensory innervation to the skin of the distal anterior leg and dorsal foot.

(Choice D) The sural nerve is a purely sensory nerve that supplies the posterolateral leg and lateral foot.

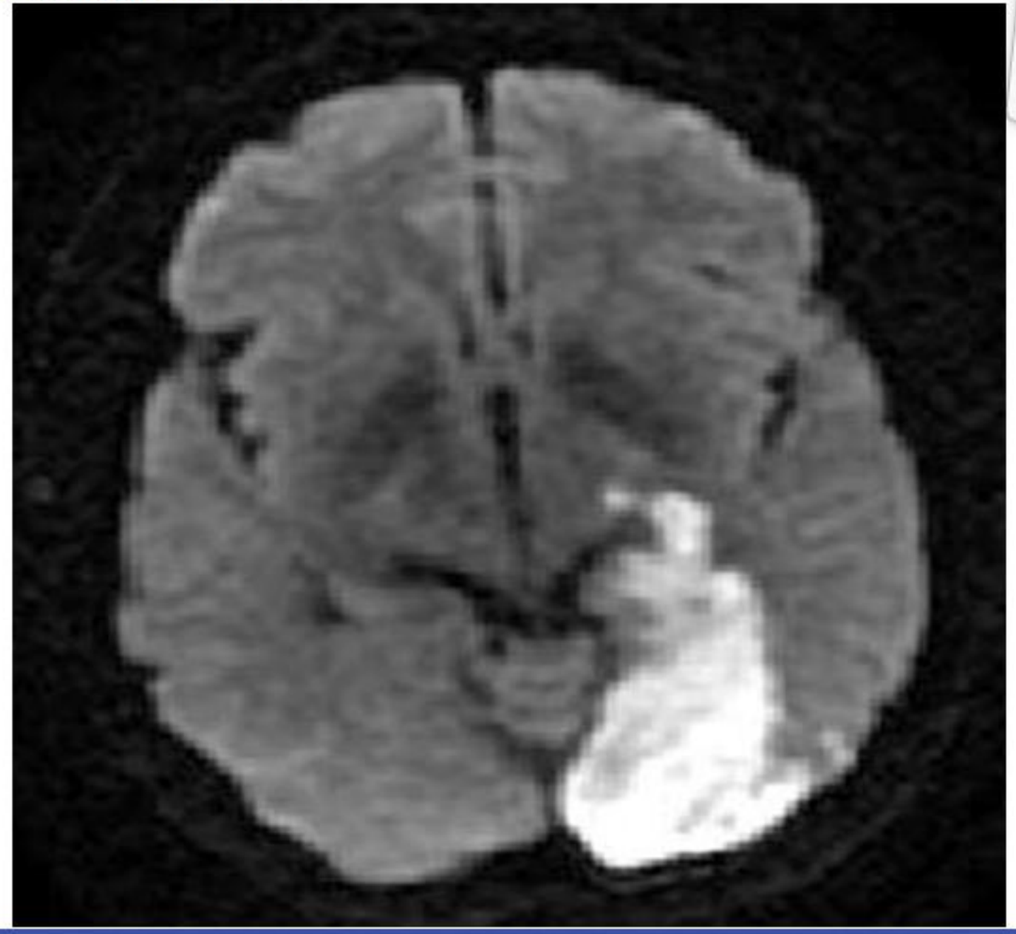
(Choice E) Obturator nerve injury classically causes spasms of the adductor muscles of the thigh.

Educational Objective:
Common peroneal nerve injury is common and typically results from trauma to the leg near the head of the fibula. Signs include foot drop and a characteristic high-stepping gait.

Time Spent: 44 seconds

Last updated: [7/7/2010]

A 70-year-old, right-handed woman comes to the emergency department because of acute loss of vision in her right visual field. She denies headache, slurred speech, difficulty swallowing, weakness, numbness, and difficulty walking. Her other medical problems include hypertension, atrial fibrillation, and hyperlipidemia. Her blood pressure is 170/102 mm Hg and pulse is 90/min and irregular. Neurologic examination shows that she is awake, alert, and oriented. Her speech is fluent, and she follows complex commands. Examination shows a right homonymous hemianopsia. The rest of the neurologic examination is within normal limits. Brain MRI with diffusion protocol reveals:

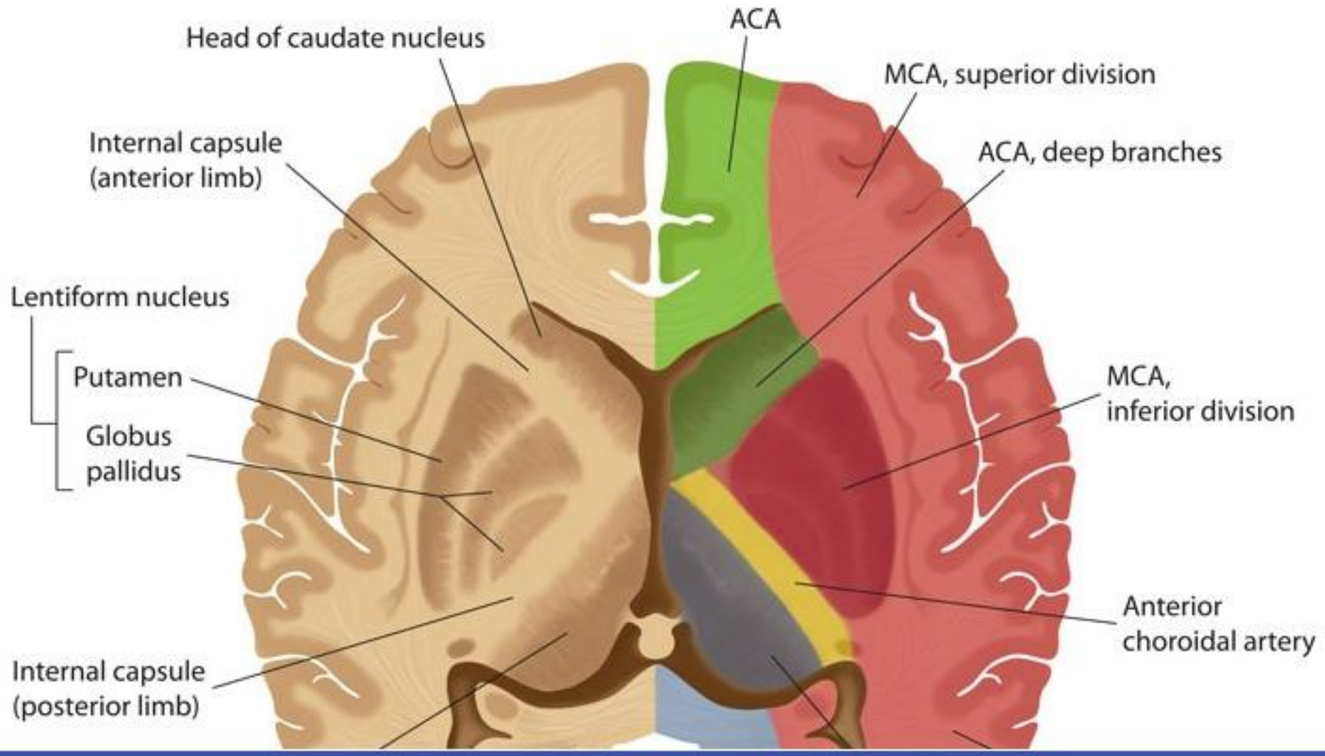


• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

A. Anterior cerebral artery [2%]
B. Anterior choroidal artery [1%]
C. Artery of Percheron [0%]
D. Basilar artery [2%]
E. Middle cerebral artery [4%]
✔ F. Posterior cerebral artery [90%]

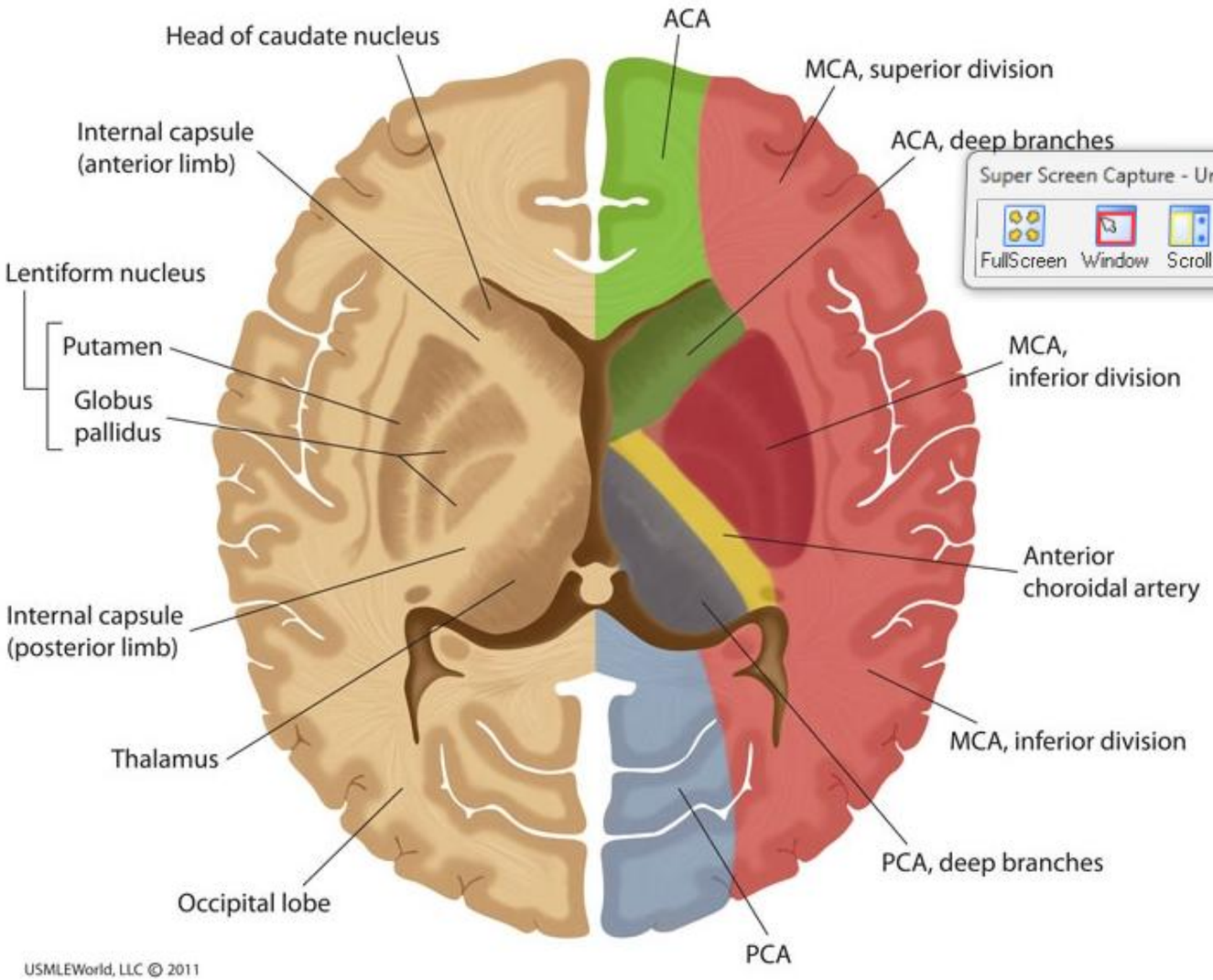
Explanation:

Blood supply to the Cerebral Hemispheres



Explanation:

Blood supply to the Cerebral Hemispheres



The brain image shows restricted diffusion on diffusion-weighted sequence consistent with an acute infarct in

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

The brain image shows restricted diffusion on diffusion-weighted sequence consistent with an acute infarct in the distribution of the posterior cerebral artery (PCA). The PCA branches off the basilar artery at the level of the pontomesencephalic junction. It is divided into two segments (P1 and P2) by the bisecting posterior communicating artery coming off the internal carotid artery. The PCA supplies cranial nerves III and IV and other structures in the midbrain. It also supplies the thalamus, mesial temporal lobe, splenium of the corpus callosum, parahippocampal gyrus, fusiform gyrus, and occipital lobe.

(Choice A) Anterior cerebral artery distribution in the brain includes inferior frontal, mesial frontal and parietal lobes, anterior 4/5 of the corpus callosum, olfactory bulb and tract, anterior portions of the basal ganglia, and internal capsule.

(Choice B) The anterior choroidal artery is the last branch off the internal carotid artery before it trifurcates. It supplies the posterior limb and genu of the internal capsule, optic tract, lateral geniculate body, choroid plexus, uncus, hippocampus, and amygdala.

(Choice C) The artery of Percheron branches off either one of the PCA segments and supplies the bilateral thalami and dorsal midbrain. It is considered to be a rare normal variant and can be seen in patients presenting with bilateral thalamic or dorsal midbrain strokes.

(Choice D) The basilar artery has a wide vascular supply in the brain, including most of the brainstem and bilateral cerebellar hemispheres, thalami, and mesial temporal and occipital lobes.

(Choice E) Middle cerebral artery distribution in the brain includes lateral convexity of the frontal, parietal, and temporal lobes. It also supplies the deep subcortical structures, such as the internal capsule and basal ganglia.

Educational objective:
The posterior cerebral artery branches off the basilar artery and supplies cranial nerves III and IV and other structures in the midbrain. It also supplies the thalamus, mesial temporal lobe, splenium of the corpus callosum, parahippocampal gyrus, fusiform gyrus, and occipital lobe.

Time Spent: 21 seconds Last updated: [1/16/2013]

A 16-year-old male presents to your office with difficulty walking. On physical examination, he has thoracic kyphoscoliosis and multiple small scars on his hands. When asked about these, he reports that he repeatedly accidentally burns his hands because he "cannot feel the heat." Neurologic examination reveals 1+ biceps reflexes and 3+ patellar reflexes bilaterally, as well as decreased muscle strength in the bilateral upper and lower extremities. Which of the following is the most likely cause of this patient's problems?

- A. Amyotrophic lateral sclerosis [18%]
- B. Guillain-Barré syndrome [8%]
- ✔ C. Syringomyelia [63%]
- D. Normal pressure hydrocephalus [1%]
- E. Multiple sclerosis [5%]
- F. Medulloblastoma [3%]

Explanation: **User Id: 477875**

This patient has chronic loss of upper extremity pain and temperature sensation, upper extremity weakness and hyporeflexia, lower extremity weakness and hyperreflexia, and kyphoscoliosis. These findings are consistent with a diagnosis of syringomyelia.

In syringomyelia, a central cystic dilation in the cervical spinal cord (a syrinx) slowly enlarges, characteristically causing damage to the ventral white commissure and anterior horns. The ventral white commissure is the site of decussation of second-order lateral spinothalamic tract neurons, and the ventral horns are the site of lower motor neuron cell bodies. The syrinx is most commonly situated at the C8-T1 cord levels and may extend rostrally, caudally, and centrifugally. Further expansion within the cervical cord in later stages of the disease can produce lower extremity weakness and hyperreflexia (upper motor neuron defect) by affecting the lateral corticospinal tract.

(Choice A) ALS is a progressive degenerative disease of upper and lower motor neurons only; it does not cause sensory loss.

(Choice B) Guillain-Barré syndrome is a peripheral nervous system autoimmune demyelinating polyneuropathy that typically causes lower motor neuron manifestations (e.g. areflexia, weakness) in a symmetric ascending pattern.

Explanation:

User Id: 477875

This patient has chronic loss of upper extremity pain and temperature sensation, upper extremity weakness and hyporeflexia, lower extremity weakness and hyperreflexia, and kyphoscoliosis. These findings are consistent with a diagnosis of syringomyelia.

In syringomyelia, a central cystic dilation in the cervical spinal cord (a syrinx) slowly enlarges, characteristically causing damage to the ventral white commissure and anterior horns. The ventral white commissure is the site of decussation of second-order lateral spinothalamic tract neurons, and the ventral horns are the site of lower motor neuron cell bodies. The syrinx is most commonly situated at the C8-T1 cord levels and may extend rostrally, caudally, and centrifugally. Further expansion within the cervical cord in later stages of the disease can produce lower extremity weakness and hyperreflexia (upper motor neuron defect) by affecting the lateral corticospinal tract.

(Choice A) ALS is a progressive degenerative disease of upper and lower motor neurons only; it does not cause sensory loss.

(Choice B) Guillain-Barré syndrome is a peripheral nervous system autoimmune demyelinating polyneuropathy that typically causes lower motor neuron manifestations (e.g. areflexia, weakness) in a symmetric ascending pattern.

(Choice D) Normal pressure hydrocephalus is characterized by gait apraxia and urinary incontinence. It is rare in patients younger than 60 years of age. It arises due to defective CSF resorption by the arachnoid granulations.

(Choice E) Multiple sclerosis is an autoimmune CNS demyelinating disorder that presents with episodic neurologic symptoms reflecting defects in random white matter tracts.

(Choice F) Medulloblastoma is the most common malignant brain tumor of children. It is a posterior fossa tumor that causes symptoms related to obstructive hydrocephalus.

Educational Objective:
The combination of fixed segmental loss of upper extremity pain and temperature sensation, upper extremity lower motor neuron signs, and/or lower extremity upper motor neuron signs in the setting of scoliosis suggests a diagnosis of syringomyelia.

Time Spent: 10 seconds

Last updated: [7/7/2010]

The glossopharyngeal nerve is transected accidentally during a surgical procedure in a 45-year-old male. Which of the following is most likely lost in this patient?

- A. Taste sensation from the anterior two-thirds of the tongue [10%]
- ✔ B. General sensation from the tonsillar lining [62%]
- C. Salivary secretion from the submandibular gland [15%]
- D. Protrusion of the tongue [12%]

Explanation:

The glossopharyngeal nerve (CN IX) originates in the medulla and exits the cranial cavity via the jugular foramen. This nerve has numerous functions:

Somatic motor: stylopharyngeus muscle only
Parasympathetic: inferior salivatory nucleus→CN IX→otic ganglion→ travels along auriculotemporal nerve (CN V)→parotid gland secretion
General sensory: inner surface of tympanic membrane, Eustachian tube, posterior 1/3 of tongue, tonsillar region, and upper pharynx (afferent portion of the gag reflex), carotid body and carotid sinus

Lesions of the glossopharyngeal nerve result in loss of the gag reflex (afferent limb), loss of sensation in the upper pharynx, posterior tongue, tonsils and middle ear cavity, and loss of taste sensation on the posterior one-third of the tongue.

(Choice A) Taste sensation from the anterior two-thirds of the tongue is mediated by the chorda tympani branch of the facial nerve (CN VII).

(Choice C) Salivary secretion from the submandibular gland and the sublingual gland is mediated by parasympathetic fibers originating in the superior salivatory nucleus carried on the facial nerve (CN VII) via the chorda tympani nerve, the lingual nerve, and across the submandibular ganglion.

(Choice D) Protrusion of the tongue is mediated by motor efferent fibers carried by the hypoglossal nerve (CN XII).

- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25
- 26
- 27
- 28
- 29
- 30
- 31
- 32
- 33
- 34
- 35
- 36
- 37
- 38
- 39
- 40
- 41
- 42

✔ B. General sensation from the tonsillar lining [62%]
C. Salivary secretion from the submandibular gland [15%]
D. Protrusion of the tongue [12%]

Explanation:

User Id: 477875

The glossopharyngeal nerve (CN IX) originates in the medulla and exits the cranial cavity via the jugular foramen. This nerve has numerous functions:

Somatic motor: stylopharyngeus muscle only
Parasympathetic: inferior salivatory nucleus→CN IX→otic ganglion→ travels along auriculotemporal nerve (CN V)→parotid gland secretion
General sensory: inner surface of tympanic membrane, Eustachian tube, posterior 1/3 of tongue, tonsillar region, and upper pharynx (afferent portion of the gag reflex), carotid body and carotid sinus

Lesions of the glossopharyngeal nerve result in loss of the gag reflex (afferent limb), loss of sensation in the upper pharynx, posterior tongue, tonsils and middle ear cavity, and loss of taste sensation on the posterior one-third of the tongue.

(Choice A) Taste sensation from the anterior two-thirds of the tongue is mediated by the chorda tympani branch of the facial nerve (CN VII).

(Choice C) Salivary secretion from the submandibular gland and the sublingual gland is mediated by parasympathetic fibers originating in the superior salivatory nucleus carried on the facial nerve (CN VII) via the chorda tympani nerve, the lingual nerve, and across the submandibular ganglion.

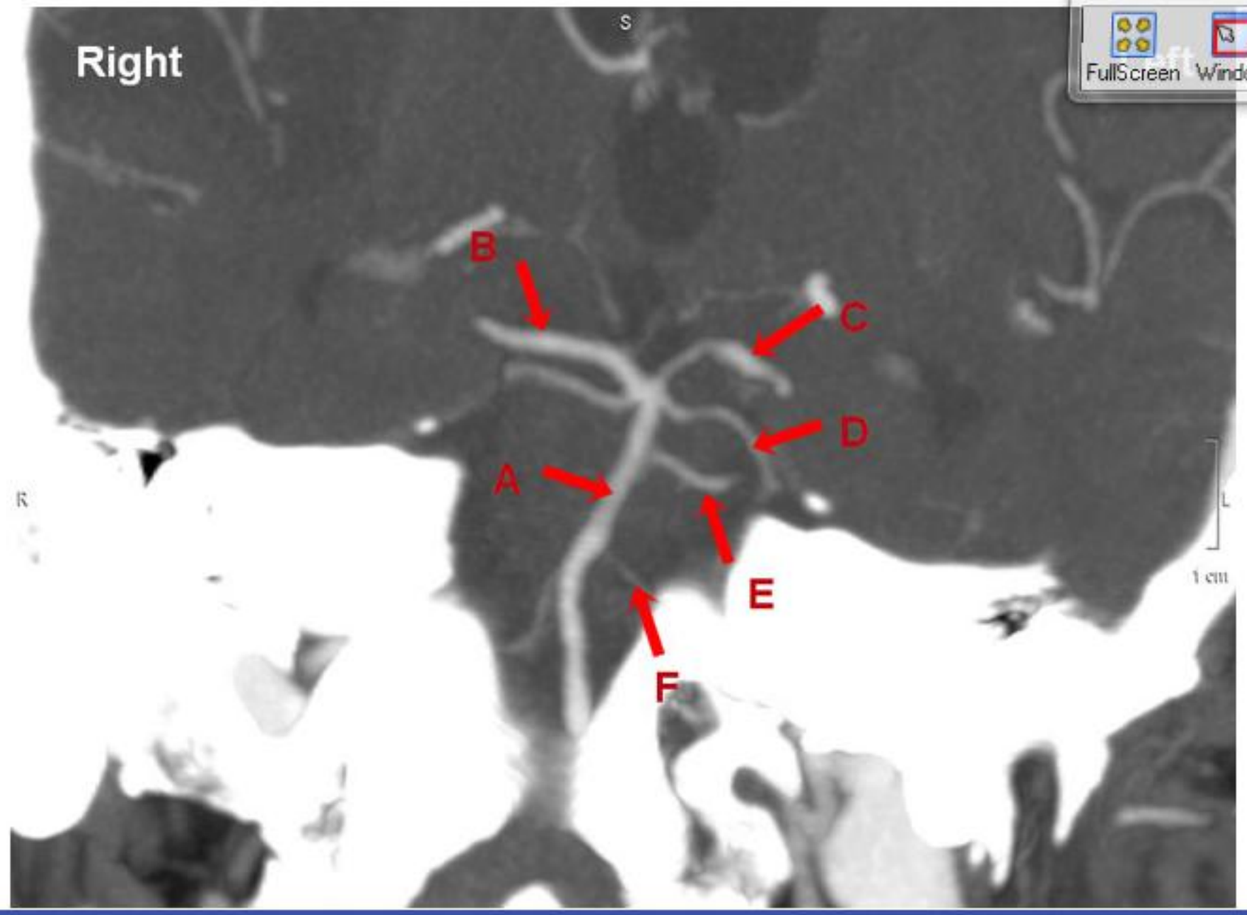
(Choice D) Protrusion of the tongue is mediated by motor efferent fibers carried by the hypoglossal nerve (CN XII).

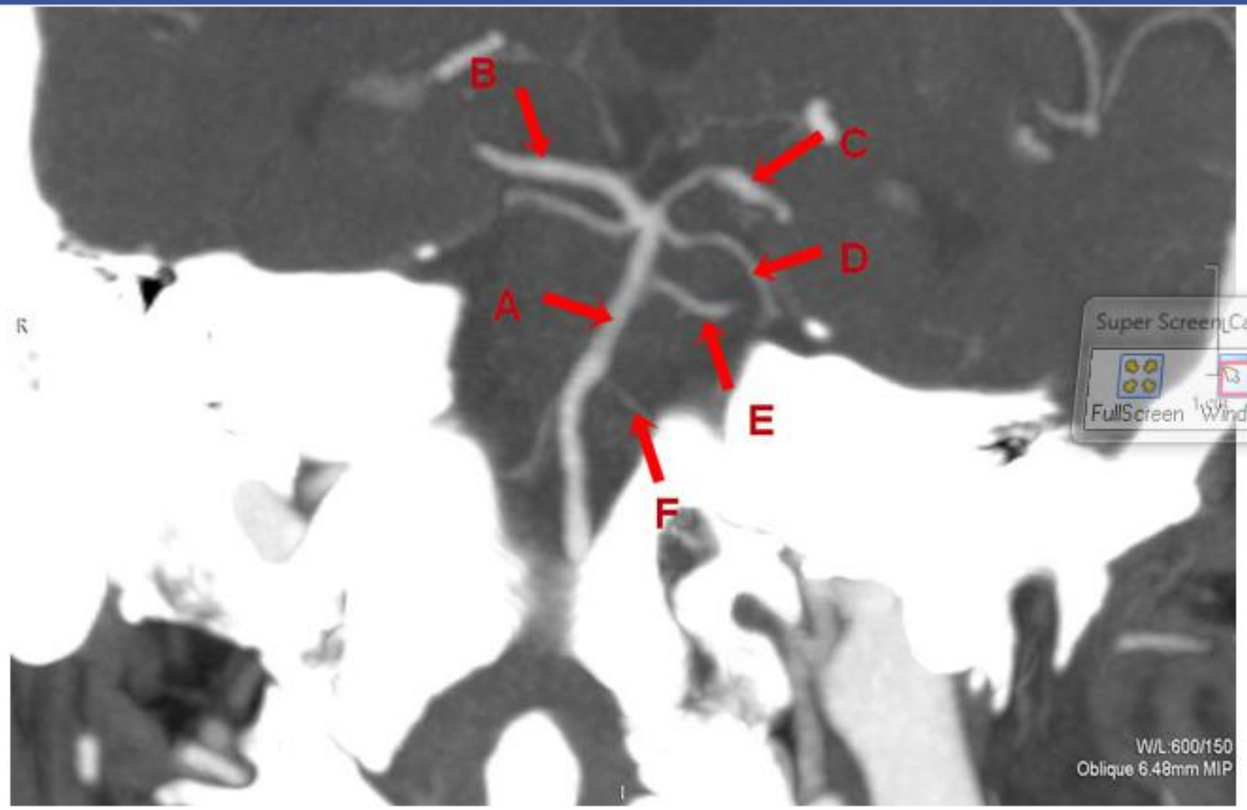
Educational Objective:
Lesions of the glossopharyngeal nerve result in loss of the gag reflex (afferent limb), loss of sensation in the upper pharynx, posterior tongue, tonsils, and middle ear cavity, and loss of taste sensation on the posterior one-third of the tongue.

Time Spent: 3 seconds

Last updated: [7/7/2010]

A 55-year-old, right-handed man comes to the emergency department because of recent onset of severe, throbbing, right-sided orbitofrontal headache and diplopia. His other medical problems include poorly controlled hypertension and chronic tobacco use. Neurologic examination shows that he is awake, alert, and oriented and follows both simple and complex commands. Testing of the cranial nerves reveals intact visual acuity bilaterally. Visual fields and optic fundi are normal. Examination shows anisocoria, with the right pupil being dilated and nonreactive to both light and accommodation. He has evidence of both vertical and horizontal binocular diplopia. The right eye is down and out with ipsilateral ptosis. The rest of the neurologic examination is within normal limits. CT angiography of the head reveals a large aneurysm in the posterior fossa. A normal CT angiogram of the head is shown below.





Which of the following identifiers from the angiogram indicates the cerebral vessel most likely to have an aneurysm causing this patient's neurologic deficits?

- A. A [4%]
- ✔ B. B [48%]
- C. C [22%]
- D. D [14%]
- E. E [7%]
- F. F [4%]

Explanation:

User Id: 477875

This patient is presenting with right non–pupil-sparing third nerve palsy secondary to a compressive aneurysm arising from the right posterior cerebral artery. It is important to remember that the third nerve courses between the posterior cerebral and superior cerebellar arteries as it leaves the midbrain and is susceptible to injury from an expanding aneurysm originating from these vessels. Chronic smoking and poorly controlled hypertension are risk factors for developing intracranial aneurysms.

The third cranial nerve (oculomotor) is a pure motor nerve carrying both the general visceral efferent (GVE) parasympathetic fibers and general somatic efferent (GSE) fibers. The GVE fibers course on the surface of the oculomotor nerve and subserve the pupillary light and near-reflex pathways. The GSE fibers course within the interior of the oculomotor nerve and subserve the skeletal muscles of the orbit (e.g., superior rectus, inferior rectus, medial rectus, inferior oblique, and levator palpebrae superioris). The GVE fibers are more susceptible to injury from a compression (e.g., aneurysm and tumor), while the GSE fibers are more susceptible to injury from ischemia (e.g., small-vessel disease due to diabetes mellitus).

(Choice A) The basilar artery is formed by two vertebral arteries. An aneurysm arising from the basilar artery typically does not lead to non–pupil-sparing third nerve palsy.

(Choice C) The posterior cerebral artery (PCA) arises from the basilar artery. An aneurysm arising from the left PCA will cause non–pupil-sparing third nerve palsy on the left but not the right.

(Choice D) The superior cerebellar artery (SCA) arises from the basilar artery before it bifurcates into the two posterior cerebral arteries. An aneurysm arising from the left SCA will cause non–pupil-sparing third nerve palsy on the left but not the right.

(Choice E) Aneurysms rarely arise from the parapontine perforating artery.

(Choice F) The anterior inferior cerebellar artery (AICA) arises from the basilar artery. An aneurysm arising from the AICA can compress the facial and vestibulocochlear nerves.

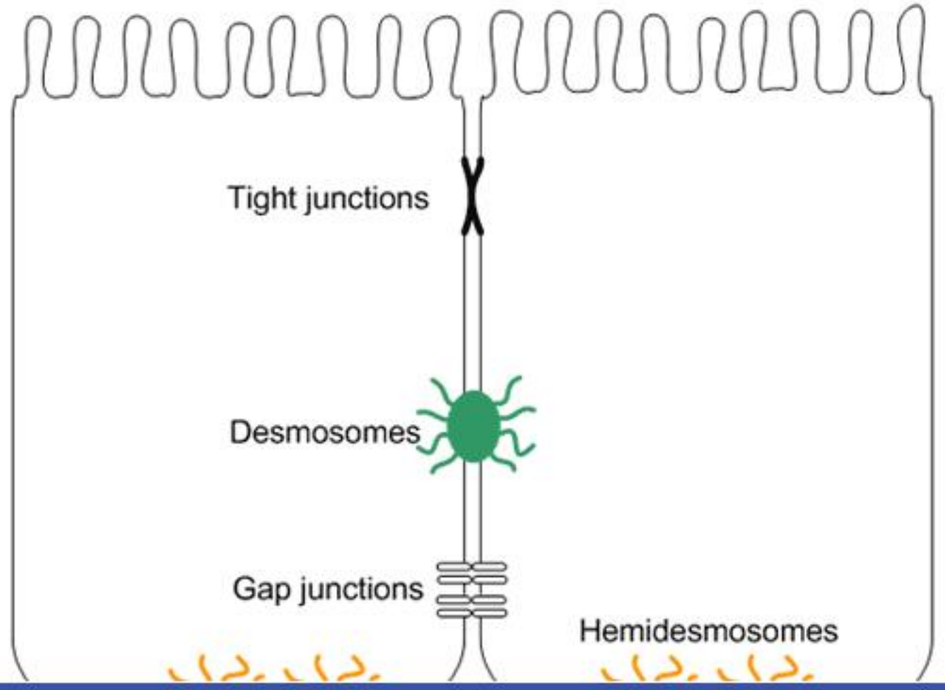
Educational objective:
The third cranial nerve (oculomotor) carrying general somatic efferent fiber and general visceral efferent parasympathetic fiber exits the midbrain and courses between the posterior cerebral and superior cerebellar arteries. An aneurysm arising from either artery can lead to a non–pupil-sparing third nerve palsy, which clinically presents with unilateral headache, eye pain, diplopia, dilated nonreactive pupil, and ptosis with the ipsilateral eye in a down and out position.

Muscle rigidity is observed in an experimental animal that has chemically-destroyed dopaminergic neurons of the substantia nigra. The animal's rigidity fails to improve with continuous dopamine infusion. Which of the following cell communications account for the lack of responsiveness to dopamine?

- A. Desmosomes [3%]
- B. Hemidesmosomes [2%]
- C. Intermediate junctions [4%]
- D. Fenestrae [4%]
- E. Gap junctions [29%]
- ✔ F. Tight junctions [57%]

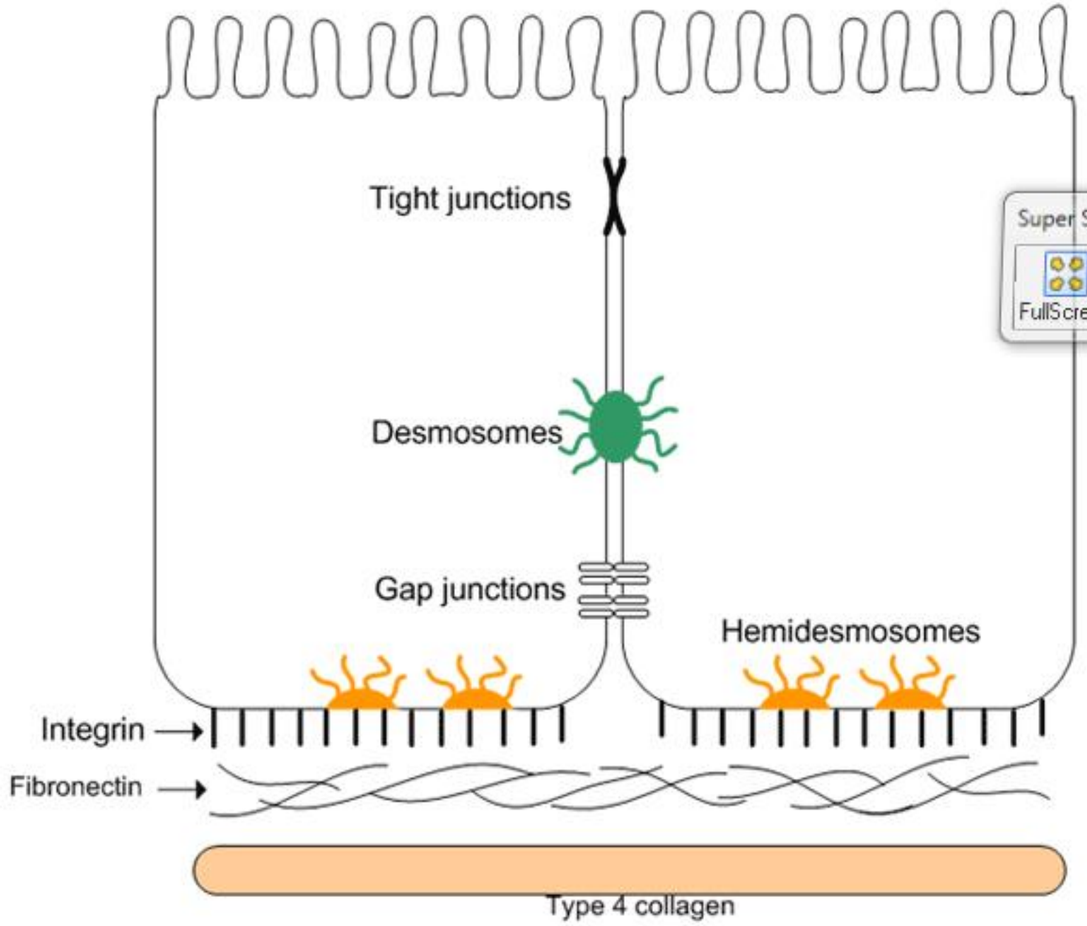
Explanation:

User Id: 477875



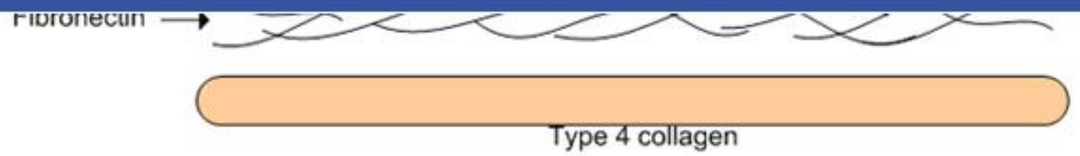
Explanation:

User Id: 477875



The experimental animal is unresponsive to an intravenous dopamine infusion due to the fact that intravenous dopamine is unable to cross the blood-brain barrier. Capillaries of the blood-brain barrier are not fenestrated, so paracellular passage of fluid and dissolved material does not occur in the CNS. The primary mediators of the blood-brain barrier are tight junctions between the endothelial cells of CNS capillaries. Tight junctions, also known as zonula occludens, are formed via the interaction of specialized transmembrane proteins with one another, such as occludens and claudens, on capillary endothelial cells. Due to tight junctions, the only

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42



The experimental animal is unresponsive to an intravenous dopamine infusion due to the fact that intravenous dopamine is unable to cross the blood-brain barrier. Capillaries of the blood-brain barrier are not fenestrated, so paracellular passage of fluid and dissolved material does not occur in the CNS. The primary mediators of the blood-brain barrier are tight junctions between the endothelial cells of CNS capillaries. Tight junctions, also known as zonula occludens, are formed via the interaction of specialized transmembrane proteins with one another, such as occludens and claudens, on capillary endothelial cells. Due to tight junctions, the only way that material can pass from the bloodstream to the brain is by transcellular movement, which is limited by the size and lipophilicity of the molecule and by carrier-mediated transport.

(Choice A) Desmosomes are referred to as "spot welds" and function as anchors holding adjoining cells together. They are most notable in the skin where they can be observed microscopically in the stratum spinosum.

(Choice B) Hemidesmosomes are similar to desmosomes, but they serve to bind the basal layer of epithelial cells to the basement membrane. Diseases of the hemidesmosome in the skin include bullous pemphigoid and junctional epidermolysis bullosa.

(Choice C) Intermediate junctions occur on surface epithelial cells below tight junctions and assist in cell-cell adhesion.

(Choice D) Fenestrae are small pores in endothelial cells that allow free exchange of intravascular fluid with extravascular fluid in the tissue surrounding the capillary bed.

(Choice E) Gap junctions are channels between cells that allow the free exchange of solute and fluid. They are typically formed by connexin proteins.

Educational Objective:
The tight junctions between endothelial cells in the capillary beds of the CNS form the blood-brain barrier. Solutes and fluids cannot move freely across the capillary membrane in the CNS; material can only move transcellularly by diffusing across the epithelial plasma membranes or by carrier-mediated transport.

Time Spent: 2 seconds

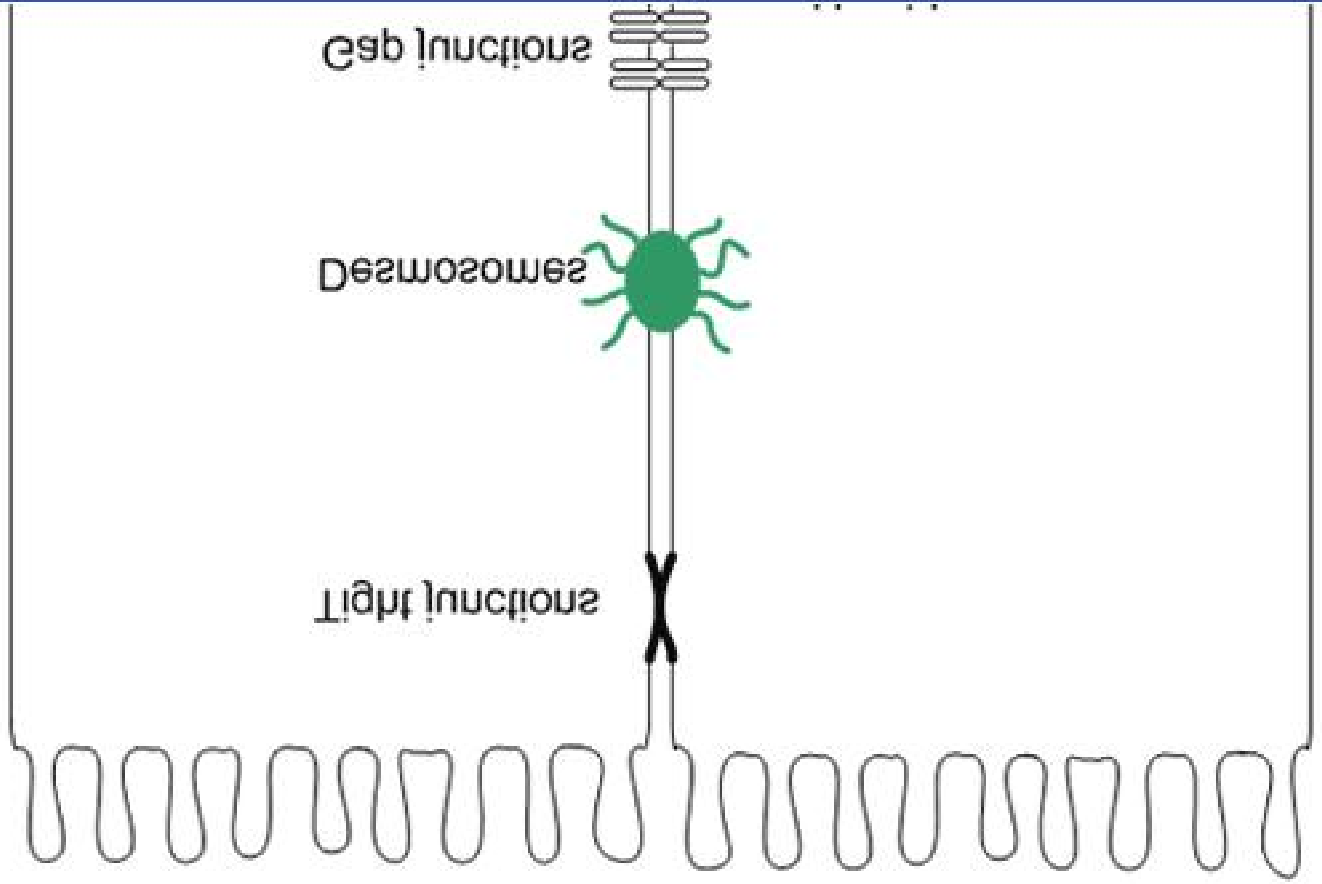
Last updated: [7/7/2010]

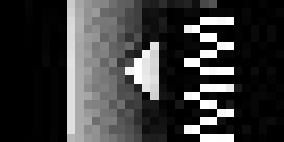
Muscle rigidity is observed in an experimental animal that has chemically-destroyed dopaminergic neurons of the substantia nigra. The animal's rigidity fails to improve with continuous dopamine infusion. Which of the following cell communications account for the lack of responsiveness to dopamine?

- A. Desmosomes [3%]
- B. Hemidesmosomes [2%]
- C. Intermediate junctions [4%]
- D. Fenestrae [4%]
- E. Gap junctions [29%]
- F. Tight junctions [57%] ✓

Explanation:

User Id: 477876





The following vignette applies to the next **2** items. The items in the set must be answered in sequential order. Once you click **Proceed to Next Item**, you will not be able to add or change an answer.

A 62-year-old female comes to the ER complaining of difficulty walking that started three hours ago. She also says that she cannot feel her right side. Physical examination reveals loss of touch sensation affecting the right upper and lower extremities and the right side of the face. Her muscle strength is 5/5 in all extremities.

Item 1 of 2
This patient has most likely suffered a stroke affecting which of the following brain

- A. Frontal cortex [9%]
- B. Internal capsule [29%]
- C. Base of the pons [14%]
- D. Caudate nucleus [4%]
- ✔ E. Thalamus [44%]

Explanation: **User Id: 477875**

The patient described is experiencing the thalamic syndrome. In this syndrome, a vascular lesion of the thalamus, such as an ischemic or hemorrhagic stroke, results in damage to the thalamic VPL and VPM nuclei, causing complete contralateral sensory loss. There are also often severe proprioceptive defects that lead to unsteady gait and falls. Patients with incomplete lesions or partial resolution of the thalamic lesion may develop abnormal painful sensations on the affected side of the body.

(Choice A) Frontal cortex lesions cause deficits of higher brain function, altering patterns of spontaneity, creativity, sexual interest and social behavior.

(Choice B) A lesion of the internal capsule would cause a motor deficit.

D. Caudate nucleus [4%]

✔ E. Thalamus [44%]

Explanation:

The patient described is experiencing the thalamic syndrome. In this syndrome, a vascular lesion of the thalamus, such as an ischemic or hemorrhagic stroke, results in damage to the lateral thalamic nuclei, causing complete contralateral sensory loss. There are also often severe proprioceptive defects that lead to unsteady gait and falls. Patients with incomplete lesions or partial resolution of the thalamic lesion may develop abnormal painful sensations on the affected side of the body.

(Choice A) Frontal cortex lesions cause deficits of higher brain function, altering patterns of spontaneity, creativity, sexual interest and social behavior.

(Choice B) A lesion of the internal capsule would cause a motor deficit.

(Choice C) Ischemic events in the pons are frequently associated with coma, bilateral paralysis, decerebrate rigidity, pinpoint pupils and often death.

(Choice D) Damage to the caudate nucleus is associated with transient hemiparesis as well as frontal lobe symptoms such as inattentiveness, abulia, and forgetfulness. There may also be agitation, psychosis, choreoathetosis and other dyskinesias.

Educational objective:
The thalamic syndrome is characterized by total sensory loss on the contralateral side of the body. Although there are no motor deficits, proprioception is often profoundly affected and may lead to difficulty ambulating and falls.

References:

1. **Pure sensory stroke. Clinical-radiological correlates of 21 cases.**

Time Spent: 5 seconds

Last updated: [1/16/2013]

Item 2 of 2

The patient was diagnosed with a pure sensory stroke and received the appropriate treatment. Her symptoms improved, and after a few weeks of physical rehabilitation, she returned home to live with her daughter. Five years later, the patient dies of a large myocardial infarction. On autopsy, there are two 5-6 mm cavities in the deep structures of her brain filled with clear fluid. Which of the following best explains the autopsy findings?

- A. Carotid atherosclerosis [19%]
- B. Malignant cell infiltration [3%]
- C. Mitral valve disease [6%]
- D. Oligodendrocyte apoptosis [36%]
- ✔ E. Small vessel lipohyalinosis [36%]

Explanation: **User Id: 477875**

Small, approximately 5mm cavities located within the basal ganglia, posterior limb of the internal capsule, pons, and cerebellum are known as lacunar infarctions. These infarctions result from occlusion of the small penetrating arteries that supply these structures, most commonly in the setting of chronic uncontrolled hypertension or diabetes mellitus.

Lipohyalinosis and microatheromas are believed to be the primary causes of lacunar infarcts. Lipohyalinosis is a destructive vessel lesion characterized by loss of normal arterial architecture, mural foam cells, and, in acute cases, evidence of fibrinoid vessel wall necrosis. Microatheromas result from an accumulation of lipid-laden macrophages within the intimal layer of a vessel. In the case of lacunar infarcts, they cause occlusion of a penetrating artery at or near its origin off the parent vessel.

(Choices A & C) Mitral valve disease and carotid atherosclerosis commonly cause cerebral infarction secondary to embolism. They can also release microemboli, which are thought to cause lacunar infarcts when no other pathological cause can be identified. However, lipohyalinosis and microatheroma are more commonly identified as the cause of lacunar infarcts at the time of autopsy.

(Choice B) Malignant cell infiltration would tend to cause a space-occupying lesion rather than a small cavity. The center of a large tumor may form a cavity due to insufficient perfusion with resultant necrosis, but

- D. Oligodendrocyte apoptosis [36%]
- ✔ E. Small vessel lipohyalinosis [36%]

Explanation:

User Id: 477875

Small, approximately 5mm cavities located within the basal ganglia, posterior limb of the internal capsule, pons, and cerebellum are known as lacunar infarctions. These infarctions result from occlusion of the small penetrating arteries that supply these structures, most commonly in the setting of chronic uncontrolled hypertension or diabetes mellitus.

Lipohyalinosis and microatheromas are believed to be the primary causes of lacunar infarcts. Lipohyalinosis is a destructive vessel lesion characterized by loss of normal arterial architecture, mural foam cells, and, in acute cases, evidence of fibrinoid vessel wall necrosis. Microatheromas result from an accumulation of lipid-laden macrophages within the intimal layer of a vessel. In the case of lacunar infarcts, they cause occlusion of a penetrating artery at or near its origin off the parent vessel.

(Choices A & C) Mitral valve disease and carotid atherosclerosis commonly cause cerebral infarction secondary to embolism. They can also release microemboli, which are thought to cause lacunar infarcts when no other pathological cause can be identified. However, lipohyalinosis and microatheroma are more commonly identified as the cause of lacunar infarcts at the time of autopsy.

(Choice B) Malignant cell infiltration would tend to cause a space-occupying lesion rather than a small cavity. The center of a large tumor may form a cavity due to insufficient perfusion with resultant necrosis, but histopathologically, tumor would be identified around such a cavity. This patient's history is more consistent with lacunar strokes.

(Choice D) Oligodendrocyte apoptosis occurs in multiple sclerosis, a demyelinating disease of the central nervous system. The CNS lesions in multiple sclerosis do not form cavities; rather, the lesions are grossly evident as pink patches in the white matter tracts.

Educational objective:
Lacunar infarctions are the result of small vessel lipohyalinosis and atherosclerosis involving the penetrating vessels supplying the deep brain structures. Uncontrolled hypertension and diabetes mellitus are risk factors for this condition.

Time Spent: 3 seconds

Last updated: [1/16/2013]

A 22-year-old male presents to your office complaining of occasional headaches. On exam, you note several pigmented spots on his trunk. You also discover a few rubbery cutaneous tumors on his neck. The cells composing these skin tumors most likely originated from which of the following structures?

- A. Surface ectoderm [8%]
- B. Neuroectoderm [32%]
- ✔ C. Neural crest [52%]
- D. Mesoderm [4%]
- E. Endoderm [2%]
- F. Notochord [1%]

Explanation:

User Id: 477875

This patient has pigmented lesions that are most likely a café-au-lait macules, and headaches that could be due to a glioma—both of which are common presentations of Neurofibromatosis Type I.

The tumors of interest in the question stem are neurofibromas. Neurofibromas are tumors of Schwann cells, which are derived from the neural crest. On exam, cutaneous neurofibromas are skin-colored or pink nodules with a rubbery texture that exhibit pathognomonic "buttonholing". The latter refers to the examiner's perception that these tumors "buttonhole" down through the skin with gentle pressure.

(Choice A) The surface ectoderm gives rise to the skin and its appendages, the nasal and oral epithelium, the anal epithelium to the dentate line, and the lens and cornea.

(Choice B) The neuroectoderm gives rise to all neurons of the CNS, the neurohypophysis, the retina, the pineal gland, preganglionic autonomic fibers, astrocytes, ependymal cells, and the choroid plexus.

(Choice D) The mesoderm is divided into paraxial, intermediate, and lateral sections and gives rise to muscles, bones, blood, genital tissues, the dermis, and most organ systems. Notably, the mesoderm does not give rise to any epithelial surfaces.

(Choice E) The endoderm gives rise to thyroid tissues (descendent from the base of the tongue) and the epithelial linings of the GI tract, lung, urethra, bladder, and outer and middle ear. The endoderm also gives rise

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

F. Notochord [1%]

Explanation: **User Id: 477875**

This patient has pigmented lesions that are most likely a café-au-lait macules, and headaches that could be due to a glioma—both of which are common presentations of Neurofibromatosis Type I.

The tumors of interest in the question stem are neurofibromas. Neurofibromas are tumors of Schwann cells, which are derived from the neural crest. On exam, cutaneous neurofibromas are skin-colored or pink nodules with a rubbery texture that exhibit pathognomonic "buttonholing". The latter refers to the examiner's observation that these tumors "buttonhole" down through the skin with gentle pressure.

(Choice A) The surface ectoderm gives rise to the skin and its appendages, the nasal and oral epithelium, the anal epithelium to the dentate line, and the lens and cornea.

(Choice B) The neuroectoderm gives rise to all neurons of the CNS, the neurohypophysis, the retina, the pineal gland, preganglionic autonomic fibers, astrocytes, ependymal cells, and the choroid plexus.

(Choice D) The mesoderm is divided into paraxial, intermediate, and lateral sections and gives rise to muscles, bones, blood, genital tissues, the dermis, and most organ systems. Notably, the mesoderm does not give rise to any epithelial surfaces.

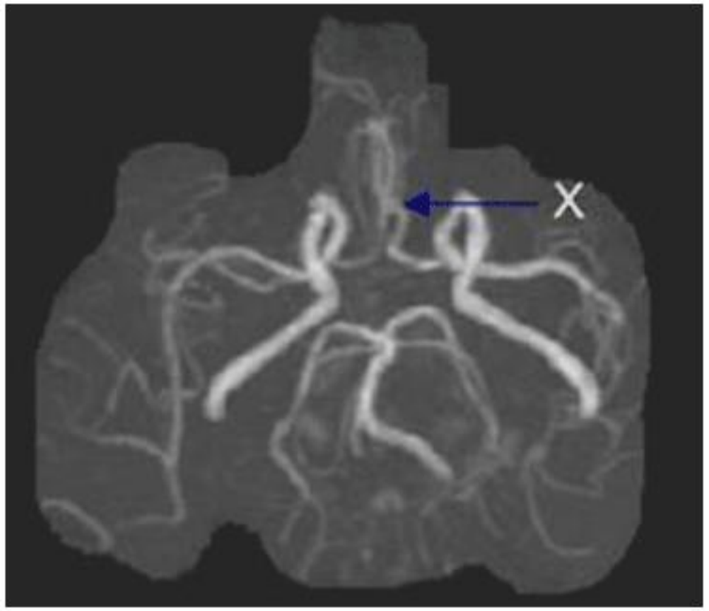
(Choice E) The endoderm gives rise to thyroid tissues (descendent from the base of the tongue) and the epithelial linings of the GI tract, lung, urethra, bladder, and outer and middle ear. The endoderm also gives rise to the bulk of the liver, pancreas, and lungs, as these structures form from outpouchings of the primitive gut tube.

(Choice F) The notochord almost completely regresses in humans. The only major vestige is the nucleus pulposus in the intervertebral disks. Vertebrae form from the paraxial mesoderm.

Educational Objective:
Neurofibromatosis Type I (NF1, or von Recklinghausen's disease) is a common autosomal-dominant disorder resulting from a defect in the NF-1 gene on chromosome 17. Cutaneous and subcutaneous neurofibromas are common in this condition and are tumors of Schwann cells, which are embryologically derived from the neural crest.

Time Spent: 1 seconds Last updated: [1/10/2013]

Shown below are the cerebral arteriography findings from a 45-year-old patient.



Occlusion of the artery labeled 'X' would most likely result in an inability to:

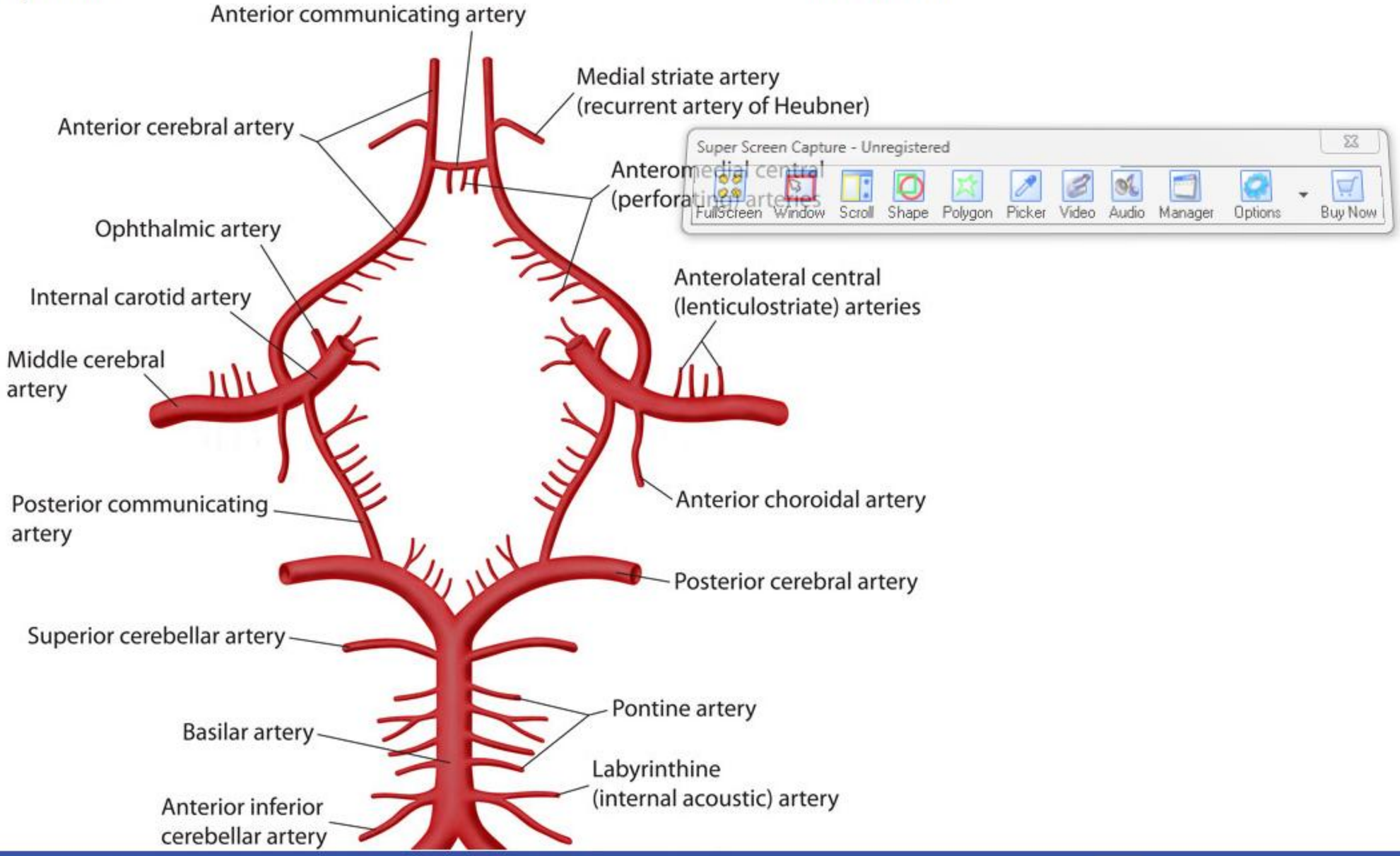
- ✔ A. Climb stairs [70%]
- B. Grip [9%]
- C. Whistle [10%]
- D. Swallow food [11%]

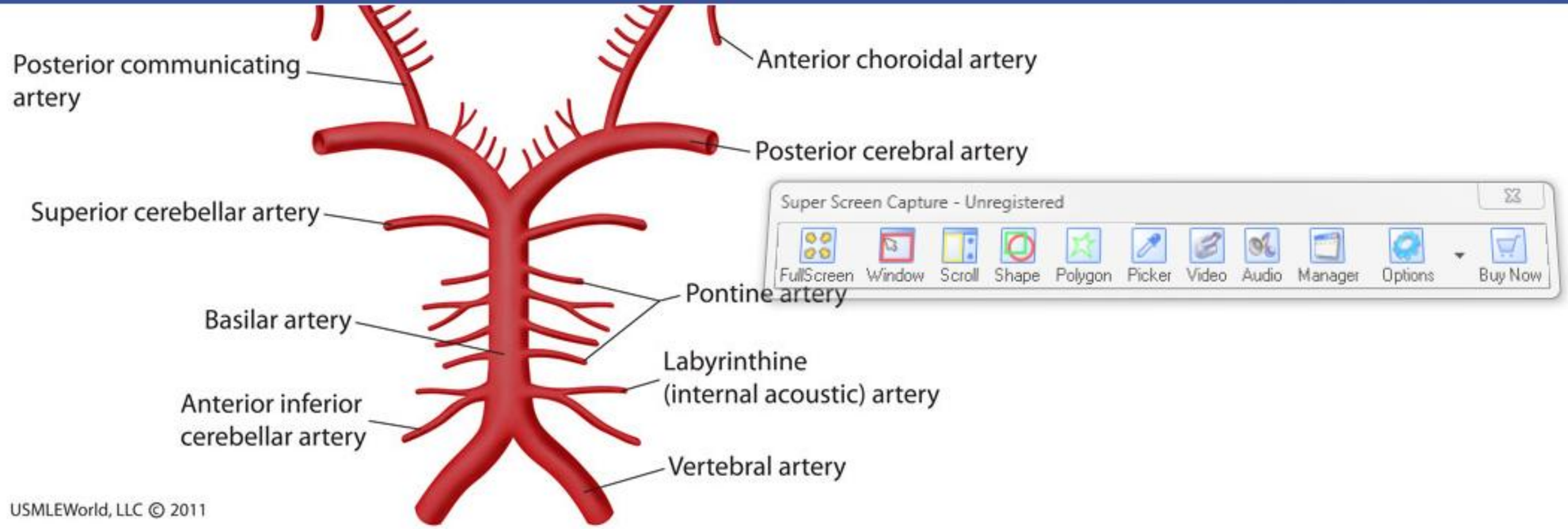
Explanation:

User Id: 477875

Explanation:

User Id: 477875





This cerebral angiogram image is projected axially, with the top of the image representing anterior regions and the bottom representing posterior regions. The very large vessels seen bilaterally are the internal carotid arteries. Each gives off a middle cerebral artery to supply more lateral regions and an anterior cerebral artery, which extends medially. The above "X" marks an anterior cerebral artery. Each anterior cerebral artery supplies the medial region of the ipsilateral hemisphere, from the frontal pole to the parietooccipital sulcus. Occlusion of the anterior cerebral artery would affect motor function of the contralateral leg and foot.

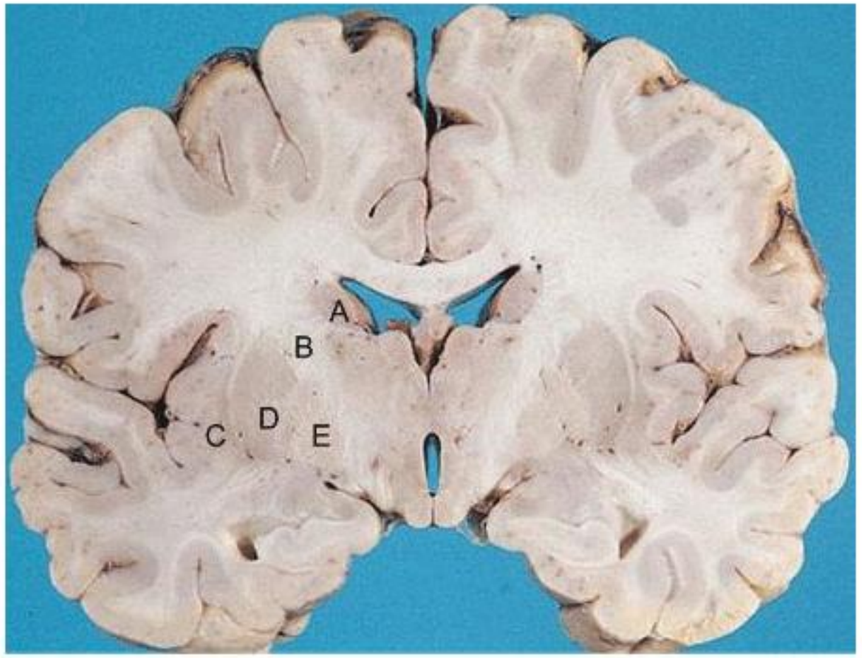
(Choices B, C and D) Motor control of the hand, head and neck would be affected by occlusion of the middle cerebral artery.

Educational Objective:
The anterior cerebral arteries supply the medial portions of the two hemispheres. Occlusion causes weakness of the contralateral legs and sensory deficits of the contralateral legs, trunk and genitals. There may also be behavior and mood changes due to injury of frontal lobe structures.

Time Spent: 4 seconds

Last updated: [1/4/2013]

A 45-year-old male presents with left arm clumsiness. Physical examination reveals motor weakness and increased muscle tone in the left arm. Specifically, with passive extension of the left arm there is initial resistance then sudden release when maximum extension is reached. Pathology within which of the following brain structures is most likely responsible?



- A. A [15%]
- ✔ B. B [42%]
- C. C [9%]
- D. D [17%]
- E. E [16%]

- A. A [15%]
- ✔ B. B [42%]
- C. C [9%]
- D. D [17%]
- E. E [16%]

Explanation: **User Id: 477875**

This patient has "clasp knife spasticity," characterized by initial jerking resistance to passive extension followed by sudden release of resistance. This form of spasticity is typical of an upper motor neuron lesion. Potential sites for upper motor neuron lesions include the corticospinal tracts of the spinal cord; the medulla, pons and midbrain; the internal capsule; or the precentral gyrus (primary motor cortex). Of these, the internal capsule is the only structure labeled above **(Choice B)**. In general, upper motor neuron lesions cause spastic paresis, hyperreflexia, and a positive Babinski sign. The clasp knife phenomenon is a form of spasticity that results from a lack of upper motor neuron inhibitory control on the spinal muscle stretch reflex arc.

(Choice A) This is the caudate nucleus, the structure affected by Huntington's disease.

(Choice C) This is the insular cortex (insula), which plays a role in the limbic system (emotion).

(Choice D) This is the putamen.

(Choice E) This is the globus pallidus.

Educational Objective:
Upper motor neuron lesions cause spastic rigidity, hyperreflexia, and paresis. Corticospinal tract, internal capsule (posterior limb), and primary motor cortex lesions can cause these symptoms.

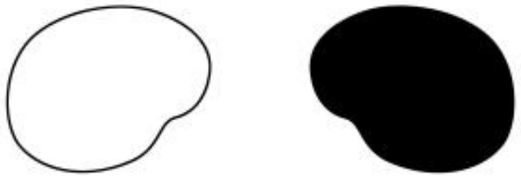
Time Spent: 9 seconds

Last updated: [11/10/2011]

A 57-year-old man is brought to the emergency department following a generalized tonic-clonic seizure. His wife reports that he has no history of seizures. However, she says that he has been complaining of intermittent headaches, memory loss, and problems with his vision for the past 2 weeks. Brain imaging shows a solitary mass within the right temporal lobe. Which of the following visual field defects is most likely present in this patient?

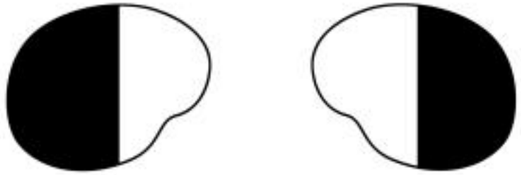
Left **Right**

A.



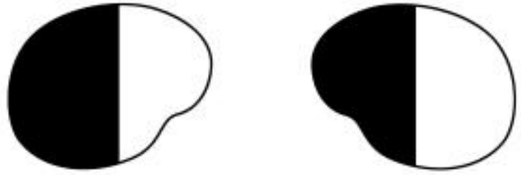
[3%]

B.



[5%]

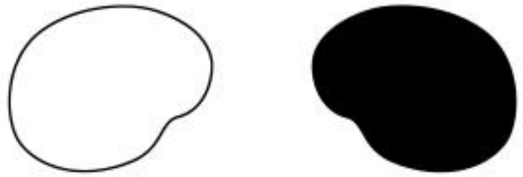
C.



[26%]

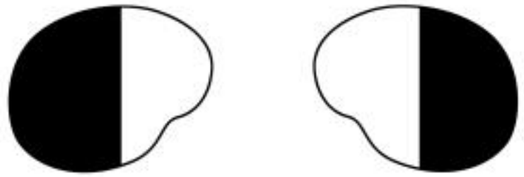
D.

A.



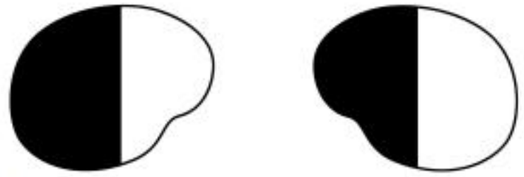
[3%]

B.



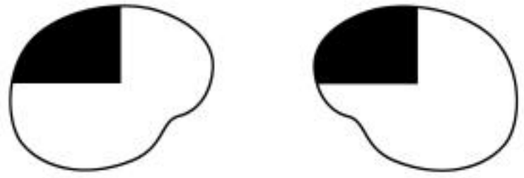
[5%]

C.



[26%]

D.

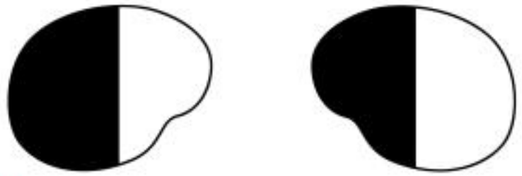


[58%]

E.

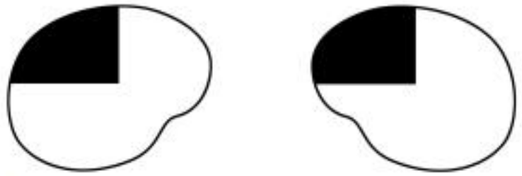
[5%]

C.



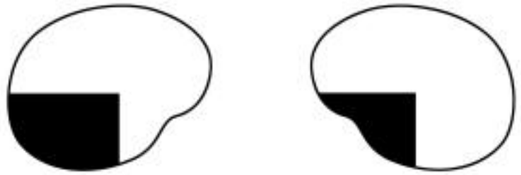
[26%]

D.



[58%]

E.



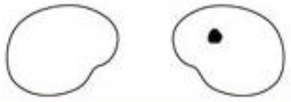
[7%]

Explanation:

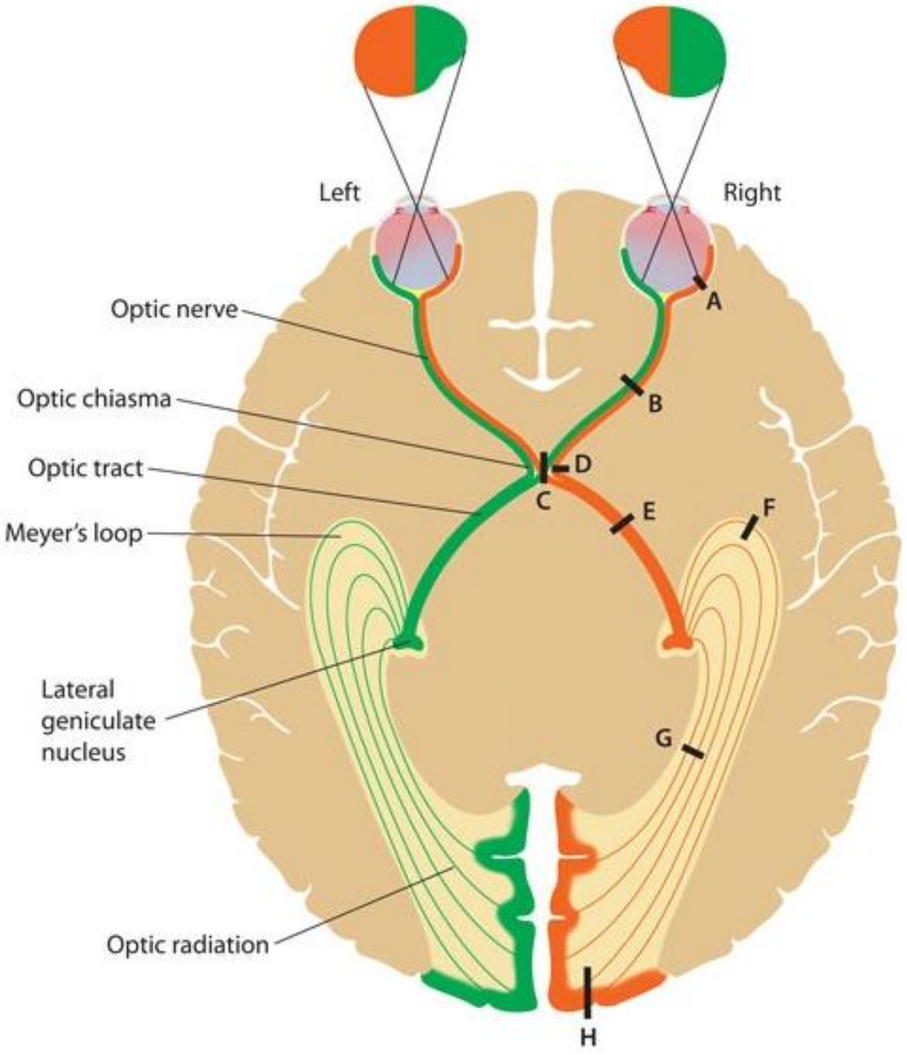
User Id: 477875

Visual pathways from above

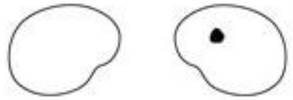
A. Monocular scotoma



Visual pathways from above



A. Monocular scotoma

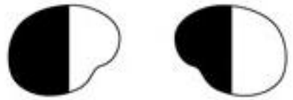


B. Right anopia

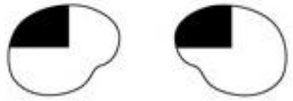
C. Bitemporal hemianopia

D. Right nasal hemianopia

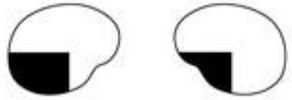
E. Left homonymous hemianopia



F. Left homonymous superior quadrantanopia ("pie in the sky")



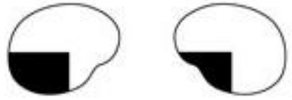
G. Left homonymous inferior quadrantanopia ("pie on the floor")



H. Left homonymous hemianopia with macular sparing

• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

G. Left homonymous inferior quadrantanopia ("pie on the floor")



H. Left homonymous hemianopia with macular sparing

Damage to the visual pathway produces distinct types of visual field defects depending on the location of the lesion. Visual perception begins with light from the nasal visual fields striking the temporal side of each retina and light from the temporal visual fields striking the nasal side of each retina. Information from the retina is then transmitted by the optic nerves to the optic chiasm. At the optic chiasm, optic nerve fibers from the nasal half of each retina cross and project into the contralateral optic tract. In contrast, nerve fibers from the temporal parts pass into the ipsilateral optic tract. The optic tract thus contains nerve fibers from the temporal part of the ipsilateral retina and the nasal part of the contralateral retina. Optic tract fibers project mainly to the lateral geniculate nucleus (LGN), but also project to superior colliculus (reflex gaze), pretectal area (light reflex), and the suprachiasmatic nucleus (circadian rhythms).

Axons from the LGN that project to the striate (primary visual) cortex are known as the optic radiation (or geniculocalcarine tract). The lower fibers of the optic radiation carry information from the lower retina (upper contralateral visual field) and take a circuitous route anteriorly into the temporal lobe (Meyer's loop) before reaching the lingual gyrus of the striate cortex. The upper fibers of the optic radiation carry information from the upper retina (lower contralateral visual field) and pass more directly from the LGN through the parietal lobe to reach the cuneus gyrus of the striate cortex.

Lesions in the temporal lobe can disrupt Meyer's loop and produce a contralateral superior quadrantanopia. Temporal lobe lesions can also produce other neurologic manifestations, including aphasia (dominant hemisphere lesions), memory deficits, seizures (complex partial and tonic-clonic), and hallucinations (auditory, olfactory, and visual).

Educational objective:
Injury to Meyer's loop in the temporal lobe results in contralateral superior quadrantanopia.

Time Spent: 19 seconds

Last updated: [2/6/2013]

A highly agitated 54-year-old man is brought to the emergency department by his family because he is unable to effectively communicate. He speaks clearly and with conviction but his sentences are incomprehensible. He does not appear to understand the doctor's questions, does not follow oral or written instructions, and cannot repeat simple phrases. Branch occlusion of which of the following arteries is most likely responsible for this patient's condition?

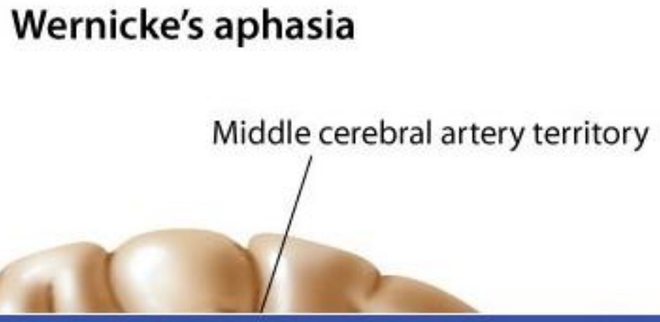
- A. Anterior cerebral artery [2%]
- B. Anterior inferior cerebellar artery [3%]
- ✔ C. Middle cerebral artery [89%]
- D. Posterior cerebral artery [5%]
- E. Posterior inferior cerebellar artery [0%]

Explanation:

User Id: 477875

This patient has fluent aphasia, a form of receptive aphasia characterized by speech that is fluent, well articulated, and melodic - but meaningless. Individuals stricken with fluent aphasia cannot understand verbal or written language. Repetition is usually affected to the same degree as the impairment in comprehension. Typically, patients will have no awareness of their cognitive deficit. Fluent aphasia is often produced by a lesion in Wernicke's area, which is located in the auditory association cortex within the posterior portion of the superior temporal gyrus in the dominant (usually left) temporal lobe.

The regions of the cerebral cortex supplied by the middle cerebral artery (MCA) are approximated by the red oval in the image below. The inferior terminal MCA branches supply Wernicke's area.

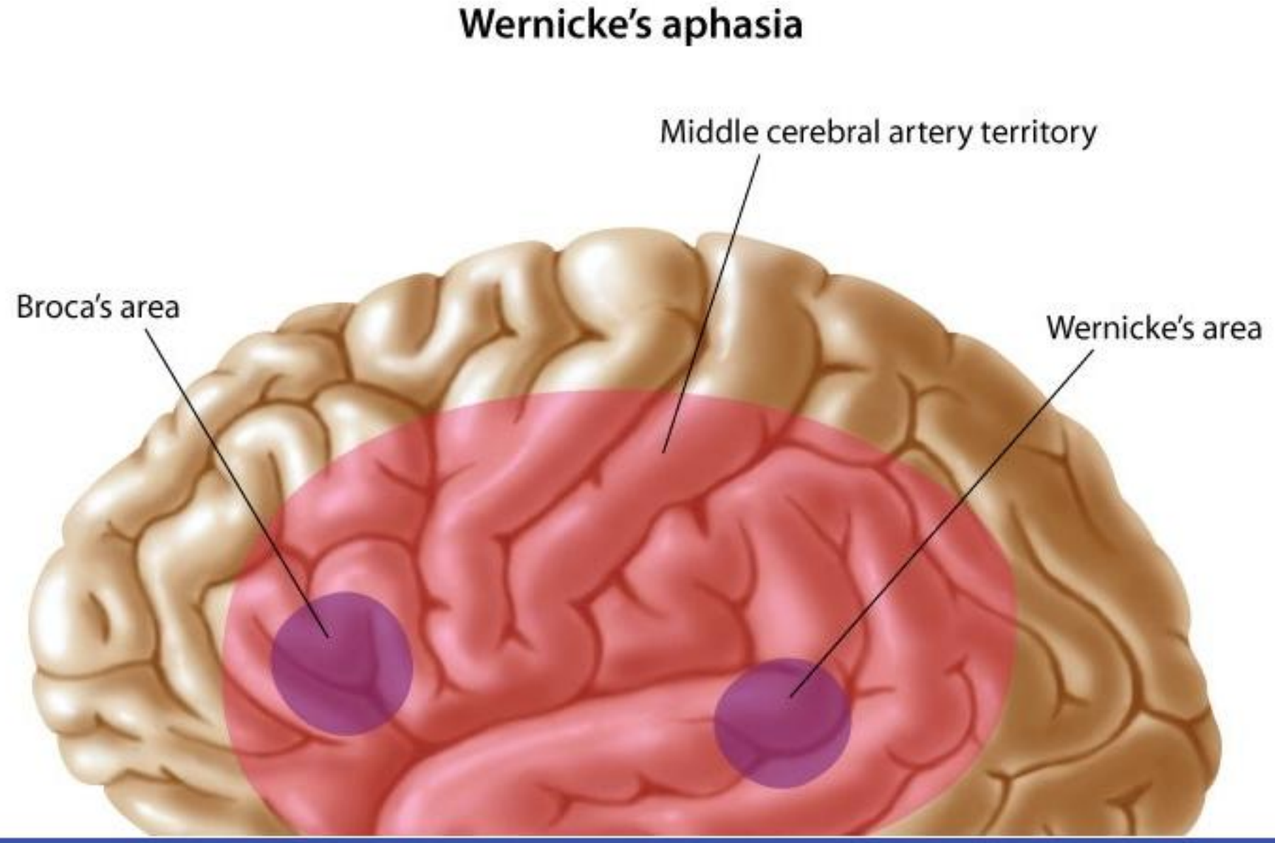


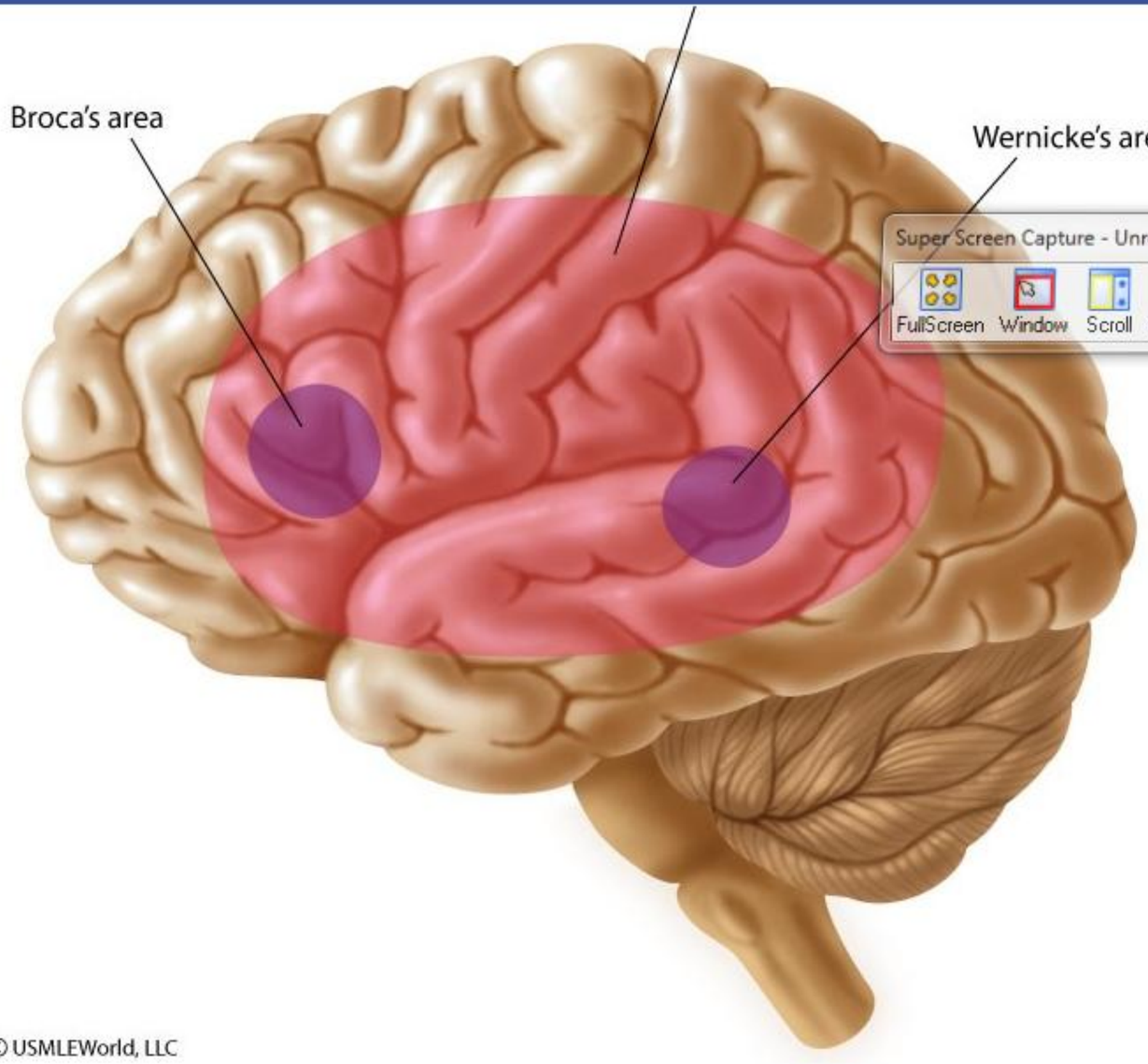
Explanation:

User Id: 477875

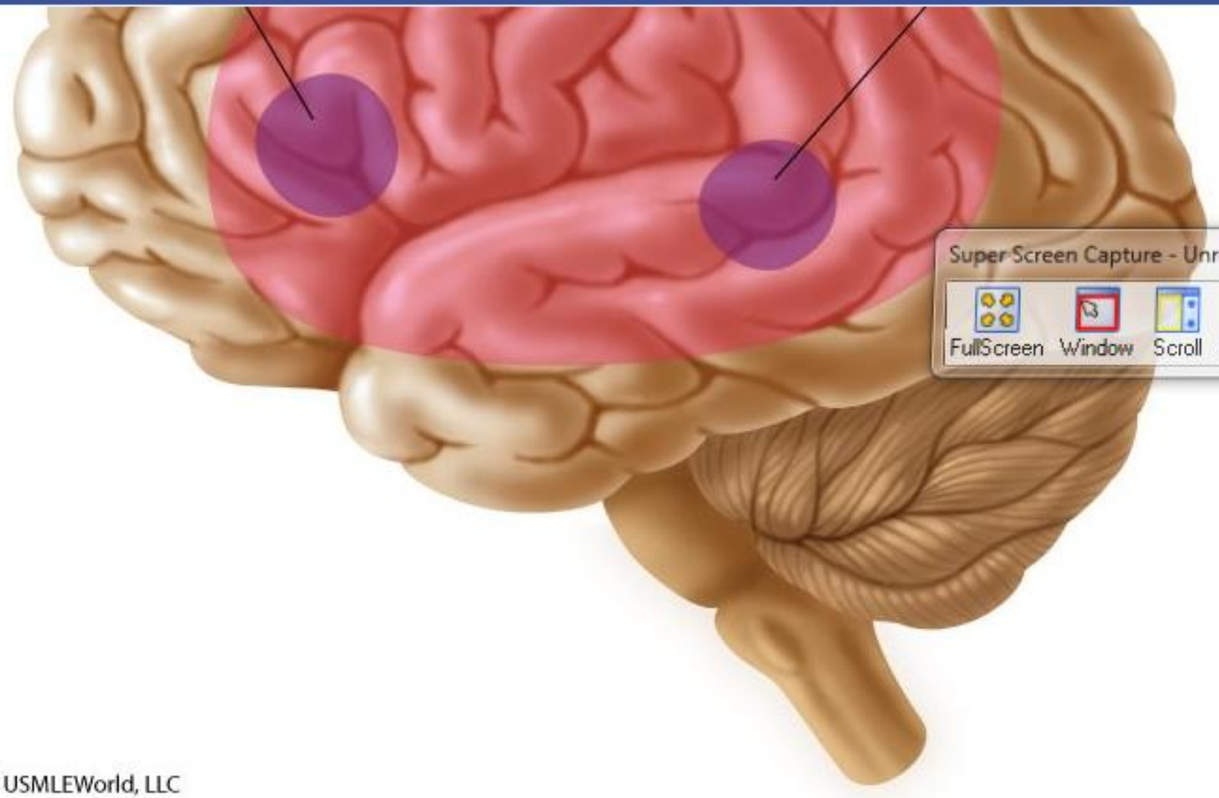
This patient has fluent aphasia, a form of receptive aphasia characterized by speech that is fluent, well articulated, and melodic - but meaningless. Individuals stricken with fluent aphasia cannot understand verbal or written language. Repetition is usually affected to the same degree as the impairment in comprehension. Typically, patients will have no awareness of their cognitive deficit. Fluent aphasia is often produced by a lesion in Wernicke's area, which is located in the auditory association cortex within the posterior portion of the superior temporal gyrus in the dominant (usually left) temporal lobe.

The regions of the cerebral cortex supplied by the middle cerebral artery (MCA) are approximated by the red oval in the image below. The inferior terminal MCA branches supply Wernicke's area.





(Choices A, B, D, and E) The anterior cerebral artery, anterior inferior cerebellar artery, posterior cerebral artery, and posterior inferior cerebellar artery do not typically service Wernicke's area. Consequently,



(Choices A, B, D, and E) The anterior cerebral artery, anterior inferior cerebellar artery, posterior cerebral artery, and posterior inferior cerebellar artery do not typically service Wernicke's area. Consequently, occlusions of these arteries would not be associated with Wernicke's aphasia.

Educational objective:
A lesion in Wernicke's area can cause receptive aphasia, which is characterized by well-articulated, nonsensical speech paired with a lack of language comprehension (**W**ernicke-**W**ord salad). Wernicke's area is located in the auditory association cortex within the posterior portion of the superior temporal gyrus in the dominant temporal lobe. The middle cerebral artery supplies Broca's area (superior division) and Wernicke's area (inferior division).

Time Spent: 2 seconds

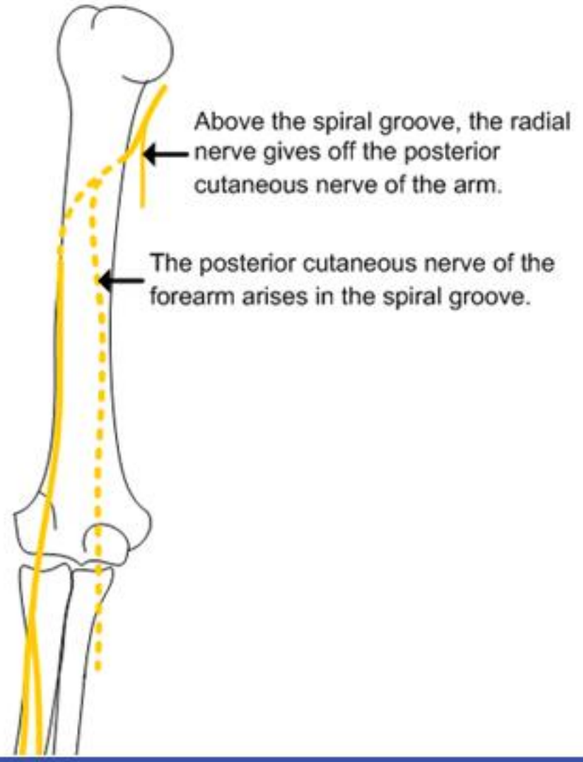
Last updated: [5/23/2013]

A patient presents to the emergency room with weak wrist extension. On physical examination, sensation to the arm is intact. The affected nerve was most likely injured at which of the following locations?

- A. Carpal tunnel [9%]
- B. Hook of the hamate [11%]
- C. Surgical neck of the humerus [16%]
- ✔ D. Head of the radius [55%]
- E. Coracobrachialis [8%]

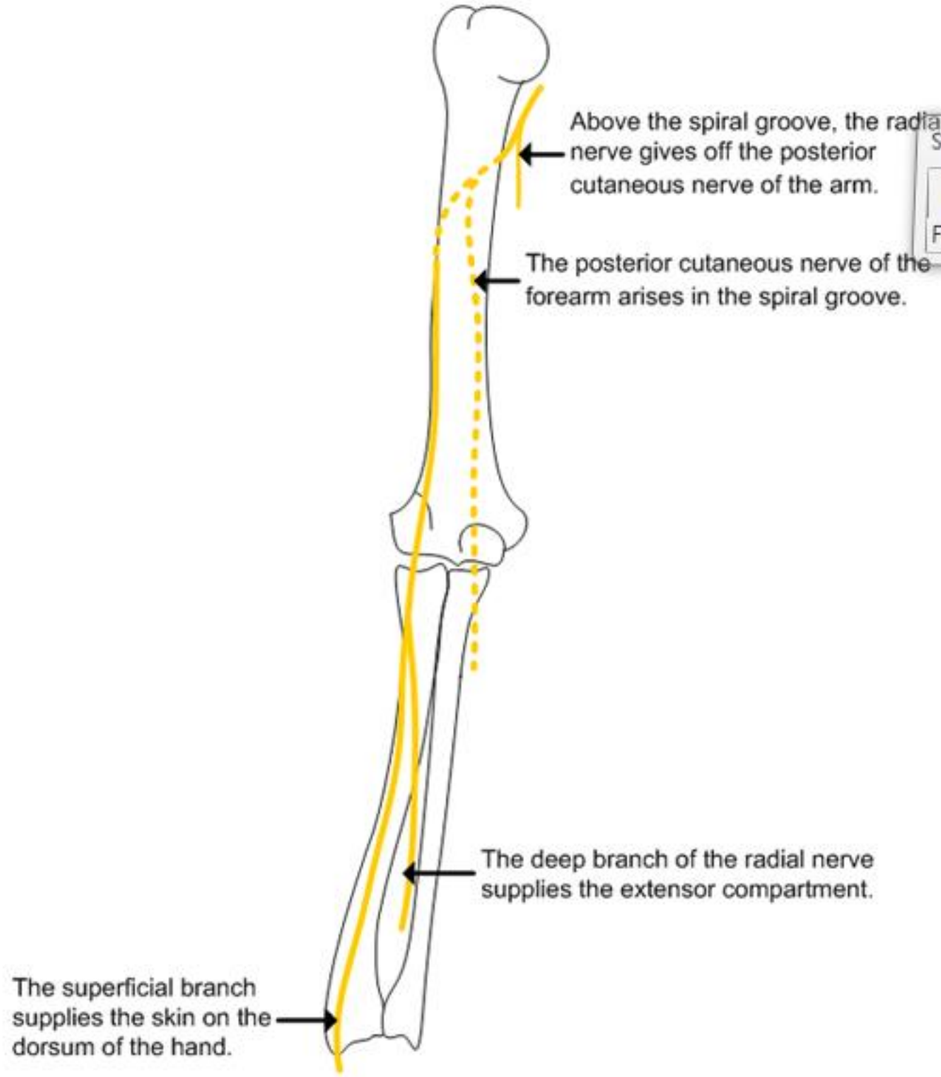
Explanation:

User Id: 477875



Explanation:

User Id: 477875



The radial nerve arises from the posterior cord of the brachial plexus. It innervates the muscles of the

dorsum of the hand.

The radial nerve arises from the posterior cord of the brachial plexus. It innervates the muscles of the posterior (extensor) compartment of the arm. After innervating the extensor compartment of the upper arm, the radial nerve enters the forearm. At the lateral epicondyle of the humerus (where the humerus articulates with the radius), the radial nerve divides into superficial and deep branches. The superficial branch of the radial nerve is purely sensory; it provides somatic sensory innervation to the radial half of the dorsal hand. (It does not, however, provide sensory innervation to the dorsal portions of the distal first through third digits. Sensory innervation of the palmar and dorsal surfaces of the distal 3 ½ digits is provided by the lateral and medial branches of the median nerve.)

Radial head subluxation ("nursemaid's elbow") is a common injury in children that can result from sudden outward pulling on an extended and pronated arm (e.g. when an adult attempts to pull a child upward by the arm). Radial head subluxation can damage the deep branch of the radial nerve, leading to weakness or paralysis of forearm extensor compartment muscles. "Wrist drop" commonly results from radial nerve injury. The deep branch of the radial nerve does not carry any somatic sensory innervation.

(Choice A) Carpal tunnel syndrome can result from any factor (e.g. inflammation) that reduces the size of the carpal tunnel, compressing the median nerve. In addition to pain, patients classically experience difficulty with fine motor control of the thumb.

(Choice B) In the wrist, the ulnar nerve passes between the hook of the hamate and the pisiform bone in a fibroosseous tunnel known as Guyon's canal. Ulnar nerve injury at this site causes dysesthesias of the ulnar side of the hand and weakness of the intrinsic muscles of the hand.

(Choice C) Fracture of the surgical neck of the humerus may cause axillary nerve injury leading to paralysis of the deltoid and teres minor muscles as well as loss of sensation on the lateral upper arm.

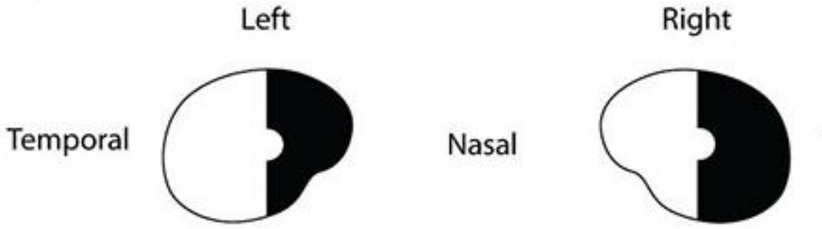
(Choice E) The coracobrachialis muscle is an arm flexor that lies deep to the biceps brachii and overlies the median nerve and brachial artery. It is innervated by the musculocutaneous nerve.

Educational Objective:
The deep branch of the radial nerve arises near the lateral epicondyle of the humerus, where the humerus articulates with the head of the radius. Radial head subluxation can damage the deep branch of the radial nerve, causing weakness of the forearm and hand extensors but no sensory deficits.

Time Spent: 2 seconds

Last updated: [1/10/2013]

A 56-year-old woman is brought to the emergency department with sudden onset of headache and partial loss of vision. She has a 3-year history of atrial fibrillation. Physical examination shows a visual field defect involving the black areas illustrated below.

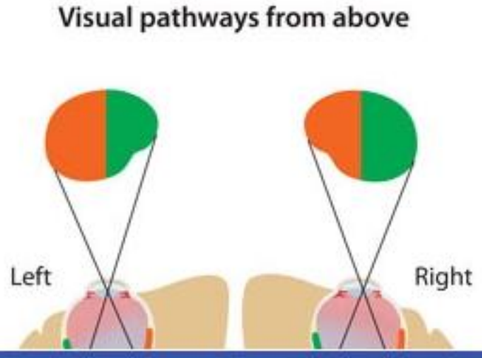


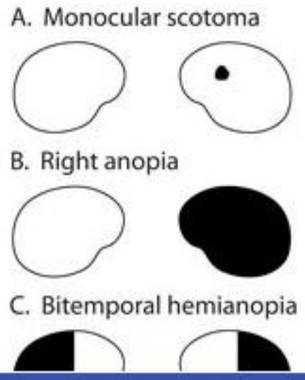
This patient most likely has occlusion of which of the following arteries?

- A. Anterior cerebral [4%]
- B. Central retinal [3%]
- C. Middle cerebral [14%]
- ✔ D. Posterior cerebral [74%]
- E. Posterior inferior cerebellar [5%]

Explanation:

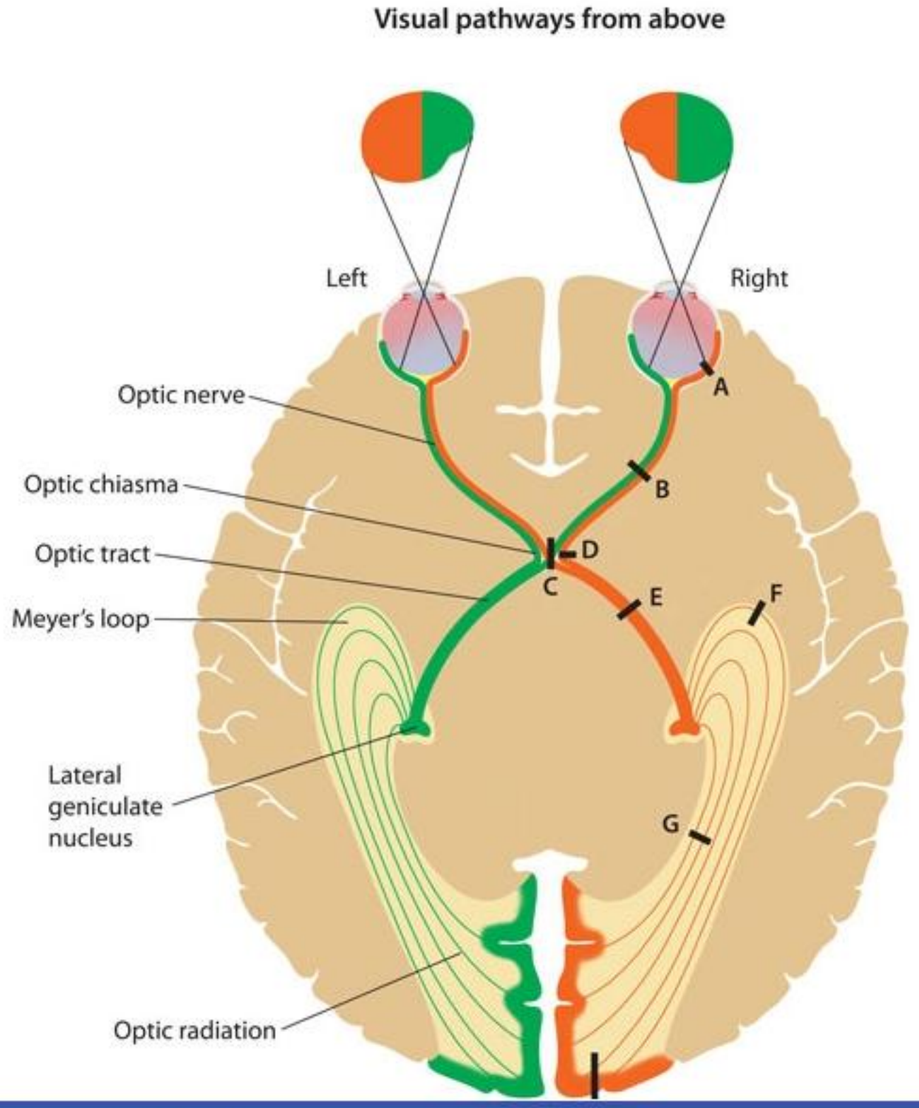
User Id: 477875





Explanation:

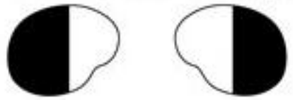
User Id: 477875



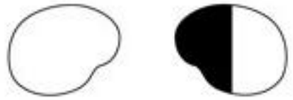
A. Monocular scotoma

B. Right anopia

C. Bitemporal hemianopia

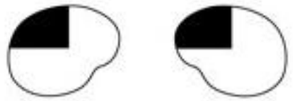


D. Right nasal hemianopia

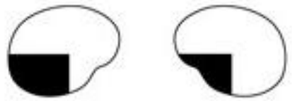


E. Left homonymous hemianopia

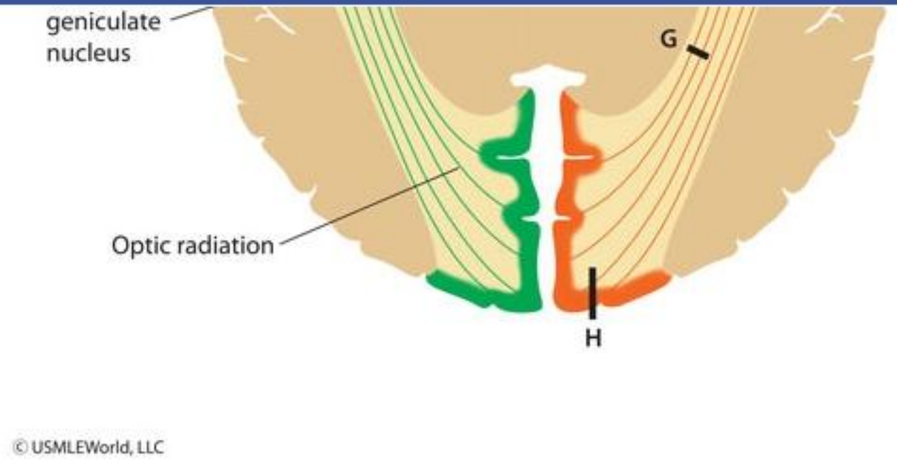
F. Left homonymous superior quadrantanopia ("pie in the sky")



G. Left homonymous inferior quadrantanopia ("pie on the floor")



H. Left homonymous hemianopia



G. Left homonymous inferior quadrantanopia ("pie on the floor")

H. Left homonymous hemianopia with macular sparing

The described vision defect is consistent with an occlusion of the posterior cerebral artery (PCA), most likely from an embolic event given this patient's history of atrial fibrillation. The PCA supplies the occipital lobe, which contains the striate or primary visual cortex. The striate cortex of each hemisphere receives information about the contralateral visual field from the ipsilateral lateral geniculate nucleus via the optic radiation. Specifically, the cuneus gyrus of the striate cortex receives information from the upper retina (lower visual field), while the lingual gyrus of the striate cortex receives information from the lower retina (upper visual field).

Occlusion of the PCA leads to ischemic injury to the ipsilateral striate cortex, producing a contralateral homonymous hemianopia with macular sparing. The macula is spared because collateral blood is supplied by the middle cerebral artery to the occipital pole, which processes central visual information. Unilateral infarcts involving only the cuneus gyrus or the lingual gyrus will produce a lower or upper quadrantanopia, respectively.

(Choice A) Anterior cerebral artery occlusion manifests as contralateral weakness that predominantly affects the lower extremity.

(Choice B) Occlusion of the central retinal artery leads to sudden, painless, and complete loss of vision in the affected eye.

(Choice C) Middle cerebral artery stroke is characterized by contralateral motor and sensory deficits (more pronounced in the upper than lower limb) and homonymous hemianopia **with macular involvement**.

A 54-year-old male undergoes evaluation for neurological symptoms. MRI scan shows bilateral infarcts in the thalami. Which of the following sensory pathways reaches the cortex without relay nuclei in the thalami?

- A. Proprioception [7%]
- B. Pain [6%]
- ✔ C. Smell [69%]
- D. Vision [10%]
- E. Hearing [4%]
- F. Taste [4%]

Explanation: **User Id: 477875**

The thalamus is a part of diencephalon and has multiple functions. It translates information from all sensory pathways other than olfaction and selectively distributes those impulses to appropriate parts of the cortex ("relay" function). The following thalamic nuclei receive input from sensory pathways:

1. Ventral posterolateral nucleus (VPL) receives input from the spinothalamic tract (pain and temperature sensation) and medial lemniscus (position and proprioception). It transmits impulses to primary somatosensory cortex (Brodmann areas 3, 1 & 2).
2. Ventral posteromedial nucleus (VPM) receives inputs from the trigeminal and gustatory pathways and transmits them to the primary sensory cortex (Brodmann's areas 3, 1 & 2).
3. Lateral geniculate body is a "relay" nucleus for the vision pathway. It receives impulses from the optic nerve and transmits them via the optic radiations to the visual cortex (calcarine sulcus).
4. Medial geniculate body is a part of the auditory pathway. It receives impulses from the superior olivary nucleus and the inferior colliculus of the pons, and projects them to the auditory cortex of the temporal lobe (Brodmann areas 41 & 42).

The olfactory tract is the only sensory pathway where input is not processed through the thalamus.

Educational Objective:
All sensory pathways except olfaction (smell) have relay nuclei in the thalamus. The VPL receives impulses from spinothalamic and medial lemniscus pathways, the VPM from the trigeminal and gustatory pathways, and the lateral and medial geniculate bodies are relay nuclei for the visual and auditory pathways, respectively.

A 34-year-old swimmer presents to your office with external ear infection. While inspecting the patient you insert a speculum into the external auditory meatus in close contact with its posterior wall. The patient faints during the procedure. Irritation of which of the following nerves was most likely induced by the procedure?

- A. Vestibulocochlear [23%]
- ✔ B. Vagal [58%]
- C. Trigeminal [7%]
- D. Facial [10%]
- E. Accessory [1%]

Explanation: **User Id: 477875**

The patient described in the question has experienced a vasovagal syncope after stimulation of his posterior external auditory canal by an otoscope speculum. In this form of syncope, parasympathetic outflow via the vagus nerve (CN X) leads to decreased heart rate and blood pressure.

The posterior part of the external auditory canal is innervated by the small auricular branch of the vagus nerve. Most of the remainder of the external auditory canal, including the external portion of the tympanic membrane, is innervated by the mandibular division of the trigeminal nerve via its auriculotemporal branch. The inner surface of the tympanic membrane is innervated by the glossopharyngeal nerve (CN IX) via its tympanic branch.

(Choice A) The vestibulocochlear nerve (CN VIII) mediates hearing and vestibular proprioception. It does not mediate any cutaneous sensation.

(Choice C) The mandibular branch of the trigeminal nerve (CN V3) does carry sensation to the majority of the external auditory meatus, except for the posterior wall.

(Choice D) The facial nerve is represented in the middle ear by one of its branches, the chorda tympani nerve. The chorda tympani nerve carries the afferent taste fibers from the anterior two-thirds of the tongue as well as efferent parasympathetic preganglionic fibers that will ultimately innervate the submandibular and sublingual salivary glands. CN VII has a small motor component to the stapedius and behind the ear but does not carry cutaneous sensory information.

(Choice E) The accessory nerve (CN XI) provides voluntary motor innervation to the trapezius and the

D. Facial [10%]
E. Accessory [1%]

Explanation:

User Id: 477875

The patient described in the question has experienced a vasovagal syncope after stimulation of his posterior external auditory canal by an otoscope speculum. In this form of syncope, parasympathetic outflow via the vagus nerve (CN X) leads to decreased heart rate and blood pressure.

The posterior part of the external auditory canal is innervated by the small auricular branch of the vagus nerve. Most of the remainder of the external auditory canal, including the external portion of the tympanic membrane, is innervated by the mandibular division of the trigeminal nerve via its auriculotemporal branch. The inner surface of the tympanic membrane is innervated by the glossopharyngeal nerve (CN IX) via its tympanic branch.

(Choice A) The vestibulocochlear nerve (CN VIII) mediates hearing and vestibular proprioception. It does not mediate any cutaneous sensation.

(Choice C) The mandibular branch of the trigeminal nerve (CN V3) does carry sensation to the majority of the external auditory meatus, except for the posterior wall.

(Choice D) The facial nerve is represented in the middle ear by one of its branches, the chorda tympani nerve. The chorda tympani nerve carries the afferent taste fibers from the anterior two-thirds of the tongue as well as efferent parasympathetic preganglionic fibers that will ultimately innervate the submandibular and sublingual salivary glands. CN VII has a small motor component to the stapedius and behind the ear but does not carry cutaneous sensory information.

(Choice E) The accessory nerve (CN XI) provides voluntary motor innervation to the trapezius and the sternocleidomastoid.

Educational Objective:
The vagus nerve provides some cutaneous sensation to the posterior external auditory canal via its small auricular branch. Sensation to the rest of the canal is from CN V3. A vasovagal syncopal episode results from stimulation of the vagus nerve, leading to a decrease in blood pressure and heart rate.

Time Spent: 3 seconds

Last updated: [7/7/2010]

A 23-year-old Caucasian woman suffers from an acute attack of optic neuritis. She has a history of relapsing-remitting multiple sclerosis. An MRI of her brain shows an area of demyelinization involving her left optic nerve. Which of the following is most likely to be found on physical examination?

	Light in the right eye		Light in the left eye		
	Right pupil	Left pupil	Right pupil	Left pupil	
✔ A.	Constrict	Constrict	No change	No change	[69%]
B.	Constrict	No change	No change	No change	[10%]
C.	Constrict	Constrict	Constrict	No change	[12%]
D.	Constrict	No change	Constrict	No change	[7%]
E.	Constrict	Constrict	No change	Constrict	[2%]

Explanation:

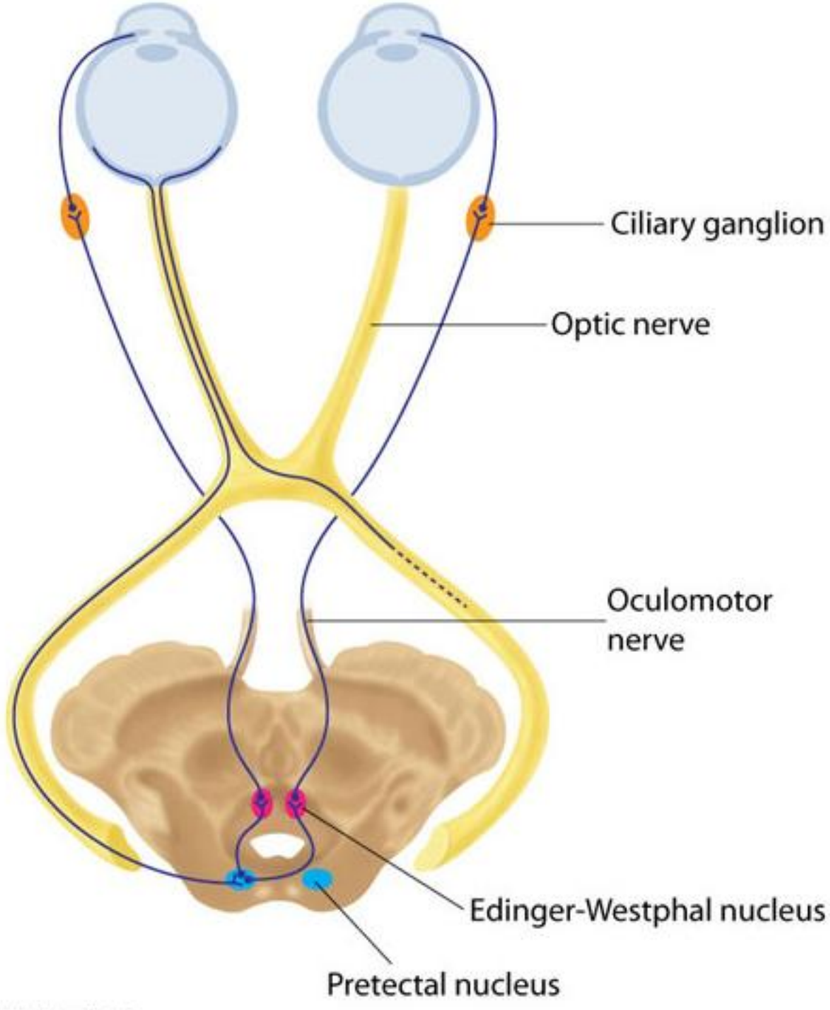
User Id: 477875

Pupillary light reflex

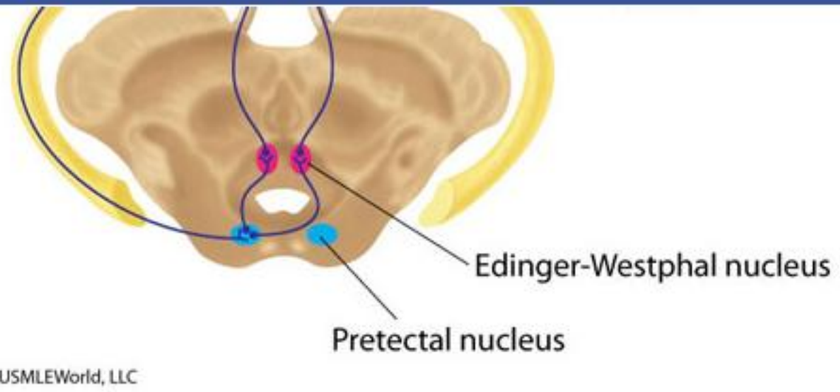
Explanation:

User Id: 477875

Pupillary light reflex



• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42



This patient is experiencing a very common adverse effect of multiple sclerosis: demyelinization of the optic nerve (CN II). This condition causes impairment of the light reflex pathway, since the afferent (sensory) limb is carried by the optic nerve. As light enters the eye, the retina generates a signal that is transmitted along the optic nerve bilaterally to the pretectal nucleus, located in the superior colliculus. From there, fibers project to the ipsilateral and contralateral Edinger-Westphal nuclei, with the decussating fibers traversing within the posterior commissure.

The efferent (motor) fibers of the reflex pathway originate from parasympathetic *pre*ganglionic neurons in the Edinger-Westphal nucleus. These travel within the oculomotor nerve to the ciliary ganglion. There they synapse on parasympathetic *post*ganglionic neurons, which in turn project fibers that innervate the sphincter of the iris.

As with many patients suffering from multiple sclerosis, this patient's injury is isolated to only 1 optic nerve. Thus, light entering the affected eye (in this case, the left) will not be transmitted to the midbrain, and neither pupil will respond. However, light in the contralateral eye will be transmitted normally to the midbrain, and the response will be transmitted along the unaffected oculomotor nerves to constrict the pupils of both eyes.

Educational objective:
The afferent limb of the light reflex pathway is the optic nerve; the efferent limb is the parasympathetic fibers of the oculomotor nerve. When an optic nerve is damaged, light in that eye will cause neither pupil to constrict (the nerve can't sense the light). However, light in the contralateral eye will cause both pupils to constrict (because the motor pathways are intact).

Time Spent: 2 seconds

Last updated: [1/17/2013]

A 59-year-old man comes to the physician because of diplopia and a drooping right eyelid. His symptoms began 1 day ago and have since worsened. Physical examination shows a dilated right pupil that is nonreactive to both light and accommodation. There is vertical and horizontal diplopia. When the patient is asked to stare straight ahead, the right eye is directed inferiorly and laterally with respect to his left eye. Magnetic resonance imaging of the brain shows an aneurysm involving the right posterior communicating artery. Which of the following muscles is most likely to remain functionally intact in this patient?

- A. Inferior oblique [9%]
- B. Inferior rectus [2%]
- ✔ C. Lateral rectus [81%]
- D. Levator palpebrae [4%]
- E. Medial rectus [2%]
- F. Superior rectus [3%]

Explanation:

User Id: 477875

Nerve	Eye muscle(s) innervated	Oculomotor functions	Lesion findings
CN III	Superior rectus, medial rectus, inferior rectus, inferior oblique & levator palpebrae superioris	Adduction, depression, elevation & external rotation	• Eye deviated downward & laterally • Diagonal diplopia • Dilation of pupil & loss of accommodation • Ptosis
CN IV	Superior oblique	Internal rotation, depression & abduction	• Eye deviated upward • Vertical & torsional diplopia

Explanation:

User Id: 477875

Nerve	Eye muscle(s) innervated	Oculomotor functions	Lesion findings
CN III	Superior rectus, medial rectus, inferior oblique & levator palpebrae superioris	Adduction, depression, elevation & external rotation	• Eye deviated downward & laterally • Diagonal diplopia • Dilation of pupil & loss of accommodation • Ptosis
CN IV	Superior oblique	Internal rotation, depression & abduction	• Eye deviated upward • Vertical & torsional diplopia
CN VI	Lateral rectus	Abduction	• Eye deviated medially • Horizontal diplopia

This patient presents with a right third nerve (CN III) palsy secondary to a compressive aneurysm. Lesions involving CN III cause ptosis (drooping of the upper eyelid) and impair adduction, depression, and elevation of the eye. As a result, diagonal (eg, horizontal and vertical) diplopia is frequently present and the eye rests in a "down and out" position. Pupillary constriction and accommodation can also be affected as CN III carries parasympathetic fibers to the ciliary muscle and the iris sphincter.

Educational objective:
Lesions involving CN III cause ptosis, a downward and laterally deviated eye, impaired pupillary constriction and accommodation, and diagonal diplopia. The most dreaded cause of CN III palsy is an enlarging intracranial aneurysm.

Time Spent: 2 seconds

Last updated: [3/12/2013]

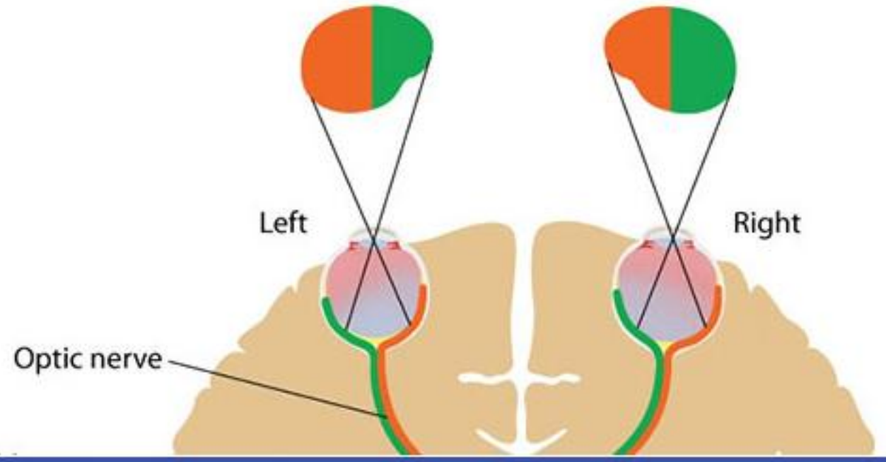
A 62-year-old woman comes to the physician with decreased vision. Over the last 6 weeks, she has had progressive difficulty with visualizing objects on her right side. She also has intermittent headaches that are worse in the morning. Her past medical history is significant for non-small cell lung carcinoma that was diagnosed 2 years ago and treated surgically. Physical examination reveals right homonymous hemianopia. When light is shown in the left eye, both pupils constrict. However, when the light is immediately moved to the right eye, her pupils appear to dilate. This patient's symptoms are most likely due to a left-sided lesion involving which of the following structures?

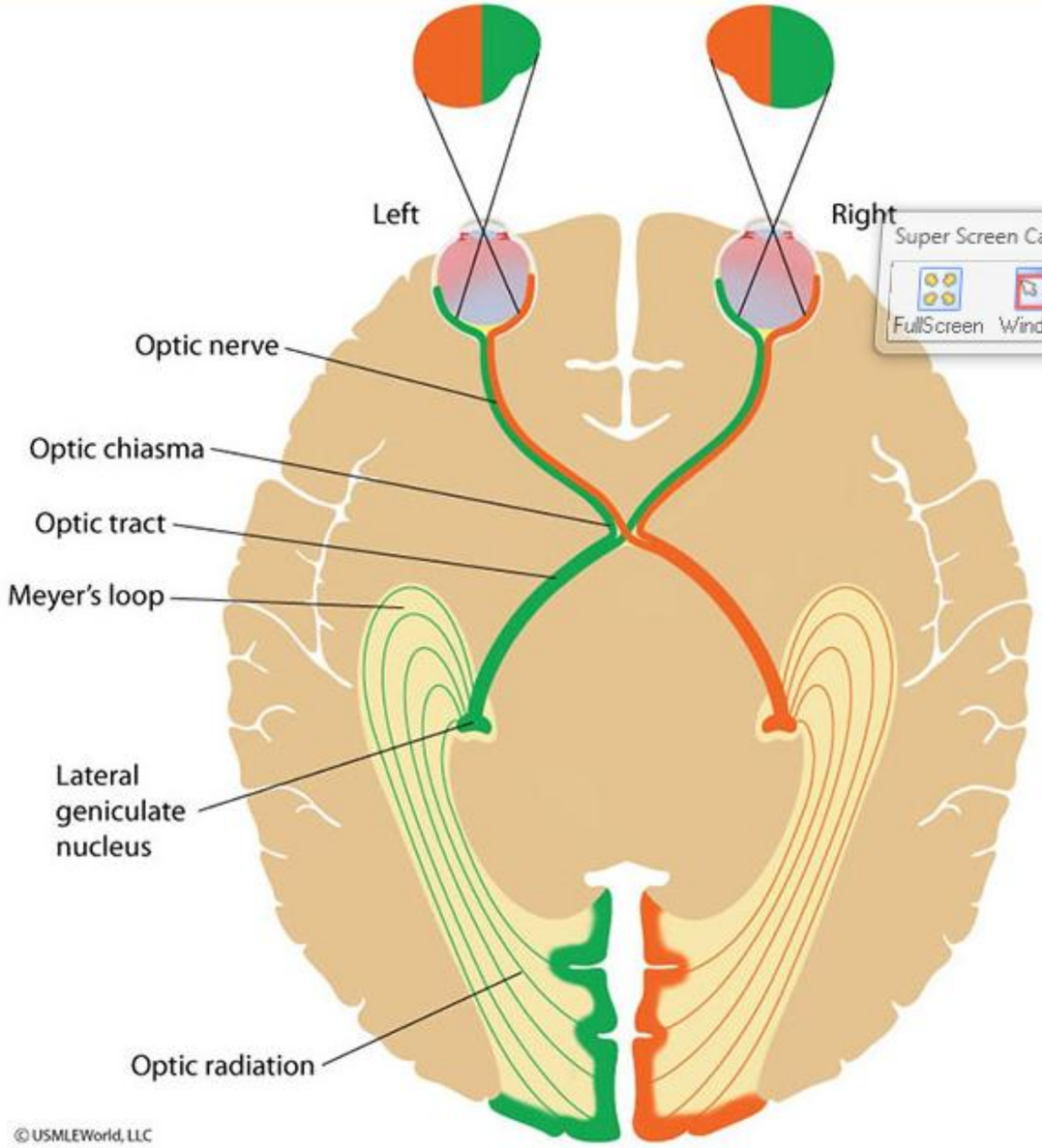
- A. Frontal eye fields [2%]
- B. Lateral geniculate nucleus [22%]
- C. Meyer's loop [8%]
- D. Optic radiation [9%]
- ✔ E. Optic tract [55%]
- F. Visual cortex [4%]

Explanation:

User Id: 477875

Visual pathways from above





This patient likely has a lesion involving the left optic tract. The optic tract contains mixed optic nerve fibers from the temporal part of the ipsilateral retina (nasal visual field) and fibers from the nasal part of the contralateral retina (temporal visual field). Lesions of the optic tract subsequently result in a **contralateral homonymous hemianopia**.

The afferent limb of the **pupillary light reflex** involves the retina, optic nerve, optic chiasm, and optic tract fibers. Although the majority of optic tract fibers project to the lateral geniculate nucleus, some project onto the pretectal nucleus in the midbrain. A relative afferent pupillary defect (Marcus Gunn pupil) often occurs with lesions involving the optic nerve, such as optic neuritis in multiple sclerosis. However, optic tract lesions can also cause a relative afferent pupillary defect in the contralateral eye, since the nasal portion of the retina contributes more input to the pretectal nucleus than the temporal portion of the retina. This defect can be observed during the swinging flashlight test since the patient's pupils constrict less (and therefore appear to dilate) when a bright light is swung from the unaffected eye to the affected eye.

(Choice A) The frontal eye fields are regions located bilaterally in the prefrontal cortex. The right eye field generates conjugate gaze movements to the left, and the left eye field generates conjugate gaze movements to the right. When a frontal eye field is affected by an acute lesion, the influence of the contralateral eye field predominates, causing the eyes to deviate toward the lesion.

(Choices B and D) Lesions involving the lateral geniculate nucleus or optic radiation can produce a contralateral homonymous hemianopia. However, pupillary light reflexes would be normal.

(Choice C) A lesion in Meyer's loop would produce a contralateral upper quadrantanopia or "pie in the sky" defect.

(Choice F) A lesion involving the visual cortex would produce a contralateral homonymous hemianopia with macular sparing. Pupillary light reflexes would be intact.

Educational objective:
A lesion in the optic tract can produce contralateral homonymous hemianopia and a relative afferent pupillary defect (Marcus Gunn pupil) in the contralateral eye.

Time Spent: 2 seconds

Last updated: [2/6/2013]

• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

A 34-year-old male is unable to tolerate everyday sounds. Injury of which of the following cranial nerves might be responsible?

- A. Hypoglossal [2%]
- ✔ B. Facial [78%]
- C. Accessory [4%]
- D. Vagal [8%]
- E. Glossopharyngeal [7%]

Explanation:

User Id: 477875

The middle ear cavity contains three auditory ossicles (malleus, incus and stapes) and two skeletal muscles (tensor tympani and stapedius) that participate in the transmission of sound from the tympanic membrane to the inner ear. The stapedius muscle arises from the wall of the tympanic cavity and inserts on the neck of the stapes. The body's smallest striated muscle, its function is to stabilize the stapes, the body's smallest bone. The stapedius muscle is innervated by the stapedius nerve, a branch of facial nerve (CN VII). Paralysis of the stapedius muscle allows the stapes to oscillate more widely, producing hyperacusis (increased sensitivity to sound). Ipsilateral hyperacusis is a common finding in Bell's palsy (peripheral facial nerve paralysis). Other findings in facial nerve paralysis include inability to close the eye or to smile on the affected side, as well as ipsilateral increased salivation and loss of taste on the anterior 2/3 of the tongue.

Injury to the other cranial nerves listed in the answer choices does not lead to hyperacusis. Note also that the tensor tympani muscle arises from the cartilaginous portion of the auditory tube and the adjoining part of the sphenoid bone and inserts into the malleus. The tensor tympani draws the tympanic membrane medially, increasing its tension. This muscle is innervated by the mandibular branch of the trigeminal nerve (CN V_3).

Educational Objective:
The stapedius muscle is innervated by the stapedius nerve, a branch of facial nerve (CN VII). Paralysis of the stapedius muscle allows wider oscillation of the stapes, and leads to increased sensitivity to sound (hyperacusis).

Time Spent: 1 seconds

Last updated: [11/10/2011]

A 6-month-old female has a head circumference that is in the 97th percentile for her age. CT scan of the head reveals significant dilation of the lateral ventricles. Which of the following is the most likely long-term complication of this patient's condition?

- A. Infection [9%]
- B. Tumor [5%]
- ✔ C. Muscle hypertonicity [53%]
- D. Lower extremity hyporeflexia [22%]
- E. Subarachnoid hemorrhage [10%]

Explanation: **User Id: 477875**

Hydrocephalus is any increase in cerebrospinal fluid (CSF) volume. In infancy and early childhood, the cause is usually impaired CSF outflow due to congenital abnormalities like Type II Arnold-Chiari malformations, hereditary aqueductal stenosis, and prenatal infections (e.g. toxoplasmosis). Hydrocephalus in early infancy typically presents with macrocephaly (defined as head circumference greater than two standard deviations above the mean for gender and age), irritability, poor feeding, muscle hypertonicity and hyperreflexia. Hypertonicity and hyperreflexia result from upper motor neuron damage caused by stretching of the periventricular pyramidal tracts.

(Choices A, B and E) Infection, tumor, and subarachnoid hemorrhage are potential causes of acquired hydrocephalus but do not result from hydrocephalus.

(Choice D) Lower extremity hyporeflexia would result from damage to the lower motor neurons of the lower extremities, as can occur in poliomyelitis or Werdnig-Hoffman disease.

Educational Objective:
Hydrocephalus in infants presents with irritability, poor feeding, increased head circumference and enlarged ventricles on CT. Long-term sequelae of hydrocephalus include lower extremity spasticity due to stretching of the periventricular pyramidal tracts, visual disturbances, and learning disabilities.

Time Spent: 2 seconds

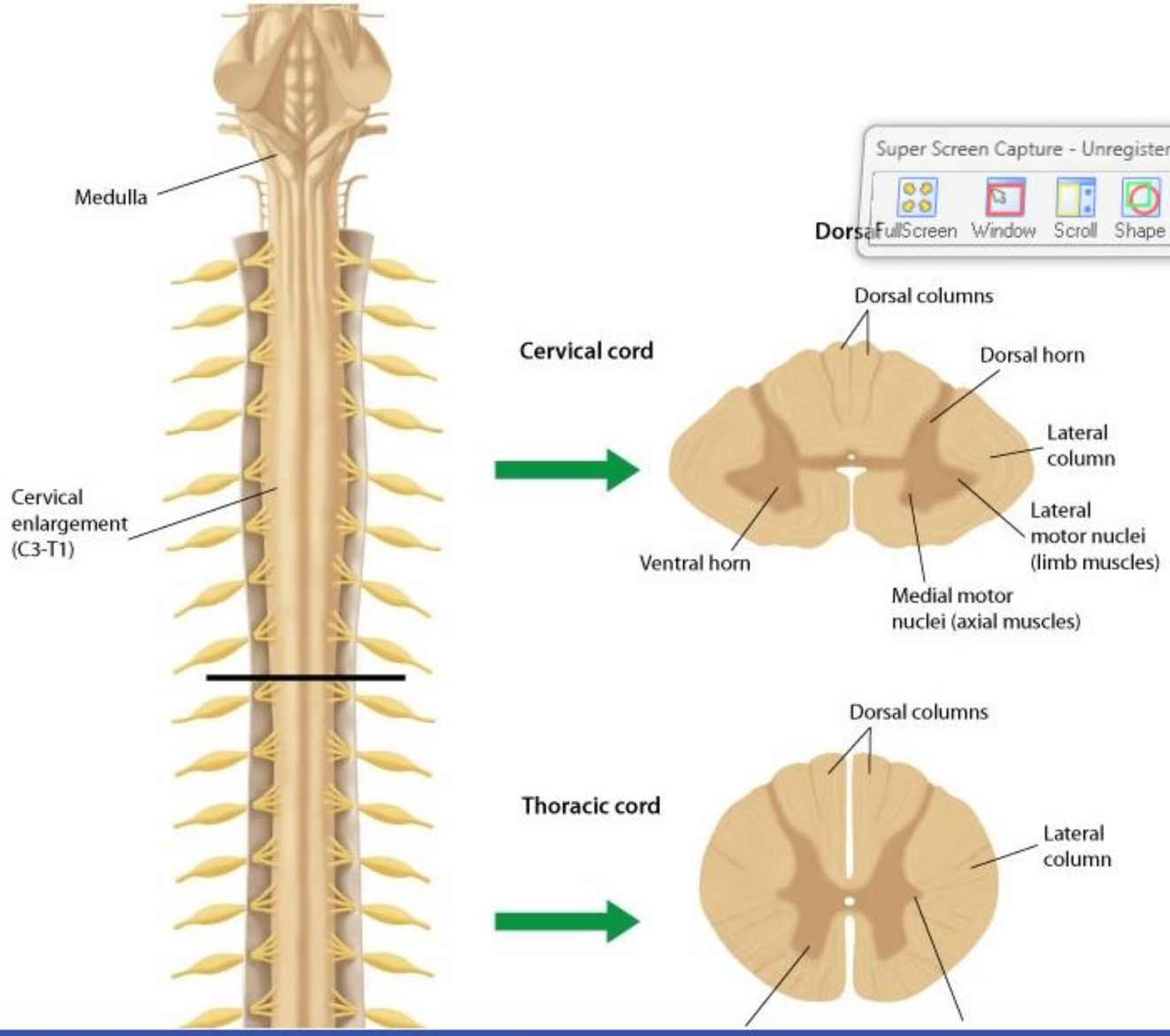
Last updated: [1/10/2013]

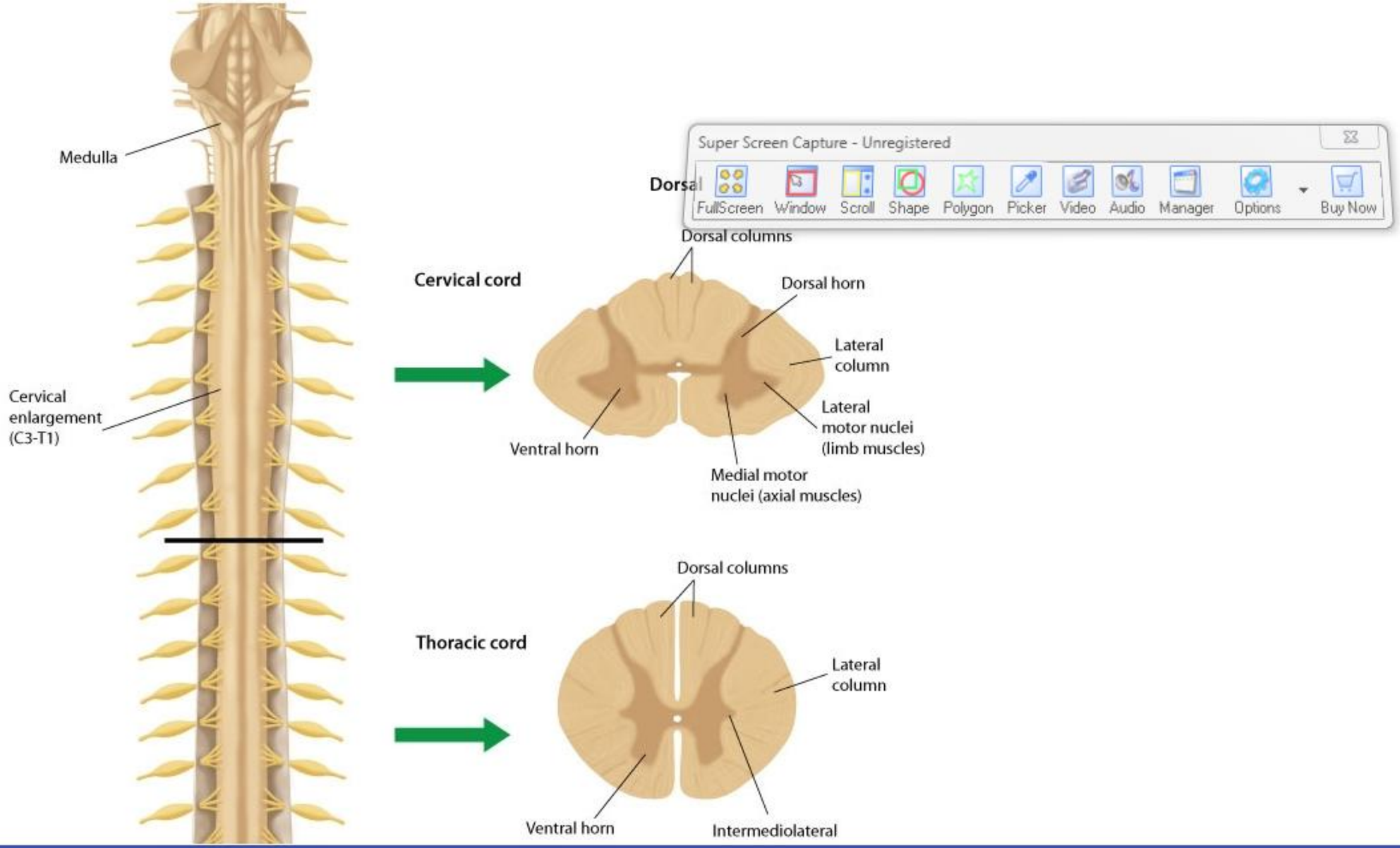
A 31-year-old man is brought to the emergency department after a motorcycle accident. He was found lying in the middle of the road by first responders, who placed him in a rigid cervical collar and put him on a backboard for spinal immobilization. The patient currently complains of severe pain in his neck and back. He is alert and fully oriented. There are a number of lacerations and bruises on his body. Neurologic examination suggests a spinal cord injury at the level shown in the illustration below.

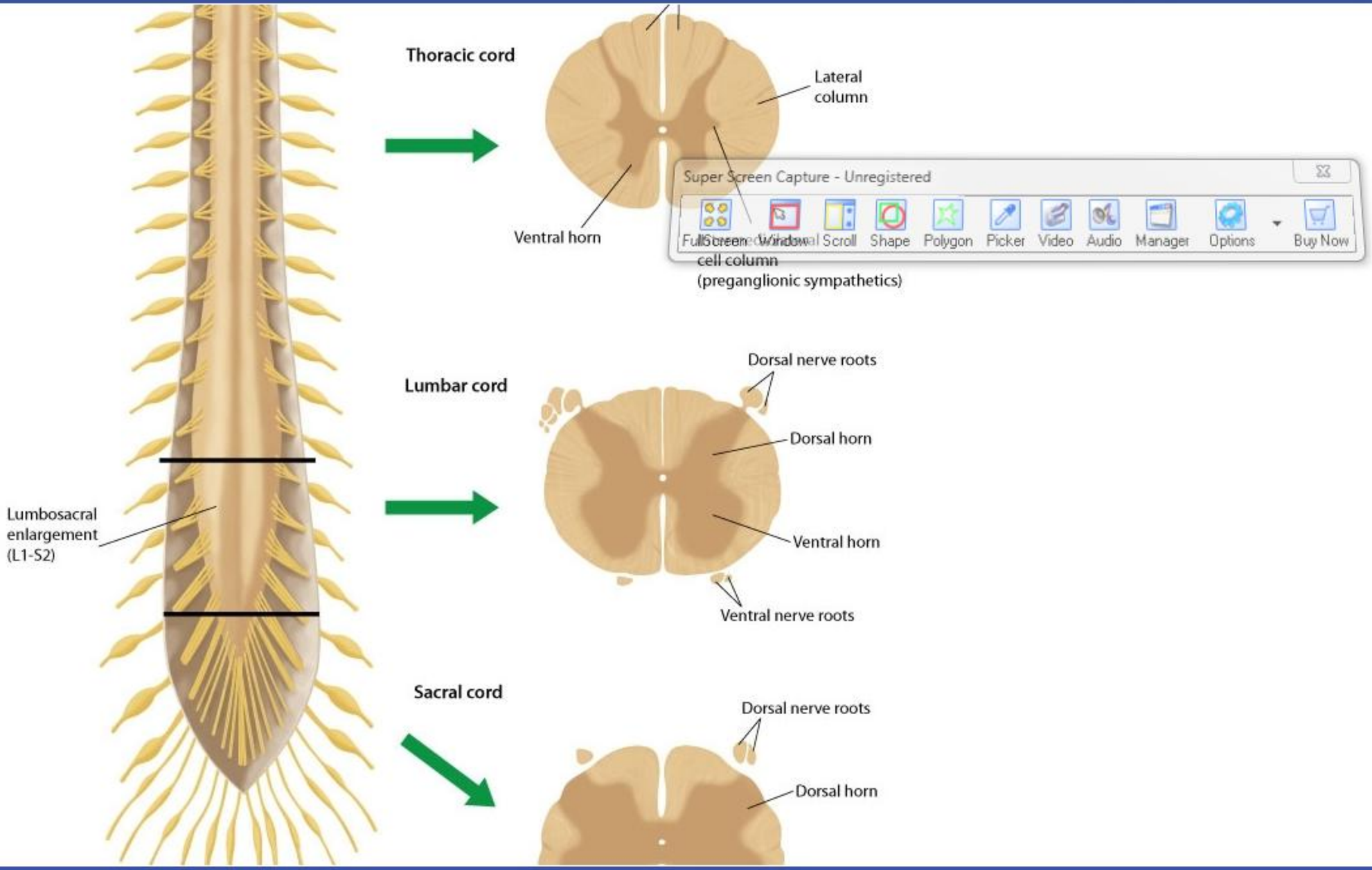
Which of the following spinal cord levels is most likely to be injured?

- A. C1 [10%]
- B. C7 [35%]
- ✔ C. T4 [49%]
- D. L5 [5%]
- E. S2 [1%]

Spinal cord sections through different levels







surrounded by white matter. The grey matter is divided into ventral (motor) horns and dorsal (sensory) horns. Certain features of the cord vary with spinal level, including the amount of white matter (in comparison to grey matter), the shape of the section (round vs oval), the size of the ventral horns, and the presence of lateral horns. Moving proximally, the amount of white matter steadily increases and the sections become more ovoid (particularly the upper thoracic and cervical regions). Further, the ventral horns of the lower cervical and lumbosacral regions are more prominent as these areas innervate the muscles of the arms and legs, respectively.

The transverse section presented in the question stem is representative of the T4 spinal level. A characteristic that is unique to thoracic and early lumbar levels (T1-L2) is the presence of lateral horns, which are made up of sympathetic preganglionic neurons (the intermediolateral nucleus). Additionally, the amount of white matter in the mid-thoracic spinal cord appears larger in relation to the rather diminutive amount of grey matter. Lower sections (lumbar and sacral) possess sparse white matter, more grey matter, and larger ventral horns. Furthermore, the overall round shape of this section is consistent with sections taken at or below the mid-thoracic region.

(Choice A) At the level of C1, the shape of the transverse section is ovoid with a considerable amount of white matter surrounding a dimunitive amount of grey matter. Both the gracile and cuneate fasciculi will also be present at this level.

(Choice B) At the level of C7, the spinal cord appears oval-shaped. There is also a larger amount of grey matter compared to the mid-thoracic region, particularly at the ventral horns.

(Choice D) At L5, the dorsal and ventral horns are large in comparison to the modest amount of white matter present at this level. There are also no lateral horns.

(Choice E) In the sacral region, grey matter occupies most of the transverse section and the white matter exists as a relatively thin mantle at the periphery of the cord.

Educational objective:
General features that aid in localizing a transverse spinal cord section:

- More proximal levels have increasing amounts of white matter and more ovoid sections
- Lower cervical and lumbosacral regions have large ventral horns
- Thoracic and early lumbar sections (T1-L2) contain lateral grey matter horns

Time Spent: 10 seconds

Last updated: [2/5/2013]

The spinal cord is a roughly round-to-oval structure containing a central "butterfly-like" area of grey matter surrounded by white matter. The grey matter is divided into ventral (motor) horns and dorsal (sensory) horns. Certain features of the cord vary with spinal level, including the amount of white matter (in comparison to grey matter), the shape of the section (round vs oval), the size of the ventral horns, and the presence of lateral horns. Moving proximally, the amount of white matter steadily increases and the sections become more ovoid (particularly the upper thoracic and cervical regions). Further, the ventral horns of the lower cervical and lumbosacral regions are more prominent as these areas innervate the muscles of the arms and legs, respectively.

The transverse section presented in the question stem is representative of the T4 spinal level. A characteristic that is unique to thoracic and early lumbar levels (T1-L2) is the presence of lateral horns, which are made up of sympathetic preganglionic neurons (the intermediolateral nucleus). Additionally, the amount of white matter in the mid-thoracic spinal cord appears larger in relation to the rather diminutive amount of grey matter. Lower sections (lumbar and sacral) possess sparse white matter, more grey matter, and larger ventral horns. Furthermore, the overall round shape of this section is consistent with sections taken at or below the mid-thoracic region.

(Choice A) At the level of C1, the shape of the transverse section is ovoid with a considerable amount of white matter surrounding a dimunitive amount of grey matter. Both the gracile and cuneate fasciculi will also be present at this level.

(Choice B) At the level of C7, the spinal cord appears oval-shaped. There is also a larger amount of grey matter compared to the mid-thoracic region, particularly at the ventral horns.

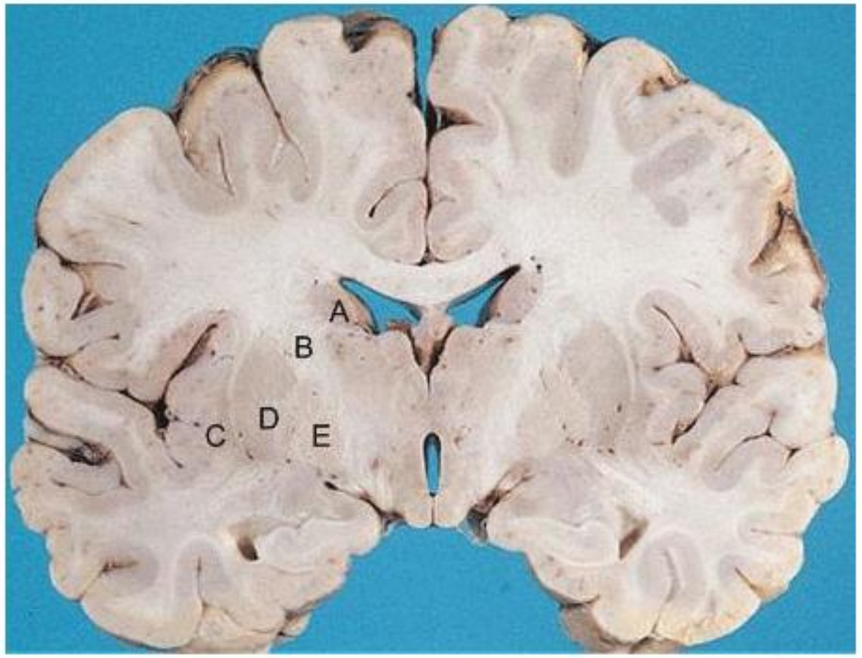
(Choice D) At L5, the dorsal and ventral horns are large in comparison to the modest amount of white matter present at this level. There are also no lateral horns.

(Choice E) In the sacral region, grey matter occupies most of the transverse section and the white matter exists as a relatively thin mantle at the periphery of the cord.

Educational objective:
General features that aid in localizing a transverse spinal cord section:

- More proximal levels have increasing amounts of white matter and more ovoid sections
- Lower cervical and lumbosacral regions have large ventral horns
- Thoracic and early lumbar sections (T1-L2) contain lateral grey matter horns

A 23-year-old Caucasian male with involuntary movements undergoes an experimental radioisotope study to localize metabolic abnormalities in his brain. The study shows abnormal metabolic activity in the caudate nucleus. Which of the following on the gross brain section slide below corresponds to the location of the abnormalities in this patient?

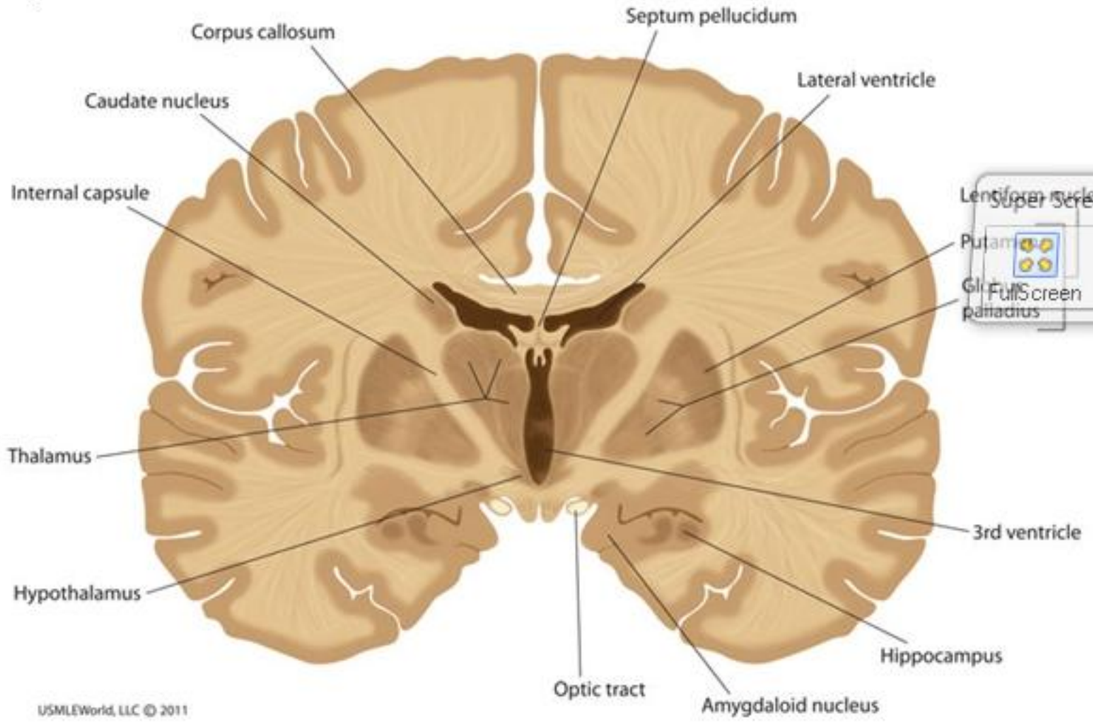


- ✔ A. A [71%]
- B. B [5%]
- C. C [3%]
- D. D [12%]
- E. E [8%]

• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

Explanation:

User Id: 477875



The patient described in the question stem is most likely suffering from Huntington's disease. This disease is an autosomal dominant condition that results from an excessive number of CAG trinucleotide repeats as compared to the unaffected population. Furthermore, families with this disease experience a process called anticipation, which is a progressive expansion of the trinucleotide repeats in successive generations leading to earlier expression of the disease in affected children of Huntington's patients. Imaging studies typically show atrophy of the caudate, and metabolic imaging studies such as PET scanning show decreased metabolic activity in the striatum, which is composed of the caudate and putamen.

The caudate nucleus **(Choice A)** is a curved or "C-shaped" structure in its complete form. The head of the caudate can be identified in the inferolateral walls of the anterior horns of the lateral ventricles. The head of the caudate nucleus is separated from the globus pallidus and putamen by the internal capsule.

(Choice B) This structure is the internal capsule. The posterior limb of the internal capsule separates the

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

The patient described in the question stem is most likely suffering from Huntington's disease. This disease is an autosomal dominant condition that results from an excessive number of CAG trinucleotide repeats as compared to the unaffected population. Furthermore, families with this disease experience a process called anticipation, which is a progressive expansion of the trinucleotide repeats in successive generations leading to earlier expression of the disease in affected children of Huntington's patients. Imaging studies typically show atrophy of the caudate, and metabolic imaging studies such as PET scanning show decreased metabolic activity in the striatum, which is composed of the caudate and putamen.

The caudate nucleus **(Choice A)** is a curved or "C-shaped" structure in its complete form. The head of the caudate can be identified in the inferolateral walls of the anterior horns of the lateral ventricles. The head of the caudate nucleus is separated from the globus pallidus and putamen by the internal capsule.

(Choice B) This structure is the internal capsule. The posterior limb of the internal capsule separates the globus pallidus and putamen from the thalamus and carries corticospinal motor and somatic sensory fibers as well as visual and auditory fibers. The function of this limb is the most important to know for the USMLE. The genu, or "knee", of the internal capsule lies between the anterior and posterior branches and carries corticobulbar fibers. The anterior limb of the internal capsule separates the caudate nucleus from the globus pallidus and putamen and carries a portion of the thalamocortical fibers.

(Choice C) This structure is the insular cortex (insula). The insula plays a role in the limbic system (emotion) as well as in the coordination of some autonomic functions, particularly of the cardiac system.

(Choice D) This structure is the putamen.

(Choice E) This structure is the globus pallidus.

Educational Objective:
The head of the caudate lies in the inferolateral wall of the anterior horn of the lateral ventricle. It is separated from the globus pallidus and putamen by the internal capsule. The caudate is atrophied in Huntington's disease.

Time Spent: 5 seconds

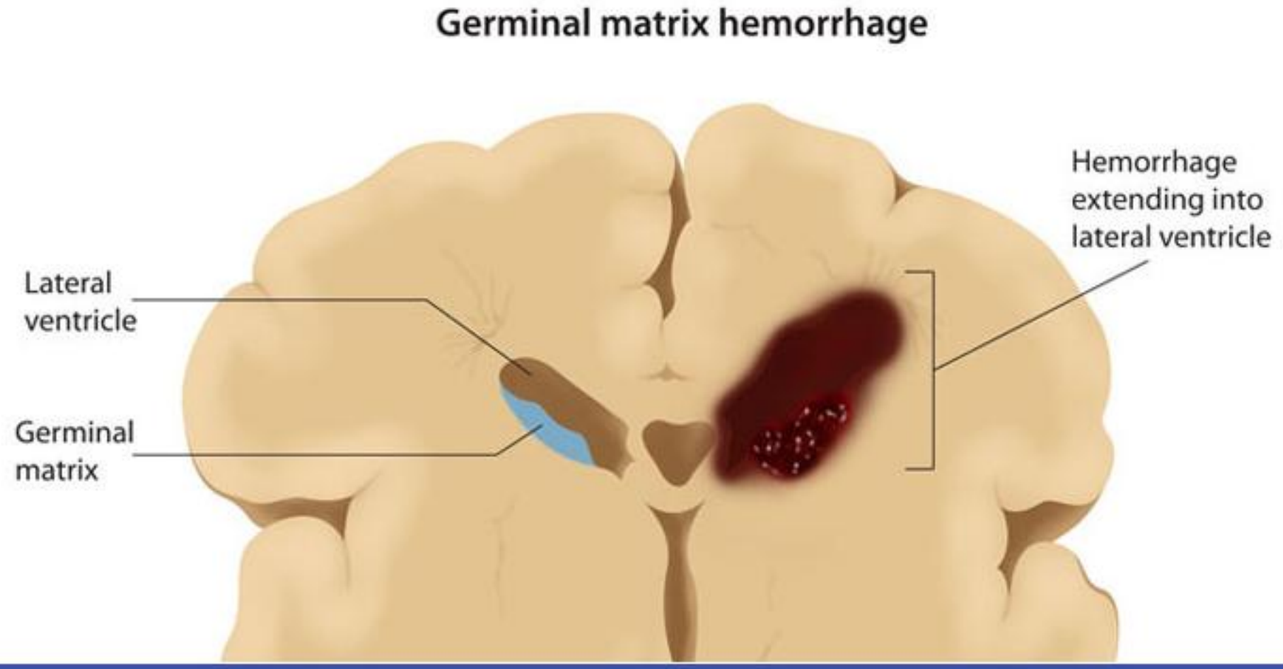
Last updated: [4/21/2013]

A 4-day-old premature infant in the neonatal intensive care unit develops a decreased level of consciousness and hypotonia. She was delivered vaginally at 30 weeks of gestation and her birth weight was 1200 g (2 lb 10 oz). Physical examination reveals a lethargic infant with a weak and high-pitched cry, prominent scalp veins, and tense fontanels. Cranial ultrasound reveals blood in the lateral ventricles. Which of the following structures is the most likely source of the bleeding?

- A. Bridging cortical veins [19%]
- ✔ B. Germinal matrix [38%]
- C. Meningeal arteries [9%]
- D. Sagittal sinus [19%]
- E. Vessels of the circle of Willis [16%]

Explanation:

User Id: 477875

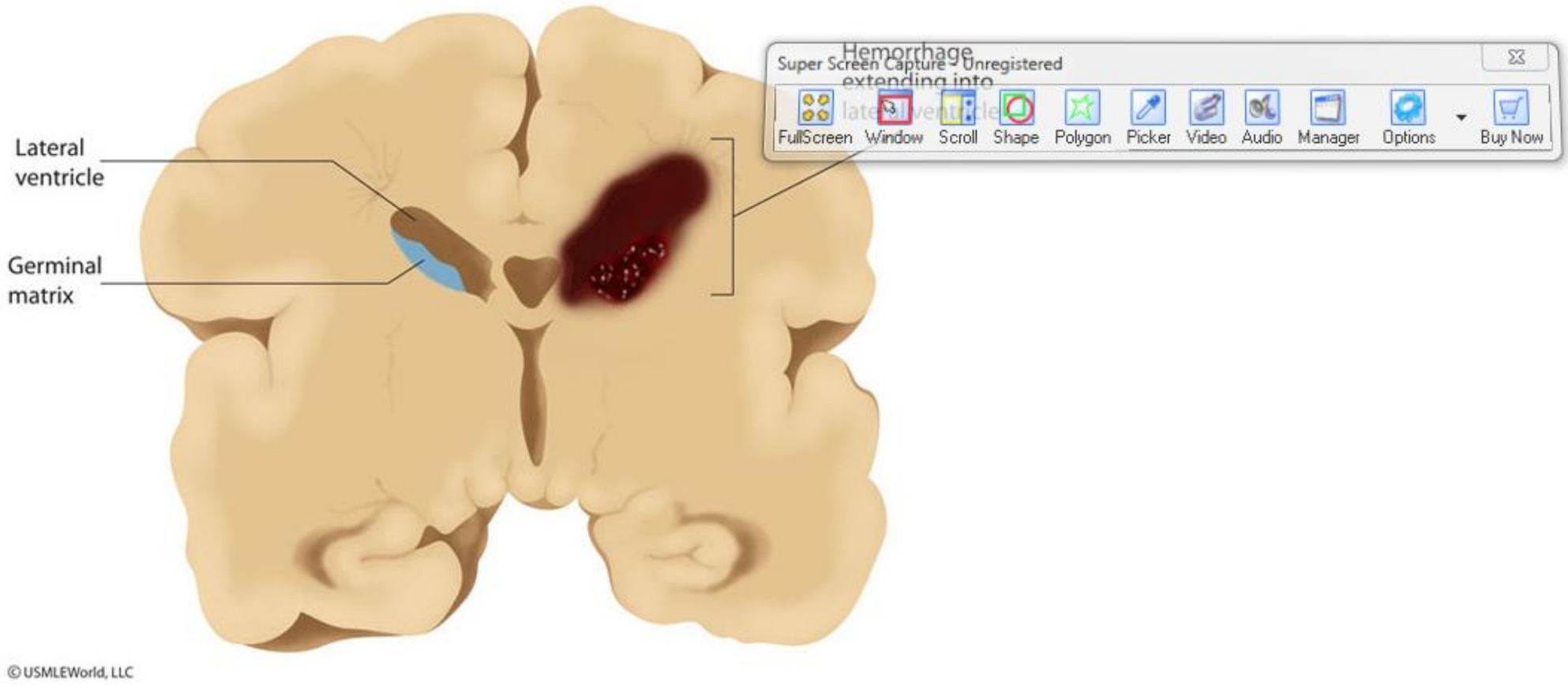


- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25
- 26
- 27
- 28
- 29
- 30
- 31
- 32
- 33
- 34
- 35
- 36
- 37
- 38
- 39
- 40
- 41
- 42

Explanation:

User Id: 477875

Germinal matrix hemorrhage



Intraventricular hemorrhage (IVH) is a common **complication of prematurity** that can lead to long-term neurodevelopmental impairment. It occurs most frequently in infants born before 32 weeks gestation and/or with birth weight < 1500 g, and almost always occurs within the first 5 postnatal days. IVH in the newborn can be clinically silent or present with an altered level of consciousness, hypotonia, and decreased spontaneous movements. Symptoms of catastrophic bleeding include a bulging anterior fontanelle, hypotension,

Intraventricular hemorrhage (IVH) is a common **complication of prematurity** that can lead to long-term neurodevelopmental impairment. It occurs most frequently in infants born before 32 weeks gestation and/or with birth weight < 1500 g, and almost always occurs within the first 5 postnatal days. IVH in the newborn can be clinically silent or present with an altered level of consciousness, hypotonia, and decreased spontaneous movements. Symptoms of catastrophic bleeding include a bulging anterior fontanelle, hypotension, decerebrate posturing, tonic-clonic seizures, irregular respirations, and coma.

IVH in preterm infants usually originates from the germinal matrix, a highly cellular and vascularized layer in the subventricular zone from which neurons and glial cells migrate out during brain development. The matrix contains numerous thin-walled vessels lacking the glial fibers that support other blood vessels throughout the brain, which contributes to the risk of hemorrhage. It is especially vulnerable to hemodynamic instability as premature infants can have impaired autoregulation of cerebral blood flow. Between 24-32 weeks of gestation, the germinal matrix becomes less prominent and its cellularity and vascularity decrease, reducing the risk of IVH.

(Choice A) Subdural hematoma can result from the rupture of cortical bridging veins. In infants, this can occur from violent shaking (shaken baby syndrome).

(Choice C) Epidural hematoma frequently occurs due to head trauma. It is often associated with temporal bone fracture and subsequent tearing of the middle meningeal artery.

(Choice D) The dural venous sinuses are venous channels found between layers of dura mater in the brain. Certain conditions (eg, malignancy, hypercoagulable states, and trauma) can result in thrombosis within the dural sinuses.

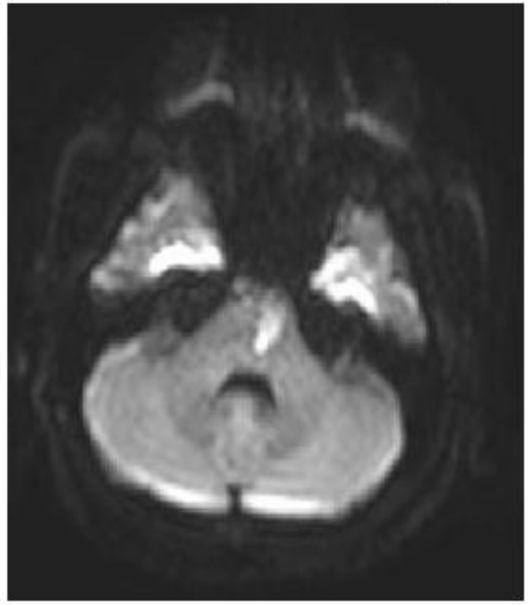
(Choice E) Saccular (berry) aneurysms are the most common cause of subarachnoid hemorrhage. They typically occur near the circle of Willis. Berry aneurysms are associated with Ehlers-Danlos syndrome and autosomal dominant polycystic kidney disease.

Educational objective:
Neonatal intraventricular hemorrhage usually occurs in the fragile germinal matrix and increases in frequency with decreasing age and birth weight. It is a common complication of prematurity that can lead to long-term neurodevelopmental impairment.

Time Spent: 3 seconds

Last updated: [12/19/2012]

A 65-year-old, right-handed man comes to the emergency department because of acute onset of slurred speech and dysphasia. He also complains of weakness on the left side of his face and body. He denies headache and double vision. His other medical problems include hypertension and diabetes mellitus. Examination shows reduced vibration and proprioception on the left side of the body. He has dysmetria and dysdiadochokinesia on the left side. He is ataxic and falls to the left while ambulating. Neurologic examination shows lower facial droop, hemiparesis, and presence of Babinski sign. Diffusion-weighted MRI of the brain reveals an acute infarct in the brainstem (as shown below):

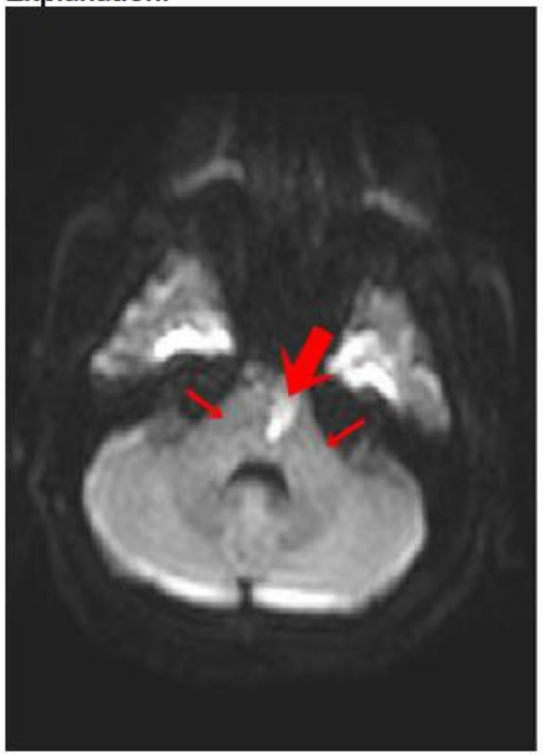


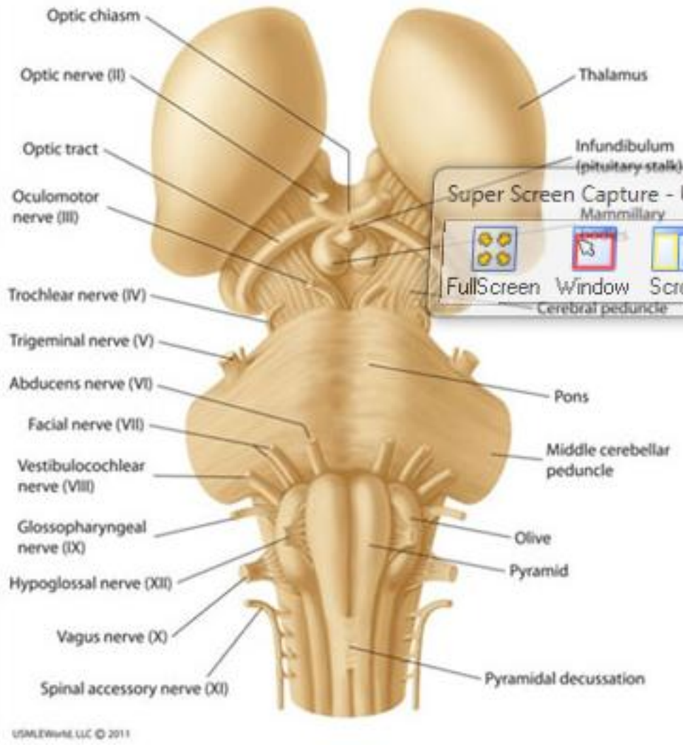
Which of the following cranial nerves is most likely to arise from this level of the brainstem?

- A. Facial [46%]
- B. Hypoglossal [21%]
- C. Oculomotor [9%]
- ✔ D. Trigeminal [19%]
- E. Trochlear [4%]

Explanation:

User Id: 477875





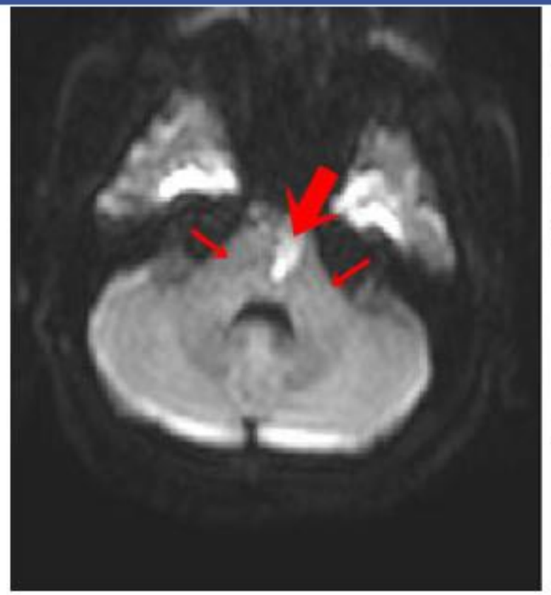
This patient is presenting with an acute lacunar ischemic stroke (thick red arrow) of the brainstem at the level of the middle cerebellar peduncle or brachium pontis (thin red arrows). The trigeminal nerve arises at the level of the middle cerebellar peduncle.

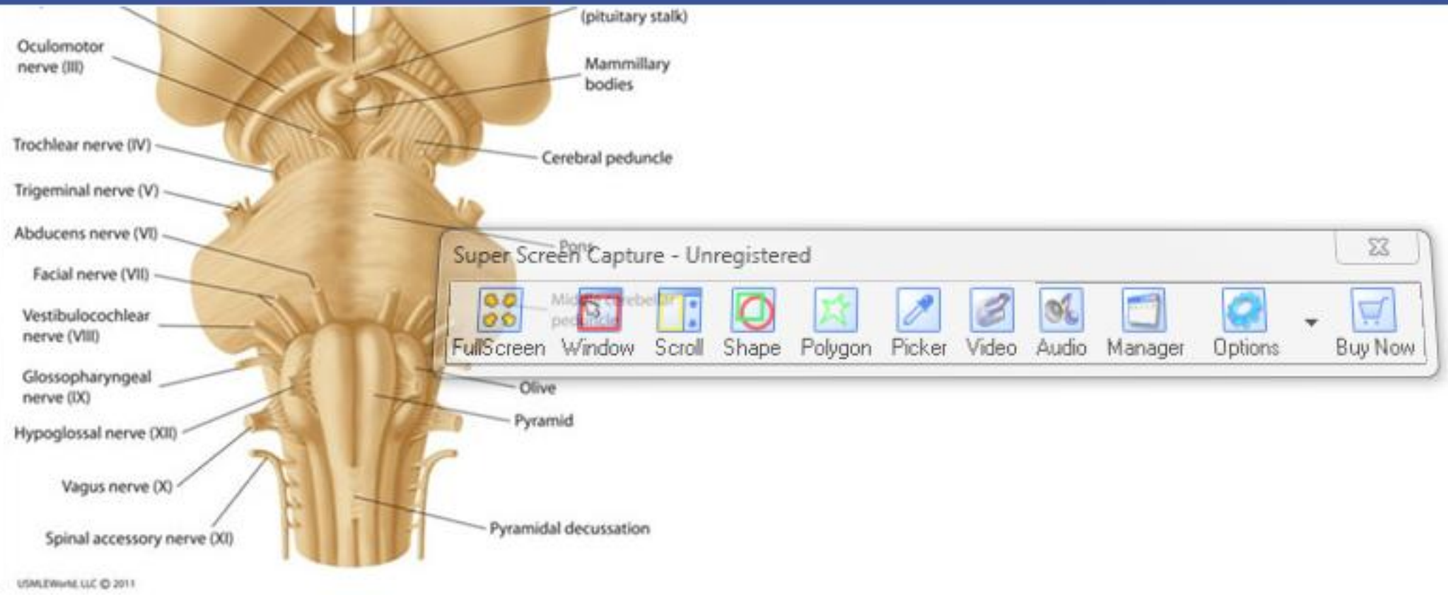
(Choice A) The facial nerve arises from the dorsolateral aspect of the pontomedullary junction (i.e., cerebellopontine angle), which is located at the level of the facial colliculus in the caudal pons.

(Choice B) The hypoglossal nerve arises from the preolivary sulcus at the level of the rostral medulla.

(Choice C) The oculomotor nerve arises at the level of the superior colliculus, which is located in the rostral mesencephalon or midbrain.

(Choice E) The trochlear nerve arises from behind the midbrain at the level of the inferior colliculus. The





This patient is presenting with an acute lacunar ischemic stroke (thick red arrow) of the brainstem at the level of the middle cerebellar peduncle or brachium pontis (thin red arrows). The trigeminal nerve arises at the level of the middle cerebellar peduncle.

(Choice A) The facial nerve arises from the dorsolateral aspect of the pontomedullary junction (i.e., cerebellopontine angle), which is located at the level of the facial colliculus in the caudal pons.

(Choice B) The hypoglossal nerve arises from the preolivary sulcus at the level of the rostral medulla.

(Choice C) The oculomotor nerve arises at the level of the superior colliculus, which is located in the rostral mesencephalon or midbrain.

(Choice E) The trochlear nerve arises from behind the midbrain at the level of the inferior colliculus. The trochlear nerve is the only cranial nerve to cross before exiting the brainstem.

Educational objective:
The trigeminal nerve arises at the level of the middle cerebellar peduncle in the pons.

Time Spent: 7 seconds

Last updated: [4/2/2013]

A patient presents to the emergency room complaining of worsening headaches, confusion, and intermittent vomiting. She is admitted, but later dies in the hospital. Examination of the brain at autopsy shows enlargement of the lateral and third ventricles and a normal-sized fourth ventricle. Where is the most likely site of obstruction in this patient?

A. Interventricular foramina of Monro [11%]

✔ B. Cerebral aqueduct [80%]

C. Medial foramen of Magendie [4%]

D. Lateral foramina of Luschka [3%]

E. Arachnoid villi [1%]

Explanation: **User Id: 477875**

This patient had findings consistent with noncommunicating hydrocephalus resulting from obstruction of cerebrospinal fluid (CSF) flow at the cerebral aqueduct.

CSF is formed by the choroid plexus in each of the four ventricles. The choroid plexus is composed of ependymal cell-covered outgrowths of the pia mater blood vessels. The ependymal epithelium is a simple ciliated columnar layer. Choroid plexus capillaries are fenestrated unlike the other CNS capillaries. The ependymal cells form tight junctions with one another and selectively allow certain materials from the blood to enter the CSF.

Once formed, CSF flows from the lateral ventricles to the third ventricle via the interventricular foramina of Monro. It then circulates to the fourth ventricle through the cerebral aqueduct (of Sylvius). CSF then exits the fourth ventricle and enters the subarachnoid space via one of three foramina, the lateral foramina of Luschka or the medial foramen of Magendie. CSF is returned to the venous circulation via the arachnoid villi (granulations).

Other forms of hydrocephalus are briefly as follows:

1. Communicating hydrocephalus: No blockage to CSF flow within the brain or brainstem. The blockage

• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

D. Lateral foramina of Luschka [3%]

E. Arachnoid villi [1%]

Explanation:

This patient had findings consistent with noncommunicating hydrocephalus resulting from obstruction of cerebrospinal fluid (CSF) flow at the cerebral aqueduct.

CSF is formed by the choroid plexus in each of the four ventricles. The choroid plexus is composed of ependymal cell-covered outgrowths of the pia mater blood vessels. The ependymal epithelium is a simple ciliated columnar layer. Choroid plexus capillaries are fenestrated unlike the other CNS capillaries. The ependymal cells form tight junctions with one another and selectively allow certain materials from the blood to enter the CSF.

Once formed, CSF flows from the lateral ventricles to the third ventricle via the interventricular foramina of Monro. It then circulates to the fourth ventricle through the cerebral aqueduct (of Sylvius). CSF then exits the fourth ventricle and enters the subarachnoid space via one of three foramina, the lateral foramina of Luschka or the medial foramen of Magendie. CSF is returned to the venous circulation via the arachnoid villi (granulations).

Other forms of hydrocephalus are briefly as follows:

1. Communicating hydrocephalus: No blockage to CSF flow within the brain or brainstem. The blockage is in the subarachnoid space where flow may be restricted by fibrosis following inflammation.
2. Normal pressure hydrocephalus: CSF is not absorbed by the arachnoid villi.
3. Hydrocephalus ex vacuo: Increased CSF volume occurring in conditions of brain atrophy.
4. Pseudotumor cerebri: A condition that classically occurs in overweight young females and is related to decreased CSF outflow at the arachnoid villi.

Educational Objective:
CSF flows from the third ventricle to the fourth ventricle via the cerebral aqueduct of Sylvius.

Time Spent: 3 seconds

Last updated: [7/7/2010]

A 43-year-old Caucasian female presents to your office with back pain after dragging a heavy box. She describes pain in the right posterior thigh and posterior calf shooting down to the foot. Physical examination reveals symmetric knee reflexes, but the ankle jerk reflex is slightly diminished on the right. Which of the following nerve roots is most likely affected in this patient?

- A. L2 [3%]
- B. L3 [3%]
- C. L4 [11%]
- D. L5 [15%]
- ✔ E. S1 [67%]

Explanation: **User Id: 477875**

The patient described in the question stem is suffering symptoms consistent with sciatic neuropathy, or sciatica. Sciatic neuropathy can result from any irritation of the sciatic nerve or its roots. Common causes include vertebral disc herniations, spinal canal stenosis, irritation by bone spurs, and irritation by the piriformis. Classic symptoms of sciatica include weakness of the posterior thigh muscles as well as weakness of all muscles below the knee. The sciatic nerve also provides sensory innervation to the posterior thigh and calf as well as the plantar surface of the foot. Transection of the sciatic nerve would result in an inability to flex the leg at the knee and paralysis of the muscles below the knee. The ankle reflex is diminished in sciatic nerve injury, but the patellar reflex is unaffected as this reflex arc is carried by fibers of the femoral nerve (L2 – L4).

The sciatic nerve is derived from the L4 through S3 nerve roots, so only choices C, D, and E are reasonable options. Sciatica most commonly involves L5 or S1. Of these, compression of the L5 root typically results in posterior and lateral thigh and leg pain shooting to the inner foot. Compression of the S1 root results in pain strictly in the posterior thigh and leg shooting to the foot accompanied by weakness of plantar flexion and loss of the ankle jerk reflex.

(Choices A and B) L2 and L3 contribute to the lateral femoral cutaneous nerve as well as other nerves such as the femoral, obturator, and genitofemoral. The lateral femoral cutaneous is a purely sensory nerve that enters the thigh deep to the inguinal ligament and supplies most of the skin of the anterior thigh.

(Choice C) L4 contributes partially to the femoral, sciatic, obturator, superior gluteal, and quadratus femoris

- D. L5 [15%]
- ✔ E. S1 [67%]

Explanation:

User Id: 477875

The patient described in the question stem is suffering symptoms consistent with sciatic neuropathy, or sciatica. Sciatic neuropathy can result from any irritation of the sciatic nerve or its roots. Common causes include vertebral disc herniations, spinal canal stenosis, irritation by bone spurs, and irritation by the piriformis. Classic symptoms of sciatica include weakness of the posterior thigh muscles as well as weakness of all muscles below the knee. The sciatic nerve also provides sensory innervation to the posterior thigh and calf as well as the plantar surface of the foot. Transection of the sciatic nerve would result in an inability to flex the leg at the knee and paralysis of the muscles below the knee. The ankle reflex is diminished in sciatic nerve injury, but the patellar reflex is unaffected as this reflex arc is carried by fibers of the femoral nerve (L2 – L4).

The sciatic nerve is derived from the L4 through S3 nerve roots, so only choices C, D, and E are reasonable options. Sciatica most commonly involves L5 or S1. Of these, compression of the L5 root typically results in posterior and lateral thigh and leg pain shooting to the inner foot. Compression of the S1 root results in pain strictly in the posterior thigh and leg shooting to the foot accompanied by weakness of plantar flexion and loss of the ankle jerk reflex.

(Choices A and B) L2 and L3 contribute to the lateral femoral cutaneous nerve as well as other nerves such as the femoral, obturator, and genitofemoral. The lateral femoral cutaneous is a purely sensory nerve that enters the thigh deep to the inguinal ligament and supplies most of the skin of the anterior thigh.

(Choice C) L4 contributes partially to the femoral, sciatic, obturator, superior gluteal, and quadratus femoris nerves. This nerve provides no sensation to the posterior thigh or leg. Damage to L4 would result in impairment of the knee jerk reflex.

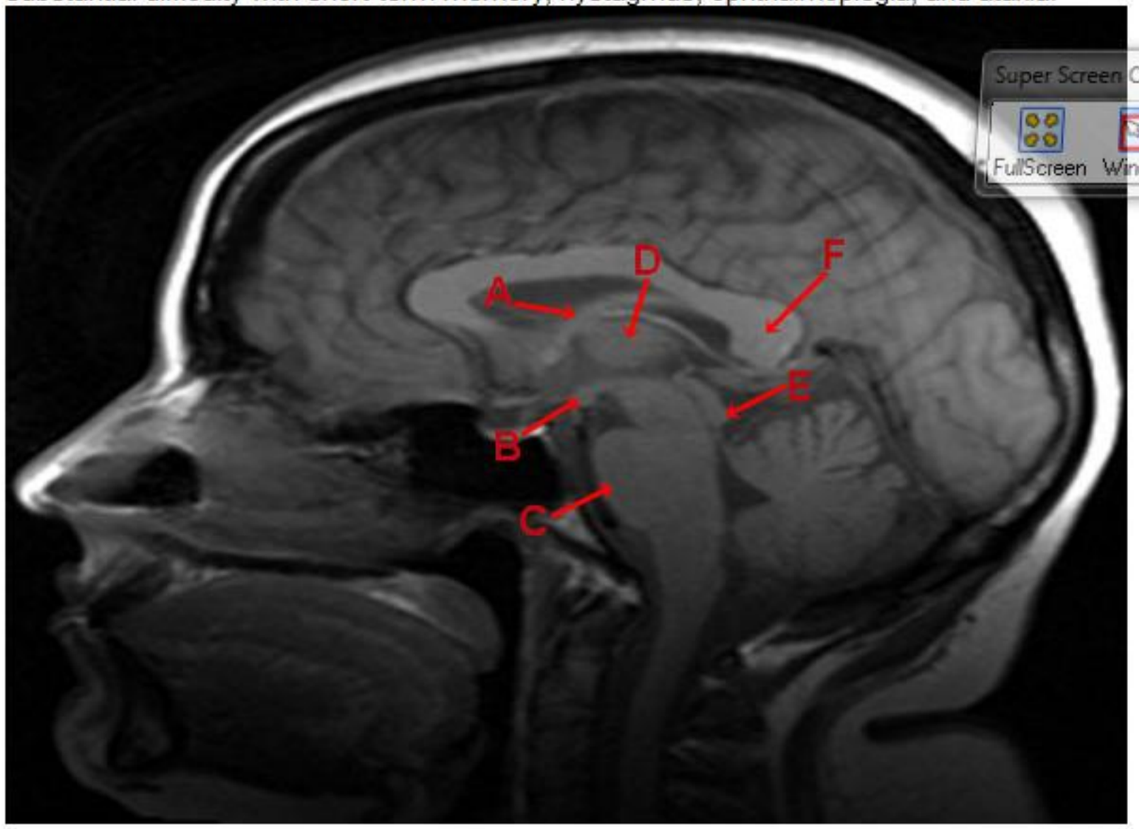
Educational Objective:
Sciatica is a painful condition characterized by shooting pain down the posterior thigh and leg that typically results from impingement of one of the spinal nerves as it leaves the vertebral column. Compression of the S1 root results specifically in pain purely in the posterior thigh and leg as well as diminution of the ankle jerk reflex.

Time Spent: 2 seconds

Last updated: [1/10/2013]

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

A 55-year-old, right-handed man is brought to the emergency department after police find him unresponsive on the street. In triage, he appears disheveled and homeless, with a strong odor of alcohol coming from his mouth. The patient is started on intravenous fluids with dextrose and admitted to the hospital for alcohol intoxication. Over the next several days, he slowly recovers. However, neurologic examination shows substantial difficulty with short-term memory, nystagmus, ophthalmoplegia, and ataxia.



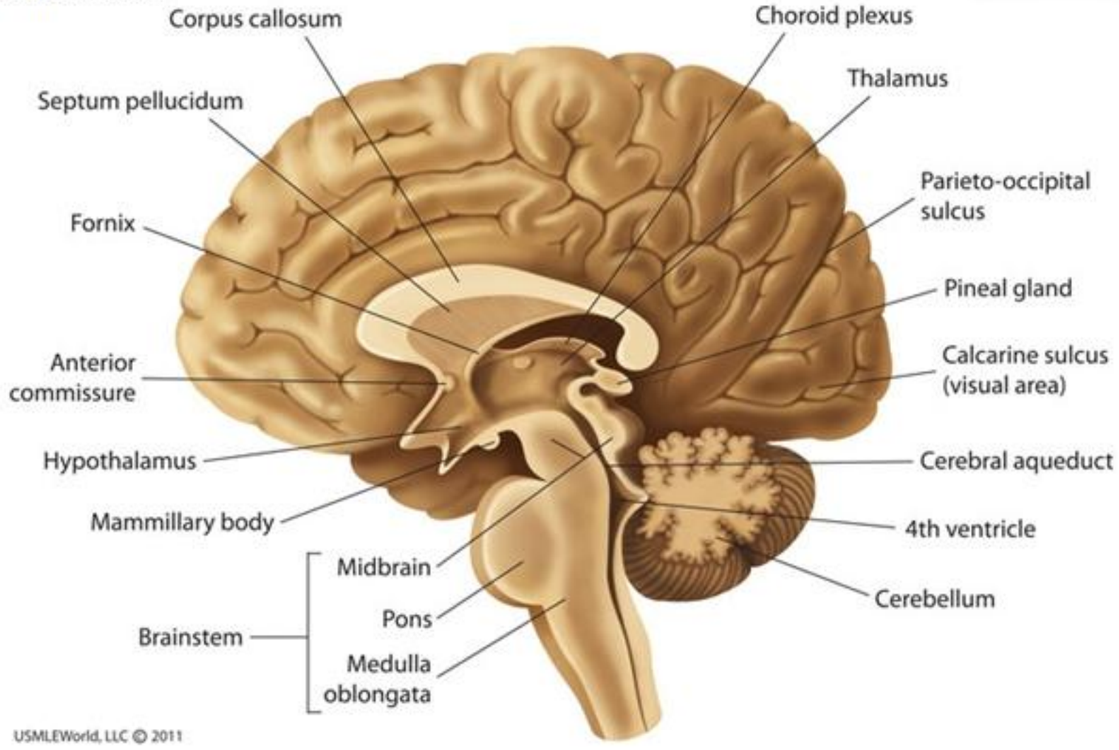
Which of the following identifiers from the brain image indicates the neural structure most likely to be damaged in this patient?

- A. A [6%]
- ✔ B. B [59%]

- A. A [6%]
- ✔ B. B [59%]
- C. C [5%]
- D. D [11%]
- E. E [16%]
- F. F [3%]

User Id: 477875

Explanation:



Chronic alcohol users are malnourished and have low levels of thiamine at baseline. Intravenous dextrose administration without prior thiamine supplementation in these patients results in an acute drop of thiamine

Chronic alcohol users are malnourished and have low levels of thiamine at baseline. Intravenous dextrose administration without prior thiamine supplementation in these patients results in an acute drop of thiamine level, leading to Wernicke encephalopathy. The clinical presentation of Wernicke encephalopathy includes ataxia, nystagmus, ophthalmoplegia, and anterograde amnesia. The chronic effects of thiamine deficiency lead to Korsakoff psychosis, which is characterized by anterograde and retrograde amnesia, apathy, lack of insight, and confabulation.

Thiamine is a key coenzyme for pyruvate dehydrogenase, which is involved in glucose metabolism. Thiamine deficiency results in the brain's inability to properly metabolize glucose and turn it into energy. The structure in the brain that most frequently undergoes necrosis in the setting of thiamine deficiency is the mammillary body. The mammillary body is part of the Papez circuit, which is a neural pathway of the limbic system that is involved in the cortical control of emotion and memory.

(Choice A) The fornix is a bundle of axons originating from the hippocampal subiculum that projects to the mammillary body. Because the fornix is part of the Papez circuit, damage to this structure can lead to a Wernicke encephalopathy. However, the most frequently affected structure in patients with Wernicke encephalopathy is the mammillary body.

(Choice C) The basis pontis is not frequently affected in Wernicke encephalopathy.

(Choice D) The dorsal thalamus is an egg-shaped structure in the diencephalon that is responsible for relaying information from the spinal cord and other subcortical structures to the cortex. The anterior nucleus of the thalamus, which is part of the Papez circuit, can be affected in patients with thiamine deficiency and lead to Wernicke encephalopathy but is not the most frequently affected structure.

(Choice F) The splenium of corpus callosum is not typically affected in Wernicke encephalopathy. Lesions (demyelinating or ischemic) in this structure will clinically result in alexia without agraphia.

(Choice E) The inferior colliculus is part of the auditory pathway and not typically affected in Wernicke encephalopathy.

Educational objective:
Thiamine (i.e., vitamin B1) deficiency acutely leads to Wernicke encephalopathy and chronically leads to Korsakoff psychosis. The neural structure most frequently affected in patients with Wernicke encephalopathy is the mammillary body, which is part of the Papez circuit. Alcoholic or malnourished patients should receive intravenous thiamine supplementation before intravenous dextrose administration because giving dextrose without prior thiamine can precipitate a Wernicke encephalopathy.

A 35-year-old male comes to your office complaining of a painful tongue sore. He also complains that over the last 2 weeks he has had a fever and been experiencing myalgias and arthralgias. He has no other medical problems. The patient works as a driver for a local delivery service. He is homosexual and admits to having unprotected sex with a stranger approximately 1 month ago. Physical examination reveals a rash over his trunk and cervical lymphadenopathy. An ulcer is located on the median sulcus of the tongue 1 cm anterior to the foramen cecum. You decide to draw blood to test for an HIV viral load and prescribe an oral analgesic gel to relieve his ulcer related pain. The pain sensation from his ulcer is most likely carried by which of the following nerves?

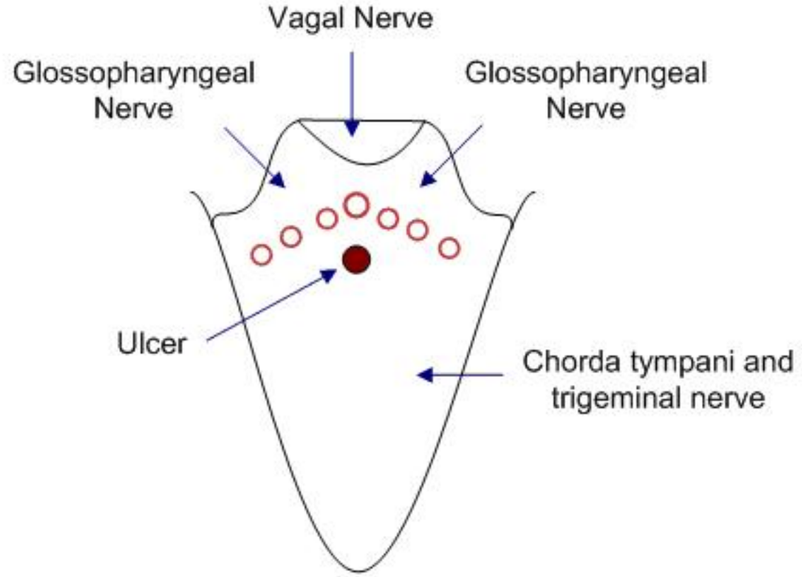
- A. Chorda tympani [9%]
- B. Glossopharyngeal nerve [29%]
- ✔ C. Mandibular division of the trigeminal nerve [50%]
- D. Maxillary division of the trigeminal nerve [9%]
- E. Vagus nerve [4%]

Explanation: **User Id: 477875**

Innervation of the tongue is complex, as there are motor, general sensory and gustatory (taste) components.

1. **Motor innervation** of the tongue is provided by the hypoglossal nerve (CN XII), with the exception of the palatoglossus muscle, which is innervated by the vagus nerve (CN X).
2. **General sensory** innervation of the tongue (including touch, pain, pressure, and temperature sensation) is provided by:
   - Anterior 2/3 of the tongue: mandibular branch of trigeminal nerve (CN V_3)
   - Posterior 1/3 of the tongue: glossopharyngeal nerve (CN IX)
   - Posterior area of the tongue root: vagus nerve (CN X)
3. **Gustatory innervation** (taste buds) is as follows:
   - Anterior 2/3 of the tongue: chorda tympani branch of facial nerve (CN VII)
   - Posterior 1/3 of the tongue: glossopharyngeal nerve (CN IX)
   - Posterior area of the tongue root and taste buds of the larynx and upper esophagus: vagus nerve (CN X)

The terminal sulcus delineates the anterior 2/3 of the tongue from the posterior 1/3. The foramen cecum is located along the terminal sulcus at the midline. Thus, an ulcer 1 cm distal to the foramen cecum would be located on the anterior 2/3 of the tongue. Pain from this region (as well as sensations of touch, pressure, and temperature) are transmitted by the mandibular branch of the trigeminal nerve.



(Choice A) The chorda tympani branch of the facial nerve (CN VII) transmits gustatory sensation from anterior 2/3 of the tongue but not painful stimuli.

(Choice B) The glossopharyngeal nerve transmits taste, pain, temperature and touch stimuli from the posterior 1/3 of the tongue.

(Choice D) The maxillary division of the trigeminal nerve does not participate in tongue innervation.

(Choice E) The vagus nerve innervates the far posterior area of the tongue root, transmitting both gustatory and general sensory stimuli.

Educational Objective:
General sensation from the anterior 2/3 of the tongue is carried by the mandibular division of the trigeminal nerve. Gustatory innervation of anterior 2/3 of the tongue is provided by chorda tympani branch of the facial

An infant born to a 22-year-old female has difficulty feeding because of an underdeveloped mandible. Development of which of the following structures is likely also impaired in this patient?

- A. Styloid process [15%]
- B. Lesser horn of the hyoid [18%]
- C. Stapes [13%]
- ✔ D. Malleus [44%]
- E. Thyroid cartilage [10%]

Explanation: **User Id: 477875**

The infant described in the question is suffering a defect in development of the first pharyngeal (branchial) arch. There are six branchial arches in the developing embryo, and all but the fifth arch contribute structures to the adult; the fifth arch regresses completely. Each pharyngeal arch is associated with a cranial nerve, and knowledge of which nerve is paired with which arch can assist in remembering which adult structures are derived from each arch. In addition, note that the muscular elements are formed by mesoderm and the bony elements are formed by neural crest cells that migrate in.

The first arch is associated with the trigeminal nerve (CN V). The neural crest cells of the first arch form the bones associated with this structure, which include the maxilla, zygoma, mandible, vomer, palatine, incus, and malleus **(Choice D)**. Aberrant neural crest cell migration into the first arch can cause bony deformities as described in the question stem. Mesodermal derivatives include all muscles of mastication, anterior belly of the digastric, mylohyoid, tensor tympani, and tensor veli palatini.

(Choices A, B and C) The styloid process, lesser horn of the hyoid, and the stapes are all neural crest derivatives of the second pharyngeal arch. The second arch is associated with the facial nerve (CN VII) and gives rise to the muscles of facial expression, the stylohyoid, the stapedius, and the posterior belly of the digastric.

(Choice E) The fourth and sixth arches together make up the cartilaginous structures of the larynx.

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

B. Lesser horn of the hyoid [18%]

C. Stapes [13%]

✔ D. Malleus [44%]

E. Thyroid cartilage [10%]

Explanation:

The infant described in the question is suffering a defect in development of the first pharyngeal (branchial) arch. There are six branchial arches in the developing embryo, and all but the fifth arch contribute structures to the adult; the fifth arch regresses completely. Each pharyngeal arch is associated with a cranial nerve, and knowledge of which nerve is paired with which arch can assist in remembering which adult structures are derived from each arch. In addition, note that the muscular elements are formed by mesoderm and the bony elements are formed by neural crest cells that migrate in.

The first arch is associated with the trigeminal nerve (CN V). The neural crest cells of the first arch form the bones associated with this structure, which include the maxilla, zygoma, mandible, vomer, palatine, incus, and malleus **(Choice D)**. Aberrant neural crest cell migration into the first arch can cause bony deformities as described in the question stem. Mesodermal derivatives include all muscles of mastication, anterior belly of the digastric, mylohyoid, tensor tympani, and tensor veli palatini.

(Choices A, B and C) The styloid process, lesser horn of the hyoid, and the stapes are all neural crest derivatives of the second pharyngeal arch. The second arch is associated with the facial nerve (CN VII) and gives rise to the muscles of facial expression, the stylohyoid, the stapedius, and the posterior belly of the digastric.

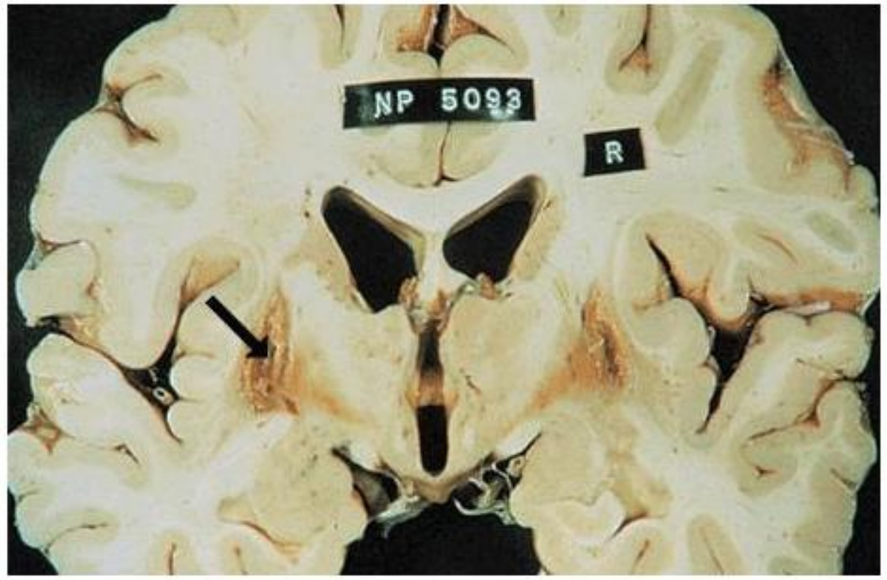
(Choice E) The fourth and sixth arches together make up the cartilaginous structures of the larynx.

Educational Objective:
The first arch can be poorly formed during embryonic development resulting in first arch syndrome. Abnormalities include malformation of the mandible, maxilla, malleus, incus, zygoma, vomer, palate, and temporal bone. The first arch is associated with the trigeminal nerve.

Time Spent: 3 seconds

Last updated: [7/7/2010]

A 54-year-old Caucasian male dies from a progressive neurological disorder. A brain section of the patient is shown below.



Which of the following corresponds to the structure with cystic degeneration (black arrow)?

- A. Globus pallidus [19%]
- ✔ B. Putamen [51%]
- C. Internal capsule [10%]
- D. Caudate nucleus [16%]
- E. Amygdala [3%]

Explanation:

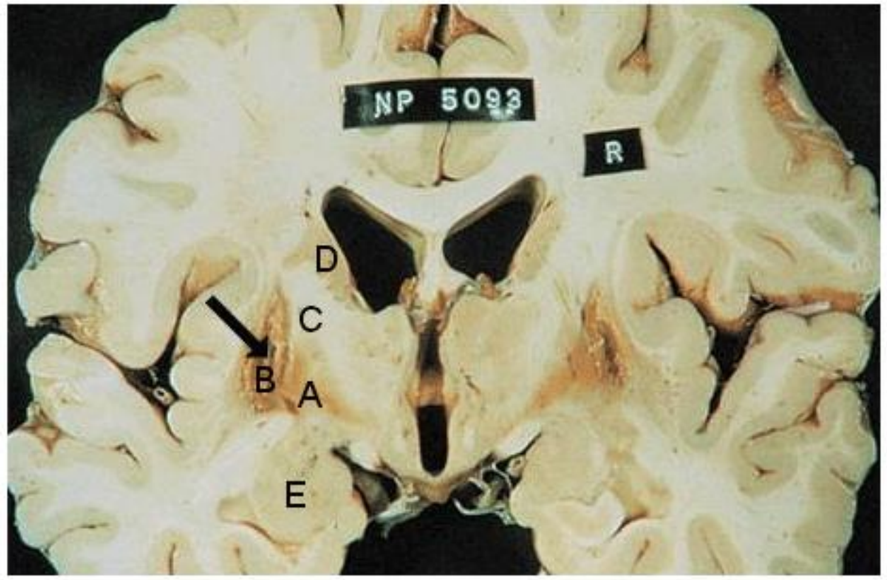
User Id: 477875

Explanation:

User Id: 477875

Many progressive neurologic diseases may be associated with cystic degeneration of the putamen, but Wilson's disease is the most likely of these to be emphasized on the USMLE.

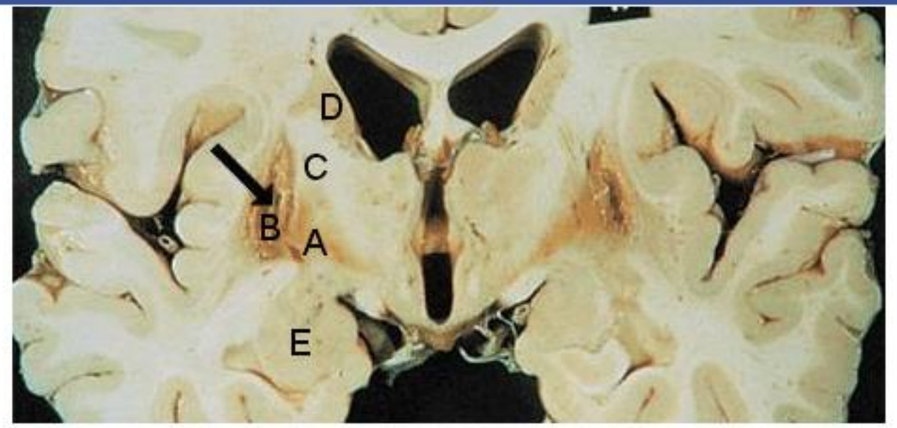
The putamen **(Choice B)** can be identified on coronal sections (either in gross specimens as above or on imaging studies) in a location immediately deep (medial) to the insula and lateral to the globus pallidus and internal capsule.



(Choice A) The globus pallidus is the orange-colored structure on the above image immediately medial to the degenerated putamen. It is considered part of the basal ganglia along with the caudate and putamen.

(Choice C) The internal capsule is the white matter structure that separates the globus pallidus and putamen from the caudate nucleus anteriorly and from the thalamus posteriorly on coronal sections.

(Choice D) In its full three dimensional structure, the caudate nucleus is a curved or "C-shaped" structure



(Choice A) The globus pallidus is the orange-colored structure on the above image immediately medial to the degenerated putamen. It is considered part of the basal ganglia along with the caudate and putamen.

(Choice C) The internal capsule is the white matter structure that separates the globus pallidus and putamen from the caudate nucleus anteriorly and from the thalamus posteriorly on coronal sections.

(Choice D) In its full three dimensional structure, the caudate nucleus is a curved or "C-shaped" structure that can be identified in the inferolateral walls of the anterior horns of the lateral ventricles. However, only a small cross-section is visible in the image above next to the lateral ventricles. This structure is affected in Huntington's disease.

(Choice E) The amygdala is a group of neurons in the medial temporal lobe located adjacent to the hippocampus that plays a role in the limbic system. The amygdala can be identified on the image above as the circular grey matter structures in the medial temporal lobe immediately inferior to the globus pallidus and putamen. The amygdala mediates fear and some sympathetic stimulation in humans.

Educational Objective:
Wilson's disease can cause cystic degeneration of the putamen as well as damage to other basal ganglia structures. The putamen is located medial to the insula and lateral to the globus pallidus on coronal sections.

Time Spent: 5 seconds

Last updated: [1/18/2013]

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

A 43-year-old female undergoes brain MRI for a long history of complex neurological complaints. The findings from the imaging study are shown below.

You suspect that this patient initially suffered from which of the following?

A. Tinnitus and unilateral deafness [2%]
B. Headaches and anosmia [8%]

You suspect that this patient initially suffered from which of the following?

- A. Tinnitus and unilateral deafness [2%]
- B. Headaches and anosmia [8%]
- ✔ C. Progressive leg weakness and spasticity [83%]
- D. Unilateral ptosis and gaze palsy [4%]
- E. Bitemporal visual field defects [2%]

Explanation:

User Id: 477875

The image above shows a tumor adjacent to the falx cerebri and compressing the medial surface of the hemisphere. This is a typical meningioma location. Compression of the parasagittal cortex causes contralateral spastic paralysis of the leg. Focal seizures may also occur.

Meningiomas are the second-most common brain tumors in adults (the most common is glioblastoma multiforme). These benign and slow-growing tumors arise from arachnoid villi. On light microscopy, meningiomas are composed of concentrically-arranged meningothelial cells. Psammoma bodies (concentric laminar calcifications) are characteristic.

Meningiomas are commonly located in the parasagittal region; they can also be found adjacent to the lateral convexity of the hemisphere, in the region of the sphenoid wing and olfactory groove.

(Choice A) Tinnitus and unilateral hearing loss are the common presenting features of a cerebellopontine angle tumor, such as an acoustic neuroma.

(Choice B) Meningiomas located in the olfactory groove present with headache and anosmia.

(Choice D) Unilateral ptosis and gaze palsy ("down and out" gaze) are features of CN III paralysis. CN III can suffer damage from compression (by berry aneurysm or uncal herniation) or via nerve ischemia (diabetes mellitus).

(Choice E) Bitemporal hemianopia occurs due to compression of the central part of the optic chiasm. Pituitary adenoma and craniopharyngioma are common causes.

Educational Objective:

- B. Headaches and anosmia [8%]
- ✔ C. Progressive leg weakness and spasticity [83%]
- D. Unilateral ptosis and gaze palsy [4%]
- E. Bitemporal visual field defects [2%]

Explanation:

The image above shows a tumor adjacent to the falx cerebri and compressing the medial surface of the hemisphere. This is a typical meningioma location. Compression of the parasagittal cortex causes contralateral spastic paralysis of the leg. Focal seizures may also occur.

Meningiomas are the second-most common brain tumors in adults (the most common is glioblastoma multiforme). These benign and slow-growing tumors arise from arachnoid villi. On light microscopy, meningiomas are composed of concentrically-arranged meningothelial cells. Psammoma bodies (concentric laminar calcifications) are characteristic.

Meningiomas are commonly located in the parasagittal region; they can also be found adjacent to the lateral convexity of the hemisphere, in the region of the sphenoid wing and olfactory groove.

(Choice A) Tinnitus and unilateral hearing loss are the common presenting features of a cerebellopontine angle tumor, such as an acoustic neuroma.

(Choice B) Meningiomas located in the olfactory groove present with headache and anosmia.

(Choice D) Unilateral ptosis and gaze palsy ("down and out" gaze) are features of CN III paralysis. CN III can suffer damage from compression (by berry aneurysm or uncal herniation) or via nerve ischemia (diabetes mellitus).

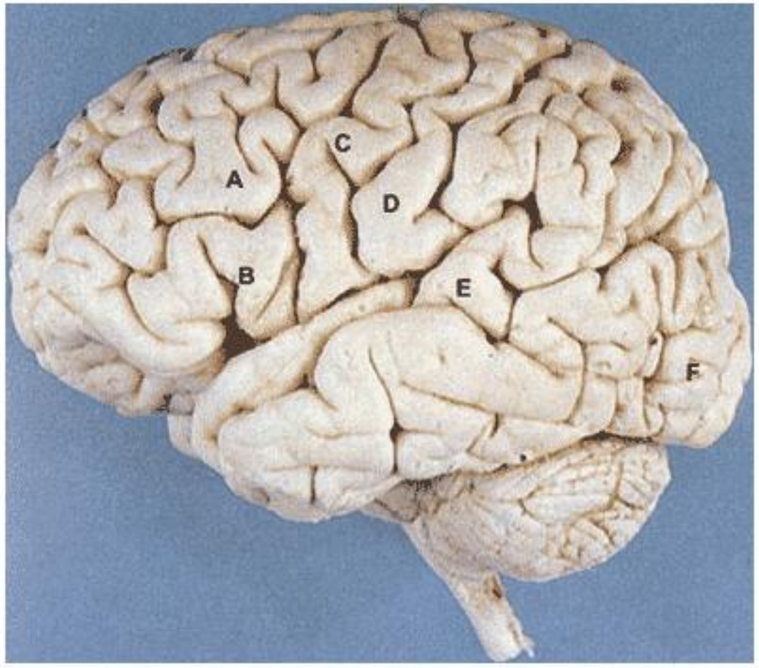
(Choice E) Bitemporal hemianopia occurs due to compression of the central part of the optic chiasm. Pituitary adenoma and craniopharyngioma are common causes.

Educational Objective:
Meningiomas are located adjacent to the cerebral surface. Parasagittal meningiomas cause contralateral spastic paresis of the leg due to compression of the leg-foot motor area.

Time Spent: 8 seconds

Last updated: [11/10/2011]

A 54-year-old male is brought to the emergency department by his wife after he began having difficulty speaking. On examination, the patient is able to state his first name and can correctly point to different body parts on command. When he is asked about the onset of his symptoms, he responds, "I... weak... morning..." and becomes very frustrated. This patient likely has a disease process affecting which of the following brain areas?



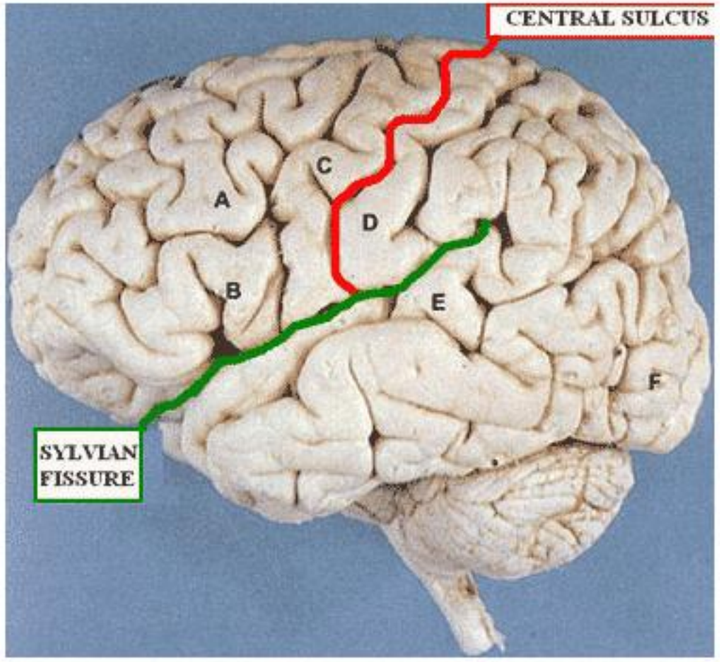
- A. A [5%]
- ✔ B. B [72%]
- C. C [2%]
- D. D [7%]
- E. E [12%]

Explanation:

User Id: 477875

Because this patient can understand spoken language and follow commands, we know that his comprehension is intact, making a transcortical aphasia unlikely. (His poor repetition is also uncharacteristic of transcortical aphasia.) The patient's speech is labored and lacking in small connecting words, and his frustration indicates that he has insight into his speaking difficulties. These features are most consistent with a Broca (motor, nonfluent) aphasia.

Patients with Broca aphasia are able to communicate meaningfully, but speech is slow, and consists primarily of nouns and verbs. Speech may be punctuated by pauses after each word as the patient attempts to verbalize the next. Broca aphasia classically results from damage to Broca's area, which is responsible for all communicative motor planning (hence why patients with Broca aphasia also have difficulty writing and signing). Broca's area **(Choice B)** is in the caudal part of the inferior frontal gyrus of the dominant (usually left) hemisphere (Brodmann areas 44 and 45).



• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

(Choice A) This labels a part of the middle frontal gyrus of the dorsolateral prefrontal cortex. This region corresponds most closely to Brodmann area 8, the frontal eye field. Damage here would cause the eyes to deviate to the ipsilateral side.

(Choice C) This labels the precentral gyrus (primary motor cortex). A primary motor cortex lesion could cause dysarthria due to paresis/paralysis of the skeletal muscles involved in movements of the mouth, tongue and larynx.

(Choice D) This labels the postcentral gyrus (primary somatosensory cortex). A lesion here would cause sensation loss in the corresponding area of the body.

(Choice E) This labels the caudal superior temporal gyrus (Brodmann area 22). This is the location of Wernicke's area. A lesion here would cause a sensory (receptive) aphasia. Wernicke aphasia is also known as fluent aphasia because speech flows readily but is meaningless. Patients classically lack insight into their problem.

Educational Objective:
Motor (Broca) aphasia is a nonfluent aphasia that results from damage to Broca's area in the inferior frontal gyrus of the dominant hemisphere. Patients understand language but cannot properly formulate the motor commands to form words or write. Speech is slow and fragmented, with short agrammatic phrases. Word-finding difficulty is often prominent. Patients have insight into their aphasia and are often frustrated by it.

Time Spent: 10 seconds

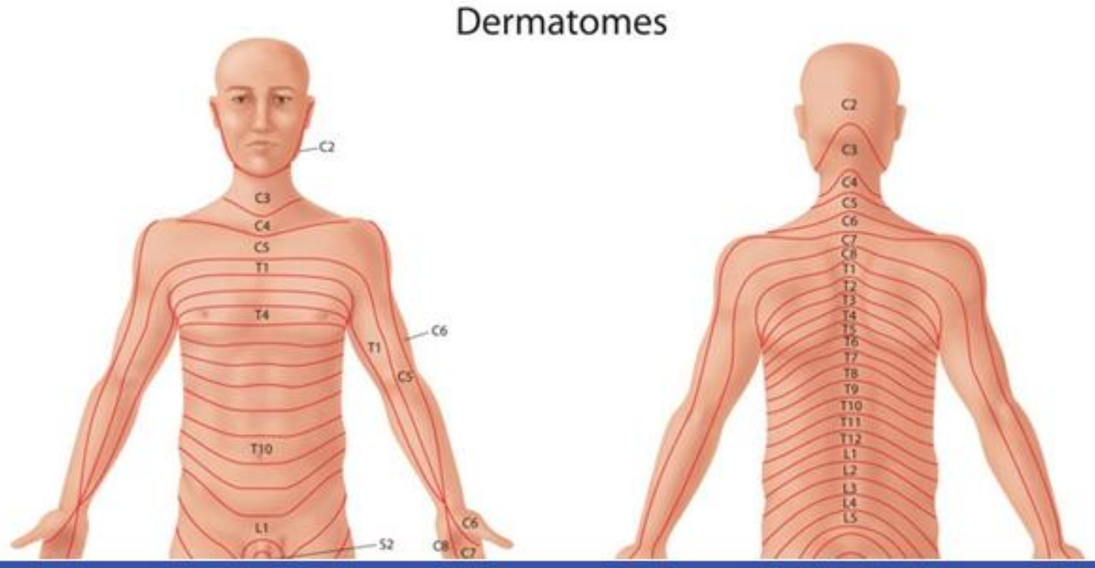
Last updated: [11/10/2011]

A 53-year-old man comes to the emergency department because of severe low back pain. His back pain started 2 weeks ago without history of trauma and has been keeping him awake at night. The pain has acutely worsened over the past 2 days and is not relieved with over-the-counter pain medications. He takes no other medication. He has no known drug allergies. He does not use tobacco, alcohol, or illicit drugs. His vital signs are within normal limits. Examination shows pain in the low back region with flexing of the back and raising of the legs. Pinprick in the perianal area does not cause rapid contraction of the anal sphincter. Which of the following nerve roots is most likely to be involved in this patient's condition?

- A. T12 [2%]
- B. L2 [5%]
- C. L4 [5%]
- D. L5 [7%]
- E. S1 [30%]
- ✔ F. S4 [51%]

Explanation:

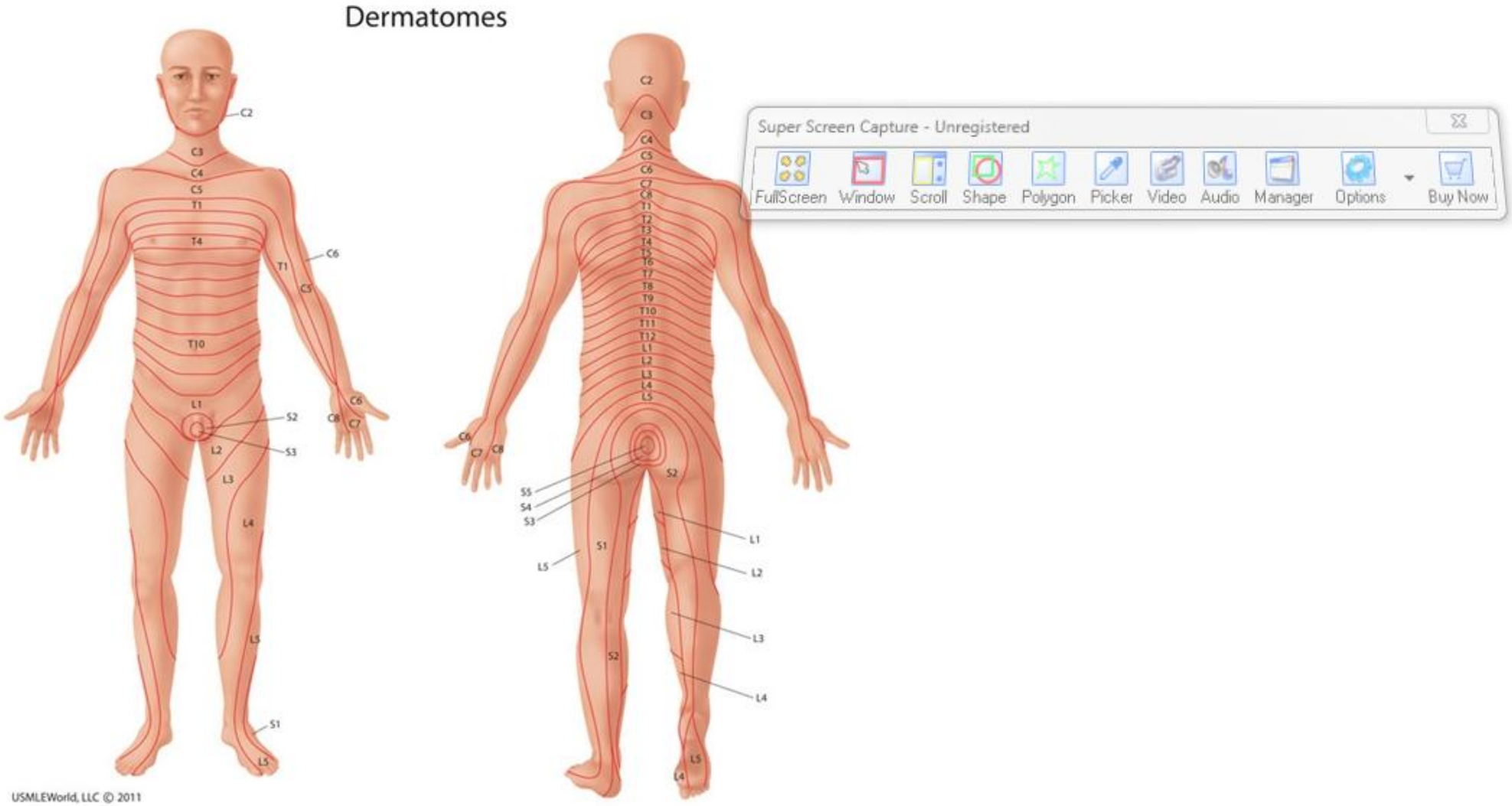
User Id: 477875



2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

Explanation:

User Id: 477875



In an adult, the spinal cord terminates in a tapering fashion at the **conus medullaris** at approximately the L2 vertebral level. After this point, spinal nerves from the conus medullaris exit inferiorly through their respective

In an adult, the spinal cord terminates in a tapering fashion at the **conus medullaris** at approximately the L2 vertebral level. After this point, spinal nerves from the conus medullaris exit inferiorly through their respective intervertebral foramina. This collection of spinal nerves (now considered peripheral nerves) is referred to as the cauda equina (i.e., horse's tail). Conus medullaris syndrome refers to lesions at L2. It has symptoms of flaccid paralysis of the bladder and rectum, impotence, and saddle (S3-S5 roots) anesthesia. There is usually mild weakness of the leg muscle if the lesion spares both the lumbar cord and the adjacent spinal and lumbar nerve roots. Common causes include disk herniation, tumors, and spinal fractures.

In contrast, cauda equina syndrome typically results from a massive rupture of an intervertebral disk that is capable of causing compression of two or more of the 18 spinal nerve roots of the cauda equina. However, it can also occur due to any trauma or space-occupying lesion of the lower vertebral column. The cauda equina nerve roots provide the sensory and motor innervation of most of the lower extremities, the pelvic floor, and the sphincters.

Classic symptoms of cauda equina syndrome include low back pain radiating to one or both legs, saddle anesthesia, loss of anocutaneous reflex (as in this patient), bowel and bladder dysfunction (S3-S5 roots), and loss of ankle-jerk reflex with plantar flexion weakness of the feet. Of the potentially involved spinal nerves, a lesion involving S2 through S4 will cause the symptoms described in this patient, indicating impairment of the pudendal nerve that innervates the perineum.

(Choice A) Compression at T12 results in impingement of the spinal cord where the lumbar spinal nerves originate.

(Choice B) L2 lesions cause anesthesia or paresthesias posteriorly in the gluteal region inferior to the iliac crests and anteriorly on the thigh inferior to the femoral triangle and inguinal ligament.

(Choice C) The L3 and L4 spinal levels contribute to the femoral nerve and mediate the quadriceps (i.e., knee-jerk and patellar) reflex. Lesions in these levels cause loss of this reflex as well as paresthesias and weakness over the anterior thigh.

(Choice D) L5 lesions cause sensory loss or paresthesias over the anterior leg.

(Choice E) The S1 and S2 roots mediate the Achilles (i.e., ankle-jerk) reflex, which tests for the integrity of the sciatic nerve. Lesions in these roots cause sensory loss or paresthesias over the posterior leg and thigh.

Educational objective:
Saddle anesthesia and loss of the anocutaneous reflex are symptoms of cauda equina syndrome, which is

In contrast, cauda equina syndrome typically results from a massive rupture of an intervertebral disk that is capable of causing compression of two or more of the 18 spinal nerve roots of the cauda equina. However, it can also occur due to any trauma or space-occupying lesion of the lower vertebral column. The cauda equina nerve roots provide the sensory and motor innervation of most of the lower extremities, the pelvic floor, and the sphincters.

Classic symptoms of cauda equina syndrome include low back pain radiating to one or both legs, saddle anesthesia, loss of anocutaneous reflex (as in this patient), bowel and bladder dysfunction (S3-S5 roots), and loss of ankle-jerk reflex with plantar flexion weakness of the feet. Of the potentially involved spinal nerves, a lesion involving S2 through S4 will cause the symptoms described in this patient. S2 through S4 form the pudendal nerve that innervates the perineum.

(Choice A) Compression at T12 results in impingement of the spinal cord where the lumbar spinal nerves originate.

(Choice B) L2 lesions cause anesthesia or paresthesias posteriorly in the gluteal region inferior to the iliac crests and anteriorly on the thigh inferior to the femoral triangle and inguinal ligament.

(Choice C) The L3 and L4 spinal levels contribute to the femoral nerve and mediate the quadriceps (i.e., knee-jerk and patellar) reflex. Lesions in these levels cause loss of this reflex as well as paresthesias and weakness over the anterior thigh.

(Choice D) L5 lesions cause sensory loss or paresthesias over the anterior leg.

(Choice E) The S1 and S2 roots mediate the Achilles (i.e., ankle-jerk) reflex, which tests for the integrity of the sciatic nerve. Lesions in these roots cause sensory loss or paresthesias over the posterior leg and thigh.

Educational objective:
Saddle anesthesia and loss of the anocutaneous reflex are symptoms of cauda equina syndrome, which is associated with damage to the S2 through S4 nerve roots.

References:

1. Cauda equina syndrome

Time Spent: 2 seconds

Last updated: [1/6/2013]

• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

A 53-year-old male complains of a "strange feeling" in his right hand. On physical examination, there is loss of sensation over the 5th digit. Which of the following nerves has most likely been injured?

- ✔ A. Ulnar [91%]
- B. Median [4%]
- C. Radial [3%]
- D. Musculocutaneous [1%]
- E. Axillary [0%]

Explanation:

User Id: 477875

Loss of sensation in the 5th digit can only be due to injury of the ulnar nerve. The ulnar nerve innervates the flexor carpi ulnaris and the medial portion of the flexor digitorum profundus as well as most of the intrinsic muscles of the hand. Injury to the ulnar nerve results in a "claw hand" deformity as well as anesthesia over the medial 1½ digits.

The ulnar nerve is a branch of the medial cord of the brachial plexus (C8-T1) that courses posteromedially in the upper arm and enters the forearm after passing posterior to the medial epicondyle of the humerus. This site, the "funny bone," is a common site of ulnar nerve injury. The ulnar nerve is also often injured where it passes between the hook of the hamate and the pisiform bone in the wrist within Guyon's canal.

(Choice B) Median nerve injury classically results from carpal tunnel syndrome or fractures of the supracondylar humerus. Patients lose sensory innervation to the majority of the palmar and dorsal 1st through 3rd digits. Motor deficits include loss of extrinsic finger flexion, loss of thumb movement and loss of pronation. There may be flattening of the thenar eminence due to denervation atrophy, producing an 'ape hand' deformity.

(Choice C) The radial nerve innervates the extensor compartment of the forearm. Injury causes wrist drop. Patients also lose sensation to the posterior arm, posterior forearm, and a small portion of the dorsal thumb.

(Choice D) Musculocutaneous nerve injury causes loss of sensation over the lateral forearm and paralysis of the forearm flexors at the elbow.

- C. Radial [3%]
- D. Musculocutaneous [1%]
- E. Axillary [0%]

Explanation:

Loss of sensation in the 5th digit can only be due to injury of the ulnar nerve. The ulnar nerve innervates the flexor carpi ulnaris and the medial portion of the flexor digitorum profundus as well as most of the intrinsic muscles of the hand. Injury to the ulnar nerve results in a "claw hand" deformity as well as anesthesia over the medial 1½ digits.

The ulnar nerve is a branch of the medial cord of the brachial plexus (C8-T1) that courses posteromedially in the upper arm and enters the forearm after passing posterior to the medial epicondyle of the humerus. This site, the "funny bone," is a common site of ulnar nerve injury. The ulnar nerve is also often injured where it passes between the hook of the hamate and the pisiform bone in the wrist within Guyon's canal.

(Choice B) Median nerve injury classically results from carpal tunnel syndrome or fractures of the supracondylar humerus. Patients lose sensory innervation to the majority of the palmar and dorsal 1st through 3rd digits. Motor deficits include loss of extrinsic finger flexion, loss of thumb movement and loss of pronation. There may be flattening of the thenar eminence due to denervation atrophy, producing an 'ape hand' deformity.

(Choice C) The radial nerve innervates the extensor compartment of the forearm. Injury causes wrist drop. Patients also lose sensation to the posterior arm, posterior forearm, and a small portion of the dorsal thumb.

(Choice D) Musculocutaneous nerve injury causes loss of sensation over the lateral forearm and paralysis of the forearm flexors at the elbow.

(Choice E) Axillary nerve injury can result from fracture of the surgical neck of the humerus or other shoulder trauma. Patients lose sensation over the lateral upper arm.

Educational Objective:
Ulnar nerve injury causes sensation loss to the medial 1½ digits of the hand.

Time Spent: 3 seconds

Last updated: [1/10/2013]

A 34-year-old female presents to your office with moderate hearing loss that she noticed several months ago. She also complains of a noise in her right ear that is very disturbing. Physical examination shows right-sided hearing loss, an asymmetric smile, and decreased corneal reflex in her right eye. This patient's condition suggests an intracranial mass located in which of the following locations?

- A. Between the medulla and the cerebellar hemispheres [13%]
- B. Above the diaphragma sellae [5%]
- C. Over the lateral hemispheric fissure [6%]
- ✔ D. Between the cerebellum and the lateral pons [65%]
- E. In the parasagittal aspect of the brain convexity [4%]
- F. Between the cerebellar peduncles [6%]

Explanation: **User Id: 477875**

Intracranial schwannomas are most commonly located at the cerebellopontine angle, which is between the cerebellum and lateral pons. Schwannomas of this location arise from CN VIII and are called acoustic neuromas. CN VII (facial nerve) and CN V (trigeminal nerve) are in proximity to CN VIII and may also be affected by acoustic neuromas via compression. The patient in this vignette displays symptoms of CN VIII involvement as well as CN V and CN VII.

1. The cochlear part of CN VIII mediates hearing. Its compression leads to sensorineural hearing loss and tinnitus (ear ringing).
2. The vestibular part of CN VIII maintains balance. Its compression causes vertigo, dysequilibrium, and nystagmus.
3. CN VII involvement leads to paralysis of the muscles of facial expression, loss of taste in the anterior 2/3 of the tongue, and hyperacusis (paralysis of the stapedius).
4. Compression of CN V causes loss of sensation around the mouth and nose, loss of corneal reflex, and paralysis of the muscles of mastication.

Bilateral acoustic neuromas are associated with neurofibromatosis type 2.

(Choice B) Germ cell tumors arise in the pineal and suprasellar regions. They can cause aqueductal stenosis (with obstructive hydrocephalus) and Parinaud syndrome (paralysis of vertical gaze).

- E. In the parasagittal aspect of the brain convexity [4%]
- F. Between the cerebellar peduncles [6%]

Explanation:

User Id: 477875

Intracranial schwannomas are most commonly located at the cerebellopontine angle, which is between the cerebellum and lateral pons. Schwannomas of this location arise from CN VIII and are called acoustic neuromas. CN VII (facial nerve) and CN V (trigeminal nerve) are in proximity to CN VIII and may also be affected by acoustic neuromas via compression. The patient in this vignette displays symptoms of CN VIII involvement as well as CN V and CN VII.

1. The cochlear part of CN VIII mediates hearing. Its compression leads to sensorineural hearing loss and tinnitus (ear ringing).
2. The vestibular part of CN VIII maintains balance. Its compression causes vertigo, dysequilibrium, and nystagmus.
3. CN VII involvement leads to paralysis of the muscles of facial expression, loss of taste in the anterior 2/3 of the tongue, and hyperacusis (paralysis of the stapedius).
4. Compression of CN V causes loss of sensation around the mouth and nose, loss of corneal reflex, and paralysis of the muscles of mastication.

Bilateral acoustic neuromas are associated with neurofibromatosis type 2.

(Choice B) Germ cell tumors arise in the pineal and suprasellar regions. They can cause aqueductal stenosis (with obstructive hydrocephalus) and Parinaud syndrome (paralysis of vertical gaze).

(Choices C and E) Meningiomas are commonly found over the lateral hemispheric fissure and in the parasagittal aspect of the brain convexity. On light microscopy, meningiomas have a whorled pattern of cell growth—also, psammoma bodies are present. Clinically, meningiomas may manifest with headache, focal deficit, or seizure.

Educational Objective:
Sensorineural hearing loss, tinnitus, paralysis of facial muscles, and loss of corneal reflex signify the involvement of CN V, VII, and VIII. Simultaneous compression of these nerves is caused by tumor of the cerebellopontine angle, which are most commonly acoustic neuromas.

Time Spent: 2 seconds

Last updated: [7/7/2010]

A 26-year-old female presents to your office with a three-month history of amenorrhea. She also notes that during this time her breasts have become engorged. She is taking a drug that helps her 'not to hear voices' and acetaminophen for occasional headaches. You proceed with giving her a pregnancy test that returns with a negative result. Which of the following dopaminergic pathway disturbances are most likely responsible for this patient's symptoms?

- A. Mesolimbic-mesocortical [11%]
- B. Nigrostriatal [13%]
- ✔ C. Tuberoinfundibular [56%]
- D. Periventricular [4%]
- E. Incertohypothalamic [14%]

Explanation: **User Id: 477875**

The patient appears to be suffering from galactorrhea, a non-puerperal secretion of watery or milky fluid that contains neither pus nor blood. The tuberoinfundibular dopaminergic pathway connects the hypothalamus and the pituitary gland and is responsible for dopamine-dependent prolactin tonic inhibition. The neurotransmitter dopamine is secreted from these neural axons and inhibits prolactin secretion from the anterior pituitary gland. Some antipsychotic drugs block dopamine in the tuberoinfundibular pathway, which can cause an increase in blood prolactin levels, leading to hyperprolactinemia and abnormal lactation (galactorrhea), disruptions to the menstrual cycle in women, and sexual dysfunction.

(Choice A) The mesolimbic-mesocortical pathway is primarily involved in regulating behavior. This area is hyperactive in schizophrenia. Antipsychotic action of the neuroleptics is by primarily blocking the dopamine in the mesolimbic-mesocortical (frontal cortex) pathway.

(Choice B) In the nigrostriatal system the neurons are projected from the substancia nigra to the caudate nucleus and putamen. This pathway primarily regulates coordination of voluntary movements. In this pathway dopamine inhibits the release of acetylcholine. Degeneration of the substantia nigra thus causes decreased dopamine and subsequent increased acetylcholine; this leads to movement disorders such as Parkinsonism. Administering high potency antipsychotics can cause some dopamine antagonism in this pathway resulting in drug-induced Parkinsonism.

- D. Periventricular [4%]
- E. Incertohypothalamic [14%]

Explanation:

User Id: 477875

The patient appears to be suffering from galactorrhea, a non-puerperal secretion of watery or milky fluid that contains neither pus nor blood. The tuberoinfundibular dopaminergic pathway connects the hypothalamus and the pituitary gland and is responsible for dopamine-dependent prolactin tonic inhibition. The neurotransmitter dopamine is secreted from these neural axons and inhibits prolactin secretion from the anterior pituitary gland. Some antipsychotic drugs block dopamine in the tuberoinfundibular pathway, which can cause an increase in blood prolactin levels, leading to hyperprolactinemia and abnormal lactation (galactorrhea), disruptions to the menstrual cycle in women, and sexual dysfunction.

(Choice A) The mesolimbic-mesocortical pathway is primarily involved in regulating behavior. This area is hyperactive in schizophrenia. Antipsychotic action of the neuroleptics is by primarily blocking the dopamine in the mesolimbic-mesocortical (frontal cortex) pathway.

(Choice B) In the nigrostriatal system the neurons are projected from the substancia nigra to the caudate nucleus and putamen. This pathway primarily regulates coordination of voluntary movements. In this pathway dopamine inhibits the release of acetylcholine. Degeneration of the substantia nigra thus causes decreased dopamine and subsequent increased acetylcholine; this leads to movement disorders such as Parkinsonism. Administering high potency antipsychotics can cause some dopamine antagonism in this pathway resulting in drug-induced Parkinsonism.

(Choices D and E) The other 2 pathways are not really well defined and not important for purpose of board examination.

Educational Objective:
Remember the 3 important Dopaminergic systems:

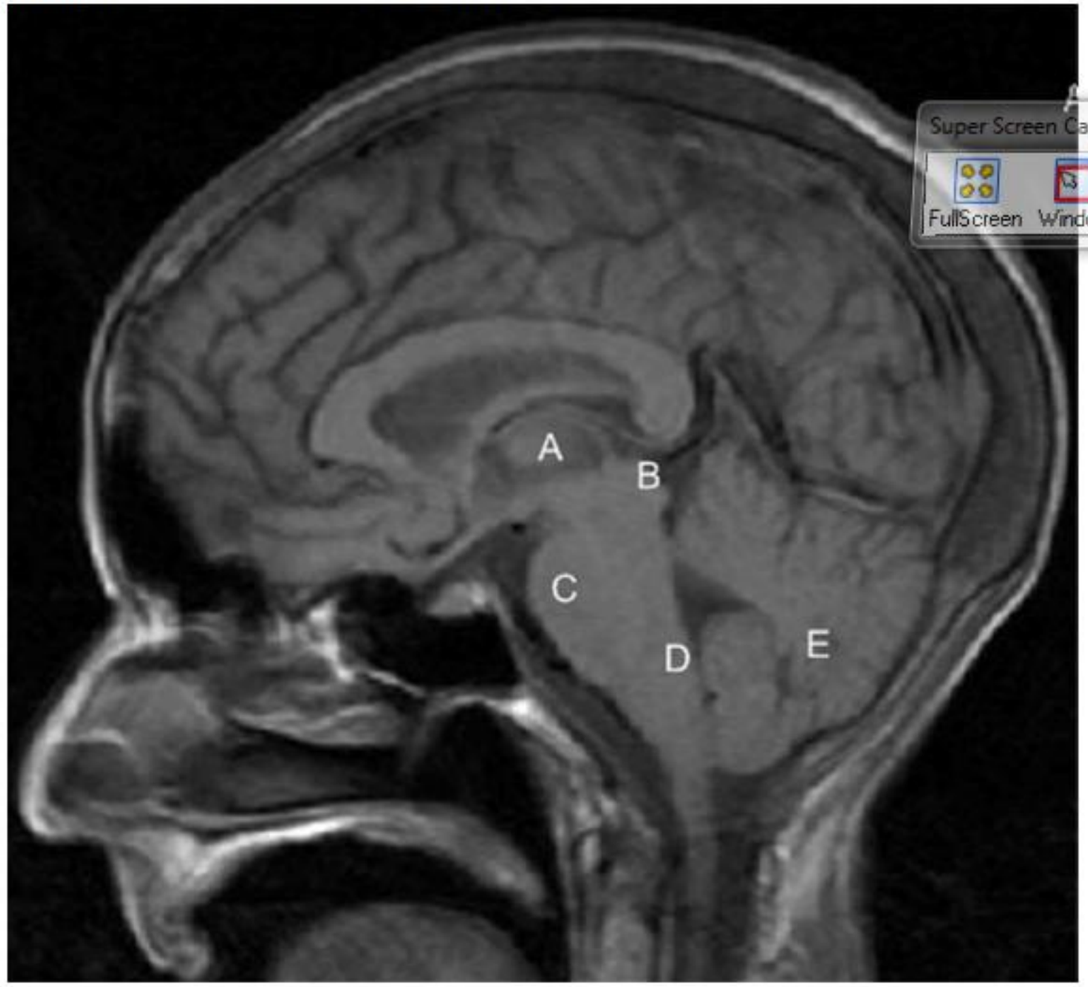
Pathway	Function	Diseases associated
Mesolimbic-mesocortical	Regulates behavior	Schizophrenia
Nigrostriatal	Coordination of voluntary movements	Parkinsonism
Tuberoinfundibular	Controls prolactin secretion	Hyperprolactinemia

Time Spent: 2 seconds

Last updated: [2/16/2012]

• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10
• 11
• 12
• 13
• 14
• 15
• 16
• 17
• 18
• 19
• 20
• 21
• 22
• 23
• 24
• 25
• 26
• 27
• 28
• 29
• 30
• 31
• 32
• 33
• 34
• 35
• 36
• 37
• 38
• 39
• 40
• 41
• 42

A 34-year-old male begins treatment with combination chemotherapy for Hodgkin's lymphoma. Shortly thereafter, he experiences severe vomiting and requires intravenous fluid supplementation. Which of the following brain sites is responsible for his symptoms?



- A. A [20%]
- B. B [18%]

- A. A [20%]
- B. B [18%]
- C. C [11%]
- ✔ D. D [44%]
- E. E [6%]

Explanation: **User Id: 477875**

The vomiting that results from administration of systemic chemotherapy is believed to be triggered by the chemoreceptor trigger zone (CTZ), located on the dorsal surface of the medulla at the caudal end of the fourth ventricle **(Choice D)** in a region known as the area postrema. The area postrema receives blood from fenestrated vessels (absent blood-brain barrier), which allows it to sample chemicals circulating in the blood.

(Choice A) This is the thalamus, which helps to coordinate the sensory and motor systems.

(Choice B) This dorsal midbrain site is the location of the superior and inferior colliculi. The third ventricle is located dorsal to these structures.

(Choice C) This is the ventral pons. Fibers of cranial nerves V-VIII, the corticospinal tract, the medial lemniscus, and the lateral spinothalamic tract course through this region.

(Choice E) The cerebellum is marked as choice E.

Educational Objective:
Acute nausea following administration of systemic chemotherapy results from stimulation of the chemoreceptor trigger zone (CTZ), which lies in the area postrema of the dorsal medulla near the fourth ventricle.

Time Spent: 17 seconds Last updated: [4/7/2013]

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42