REVIEW VERTEBRAE, SPINAL NERVES, REFLEXES

<u>1) VERTEBRAE</u> - NORMAL SPINAL CURVATURES: <u>Primary</u> = <u>Concave Anterior</u> - (fetal curvature); preserved in adult <u>Thorax</u>, <u>Sacrum</u>

<u>Secondary</u> = <u>Concave Posterior</u> (develop in childhood) - <u>Cervical</u> (support head), <u>Lumbar</u> (support body)

ABNORMAL CURVATURES - all can cause pain from compression of spinal nerves

| | Curvature | Location (Most common) | Cause |
|-----------|---------------------|------------------------------|--------------------------------------|
| Kyphosis | Exaggerated Concave | Often in Thoracic Region | Osteoporosis, etc loss of bone in |
| | Anterior | (Hump back) | bodies of vertebrae |
| Scoliosis | Exaggerated Lateral | Thoracic, Lumbar most | Hemivertebra (half of vertebral body |
| | | common | does not form in development), etc. |
| Lordosis | Exaggerate Concave | Lumbar (normal in pregnancy) | Obesity, etc. |
| | Posterior | | |



SUMMARY OF LIGAMENTS OF VERTEBRAE AND DISC HERNIATION

| Ligament | Connects | Clinical |
|------------------------|-----------------------------|---|
| Anterior Longitudinal | Anterior side of bodies of | Broad band; Prevents disc herniation anteriorly |
| Ligament | vertebrae | |
| Posterior Longitudinal | Posterior side of bodies of | Narrow band; (intervertebral discs herniate in postero- |
| Ligament | vertebrae (inside canal) | lateral direction, lateral to ligament) |
| Ligamenta Flava | Elastic layer connecting | Last layer penetrated by needle in Epidural anesthesia; |
| _ | Laminae of vertebrae | (Note: Dura is last in Lumbar Puncture spinal tap) |
| Interspinous and | Spines of vertebrae | Thickened in neck to form Ligamentum nuchae |
| Supraspinous ligaments | | (extends from Ext. Occipital Protuberance to C7) |

Note: Herniation of Nucleus pulposus = 'Slipped Disc' - Nucleus pulposus bulges out through Annulus fibrosus; usually in\a Posterolateral direction (lateral to the Posterior Longitudinal Ligament); Most common at levels L4-L5 or L5-S1. Note: Cervical Intervertebral Disc Herniation - Second most common region for disc herniation; Lower cervical disc hernation - Symptoms in Upper Extremity, if below C4 (Brachial Plexus C5-C8, T1)



SUMMARY OF SOME FEATURES OF VERTEBRAE ON CT, LANDMARKS AND SOME CLINICAL SIGNS

| Vertebra | ID Features on CT | Clinical, Associated Structures on CT |
|------------|---|---|
| Cervical | Foramina Tranversaria transmit Vertebral | 1) Damage to vertebral artery - brainstem |
| (7) | Artery (C1-C6) | symptoms (can be related to neck rotation) |
| | C1 = Atlas - no body | 2) Upper cervical fracture (C1 or dens of C2) - |
| | C2 = Axis - dens | Quadriplegia; |
| | C7 = Vertebra prominens (long palpable spine) | 3) Disc Herniation in Lower Cervical Vertebrae |
| | | - symptoms in upper extremity (Brachial plexus) |
| Thoracic | Ribs abut bodies (head of rib), transverse | Landmark: Thoracic aorta anterolateral to |
| (12) | processes (tubercle of rib); | bodies |
| Lumbar (5) | Large bodies; No surrounding bones | Landmarks: Erector spinae posterior; Psoas |
| | | major lateral; IVC and Abdominal aorta anterior |
| | | to bodies |

2) GROSS ANATOMY OF SPINAL CORD AND SPINAL NERVES

| Syndrome/ Procedure | Anatomy | Structures | Clinical, ID Features on CT |
|--------------------------------------|---|---|---|
| Spinal Nerve Compres- sion | Convention: Cervical spinal nerves <u>C1-C7</u> exit Above | Dermatomes - area of distribution of single nerve root to skin: | Symptoms of compression of nerve root - Paresthesia, pain, sensory loss, hyporeflexia, muscle weakness |
| | corresponding vertebrae; C8 and All other spinal nerves exit <u>Below</u> vertebrae | [V1 - Face (above eyes *) V2 - Face (below eyes*) V3- Face (below mouth)*] C5 - Shoulder C6 - Thumb C8 - Little finger T1 - Armpit T4 - Nipple T7 - Xiphoid T10 - Umbilicus L1 - Inguinal lig. L4 - Big toe S1 - Little toe [* Note: V - also Oral, Nasal Cav., Cranial Dura Mater - headache] | Note: overlap of dermatomes in region of trunk: sensory loss in trunk only with Two Thoracic spinal roots |
| Lumbar Puncture | Inferior end of Spinal Cord = Conus medullaris | Conus medullaris at 1. In Newborn , vertebral level L3 2. In Adult , conus at vertebral level L1 | Lumbar Puncture done below Conus Medullaris (region of Cauda Equina); Level: 1. Children - L4-L5 2. Adult - L3-L4 or L4-L5 |
| Metastasis to Vertebral Column | Epidural Space (outside Dura) Dura is separated from inner side of vertebral canal; Note: in Skull, there is no epidural space | Internal Vertebral Venous plexus - inside vertebral canal in Epidural Space; drains to External Venous plexus (outside vertebrae) by Radicular and Intervertebral veins | Disease processes (ex. cancer) can spread to vertebrae and spinal cord via anastomoses of Vertebral venous plexus and intervertebral veins with Lumbar veins (ex. carcinoma of prostate can metastasize to vertebral column) |

LAYERS PENETRATED IN EPIDURAL ANESTHESIA/LUMBAR PUNCTURE (superficial to deep)

Skin, 2. Superficial Fascia, (3. Supraspinous ligament,
 Interspinous ligament)

5. Ligamentum Flavum (sudden yield, first 'pop') - now in Epidural space

6. Epidural Space - STOP HERE FOR EPIDURAL ANESTHESIA

7. Dura Mater (sudden yield, second 'pop')
(8. Arachnoid - adherent to inner side of dura mater)
9. Subarachnoid Space (Lumbar Cistern) -

STOP HERE FOR LUMBAR PUNCTURE/CSF



3) SPINAL REFLEXES AND DIAGNOSIS OF UPPER AND LOWER MOTOR NEURON LESIONS

| REFLEX | STIMULUS/SENSE ORGAN(S) EXCITED | RESPONSE | CLINICAL/ABNORMAL RESPONSES |
|--|---|---|---|
| Stretch (Myotatic, Deep Tendon) Reflex | Rapid Stretch of muscle (test: tap on muscle tendon) Excites Muscle Spindle Primary (la) and Secondary (II) sensory neurons (NOT Golgi Tendon Organ) | Stretched muscle contracts rapidly (monosynaptic connection); also excite synergist and Inhibit antagonist Note: Gamma motor neurons can enhance stretch reflexes (Gamma dynamic motor neurons specifically enhance la sensitivity; tell patient to relax before test) | Hyporeflexia- decrease in stretchreflexes occurs in LowerMotoneuron Diseases, Muscleatrophy etc.Hyperreflexia- (increase) -characteristic of Upper MotorNeuron lesions (ex. spinal cordinjury, damage Corticospinaltract); note: Clonus =hyperreflexia with repetitivecontractions to single stimulus |
| Autogenic Inhibition (Inverse Myotatic Reflex) | Large force on tendon excites Golgi Tendon Organ Ib (test: pull on muscle when resisted) | Muscle tension decreases; Also inhibit synergist muscles; excite antagonist muscles | Clasped Knife Reflex - occurs in Upper Motor Neuron lesions - forceful stretch of muscle is first resisted then collapses |
| Flexor Reflex | Sharp, painful stimulus, as in stepping on nail; Excites - Cutaneous and pain receptors | Limb is rapidly withdrawn from stimulus; protective reflex; also inhibit extensors of same limb and excite extensors of opposite limb (Crossed Extensor Reflex) | Babinski sign- toes extend (dorsiflex) to cutaneous stimulus of sole of foot (normally plantar flex); characteristic of Upper Motor Neuron lesion |

LOWER AND UPPER MOTOR NEURON LESIONS

| Lesion | Structure Affected | Symptoms | Examples |
|---|---|---|---|
| Lower Motor Neuron Lesion (Flaccid Paralysis) | Lower Motor Neurons = Alpha Motor neurons with axons that innervate skeletal muscles | Muscle is effectively denervated: 1) Decrease Stretch (Deep Tendon) Reflexes 2) Decreased Muscle Tone 3) Muscle atrophy; Fasciculations (twitches) precede atrophy 4) No Babinski sign | Compression of spinal nerve Poliomyelitis - viral infections affecting motor neurons |
| Upper Motor Neuron Lesion (Spastic Paralysis) | Upper Motor Neurons = All descending neurons that affect Lower Motor Neurons (ex. Corticospinal Reticulospinal neurons) | Disrupt voluntary control and regulation of reflexes (remove inhibition): 1) Increase Stretch (Deep Tendon) Reflexes 2) Increased Muscle Tone 3) No Fasciculations 4) Babinski sign 5) Clasped Knife Reflex | 1) Damage to Corticospinal (corticobulbar) tracts - can occur at all levels from cortex to spinal cord (including brainstem) |

Note: Some diseases produce both Upper and Lower Motor Neuron Symptoms - (ex. ALS Amyotrophic Lateral Sclerosis)

REVIEW: CLINICAL EMBRYOLOGY OF HEAD AND NECK

| Clinical Condition | Normal development | Abnormal | Signs/ Symptoms | Treatment |
|--|--|---|--|--|
| Cleft Lip (cheiloschisis) | Fusion of medial nasal and maxillary processes forms upper lip | Failure of fusion of medial nasal and maxillary processes | Cleft at philtrum of upper lip | Surgical repair |
| Cleft Palate (palatoschisis) | Anterior - Fusion of medial nasal processes (Primary palate) and maxillary processes (Secondary Palate); Posterior - Secondary palate formed by fusion of Maxillary processes of two sides | Failure of fusion | Anterior - Cleft <u>anterior</u> to Incisive foramen; Posterior - Cleft <u>posterior</u> to Incisive foramen | Surgical repair |
| Malformation of nasolacrimal duct (dacryostenosis) | Duct forms as cord between maxillary and frontonasal processes extends from lacrimal sac (at medial canthus of eye) to nasal cavity (inferior meatus) | Cord fails to canalize | Continuous flow of tears over lower lid onto face | Surgical repair |
| First Arch (Treacher Collins) Syndrome | First brachial arch forms skeletal elements: 1) malleus, incus 2) contributes to mandible (Meckel's cartilage) | Neural crest cells do not migrate into Arch 1 | Mandibular hypoplasia Conductive hearing loss Facial malformation | Some surgical repair |
| Thyroglossal duct cysts | Thyroid forms as evagination at foramen cecum of tongue; tissue migrates ant. to Hyoid bone in midline of neck to location below Cricoid cartilage | Glandular tissue or cysts develop anywhere along path of migration | Mass in midline of neck | Surgical removal (remove tract to tongue) |
| Abnormal location/ Accidental Removal of parathyroid glands | Normally posterior to thyroid gland or embedded in it; develop from branchial pouches 3 and 4 Inferior parathyroid - pouch 3 Superior parathyroid - pouch 4 | Can be located within thyroid gland or ectopic | Normally no symptoms; calcium imbalance If accidentally remove (during thyroid surgery) | Treat calcium imbalance pharmaco- logically, etc. |



BRANCHIAL ARCHES AND DERIVATIVES

| ARCH (NERVE) | SKELETAL | LIGAMENTS | MUSCLES |
|--------------|---|---|---|
| First (V) | 1) Malleus 2) Incus | Ant. ligament of malleus Spheno- mandibular ligament | Muscles of Mastication Tensor tympani Tensor palati Mylohyoid Ant. belly of Digastric |
| Second (VII) | Stapes Styloid process Hyoid bone - lesser horn, upper half of body | Stylohyoid ligament | Muscles of Facial Expression Stapedius Stylohyoid Post. belly of Digastric |
| Third (IX) | Hyoid bone - greater horn, lower half of body | | Stylopharyngeus |
| Fourth (X) | Cartilages of Larynx | | All muscles of Larynx All muscles of Pharynx (except Stylopharyngeus) All muscles of Soft Palate (except Tensor palati) |
| Sixth (XI) | | | 1) Sternocleidomastoid 2) Trapezius |

STRUCTURES DERIVED FROM BRANCHIAL POUCHES, CLEFT AND MEMBRANE: BRANCHIAL 'CLEFT' CYSTS (FISTULI = channels from pharynx to skin)

| POUCH | FORMS | CLINICAL |
|--------|--|---|
| First | Auditory tube Tympanic cavity | First Branchial 'Cleft' cyst - tract to external auditory meatus or auditory tube |
| Second | Lining (crypts) of palatine tonsils | Second Branchial 'Cleft' cyst - tract to tonsillar fossa (palatine tonsils) - MOST COMMON CYST |
| Third | 1) Inferior parathyroid gland 2) Thymus | Third Branchial 'Cleft' cyst - tract to thyrohyoid membrane or piriform recess |
| Fourth | Superior parathyroid gland C-cells of Thyroid | rare |

Note: Pouch 3 structures migrate below (caudal) to Pouch 4 structures. Note: Location of Cysts and Fistuli - <u>in lateral neck</u>, <u>anterior to Sternocleidomastoid muscle</u> Note: First Branchial Cleft forms Ext. Auditory Meatus; First Branch. Membrane = Tympanic Membrane



CLINICAL ANATOMY OF HEAD AND NECK

| Clinical | Anatomy | Cause | Sign/Symptom | | |
|---|---|---|---|--|--|
| Anterior Cranial Fo | Anterior Cranial Fossa - Cranial nerve I, Nasal Cavity | | | | |
| Fracture of cribriform plate of ethmoid bone | Nasal septum continuous with crista galli of ethmoid bone; Olfactory nerve passes through cribriform plate of ethmoid bone | Blow to nose; fracture produces continuity between subarachnoid space and nasal cavity | Leakage of CSF from nose ('runny nose'); Decreased sense of smell (hyposmia) | | |
| Middle Cranial Fos | ssa - Cranial nerves II-VI Orbit, Ey | e Movements, Face | | | |
| Rapid loss of vision in one eye | Central artery of retina (branch of Ophthalmic artery from Int. Carotid) is an normally an end artery with no functional anastomoses (exception: Chorioretinal anatomoses) | Occlusion of Central Artery of Retina | Sudden onset blindness in one eye (one eye only, sign: artery occlusion visible through ophthalmoscope) | | |
| Slow loss of vision in one eye | Dura mater and subarachnoid continue over optic nerve; Optic nerve function affected by CSF pressure | Communicating hydrocephalus (many causes) | Decreased visual function both eyes; sign: papilledema in ophthalmoscope view; also other signs of increased intracranial pressure (headache, etc.) | | |
| Abducens nerve palsy | Abducens nerve innervates only Lateral Rectus muscle (action: abduction of eye) | Damage Abducens nerve VI (causes ex. increased intracranial pressure, Cavernous sinus thrombosis) | Diplopia and Medial strabismus | | |
| Trochlear nerve palsy | Trochlear nerve innervates only Superior Oblique muscle (action: abduct, depress and medially rotate eye) | Damage Trochlear nerve (ex. trauma) | Inability to look down and out (difficulty walking down stairs); Head tilted toward side opposite lesion | | |
| Oculomotor nerve palsy | Oculomotor nerve innervates Superior, Medial and Inferior Rectus and Inferior Oblique; part of Levator palpebrae superioris; also provides parasympathetics to pupillary constrictor, ciliary muscles | Damage Oculomotor nerve (frequently idiopathic) | Lateral strabismus, dilated pupil, ptosis; also loss of accommodation (near vision) due to paralysis of ciliary muscles | | |



CSF SURROUNDS OPTIC NERVE



1000

OCULOMOTOR (III) PALSY

1) LATERAL STRABISMUS (WALL-EYED) DUE TO PARALYZE MEDIAL RECTUS

2) PTOSIS - DROOPING EYELID PARALYZE LEV. PALPEBRAE SUPERIORIS

3) DILATED PUPIL -(MYDRIASIS) PARALYZE PUPILLARY CONSTRICTOR

| Clinical | Anatomy | Cause | Sign/Symptom |
|--------------------|--------------------------------------|-------------------------|---------------------------|
| Middle Cranial Fos | ssa - Cranial nerves II-VI Orbit, Ey | e Movements, Face (cont | .) |
| Horner's | Sympathetics in head | Block conduction in | Ptosis (drooping eyelid |
| Syndrome | innervate smooth muscle part | Sympathetics to head | from smooth muscle part |
| | of Levator Palpebrae | (tumors, etc) | of Levator Palpebrae |
| | Superioris; Pupillary Dilator | | Superioris); |
| | muscle; sweat glands of skin; | | Constricted pupil |
| | Pathway: pre-ganglionic | | (miosis due to paralyze |
| | neurons out cord at T1,2; | | Dilator pupillae); |
| | ascend in chain; post- | | Anhydrosis of forehead |
| | ganglionics in Sup. Cerv. | | (denervate sweat glands) |
| | Ganglion; distributed with | | |
| | arteries (ex. Ophthalmic A.) | | |
| Cavernous | Branches of cranial nerves (III, | ex. Infection in cav. | Dipiopia (biurred vision) |
| sinus | IV, VI, VZ, VI) and internal | sinus spread from | due to disruption of eye |
| thrombosis | value of Covernous sinue: | Infection of face | movements, increased |
| | Cavernous sinus drains | (angle of nose of upper | produces ongergement |
| | ophthalmic voins which | dangorous) | in voins of roting (view |
| | apastomose with branches of | dangerous) | in ophthalmoscope) |
| | Facial Vein: veins have no | | +other symptoms |
| | valves | | |
| Epidural | Middle Meningeal artery | Blow to side of head | Patient conscious after |
| Hematoma | (branch of Maxillary artery that | (fracture skull in | accident; loses |
| | passes through foramen | region of pterion) | consciousness within |
| | spinosum) supplies bone of | · · <i>,</i> | hours; coma, death |
| | calvarium | | (Note: hematoma is |
| | | | lens-shaped on CT) |
| Subdural | Bridging veins link Superficial | Blow to head; in | Slow onset of |
| Hematoma | cerebral veins on surface of | elderly can occur | neurological symptoms, |
| | brain and Superior Sagittal | without distinct event | headache (often hours to |
| | sinus (also other venous | | days) |
| | sinuses) | | (Note: hematoma is |
| | | | crescent-shaped on CT) |
| Communicating | CSF produce in choroid | In elderly, | Headache, papilledema |
| Hydrocephalus | plexus; reabsorbed from | Calcification of | |
| due to | subarachnoid space at | arachnoid villi | |
| decreased CSF | arachnoid villi into venous | (arachnoid | |
| reabsorption | sinuses | granulations) | |



| Clinical | Anatomy | Cause | Sign/Symptom |
|--|--|------------------------------------|--|
| Middle Cranial Fos | ssa - Cranial nerves II-VI Orbit, Ey | e Movements, Face | |
| Numbness of regions of face | V is major sensory nerve of face and head; Sensory neuron cell bodies are in Semilunar (Trigeminal) Ganglion ; V1 above lateral margin eyelids; V2 eyelids to upper lip; V3 below lateral margins of lips | Many; ex. Trigeminal Anesthesia | Numbness in specific region can be correlated with specific division of V |
| Pain in external auditory meatus following Facial paralysis | Skin of ear and external auditory meatus receive sensory innervation from V, VII, IX and X | Bell's palsy | Ear ache (following or accompanying Facial paralysis) |
| Clinical | Anatomy | Cause | Sign/Symptom |
| Weakness of muscles mastication | Muscles mastication innervated by V3; Lateral Pterygoid opens mouth; all other muscles Mastication close mouth | ex. Tumor at foramen ovale | When open mouth, jaw deviates toward paralyzed side |
| Posterior Cranial F | ossa - Cranial Nerves VII-XII, fac | e, ear, pharynx, tongue | |
| Facial paralysis (with effect on VIII) | CN VII and VIII exit post. cranial fossa via Internal auditory meatus; VIII ends in temporal bone; VII enters facial canal and gives off branches in temporal bone; 1) parasymp. to Lacrimal gland, mucous glands of nose, palate; 2) Nerve to Stapedius muscle; 3) Chorda tympani - taste to ant. 2/3 of tongue; parasymp. to Submandibular, Sublingual salivary glands | Acoustic neuroma | Loss or reduction of hearing in one ear; Full Facial nerve palsy (Bell's palsy) symptoms: 1) Facial paralysis and loss of Corneal reflex (V1 sensory, VII motor) 2) Loss of taste to ant. 2/3 of tongue 3) Decreased secretion tears and saliva 4) Hyperacousia |
| Facial paralysis (no effect on VIII) | Facial nerve exits skull via Stylomastoid foramen; only has motor branches after leaving skull | Parotid tumor | Facial paralysis; Loss of corneal reflex but no loss of taste or decrease in tears or saliva; no hypercousia |



| Clinical | Anatomy | Cause | Sign/Symptom | | |
|--|---|--|---|--|--|
| Posterior Cranial Fossa - Cranial Nerves VII-XII, face, ear, pharynx, tongue (cont.) | | | | | |
| Loss of function of IX and X | IX is major sensory nerve to pharynx (oropharynx); X is motor to all muscles of pharynx except Stylopharyngeus; all muscles of palate (except Tensor palati) | Tumor at Jugular Foramen | Difficulty in swallowing; Absence of Gag Reflex; (Gag reflex - IX sensory, X motor) Uvula deviates away from side of lesion | | |
| Hoarse voice after thyroid surgery | X is motor to all muscles of larynx; also sensory to larynx; Recurrent Laryngeal nerve passes posterior to Thyroid gland with Inf. Thyroid artery; motor to all laryngeal muscles except Cricothyroid | Damage Recurrent Laryngeal nerve during Thyroid surgery | Hoarse voice due to unilateral paralysis of all laryngeal muscles (except Cricothyroid) | | |
| Torticollis | XI innervates Sternocleidomastoid and Trapezius | Torticollis can be congenital or acquired | Contracture of Sternocleidomastoid - head is rotated with face directed to opposite side (Note: Trapezius - clinical test for XI - shrug shoulders) | | |
| Paralysis of muscles of tongue | XII is motor to all muscles of tongue (no sensory component) | XII hypoglossal nerve palsy | Atrophy of muscles of tongue on one side; protruded tongue deviates toward side of lesion due to Genioglossus) in Lower Motor Neuron Lesion | | |

LOWER MOTOR NEURON LESION VAGUS (X) - UVULA DEVIATES AWAY FROM SIDE OF LESION



TORTICOLLIS

Contracture of Sternocleidomastoid; Face turned to opposite side



LOWER MOTOR NEURON LESION XII



LOWER EXTREMITY CLINICAL/ANATOMICAL REVIEW

| Clinical Condition | Anatomy | Cause | Symptom | | |
|---|---|---|---|--|--|
| Hip/Pelvis | | | | | |
| Femoral Hernia | Femoral ring is a weak point in abdomino-pelvic cavity; Lymphatic vessels course through Femoral ring to Femoral Canal in medial part of Femoral sheath (Sheath surrounds Fem. Art, Vein, Lymph) | Increase in pressure in abdomen (lifting heavy object, cough, etc.) can force loop of bowel into Femoral Canal (out Saphenous opening) | Bulge in anterior thigh below Inguinal Ligament | | |
| Hip Pointer | Anterior Superior Iliac spine (origin of Sartorius, Tens. Fasc. Lata m.) is subcutaneous | Fall on hip causes contusion at spine | Bruise on hip | | |
| Pulled Groin | Adductor muscles of thigh take origin from pubis | Tear in Adductor muscles can occur in contact sports | Pain in groin (at or near pubis) | | |
| Hamstring Pull | Hamstring muscles of post. thigh have common origin at Ischial Tuberosity | Excessive contraction (often in running) produces tear or avulsion of hamstring muscles from Ischial tuberosity | Agonizing pain in posterior thigh if muscles are avulsed | | |
| Gluteal Gait | Gluteus Medius and Minimus act to support body weight when standing (essential when opposite leg is lifted in walking) | Damage to Superior Gluteal Nerve or polio | Gluteal Gait (Trendelenberg Sign): pelvis tilts to down toward non-paralyzed side when opposite (non- paralyzed) leg is lifted in walking | | |
| Collateral circulation at hip | Cruciate anastomosis links Inf. Gluteal artery (from Int. Iliac.) and Profunda Femoris, Med. and Lat. Fem. Circumflex | Damage to External Iliac or Femoral arteries (stab wounds, etc.) | Bleeding (can ligate between Internal Iliac and Profunda femoris) | | |
| Avascular necrosis of head of femur | Medial Femoral Circumflex artery supplies head of femur (also small supply from Obturator Artery) | Falls (common in elderly) can produce fracture of neck of femur (treatment is hip replacement) | Leg is rotated laterally (by action of Gluteus Maximus and short posterior rotator muscles) | | |
| Dislocate Hip (head of femur displaced superiorly) | Hip joint ligaments usually strong | Congenital - Upper lip of acetabulum can fail to form | Leg is rotated medially (by action of Gluteus Medius and Minimus) | | |

FEMORAL HERNIA



'HIP' FRACTURE







| Clinical | Anatomy | Cause | Symptom | | |
|-----------------------|---|--|---|--|--|
| | | | | | |
| KNEE Toor Antorior | Antorior Cruciota Ligamont | Danidly ratate hady when fact | Antonian drowar toot | | |
| Cruciate | extends from Lateral Condyle of | planted on ground | pull tibia anteriorly | | |
| Ligament | Femur to Ant. part of Intercondylar | | ····· | | |
| (ACL) | eminence of tibia; limits ant. | | | | |
| | movement of tibia | | | | |
| Terrible Triad | Medial Meniscus is firmly attached to Medial Collateral ligament | In sports, blow to lateral side of leg tears Medial Meniscus, Medial Coll. Lig, ACL | Pain and high mobility (ACL - positive Anterior Drawer test) | | |
| LEG, ANKLE ar | | | | | |
| Foot drop | Common Peroneal nerve is | Blow to lateral leg at head of | Inability to dorsiflex | | |
| | fibula: Deep Peropeal perve in | wearing a log cast: | foot); cannot int loot | | |
| | anterior compartment: | Compartment syndrome | ITOITI GIOUTIU IIT Walking | | |
| Anterior Leg | Fascia of anterior muscular | Exercise or fracture of tibia: | Foot drop (inability to | | |
| Syndrome | compartment of leg is very tight | compress of Deep Peroneal | dorsiflex foot); cannot | | |
| - | | nerve in anterior | lift foot from ground in | | |
| | | compartment | walking | | |
| Tarsal Tunnel | Tendons and vessels pass under | Swelling of tendons under | Numbness of sole of | | |
| Syndrome | Flexor retinaculum on medial side | flexor retinaculum produces | toot and toes, | | |
| | of ankle (Iom, Dick and Harry: | compression of Tibial Nerve | weakness in flexion | | |
| | Indialis posterior, Flexor Digitorum | | ortoes | | |
| | Tibial Nerve, Flexor Hallucis | | | | |
| | longus) | | | | |
| Intermittent | Posterior tibial artery (from | Atherosclerosis produces | Painful cramps after | | |
| Claudication | Popliteal artery) supplies posterior | narrowing of artery, limiting | exercise that | | |
| | compartment of leg and most of | blood supply to leg and foot | subsides with rest | | |
| | foot | | | | |
| Ankle sprain | Ligaments on lateral side of ankle | Excessive Inversion produces | Pain on lateral side | | |
| | are weaker than medial side | Stretch of Anterior | of ankle | | |
| | | Calcanoofibular ligamonts | | | |
| Pott's | Deltoid ligament on medial side of | Excessive eversion of ankle | Pain in ankle | | |
| Fracture | ankle is strong | fractures distal tibia (medial | | | |
| | | malleolus) and fibula | | | |
| Fallen Arch | Medial arch of foot held by | Loss or decrease in medial | Foot pain, | | |
| (Pes planus) | Plantar Calcaneonavicular | arch; can be developmental or | particularly on | | |
| _ | ligament | related to use | medial side | | |

NOTE: DERMATOMES - L1 INGUINAL REGION; L4 BIG TOE, S1 LITTLE TOE PATELLAR TENDON REFLEX - TEST L3-L4; ACHILLES TENDON REFLEX - TEST S1 FEMORAL TRIANGLE - STRUCTURES LAT. TO MED. - NAVL (Femoral Nerve, Artery, Vein, Lymphatics)





foot not lifted when walking



REVIEW QUESTIONS ON VERTEBRAE, SPINAL CORD, SPINAL NERVES



1. _____ A 28-year-old-women presented to the hospital emergency room with intense lower back spasms in the context of coughing during an upper respiratory infection. Review of her medical records showed that she had experienced progressive lower back problems for the preceding 6 years. She had gained 15 pounds during that period but was not morbidly obese. MRI scan of the vertebral column (image above) showed an exaggerated anterior-posterior curvature. Based upon this image, the radiologist would diagnose this as which of the following conditions?

- A. Scoliosis in vertebrae L3-S1
- B. Kyphosis in vertebrae T12-L3
- C. Increased lordosis in vertebrae L3-S1
- D. Increased lordosis in vertebrae T12-L1
- E. Scoliosis in vertebrae T12-L3



2.____ A 70 year old female with no health insurance was seen at a community based clinic. She complained of stooping of her posture (photo left above). She stated that the condition had been developing over a number of years. However, the deformity had increased to the point that she had difficulty holding her neck upright. She had also begun experiencing chronic back pain. The image (above right) is a lateral view x-ray of the thoracic spine. Which of the following would be a diagnosis of this condition?

- A. Congenital scoliosis
- B. Degenerative kyphosis associated with osteoporosis
- C. Post-traumatic fracture of bodies of thoracic vertebrae
- D. Scoliosis due to the presence of a hemivertebra
- E. Degenerative lordosis of thoracic vertebrae



3. <u>A 45 year old man was helping a friend move a piano when he</u> experienced sudden lower back pain. Physical examination showed weakness in dorsiflexion of the foot. The MRI image of the lumbosacral spine (above) shows a structure pressing against the cauda equina. The herniated structure would be immediately adjacent to which of the following spinal ligaments?

- A. Anterior Longitudinal ligament
- B. Ligamentum Flavum
- C. Interspinous ligament
- D. Posterior Longitudinal ligament
- E. Supraspinous ligament



4.____ A 2.2 kg girl was born at 34 weeks and showed severe respiratory distress. The neonate had a malformed thorax that limited normal respiration. The skeleton was imaged by CT and showed multiple abnormalities. Three dimensional reconstruction (shown above) of the spine showed a distinct discontinuity in the vertebrae (arrow). Which of the following describes this discontinuity?

- A. Lordosis due to the presence of a 'hemivertebra'
- B. Scoliosis due to the presence of a 'hemivertebra'
- C. Congenital Kyphosis
- D. Exaggerated primary curvature
- E. Exaggerated secondary curvature in the lumbar region

5._____ A 25-year-old rugby player injured his neck while tackling another player. He felt numbness over the region of the thumb on the palmar surface that persisted for several days. Physical examination by his physician showed weakness in the biceps muscle. These symptoms could result a sign of herniation of an intervertebral disc located between vertebrae at which of the following levels?

A. C3-C4 B. C4-C5 C. C5-C6 D. C6-C7 E. C7-T1

6. <u>A newborn baby born at 37 weeks is noted to be unwell, feeding poorly</u> and is jittery, with a temperature of 38°C. A clinical diagnosis of early sepsis is made and a lumbar puncture to sample cerebrospinal fluid (CSF) is suggested on the ward round as a part of sepsis evaluation. To perform the procedure of lumbar puncture (spinal tap) safely in a newborn, the needle must be inserted between which of the following vertebrae?

A. T12-L1 B. L1-L2 C. L2-L3 D. L3-L4 E. L4-L5

7. <u>A 24-year-old-patient is seen for a routine neurological exam.</u> The patient is a medical student who has been studying intensely for Step 1 board (or Final) examinations. Testing of patellar tendon reflexes (deep tendon reflex) shows bilateral, mild hyperreflexia (scored 3). The physician suspects that this is not pathological but due to increased activation of Gamma dynamic motor neurons associated with nervousness and anxiety. Which of the following is an action of Gamma dynamic motor neurons that could produce the mild hyperreflexia?

- A. Increase sensitivity of Golgi tendon organs
- B. Increase sensitivity of la fibers in muscle spindles
- C. Directly produce contraction of all muscle cells
- D. Increase sensitivity of free nerve endings in muscles
- E. Produce relaxation of muscle cells in muscle spindles

8. ____ Both Lower motor neuron and Upper motor neuron lesions can cause muscle paralysis. Differential diagnosis is often complex and based upon a number of tests. Which of the following is a characteristic of Lower motor neuron lesions which does not occur in Upper motor neuron lesions?

- A. Hyperreflexia
- B. Fasciculations
- C. Increased muscle tonus
- D. Clasped knife reflexes
- E. Babinski sign



9. _____ A patient who was treated for advanced carcinoma of the prostate begins to experience back pain. An MRI image of a lateral view of the vertebral column is shown above. Which of the following could serve as an anatomical pathway by which metastasis spread to the structures indicated by the arrow?

- A. External Iliac vein
- B. Renal vein
- C. Testicular vein
- D. Lumbar veins
- E. Deep Femoral vein

10. _____ A first year resident in OBGYN, who has been on call for 18 hours, is asked to administer an epidural anesthetic to a patient prior to delivery. As the needle is being inserted, the resident struggles to remember the anatomy of the vertebral column to know when to stop and administer the anesthetic. Which of the following is the last structure the needle should pass through in administering an epidural anesthetic?

- A. Anterior Longitudinal Ligament
- B. Posterior Longitudinal Ligament
- C. Supraspinous Ligament
- D. Ligamentum flavum
- E. Nuchal Ligament

11. _____ A patient experiences intermittent numbress of the big toe. The physician suspects that the cause may be due to osteophyte formation at an intervertebral foramen. At which of the following levels would foraminal encroachment by osteophyte formation produce numbress of the big toe?

- A. Intervertebral foramen at L1-L2
- B. Intervertebral foramen at L2-L3
- C. Intervertebral foramen at L3-L4
- D. Intervertebral foramen at L4-L5
- E. Intervertebral foramen at T12-L1

12. _____ A 29 year old female is driving her car and suffers a 'whiplash' injury to the neck in a head on collision. The air bag in her car is defective and her neck is bent into hyperflexion when her thorax rebounds anteriorly. Examination in the emergency room and radiographs show no fractures or vertebral subluxations. However, she subsequently develops chronic pain when attempting to flex her neck. The pain is diffuse and extends from the base of the occipital bone to the first thoracic vertebra. Damage to which of the following structures could account for these symptoms.

- A. Anterior Longitudinal Ligament
- B. Longus Colli muscle
- C. Longus Capitis muscle
- D. Ligamentum Nuchae
- E. Scalenus Posterior muscle



13. A 47-year-old man presented with fainting (syncope) when turning his head to the right. He had a history of rotational neck injury with operative repair, Angiography of the Subclavian artery (attached image) showed mild stenosis of an arterial branch that was attributable to an osteophyte at C5-C6. The artery became occluded (*- on image) on rotating the patient's head to the right. Which of the following arteries would produce this condition?

- A. Common Carotid Artery
- B. Inferior Thyroid Artery
- C. Vertebral Artery
- D. Costocervical Trunk
- E. Internal Carotid Artery

Key to Questions on Vertebrae, Spinal Cord, Spinal Nerves

1. C

2. B

3. D

4. B 5. C

6. E 7. B

8. B

9. D

10. D

11. D

12. D

13. C

HEAD AND NECK EMBRYOLOGY PRACTICE QUESTIONS



1. _____ A neonate is examined and found to have a large defect located at the philtrum of the upper lip (photo above). This condition arises because of failure of fusion of structures in embryonic development. Failure of fusion of which of the following structures would result in this condition?

- A. Maxillary and Mandibular processes
- B. Maxillary and Medial Nasal processes
- C. Maxillary and Lateral Nasal processes
- D. Medial and Lateral Nasal processes
- E. Frontonasal process with Medial Nasal process.



2._____A young boy is brought to a physician working in a field hospital. The mother of the boy says he has difficulty swallowing and that food is expelled through the nasal cavity. Upon examination, the physician finds a large defect in the hard and soft palates (photo above) and suspects that the child developed with a Posterior Cleft palate. Which of the following is the anatomical landmark that would be used to differentiate Posterior and Anterior cleft palate?

- A. Greater palatine foramen.
- B. Infraorbital foramen
- C. Incisive foramen
- D. Mental foramen
- E. Mandibular foramen



3. _____ An infant has a continuous secretion of tears from the left eye (photo above). MRI of the orbit appears normal and the lacrimal gland is not enlarged. The physician suspects that the condition is resulting from obstruction of the nasolacrimal duct due to failure of canalization of the duct in development. The obstruction prevents normal drainage of tears. The nasolacrimal duct normally drains to which of the following structures?

- A. Inferior meatus of the nasal cavity
- B. Superior meatus of the nasal cavity
- C. Bulla ethmoidalis of the nasal cavity
- D. Infraorbital foramen
- E. Maxillary sinus

4. _____ During a routine auditory test, a child is found have a severe conduction deficit in one ear. High resolution CT scan of the tympanic cavity shows a complete agenesis of the stapes. This condition could result from failure of formation of the stapes from which of the following structures?

- A. First branchial arch
- B. Second branchial arch
- C. Third branchial arch
- D. Frontonasal process
- E. First branchial pouch



5. _____ A 4-year-old boy presents with an asymptomatic, left-sided neck swelling that had been present since birth. CT imaging (above) shows a mass (white arrow) in the anterior neck that had displaced the carotid vessels, the trachea and thyroid gland (black arrows). .The mass was determined to be connected to a tract that extended to the thymus gland in the anterior mediastinum. Superiorly the tract terminated in the piriform recess. Which of the following is likely to be the initial embryonic origin of the mass and cause of the cyst?

- A. First branchial pouch, persistent cervical sinus
- B. First branchial arch, persistent branchial cleft
- C. Second branchial pouch, persistent cervical sinus
- D. Second branchial arch. persistent branchial cleft
- E. Third branchial pouch. persistent cervical sinus



6. _____ A 24 year old woman develops a mass in her neck (see photo above). The mass is located immediately anterior to the sternocleidomastoid muscle. The physician suspects that this condition has result from a branchial cyst. During surgery, the mass is found to be connected to a tract that extends superiorly and medially. The tract is most likely to be connected to which of the following structures?

- A. Middle meatus of the nasal cavity
- B. Pharyngeal tonsil
- C. Tonsillar fossa (palatine tonsils)
- D. Lingual tonsil
- E. Mandibular fossa



7. _____ A young child develops a mass in the midline of the neck (photo above). The mass is located anterior to the hyoid bone, superior to the thyroid cartilage. .Palpation of the salivary glands and thyroid gland show that they are normal in size. The child is scheduled for surgical removal of the mass. During surgery, the mass is found to be connected to a tract that courses superiorly. The tract is most likely to be connected to which of the following structures?

- A. foramen cecum of the tongue
- B. lingual tonsil
- C. sublingual papilla
- D. palatine tonsils
- E. submandibular duct



8. _____ A young child is brought to a pediatrician by his parents. The child (photo above) shows micrognathia (small mandible) and downward slanting eyes. Tests of auditory function indicate a hearing loss. The physician suspects that the child has Treacher-Collins syndrome, a congenital disorder associated with malformation of structures that develop in association with the first branchial arch. Which of the following structures normally develops with the first branchial arch and could have been malformed to cause the hearing loss?

- A. Auditory tube
- B. Cochlea
- C. Malleus and Incus
- D. Vestibulocochlear nerve
- E. Stapes

9. _____ Accidental removal of the parathyroid glands during thyroid surgery is the most frequent cause of hypoparathyroidism. The parathyroid glands are typically located on the posterior surface of the thyroid or within the substance of the gland but their location are variable. This variability is due to the multiple origin of the parathyroid glands from the

- A. First and second branchial pouches
- B. Second and third branchial pouches
- C. First and third branchial pouches
- D. Third and fourth branchial pouches
- E. Second and fourth branchial pouches

Head and Neck Embryology Question Key

- 1. B
- 2. C
- 3. A
- 4. B 5. E
- 6. C 7. A
- 8. C
- 9. D

HEAD AND NECK ANATOMY PRACTICE QUESTIONS



1. _____ A patient complains that he has lost sensation on his face and that the skin of his face feels numb. The physician tests tactile acuity by touching the forehead (see photo above) and finds severe loss of sensation. Which of the following is the location of the sensory neuron cell bodies that innervate this area?

- A. Mesencephalic nucleus of V
- B. Semilunar (Trigeminal) ganglion
- C. Geniculate ganglion
- D. Ciliary ganglion
- E. Pterygopalatine ganglion



A person is in an automobile accident and gets struck on the side of the head. The patient refuses to be taken to the hospital and instead demands to simply go home and lie down for a while. Within hours, the person is rushed to the hospital after losing consciousness. The image above is a CT scan section at the level of the cranial cavity.

2. _____ The physician suspects that this is a hematoma that has resulted from tear of a vascular structure. Which of the following describes the type of hematoma and the vascular structure that was damaged?

- A. Subdural hematoma, Ophthalmic artery
- B. Subdural hematoma, Middle Meningeal artery
- C. Epidural hematoma, Ophthalmic artery
- D. Epidural hematoma, Middle Meningeal artery
- E. Epidural hematoma, Deep Temporal artery
- 3. _____ This artery is a branch of the
 - A. Internal Carotid Artery
 - B. Superficial Temporal Artery
 - C. Occipital Artery
 - D. Maxillary Artery
 - E. Facial Artery



A patient sees a physician because the eyelid of her left eye is drooping and she is having double vision. Examination of the patient (photo above) shows ptosis of the left eyelid and deviation of the left eye when the patient is told to look straight ahead. Further examination demonstrates that pupil is dilated in the left eye.

4. _____ Which of the following nerves is likely to have been damaged?

- A. Trochlear
- B. Abducens
- C. Oculomotor
- D. Facial
- E. Ophthalmic division of the Trigeminal (V1).

5. _____ The ptosis is likely to be due to partial paralysis of which of the following muscles?

- A. Superior oblique
- B. Levator Palpebrae Superioris
- C. Frontalis
- D. Superior Rectus
- E. Orbicularis Oculi

6. _____ The pupil is dilated because the action of the dilator pupillae muscle is unopposed. Which of the following is the innervation of the dilator pupillae muscle?

- A. Sympathetic fibers
- B. Facial nerve
- C. Infraorbital nerve (V2)
- D. Trochlear nerve
- E. Optic nerve

A teenager patient develops a pimple on the face lateral to the nose and scratches the sore. In time, the sore becomes infected but remains untreated. The patient then develops neurological symptoms and has the major complaint of 'blurred vision' which is diagnosed as Diplopia.

7. _____ The physician suspects that the infection has spread to a structure inside the cranial cavity. Which of the following is likely to be the structure and the route by which the infection has spread?

- A. Superior Sagittal sinus, 'bridging' veins
- B. Inferior Petrosal sinus, middle meningeal vein
- C. Cavernous sinus, ophthalmic veins
- D. Transverse sinus, mastoid veins
- E. Cavernous sinus, retromandibular veins

8. _____ The blurred vision is likely result from compromised function of which of the following?

- A. optic nerve (II)
- B. optic chiasm
- C. long ciliary nerves
- D. short ciliary nerves
- E. nerves to eye muscles (III, IV, VI)



9. _____ A 35-year-old male is referred to a neurologist because of hearing loss. The patient also states that he has begun experiencing episodes of facial weakness and drooping at the corner of the mouth. An MRI (imaged above) shows a mass in the posterior cranial fossa at the cerebellopontine angle. Further testing demonstrated that the patient had a number of other neurological and physical deficits. Which of the following would NOT be likely to be shown by this patient?

- A. decreased salivation
- B. facial paralysis
- C. loss of taste to the anterior 2/3 of the tongue
- D. decreased secretion of the lacrimal gland
- E. dilated pupil of the eye



10. _____ A 63-year-old aging rock musician fell off the stage during a concert tour and his head struck a large speaker in front of the stage. While he felt fine but bruised on the day of the fall, within the next week he developed a bad headache and was more verbally incoherent than usual. X rays taken at the hospital showed no fractures of the skull but there was evidence of papilledema. The image above is an MRI image from a series that was subsequently ordered. Damage to which of the following vessels is most likely to account for the symptoms?

- A. Internal Carotid Artery
- B. Internal Jugular Vein
- C. Vertebral Artery
- D. Superficial Temporal Artery
- E. 'Bridging' Vein or Venous Sinus

11. _____ A patient chronically suffers from excess production of mucous in the nasal cavity. He also complains that he often has tears in his eye. These symptoms could result from damage to the parasympathetic innervation of the mucous glands of the nose and the lacrimal gland. Damage to which of the following cranial nerves and associated ganglion could produce these symptoms?

- A. CN VII, Pterygopalatine ganglion
- B. CN IX, Otic ganglion
- C. CN III, Ciliary ganglion
- D. CN V, Semilunar ganglion
- E. CN VII, Submandibular ganglion

12. _____ Access to the circulatory system may be obtained in neonates by a needle placed into the skull at the Anterior fontanelle. Which of the following is the vascular structure that would be accessed in this procedure?

- A. Superior Sagittal sinus
- B. Inferior Sagittal sinus
- C. Sigmoid sinus
- D. Middle Meningeal vein.
- E. Cavernous sinus

13._____ A patient complains that he has difficulty chewing and that part of his face feels numb. When asked to open his mouth, the jaw is observed to deviate toward the right. Damage to which of the following nerves could produced the jaw deviation?

- A. right Facial nerve
- B. left Trigeminal nerve
- C. right Trigeminal nerve
- D. left Facial nerve
- E. left Glossopharyngeal nerve



14. _____ A 64 year-old female is in the back seat of car that suddenly decelerates in an accident. She shows no acute injury but in the following days she begins having double vision. Examination of the patient shows that she is holding her head tilted (see photo above). Cranial nerve examination finds that she has difficulty moving her right eye downward, particularly from an adducted position. A head MRI is ordered to specifically image which the following cranial nerves?

- A. right cranial nerve III
- B. left cranial nerve IV
- C. right cranial nerve IV
- D. left cranial nerve III
- E. right cranial nerve VI

15. _____ A patient has difficulty in swallowing. Neurological tests show that the Vagus and Glossopharyngeal nerves are normal. Which other nerve that should be tested, as it also innervates a muscle of the soft palate and could produce the difficulty in swallowing?

- A. Transverse cervical nerve
- B. V (Trigeminal)
- C. XI (Accessory)
- D. VII (Facial)
- E. XII (Hypoglossal)



16._____ A 19 year old suffers a violent blow to the nose during a fist fight. Over the following week, the person notices that a clear fluid persists in dripping from the nose and goes to the local hospital emergency room. The physician orders a CT scan (image above) and finds a defect (arrow) in the floor of anterior cranial fossa. This defect is likely a fracture of which of the following bones?

- A. Maxillary bone
- B. Vomer
- C. Horizontal process of the frontal bone
- D. Greater wing of the sphenoid bone
- E. Cribriform plate of the ethmoid bone



17. _____ The parents of a small child notice that she appears to have a 'twisted' neck. When the child is brought to the pediatrician's office, the head is held so that the face is directed partially toward one shoulder (she photo above). The physician suspects that the child has a torticollis resulting from the contracture of a neck muscle. Contracture of which of the following muscles could cause this condition?

- A. Left Sternocleidomastoid muscle
- B. Right Sternocleidomastoid muscle
- C. Left Omohyoid muscle
- D. Left Sternothyroid muscle
- E. Left Digastric muscle



18. _____ This is a photo a patient attempting to smile and raise their eyebrows. Which of the following would be an additional symptom shown by this patient?

- A. Pain (ear ache) in right ear
- B. Sounds seem too loud in left ear
- C. Decreased taste sensation on right side
- D. Pupillary constriction in left eye E. Loss of sensation to skin of forehead on left side



19. _____ An 18-year-old female sees a physician because one of her eyes 'won't stay open' (photo above). Tests show that the patient's visual acuity and eye movements are normal. However, further tests show that pupil of the left eye is constricted (relative to right eye). These symptoms could be caused by a tumor at which of the following locations?

- A. at the Superior Orbital Fissure compressing the Oculomotor nerve.
- B. at the Internal Auditory meatus compressing the Facial nerve
- C. in the neck compressing the Sympathetic chain.
- D. at the Supraorbital foramen compressing the Supraorbital nerve.
- E. at the Inferior Orbital fissure compressing Infraorbital nerve.



20. _____ A patient complains that he is having difficulty speaking and that he is biting his tongue when chewing his food. The physician asks the patient to protrude his tongue (photo above). Other tests show that there is no loss of taste or touch sensation in the tongue. Damage to which of the following nerves could produce these symptoms?

- A. Right Lingual nerve
- B. Right Hypoglossal nerve
- C. Left Lingual nerve
- D. Left Hypoglossal nerve
- E. Left Glossopharyngeal nerve



21. _____ A patient undergoes surgery for removal of thyroid nodules. The nodules are found to be noncancerous but post-operatively the patient has a 'hoarse' voice. Laryngoscopic examination (photo above) shows asymmetry in position of the vocal folds when the patient is told to breathe deeply. The physician suspects that this is due to damage of which of the following structures?

- A. Right Superior Laryngeal nerve
- B. Right Recurrent Laryngeal nerve
- C. Left Superior Laryngeal nerve
- D. Left Recurrent Laryngeal nerve
- E. Right Sympathetic chain



22. _____ An 85 year old woman complains of persistent headaches. Examination of the optic nerve with an ophthalmoscope (image above) shows bulging consistent with the occurrence of papilledema. The appearance is similar in both eyes. The physician suspects that this may be cause by increased intracranial pressure. Calcification of which of the following structures could cause this condition?

- A. choroid plexus
- B. pterygoid venous plexus
- C. denticulate ligaments
- D. emissary veins
- E. arachnoid villi



23. _____ A 23-year old soldier states that he has developed recurring headaches over the past 6 months. Treatment with non-steroidal anti-inflammatory drugs (acetaminophen, ibuprofen) provided only partial relief. Neurological testing showed only mild anosmia. An MRI scan (attached) revealed a mass at the base of the anterior cranial fossa that was diagnosed as a meningioma. Which of the following nerves innervates the dura mater in this region and could produce the patient's symptom of headache?

- A. Olfactory nerve (CN I)
- B. Trigeminal nerve (CN V)
- C. C1 spinal nerve
- D. Vagus nerve (CN X)
- E. Facial nerve (CN VII)



24. _____ A 71-year-old woman was in an automobile accident and her sternum forcibly struck the steering wheel. There was no external trauma to the face or neck. However, she developed progressive visual loss and pulsatile proptosis (bulging of the eye due to dilatation of the veins draining the eye). An angiogram of her Internal Carotid artery (image above) showed bleeding and communication of the artery with the Inferior Ophthalmic vein. She was diagnosed as having an arteriovenous fistula. This fistula is present in which the following structures?

- A. Superior Sagittal sinus
- B. Inferior Sagittal sinus
- C. Cavernous sinus
- D. Superior Petrosal sinus
- E. Inferior Petrosal sinus



25. _____ A 7 year old child states that she is seeing everything 'twice' (double vision). Examination (photo above) shows marked deviation of the right eye when the child tries to look straight ahead. On attempting to look to the right, the left eye moves normally but the right eye shows minimal movement. Which of the following is the most likely cause of these symptoms?

- A. Right Oculomotor nerve palsy
- B. Left Abducens nerve palsy
- C. Right Trochlear nerve palsy
- D. Right Abducens nerve palsy
- E. Left Trochlear nerve palsy



26. _____ A patient is seen because of a very 'sore throat' Inspection of the soft palate (image above) shows enlarged masses in the lateral wall of the oropharynx. The masses are surgically removed and the patient returns home. However, that evening, there is extensive arterial hemorrhage in the oropharynx. This is most likely due to injury to a branch of which of the following arteries?

- A. Superior Thyroid artery
- B. Lingual artery
- C. Facial artery
- D. Posterior Auricular artery
- E. Ophthalmic artery

27. _____ In the case above, the artery was repaired but, in the succeeding weeks, the patient noticed that food tasted strange in the 'back of her mouth'. Tests showed a persistent lack of sensation in the posterior one third of the tongue. This was most probably due to damage of a branch of which of the following nerves during the initial surgery?

- A. Glossopharyngeal nerve (CN IX)
- B. Vagus nerve (CN X)
- C. Facial nerve (CN VII)
- D. Trigeminal nerve (CN V)
- E. Transverse cervical nerve

28. _____ A 20-year old is in an amateur boxing match and suffers a powerful blow to his cheek. He wins the fight but, in succeeding weeks, he finds that he is unable to keep food between his teeth when he chews on that side. Neurological examination by shows normal function in the Trigeminal and Facial nerves. The physician suspects that the symptoms are due to direct damage to a muscle. Which of the following muscles is mostly likely responsible for the patient's condition.

- A. Temporalis
- B. Depressor anguli oris
- C. Buccinator
- D. Platysma
- E. Mentalis

HEAD AND NECK SAMPLE QUESTIONS KEY

1. B

2. D

3. D 4. C

5. B

6. A

7. C

8. E

9. E 10. E

11. A

12. A 13. C

14. C

15. B 16. E

17. A

18. B

19. C

20. B

21. B 22. E

23. B

24. C

25. D

26. C 27. A

27. A 28. C

LOWER EXTREMITY PRACTICE QUESTIONS

1. _____ A skier went off a down hill course and caught one ski under a log. X ray after the accident showed that he had fractured the tibia. A cast was placed on the leg that went from the knee to the foot. When the cast was removed, the patient dragged his foot and was unable to lift it from the ground. This condition most likely resulted from pressure of the cast on which of the following nerves?

- A. Femoral
- B. Obturator
- C. Superficial Peroneal
- D. Common Peroneal
- E. Tibial



2. ____A football player was tackled from the lateral side while attempting an end around run in a tie game. The foot on that leg was planted on the ground and the tackle was made by another player who weighed 312 pounds and was running at the rate of 3.5 miles per hour. MRI of the patient's knee (arrow above) shows a tear in which of the following structures (note position of patella)?

- A. Tibial Collateral ligament
- B. Fibular Collateral ligament
- C. Anterior Cruciate ligament.
- D. Posterior Cruciate ligament.
- E. Semitendinosus tendon

3. ____A cross country runner was attempting to pass another runner in a race and stepped off the path. His foot landed on a small stump resulting in hyperinversion of the foot. Subsequent x-ray showed no fractures of the tarsal bones, distal tibia or fibula but the ankle was swollen and painful. Which of the following structures was (were) most likely to have been damaged?

- A. deltoid ligament.
- B. long plantar ligament.
- C. spring ligament.
- D. calcaneofibular and anterior talofibular ligaments.
- E. calcaneofibular and posterior talofibular ligaments.



4. ____A 63 year old grandmother lifted her 7 year old grandson and felt a sharp pain in her left thigh. She was admitted to the emergency room and examination by palpation detected a bulge below the level of the inguinal ligament on the left side. MRI imaging was performed. A transverse section (image above) showed structures projecting from the anterior thigh on the left The fascial layer that is immediately overlying the bulge is continuous with the

- A. fascia of the Internal Oblique muscle
- B. transversalis fascia
- C. Camper's fascia
- D. Rectus sheath
- E. Iliotibial tract



5. ____A runner accelerated toward the finish line of a race and suddenly felt a pop on the back of his thigh. He then fell down in excruciating pain. Xray of the pelvis (image above) showed that a small piece of bone had been fractured and avulsed by muscle tendons. This piece of bone is part of which of the following structures?

- A. pubis
- B. ischial spine
- C. ischial tuberosity
- D. acetabulum
- E. ilium

6. _____ Following hip replacement surgery on the left side of the body, an adult patient complains that he has difficulty walking. He is also very unstable when standing if he lifts his right leg. When the patient is observed while walking in a physician's office, the pelvis sways considerably and tilts toward the right when the right leg is lifted. Which of the following nerves was likely to have been damaged in the hip surgery?

- A. Left Inferior Gluteal Nerve
- B. Right Inferior Gluteal Nerve
- C. Left Sciatic Nerve
- D. Left Superior Gluteal Nerve
- E. Right Superior Gluteal Nerve

7. _____ While on a hunting trip, a teenage patient falls and the hunting knife in his belt penetrates his upper thigh. After being rushed to an emergency room, Inspection of the wound shows a deep cut 1.5 inches below the inguinal ligament that is bleeding profusely. The physician suspects that the femoral artery has been severed and ligates the Femoral artery immediately below the inguinal ligament. The lower limb is still able to receive a sufficient supply of arterial blood because of which of the following anastomoses.

A. Inferior Gluteal artery with the Medial and Lateral Femoral Circumflex arteries.

B. Internal Pudendal artery with the Medial and Lateral Femoral Circumflex arteries.

C. Superficial Circumflex Iliac artery with the Inferior Gluteal artery.

D. Inferior Epigastric artery with the Medial and Lateral Femoral Circumflex arteries.

E. Inferior Epigastric artery with the Inferior Gluteal artery.



8. _____ A 76-year-old woman is walking down the stairs of her house and falls. She is in pain and has difficulty walking but she does not see a physician. After one week, the pain has become unbearable and she goes to the emergency room of her local hospital. An xray of the thigh (image above) shows a fracture in the neck of the femur and degenerative changes in the femoral head. The blood supply from which of the following arteries is likely to be compromised by the fracture and result in insufficient blood supply to the head of the femur?

- A. Lateral Femoral Circumflex artery
- B. Medial Femoral Circumflex artery
- C. Inferior Epigastric artery
- D. Inferior Gluteal artery
- E. Superficial External Pudendal artery



9. _____ A carpenter is working on a building site and a large beam falls on the lateral side of his foot. An xray image of the foot (above) shows fractures to the lateral bones of the foot. Healing of the fracture indicated by the arrow at right could be complicated because the tendon of leg muscle inserts at this point. Which of the following muscles inserts at the point indicated by the right arrow (Note: not in review sheet but this was a question on the last board exam)?

- A. Tibialis posterior
- B. Peroneus longus
- C. Tibialis anterior
- D. Peroneus brevis
- E. Extensor digiti minimi



10. _____ A patient complains that the medial side of the sole of his foot is painful when he stands or walks. The xray of his foot (above) shows a substantial decrease in the height of the medial arch. Weakness in which the following structures could produce this condition?

- A. Plantar calcaneonavicular ligament
- B. Long plantar ligament
- C. Anterior talofibular ligment
- D. Deltoid ligament
- E. Posterior talofibular ligament



11. _____ A young female is in a serious automobile accident that occurs as a head-on collision. She is taken to an emergency room and physical examination shows an asymmetry in the position of the greater trochanter of the femur. The trochanter on right is elevated relative to the left side. The position of the leg and foot is also abnormal on the right side. Xray of the hip is taken (image above) and shows no fractures in the femur on either side. Which of the following describes the position of the leg and foot on the right side?

- A. foot and leg are rotated laterally
- B. foot and leg are rotated medially
- C. foot and leg are flexed
- D. foot and leg are extended
- E. foot is everted



12. _____ A patient complains of pain in the sole of his foot when he walks. Examination shows that the pain is localized to an area below the head of the first metatarsal bone. X ray of the foot shows mild degenerative changes in two small seaside bones (arrows in image). The pain during walking is probably due to the use of the muscle that courses <u>between</u> the sesamoid bones. This muscle is which of the following?

- A. Flexor Hallucis brevis
- B. Flexor Hallucis longus
- C. Tibialis posterior
- D. Extensor Hallucis longus
- E. Abductor Hallucis longus



13. _____ A patient suffers a deep knife cut to his shin (anterior compartment). He does not seek medical attention but wraps it in bandages. In succeeding days, the wound does not heal and bleeding is persistent. Examination by an emergency room physician shows extensive infection. The wound is opened and cleaned (photo attached). Damage to an arterial branch is repaired and care is taken not to damage the nerve that accompanies the artery. Which of the following are the artery and nerve?

- A. Anterior Tibial Artery, Superficial Peroneal Nerve
- B. Anterior Tibial Artery, Deep Peroneal Nerve
- C. Peroneal Artery, Tibial Nerve
- D. Peroneal Artery, Superficial Peroneal Nerve
- D. Popliteal Artery, Common Peroneal Nerve



14. _____ A soccer goalie is in a match and shifts his body laterally as he tries to block a shot to the net. After successfully blocking the shot, the goalie feels an intense pain in his medial thigh (arrow in image). The team physician diagnoses this as a groin (muscle) pull but is concerned that the nerve to muscle may also be damaged. This nerve is which of the following?

- A. Femoral nerve
- B. Common Peroneal nerve
- C. Inferior Gluteal nerve
- D. Superior Gluteal nerve
- E. Obturator nerve

15. _____ A patient who is diabetic develops tingling and numbness on the front of his thigh. Examination by a neurologist shows that the patellar tendon reflex is diminished and sluggish (score +1). The neurologist suspects that the patient is developing a peripheral neuropathy in the nerve to the anterior thigh. This nerve is which of the following?

- A. Femoral nerve
- B. Common Peroneal nerve
- C. Inferior Gluteal nerve
- D. Superior Gluteal nerve
- E. Obturator nerve

16. _____ A tennis player is in an intense match and runs toward the net. He feels a 'snap' in his calf. After the match he feels intense pain deep in his posterior calf. Physical examination shows that the Tendo Calcaneus (Achilles tendon) has not been ruptured or sprained but the pain is intensified if the patient attempts to plantar flex the foot. The physician suspects that the symptoms are due to damage to a deep muscle that inserts on the Achilles tendon. Which of the following muscles is most likely to be damaged?

- A. Plantaris
- B. Tibialis Posterior
- C. Flexor Hallucis longus
- D. Peroneus Tertius
- E. Flexor Digitorum longus

LOWER EXTREMITY ANSWER KEY

1. D

2. C

3. D

4. B 5. C

6. D

7. A

8. B

9. D

10. A

11. B

12. B

13. B 14. E

14. E 15. A

16. A